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TOWER MARKET REPORT

Infrastructure, regulatory and financial information for the antenna-siting community

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DAS IN NEW YORK SUBWAYS

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Tower Market Report

Departments

on the cover

Metropolitan Transit Authority patrons will receive wireless communications service in six subway stations, thanks to a pilot program expected to lead to service at all 271 stations by 2015. See Ernest Worthman's article on page 26.

Cover design and Tower of the Month photo by Scott Dolash

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editorial comment

The DAS of 1922

In 1922, the publisher and editor of *Radio News*, Hugo Gernsback, wrote about a new activity: radio broadcasting. Some were speculating that broadcasting was only a fad. Whether a fad or not, radio broadcasting showed the rapid growth in 1922 that would today be called "hockey stick," the shape of a line graph that shows sudden change from slow growth to rapidly accelerating growth.

The 1922 radio receivers were tricky devices that weren't easy to use. Listeners installed lengthy wires for antennas or sometimes wound wire into large loops. Tiny antennas enclosed within the radios had not been developed or were not in common use.

Gernsback reported that large Eastern hotels were looking into the possibility of installing loop antennas into guest room walls. Guests with their own radios then could plug them into the antennas. The guests would have the convenience of listening to broadcasts while away from home.

That sounds much like the distributed antennas of today, although at a much more crude, but nonetheless practical, level. Distributed antenna system (DAS) networks began to see rapidly accelerating growth rapidly accelerating growth 18 months to two years ago, as has been noted by speakers at industry conferences. Whether DAS shows hockey-stick growth or not, DAS has entered into mainstream deployment, just as radio broadcasting did.

Entertainment venues, shopping centers, office buildings and hotels benefit from the wireless communications that DAS brings. It's often said that there is nothing new under the sun, and it is interesting to see that DAS has an ancestor from 90 years ago when hotels looked for ways to help guests access the wireless signals of their era.

Manufacturers continue to seek ways to make receiving antennas smaller, just as they did in the 1920s. Speaking at the New York State Wireless Association Trade Show and Conference, Mark Pecen said that Research in Motion is looking into using barium strontium titanate variable capacitors to allow smartphones that now cover six frequency bands to use as many as 15 frequency bands without having a larger form factor. The capacitors alter antennas' resonant frequencies and impedance matches. Pecen is the company's senior vice president of research and development.

I don't know whether many ideas for modern technology can be found among examples of equipment from the 1920s and earlier, but the equipment is fun to see. Ron Frisbie's Marconi Museum in Akron, Ohio, the Electronic Communication Museum in Bloomfield, N.Y., the Hammond Museum of Radio in Guelph, Ontario, and the Spark Museum of Electrical Invention in Bellingham, Wash., have splendid displays. ∎

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

Hugo Gernsback, shown watching a television in 1928, six years after writing about antennas for hotel guest rooms.

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Summer Break

Ah, the excitement of the summer. As a parent of young(ish) kids, my work schedule tracks well with the little people. Finish up all kinds of projects in May and June and chillax (a new word I learned from them) as much of the summer as you can. I used to be able to do that as a semi-self-employed person, but having taken on additional responsibilities recently, I can't quite chillax as much as I did in previous years. However, *AGL* got a lot done this spring. We kicked off some great regional conferences in Philly; Bethesda, Md. (D.C. beltway); and Kansas City, Mo. We're chillaxing with our summer combined July/August issue and planning for a busy fall. August puts us in Seattle, and the late fall puts us in Detroit and Dallas. And, of course, Orlando, Fla., in October.

Some highlights: We've been working on our website for some time. We've had a few false starts (what small business hasn't?), however, we're totally jazzed about our new site (*www.agl-mag.com*). We've gone with a system that lets the content be a good bit more dynamic and more real-time. We've added brief interviews that we've been conducting at our conferences. We've added discussion areas and the ability to bring the magazine, email newsletters and other content together, and most important, we made it searchable.

Check out the Jake MacLeod interview. I think it's great. And yes, I'm the guy off camera asking the questions. Head over and give it a look. I think the interviews are some of the most impressive I've seen in the industry. But I am biased.

On the topic of social media, we're very happy with the ongoing dialog on LinkedIn. The nice thing about LinkedIn is that you don't have to go to another site, taking time and introducing ads. It's also a little more sociable. Anyone can pretty much say anything and keep the conversation honest. Yes, if someone is selling Viagra, we can delete the posting, but pretty much unless something is over the top or just wrong, we don't filter anything. And honestly, we have not needed or wanted to.

Just to let you know, if you are not a member of LinkedIn, it's a great professional alternative to Facebook. It's all about who you know and who you have worked with. It's more of a resume verification and name game site than anything else. It has a variety of discussion groups for companies like *AGL*, and it's a pretty effective communications tool. I'm a big fan.

Keep 'em coming

Emails are always a great way to be in touch and help us figure out what we are doing right and wrong. We enjoy the dialog, and emails often help us redirect our energy into things that are current, relevant and important to you.

About those other responsibilities I mentioned. I'm working on a small-site network deployment in New England. It involves attaching macro sites to telephone poles. It is essentially a DAS network, but without the fiber.

I was fortunate enough to be directly involved with the industry as it was beginning from about 1983 until I sort of retired in 2005. Twenty-two years of experience gave us plenty of things to write about at *AGL*. However, things are changing, and I could figure no better way to hop back in and get a ringside seat at the next major change in the antenna siting industry than to go out and do it. I'll be writing more about my new direction in the future.

What about *AGL*? Nothing is changing. For many years, the magazine has been relying on the great talents of people other than me, and it is doing just fine. I remain involved, help set the direction of each issue and identify the important topics. Really, nothing is changing with *AGL*.

Keep in touch. ∎

By Rich Biby, Publisher
rbiby@agl-mag.com

Picture of the Month

New cell site installation in Butte, Mont.

Photography courtesy of Randy LeBeff, P.E.

Summer Driving Tips

By David Saul, AAI

Hitting the road for a sunny driving vacation can be one of the greatest getaways of all time, and with opportunities to head out on family holidays and road trips, and some warm weather for cruising down the freeway, the summer holds plenty of appeal for motorists. However, there are precautions you should take to keep yourself, your vehicle and your traveling companions safe and sound during a hot-weather road trip. Here are some.

Tire pressure: Hot air can wreak havoc on your vehicle's tires, causing them to expand, which can have severe consequences while you're driving, because over-inflated tires reduce the tread contact your tires have with the road. The key is to check your tire pressure on a regular basis — as often as once a month, to ensure that your tires are at a safe level for the conditions. Remember to wait until your tires are cold before changing the pressure.

Car fluids: Because all that summer heat is likely to have adverse effects on your vehicle's cooling system, you'll want to keep a close eye on your radiator during the summer months. Make sure that both coolant and water levels are regularly topped up, and that you check the radiator for any leaks or indication of corrosion. Any problems here could suggest that your radiator is about to fail.

Personal fluids: Stock up with more drinking water than you think you'll ever need. It's better to end up with some left over after your trip than end up stranded without any.

Traveling companion: Travel with a companion, preferably someone you know well and trust. You're less likely to be the victim of crime when not traveling solo, for one thing, and it's also easier to stay alert while driving when you have someone to chat with.

Non-traveling companions: Be incredibly prudent about picking up hitchhikers or even in assisting someone in apparent hardship. It's better to call the police to assist someone with a flat tire than risk your own safety by assuming they aren't a threat.

Road rage: Keep your cool, figuratively speaking, in the event of potential road rage scenarios, which are more prevalent during summertime when more people are on the road and heat can lead to agitation. You never know who might be armed, and there's no point in risking your neck over someone cutting you off in traffic.

Driving alert: Make sure you're always fully alert when driving during the summer, when it's easy to let the heat melt you into a stupor. Get a good night's sleep, keep the A/C on as much as possible, eat healthy foods and take turns driving if you're in a group.

Handling flooding: In some areas of the country, such as Arizona during its monsoon season, the summer months don't just bring sun but also a substantial risk of flash flooding. If you're driving in an area where this has occurred, remember to be careful about heading into side streets where water is rising, because it's easy to become trapped by flooding. Also, check that your vehicle is equipped to handle wet weather driving; for example, ensure that your windshield wipers are in working order.

Interior overheating: Not only do vehicles heat up on summer journeys, but also the people and pets inside them will too as the interior gets warmer. This presents a danger of dehydration, so make sure you have some drinks — especially bottles of water — stored away in an insulated container. Also,

Safety

Flooding

Overheating

Road rage

SUMMER DRIVING T

Photography by Tom Strongman
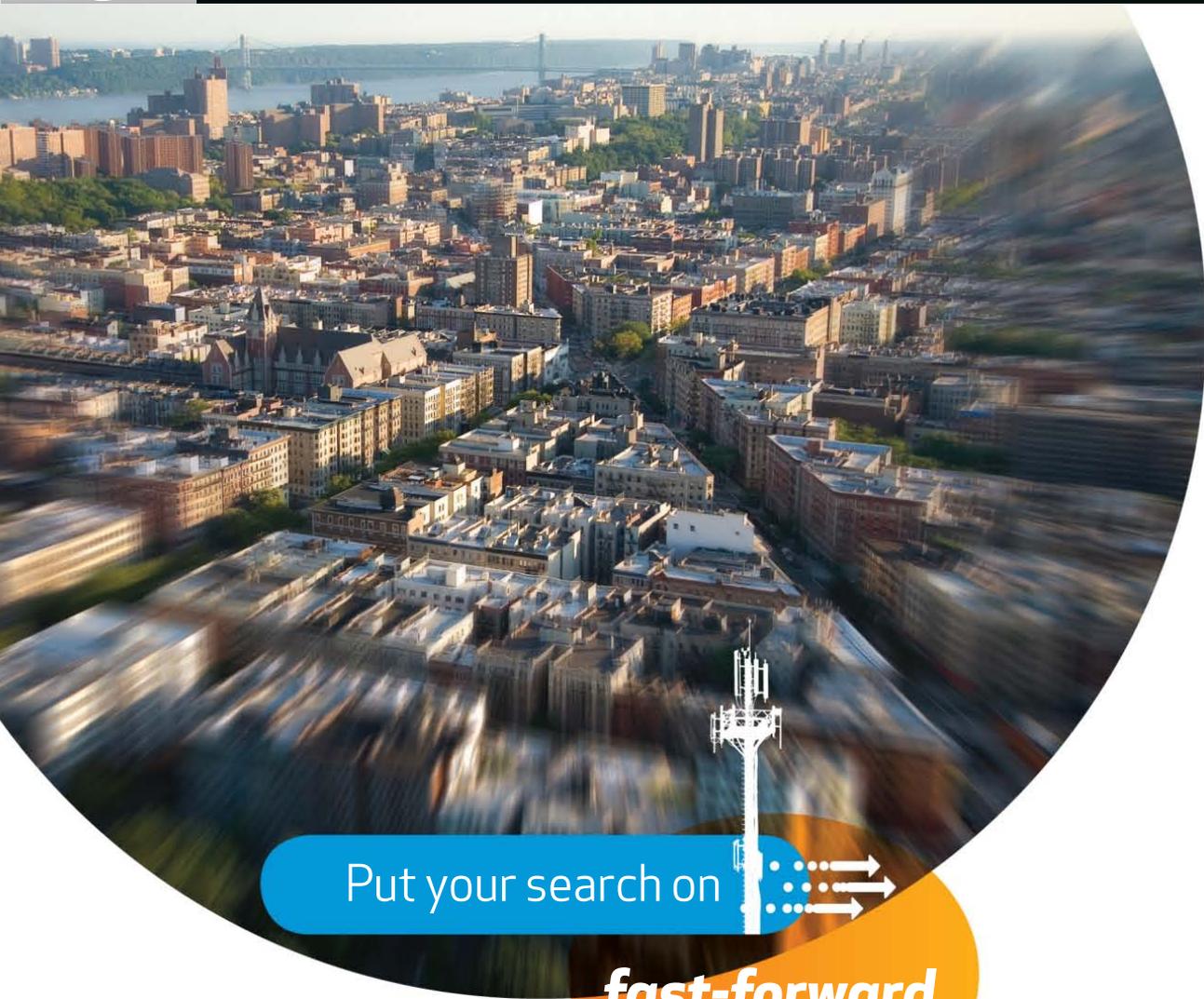
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driving in hot weather can make you feel drowsy, so you might want to consider making regular stops to avoid falling asleep at the wheel.

Safety: It's always important to keep a well-charged cell phone handy and make sure you're signed up with a roadside assistance/towing company. If you do break down in the middle of nowhere, your well-being could depend on a good cell phone and roadside help.

Keeping the children entertained: Setting off on this family vacation with the kids can be a daunting prospect if you don't prepare well. Children may soon begin to whine, argue with their siblings, and generally make everyone else in the car miserable if they have nothing to keep them busy during the trip. If you're about to take the kids on a cross-country car trip, you need to pack appropriate items to keep them happy as you travel down the highway. Try these tips to make your family road trips a pleasant experience.

- Purchase travel-sized games for your kids. Most discount stores sell smaller versions of popular games so that kids can play them on the road. Whether your children like to play games like checkers or Memory, you should be able to find reasonably priced travel games that will keep them occupied during a long road trip.
- Go to a dollar store to buy some cheap coloring books and crayons. Most kids love to color, and they'll happily scribble away as you drive in relative peace and quiet. If you have older children, consider purchasing word searches, activity books and crossword puzzles.
- Check out books on CDs or tapes from the public library. You can find popular titles that will keep your kids enthralled as the miles fly by. Whether they like spooky stories or funny ones, you should be able to find an interesting audio book that will keep your kids quiet as they sit in the back seat.
- Purchase a portable DVD player and check out some free DVDs from the public library. Portable DVD players are relatively inexpensive, and they can be found in discount stores like Wal-Mart. The kiddies can watch their favorite flicks, allowing you to drive without too many distractions.
- Pack healthy snacks for the trip. Kids can munch on nuts, pretzels and fruit to keep them happy. Bring along plenty of bottled water so you don't have to rely on sugary soft drinks.

Have a safe and enjoyable summer!∎

David Saul is executive vice president of Atlantic Risk Management, Columbia, Md., and is an accredited risk advisor in insurance (AAI). His email address is *dsaul@atlanticrisk.com.*

RCA Annual Convention

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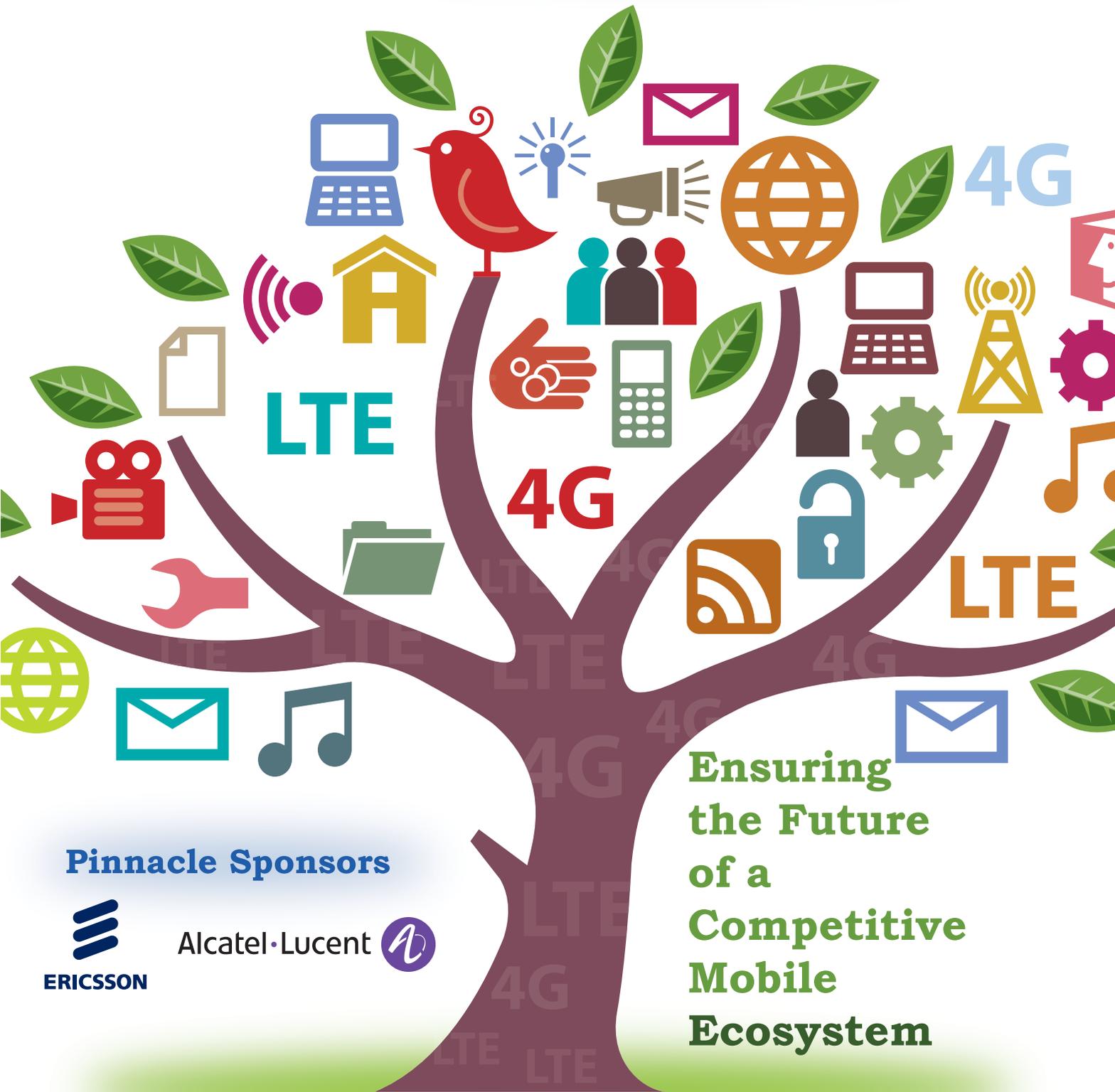
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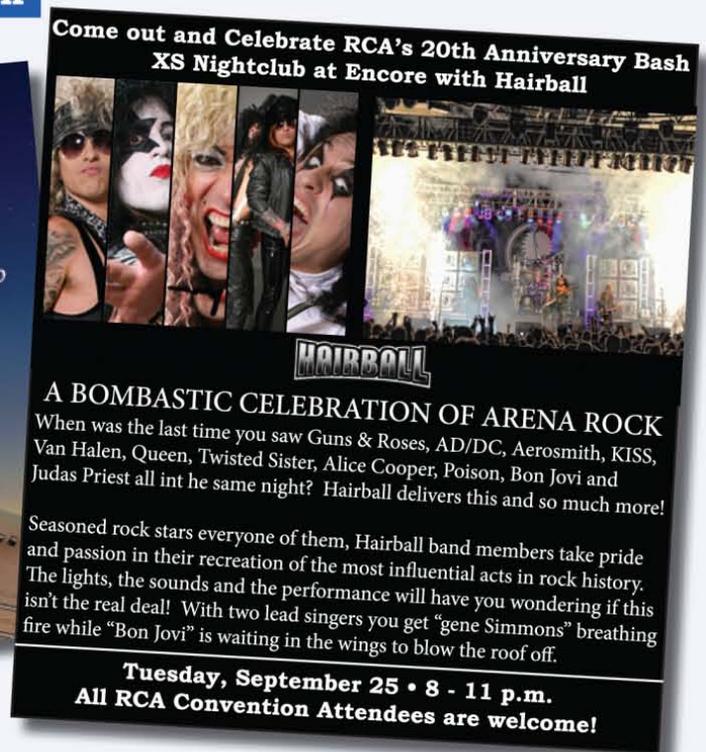
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**Tuesday, September 25 • 8 - 11 p.m.
All RCA Convention Attendees are welcome!**

Featured Speakers

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Senior Vice President &
General Manager
ESPN Mobile

Jason Marcheck
Managing Director for News,
Insights & Analysis
RCR Wireless
RCRWireless INTELLIGENCE ON ALL THINGS WIRELESS

Erik Prusch
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Steven K. Berry
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Patrick Riordan
President and CEO
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Cellcom Clearly The Best

David Hagan
President, Chief Executive
Officer and Director, Boingo
boingo Don't just go. Boingo!

Hu Meena
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Craig Stein
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Michael Prior
President & CEO
Atlantic Tele-Network
ATN Atlantic Tele-Network

Chuck Willis
Vice President
Bluegrass Cellular, Inc.
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Schedule-at-a-Glance

Sunday, September 23

Noon – 6 p.m.	Registration
1 – 5 p.m.	Exhibitor Setup
11 a.m.	Bus Departs Wynn Las Vegas for golf course
12:30 p.m.	Golf Tournament Shotgun Start
7 – 8 p.m.	Chairman's Reception
8 – 10 p.m.	RCA Gala Dinner - Celebrating 20 Years of Competitive Carriers

Monday, September 24

7 a.m. – 5:30 p.m.	Registration
9 a.m. – 4 p.m.	Exhibitor Set-up
9:30 – 11:45 a.m.	Pre-Conference Seminars
Noon – 12:30 p.m.	Box Lunch
12:45 – 3:30 p.m.	Pre-Conference Seminars
3:30 – 4 pm.	Events Committee Meeting
4 – 4:30 p.m.	Associate Member Meeting (Exhibit Hall)
4:30 – 7:30 p.m.	Carriers Appreciation Reception (Exhibit Hall)

Tuesday, September 25

7 a.m. – 5:30 p.m.	Registration
7 – 8:30 a.m.	Chairman's Breakfast and Annual Business Meeting
8:45 – 10:25 a.m.	Welcome & Opening General Session
10:30 a.m. – 1 p.m.	Exhibit Hall Open
11:30 a.m. – 1 p.m.	Luncheon (Exhibit Hall)
1 – 2:15 p.m.	General Session & Awards Presentation
2:15 – 2:30 p.m.	Break
2:30 – 3:30 p.m.	Concurrent Educational Sessions
2:30 – 4:45 p.m.	RCA Board of Director's Meeting
3:30 – 3:45 p.m.	Break
3:45 – 4:45 p.m.	Concurrent Educational Sessions
4:45 – 7 p.m.	Exhibitor Reception (Exhibit Hall)
7 – 9 p.m.	Exhibit Tear Down
8 – 11 p.m.	RCA's 20th Birthday Bash

Wednesday, September 26

7:30 – 10 a.m.	Registration
8 – 8:30 a.m.	Continental Breakfast
8:30 – 10:30 a.m.	General Session
10:45 – 11:45 a.m.	Concurrent Educational Sessions

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Registration Fees*

	Early Bird Until 8/31/12	After 8/31/12 and on-site
RCA Carrier Member (First Attendee)	$595	$695
Additional RCA Carrier Member	$495	$595
RCA Associate Member (First Attendee)	$595	$695
Additional RCA Associate Member	$495	$595
RCA Affiliate Member (First Attendee)	$595	$695
Additional RCA Affiliate Member	$495	$595
Non-Member	$1,345	$1,445
Spouse/Guest	$295	$295
Golf	$175	$200

*Fees include all scheduled meal functions and admission to the RCA Gala Dinner.

Exhibitor Information

	Early Bird Until 8/31/12	After 8/31/12 and on-site
RCA Member Booth Fee	$2,750	$2,850
Non-Member Booth Fee	$5,000	$5,100

Booth fee includes two (2) complimentary registrations. Additional company representatives will need to pay $495.
Only representatives who are employed by the exhibiting companies will receive this rate. All other visitors must pay
non-member rate. Contact Pat Holder at 512/349-7470 for booth availability.

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Diamond	$10,000 or above
Platinum	$5,000 or above
Gold	$2,000
Silver	$1,500
Bronze	$1,250

Opportunities Grow for Tower Investments

During the AGL East Regional Conference in Bethesda, Md., AGL interviewed Jason Hill, a managing director of Media Venture Partners. The company provides investment banking advisory services for businesses in the telecommunications, towers, Internet infrastructure and media sectors. Here are his remarks, edited for length and style.

AGL: A year ago, it was doom and gloom: T-Mobile USA and AT&T Wireless. Now, we're back to highs for the industry with a great tower portfolio coming back on the market. Your thoughts?

Jason Hill: It's a better time out there. We all were concerned about what would happen with AT&T and T-Mobile and how that would affect the smaller companies in the tower industry, and whether any opportunities for them would remain. The merger fell apart, but there still is uncertainty about how fast the build outs are going to happen. But having four major tenants is better than having three. More builds are going to have to come. More amendments are going to have to come because the

demand for data is so great.

AGL: LightSquared probably is dead and gone. Clearwire is maybe back from the edge. How are they affecting the industry?

Jason Hill: The LightSquared news probably confirms what many suspected. It was a tough play. There were many reports in the news about LightSquared having difficulty dealing with the GPS interference problem and certainly with the GPS lobby, which is powerful with pilots and the agricultural community. Tower companies began to discount whether LightSquared would become a solid tenant. You'll see LightSquared tied up in some kind of litigation. Harbinger Capital, which backs Light-Squared, said it might be going into bankruptcy. Tower companies began to forecast that LightSquared would not become a tenant anytime soon, if ever.

Last year, it was uncertain until November what Clearwire would be doing with Sprint. That relationship seems to have been further cemented and appears to be growing stronger. Clearwire is going the 4G route that Sprint ultimately wants it to. Tower companies are growing

more confident that Clearwire will be around for a while. We'll see. You're not seeing Clearwire being valued as a tower tenant the same as AT&T, T-Mobile and Verizon. But there is more comfort with Clearwire today than there was last fall.

AGL: Is it still possible for a mom and pop to enter the tower industry, build a tower, and make any money?

Jason Hill: Sure. Absolutely. There is room for everyone. We have many mom-and-pop clients who have built up a tower portfolio of 10 to 30 towers, sold them, and then used the proceeds to do it again. Last year was slower for that business. We didn't see as many of our mom-and-pop clients build up a large portfolio of towers to then be sold. But we are seeing more activity starting to bubble up this year. It is just a matter of having the right relationships with the carriers, finding the right spots, getting the capital and putting the portfolio together.

If you look at lots of industry reports from the perspective of what the wireless carriers are looking to do and where the

demand is going to be, we still will need additional towers, whether for in-fill or additional coverage. The opportunity still exists for the mom and pops. It is not as easy as it was from 2008 to 2010, but we are starting to see the dam start to break — slowly — with respect to the opportunities for the mom and pops.

AGL: As technology changes, the need for sites is changing. Are you a fan of the so-called street furniture model of serving dense urban areas? Are carriers going to be placing antennas everywhere, not just on towers and rooftops?

Jason Hill: In urban areas, carriers are going to look to do whatever they can do to satisfy the demand for data they will have in those areas. In an urban area, macro sites that cover small geographies will remain an option. Distributed antenna systems will remain a viable option in urban areas. And Wi-Fi will be an option in urban areas. We expect equipment to be put on many different things to satisfy the demand in urban areas. As network coverage extends to more rural areas, it will become more of a macro site-based

AGL Photo / Don Bishop

business. But certainly, the denser areas will see many kinds of approaches used to try to serve the data need.

AGL: Five years from now, we're going to look back and say, "I wish I

Jason Hill: "We still will need additional towers, whether for in-fill or additional coverage. The opportunity still exists for the mom and pops."

had started a business doing …" What will that business be?

Jason Hill: It would be a business that does mobile photographs and allows Facebook to buy it for $1 billion without

any revenue. If I could invest in that business, I would be doing it all day long, even though I don't understand what it is.

I don't see how staying within our space is bad. You're in an industry where you are only at the beginning of the phone being used for data. More and more smartphone adoption will take place. As the younger generation matures and becomes teenagers, they will be getting smartphones. They won't just be getting a voice-enabled phone. The older generation is learning to adopt smartphones and figure out what the technology is and whether it's the face time with their children at college or face time with their grandchildren or watching videos that their kids put on YouTube — watching that on their mobile — we're in a space where data is going to drive a lot of success for those who stay in this space. And particularly with this photo-sharing thing, Mark Zuckerberg tends to agree. ∎

Distributed Antenna Systems

Paula Doublin, a distributed antenna system (DAS) expert with AT&T Services, spoke at the DAS Congress. Edited for length and style, here are questions from the conference chairman, Joe Madden, and from the audience, along with her answers.

Joe Madden, Mobile Experts: I'm interested in knowing how AT&T looks at doing neutral-host systems and building out a DAS and then hosting other carriers. How often do you think you will do that instead of relying on the building owners themselves to step in and take that role?

Doublin: Neutral host — that's in our charter, actually. When we stood the Antenna Solutions Group up, we wanted to be a neutral-host provider. I believe we are a pretty good one. We would prefer to own. We certainly will join. When you get right down to it, it is not that much harder to do a neutral-host system than it is to build out a proprietary DAS.

Audience member: What are the criteria you use to decide when to join? I can understand with malls, airports and stadiums. With a university, everyone wants the stadium. Is there a dollar figure per subscriber that is a magic number that AT&T would use for a static audience for administrative buildings, for students?

Doublin: It goes into a model. We're going to take a look at the market itself. Where are we positioned in the market? We have to take a look at where our macro network is. How is it performing? How big is the building and how old is it? What is the occupancy rate? The answers all feed into the model. Then there is the cost to join. Is the building owner going to ask for a capital contribution? Are we going to pay a monthly rent? How are the four corners of the deal structured?

Audience member: From a financial perspective, is there a magic number that I can understand for a high-traffic place? Like the mall or stadium, that number is a lot lower per user, whereas in a static audience, what makes the decision that we would join a particular building and not another?

Doublin: There is no secret sauce to that, really. We look at each building on an individual basis. There are some things that just make absolute sense to do.

Audience member: It seems like the AT&T DAS construction standard requires the use of a lot more space, equipment and antennas than what we are looking for in a multicarrier environment in a university. Help me understand. Is a standard just what you want versus the average within the industry?

Doublin: Number one, we're future-proofing to a certain extent. We build out to three-year capacity requirements. We see the consumer's use of data, applications, handsets, iPads and all those devices. We don't see that use going anywhere but up. So, yes, they are big systems, and they do take up space, and they perform beautifully.

Steve Ambrose, Texas Christian University: As a neutral host, we're having a difficult time because we have trained our students, faculty and staff to call us with wireless service complaints. We're having a real difficult time pinpointing areas with inadequate service. Are we going to have to walk around with users' cell phones and try to replicate problems?

Doublin: The answer is monitoring and alarming a DAS product straight down into the antennas. We have done some work in the areas of simple network management protocol (SNMP) where we can actually see performance. We have a box that we can deploy down into the network that just basically sits there and gathers information about it, and whenever we see a trend, or we see something that doesn't feel right or look right, that means you need to dispatch or you need to at least remotely log on to your system and see.

Not everyone is doing that. In the spirit of full disclosure, we have only been doing it for a little over a year. But what I'm seeing on it is probably a game-changer at least from an operator perspective. Every system has the capability to do that, systems that are relatively new. The older systems don't have the capability.

Paula Doublin: "I would love to build out every college campus in this country."

AGL Photo / Don Bishop

Ambrose: What is your appetite for stadium venues or a campus environment with a concentrated number of people?

Doublin: As far as the money goes, I would love to build out every college campus in this country. It really depends on the kinds of agreements that have been entered into by the campuses and whether it is a third-party provider or we are going in or Verizon is going in or whoever is going in, it just really depends. I think every one of us would want to be on there. I would be happy to chat with you about it.

Ambrose: Are you leaning away from some of the stadiums?

Doublin: If you had asked me that question three weeks ago, I probably would have said, absolutely. But over the last three weeks, the number of stadiums and campuses that have hit,

shows that that part of the market is as hot as ever.

Andy Hulsey, University of Central

Florida: We're trying to work with your company to build out our DAS. References of private corporations, universities and colleges where AT&T has built a neutral-host DAS always say AT&T did a great job. But when the question comes up, has AT&T added another car-

rier, each reference says other carriers have expressed interest, but none has been added. Why not?

Doublin: We are two years old, and it took a while for us to build a reputation. I know we have to overcome the perception that carriers might not want to join another carrier's neutral-host system. Verizon, Sprint, AT&T — we join each other's neutral-host DAS. I don't know how to better answer your question. There has to be some faith that comes into it. And other carriers have to be assured that if they join our systems, it will be a great experience for their customers. ∎

Paula Doublin is assistant vice president of construction and engineering for distributed antenna systems at AT&T Services. She spoke at the American Conference Institute's DAS Congress. For information about the DAS Congress, visit www.dascongress.com.

Appeals Court Overturns OSHA Citations

The federal Circuit Court Of Appeals for the D.C. Circuit has overturned numerous willful OSHA citations and has clearly reminded OSHA and the OSHA Review Commission that willful citations are difficult to prove.

By Mark A. Lies II and Craig B. Simonsen

One of the Occupational Safety and Health Administration's (OSHA's) most potent enforcement weapons is the willful citation, which can carry a monetary penalty of up to $70,000 per violation. If OSHA can prove that the willful violation resulted in a fatality, there is potential criminal liability. A willful violation can also affect third-party liability litigation if it arose out of an accident involving personal injury. It can affect the employer's business reputation and liability insurance premiums. As a result, no employer would ever wait to receive a willful citation.

Recently, the Federal Circuit Court of Appeals for the D.C. Circuit issued a decision that will significantly affect OSHA's ability to issue and to prove a willful violation. *Dayton Tire v. Secretary of Labor*, No. 10-1362 (D.C. Cir., March 6, 2012). The Court reaffirmed that OSHA has a high evidentiary burden to establish a willful violation.

In the process, the Court was also very critical of the timeliness and the manner in which OSHA prosecuted the case.

In 1993, a Dayton employee died from injuries sustained when a machine activated unexpectedly. The incident prompted OSHA to send an inspector to the plant to assess Dayton's lock-out/tag-out (LOTO) compliance. Based on that inspection, OSHA cited Dayton, alleging 107 willful LOTO violations and proposing a $7.5 million penalty. Of the 107 cited violations, 98 were for failing to train individual Dayton employees to the "authorized" level. The remaining nine violations were for failing to develop adequate safety procedures for particular machines, failing to utilize LOTO procedures, failing to provide necessary locks and tags to authorized employees, and failing to conduct periodic inspections.

After a hearing before an Occupational Safety and Health Review Commission (OSHRC) administrative law judge (ALJ), which included testimony from 90 witnesses during more than 31 days of trial, the ALJ issued a decision in 1997 that affirmed each violation that had not been withdrawn by OSHA. Additionally, even though the ALJ found that Dayton's "actions were consistent with a good faith belief and effort to comply with the LOTO standard throughout the Oklahoma City plant," he characterized 37 of the violations as willful because "Dayton knew its corporate parent, Bridgestone, had

previously been cited under the LOTO standard for similar violations." Dayton Tire, 1997 WL 152083 (No. 94-1374, 1997). The ALJ assessed a total penalty of $518,000.

Review Commission decision

From 1997 until 2010, the case sat fully briefed before the OSHRC. Then, in 2010, two members of the OSHRC not only upheld the citations, but overturned the ALJ and held that *all* of the violations were willful, with a penalty of $1.975 million. The company filed an appeal.

Circuit Court decision

The Circuit Court found that although it took the Commission more than 12 years to rule on the case, Dayton was not entitled to dismissal based on the OSHRC's failure to adjudicate the case. "Although we are empowered to set aside the Commission's order on the basis of delay, we decline to do so here. Yes, in the words of the secretary herself, the Commission's 12-year delay was 'excessive and deplorable.' But as Dayton admits — and its cited cases demonstrate — delay alone is not enough; it is the 'consequence[s] of the Commission's delay' that dictate whether corrective action is needed. And in this instance, the consequences of the Commission's delay do not justify setting aside its chosen penalty." The Court noted that "[w]hile the deterrent effect of a single penalty is difficult to assess with much precision, we are confident that enforcement of this penalty will have some effect on Bridgestone and employers in general." The Court concludes, though, that "[o]ur willingness to enforce the Commission's penalty should not be mistaken for approval of its 'deplorable' conduct."

The OSHRC in its 2010 decision found sufficient evidence to conclude that Dayton had willfully violated the Occupational Safety and Health Act as a matter of corporate policy. The linchpin of the OSHRC willfulness determination was its finding that Dayton's safety manager either knew Dayton was noncompliant or was unwilling to investigate for fear of uncovering Dayton's noncompliance.

The Court found that this position was based more on speculation than evidence. Accordingly, the OSHRC's willfulness characterization did not withstand review. The Court found the evidence in the record proved "negligence at most." Specifically, the Court noted that each time an issue was raised about Dayton's compliance with the LOTO standard, the safety manager took some action. Although the safety manager's effort and analysis may not have been as thorough as the Court would have hoped, the Court stated that it was "not nothing." The Court explained that establishing the plain indifference necessary to support a willful violation is a high burden. The Court likens the test to a lack of good faith, and in rejecting the OSHRC's decision the Court states:

"Indeed, what the ALJ acknowledged and the Commission dismissed was the possibility of good faith." The safety manager "made some effort to ensure Dayton's LOTO compliance, and under these circumstances, some effort is enough to save Dayton from a willfulness determination."

The Court concluded that the OSHRC "lacked substantial supporting evidence for its finding that Dayton's violations were willful. Accordingly, we vacate that portion of the Commission's order and remand for the Commission to reassess the nature of Dayton's violations and recalculate the appropriate penalty."

Recommendations

In order to avoid potential liability for willful violations, an employer should be prepared to establish that it acted in good faith — the antithesis of willful conduct. This can be done by:

- Undertaking a thorough hazard assessment of the workplace
- Developing compliance programs to address such hazards
- Conducting and documenting training of employees regarding such programs
- Enforcing compliance with documented discipline up to and including termination for violations ■

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regulation and control

Venn and the Art of W

A perfect intersection of regulation and control, technology and willingness on the part of landowners must be met to allow development of wireless telecommunications sites. Is it any wonder that worry keeps site developers awake at night?

It's important to educate legislators and local governments about the 1996 Telecommunications Act, which added Section 332(c)(7) to the Communications Act of 1934. This section, also referred to as Section 704, affects the permitting of wireless facilities by preserving local government authority over tower siting decisions, while placing certain limitations on the exercise of that authority.

Congress thereby set up a balancing act. It encouraged rapid development of new communications technology, yet it preserved state and local authority over tower siting. Thus, local government authorities viewed the 1996 Telecommunications Act as affirming their control over tower siting decisions and, in fact, the very title of Section 704 of the Act identifies the preservation of local authority over tower siting as its purpose. Those in the industry viewed the Act as sup-

porting rapid deployment by limiting local government authority. It's that balancing act that keeps so many site acquisition specialists and attorneys busy and employed.

It also keeps many site developers awake at night, wondering why it takes so long to develop a tower site. It is because of the multiple layers of regulation and control (see Figure 1). One of the cable news shows has a segment called "Regulation Nation," which highlights extensive U.S. regulation and its effect on businesses, and you need look no further than wireless telecommunications to find an industry that is heavily regulated by nearly all levels of government.

Perfect intersection

Getting a site on the air requires finding the perfect intersection of a willing landlord, radio-frequency (RF) technology requirements, com-

munity approval and numerous levels of federal, state and local government approvals. You have to have a willing landlord because carriers can't just condemn land, telling owners they're going to take it just because it's ideal for the network. Although a perfect RF world of flat land, no foliage, no obstructions and no limitations on tower heights does not exist almost anywhere that people live or use their mobile phones, certain RF requirements must be met. Residents of the community have to be able to offer input. Mostly the FCC, but also other federal agencies, impose numerous requirements involving environmental protection, historic preservation, migratory birds, wetlands — you name it. And state and local governments also exert a degree of control in many cases duplicating historic and environmental reviews. Many other circles of regulation and control could be added to Figure 1, but you get the idea of why it is so challenging to locate an antenna site.

What are the limitations on local authority? Although municipalities can discriminate, the discrimination must not be unreasonable, and the discrimination must stop short of having the effect of prohibiting wireless service. Municipalities must act within a reasonable amount of time. Moreover, the denial of an application for a permit must be in writing and must be

Limitations on Local Authority

- No unreasonable discrimination
- No prohibition on service
- Must act within a reasonable amount of time
- Denial must be in writing supported by substantial evidence
- No denial based on RF emissions if FCC-compliant

Wireless Regulation

By Lisa Murphy

Multiple Layers of Regulation & Control
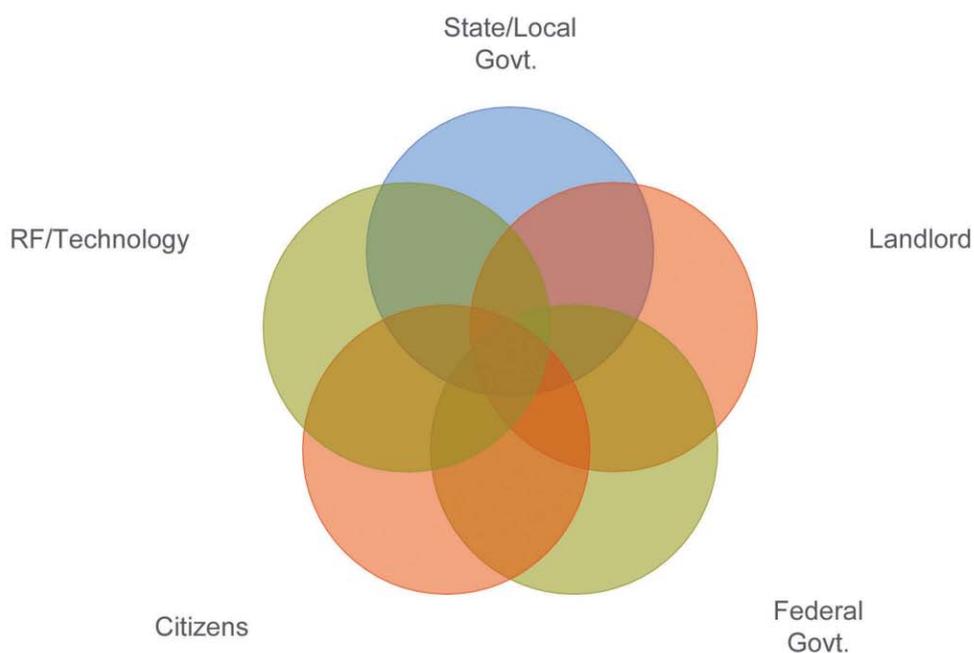
Figure 1. A Venn diagram of several sources of regulation and control of wireless telecommunications antenna site development shows that many requirements must perfectly intersect to bring about approval for antenna collocation or new site construction.

supported by substantial evidence. The municipality cannot deny an application based on the perceived effects of RF emissions on health, provided that the carrier proves its proposed facility is FCC-compliant. That's an important thing to remember when making an application for an antenna site or pleading your case at a public hearing.

Local governing authorities have been parsing the language of the Act, which places limits on their authority, to determine what exactly is meant by "unreasonable discrimination" or "prohibition." Carriers have gone to

court in all of the federal judicial circuits to figure out exactly what reasonable or unreasonable discrimination means, and what prohibition means

and to further clarify what Congress intended by the language it used in Section 704. For example, if one carrier is allowed to place an antenna in

Municipal Perspective

- Municipalities are protecting citizens from harmful land use.
- Land use regulation starts at a place of "No."
- Wireless facilities are typically conditional or special uses.
  - Uses deemed incompatible with surrounding uses except if certain conditions are met.

regulation and control

a given area, and you're the second carrier in the area asking for a site, can the authorities deny you? Would that be prohibition?

In 2008, CTIA asked the FCC to clarify what these key terms in the Act mean and to help speed up the local government approval process. CTIA asked the FCC to set a 45-day time limit for local governments to process applications for sites involving antenna collocation and 75 days for sites involving the construction of new towers, which some concluded was a little bit aggressive. CTIA asked the FCC to deem an application approved if these deadlines were not met.

CTIA also wanted the FCC to define what prohibition of service means. Is it one carrier in a search ring? Two carriers? What exactly was intended?

Once again, a little bit aggressively,

> **Unfortunately, the FCC's ruling did not go so far as deeming applications approved in the event that a municipality does not strictly adhere to the deadlines; nevertheless, the shot clock ruling certainly is helpful.**

CTIA wanted the FCC to pre-empt any ordinance that required an automatic variance for a tower.

In response to CTIA's request and after an extensive public comment period, on Nov. 18, 2009, the FCC issued a declaratory ruling, which is commonly referred to as the shot clock ruling. In the shot clock ruling, the FCC declared that 90 days to process an application for a collocation on an existing telecommunications site

and 150 days to process an application for a new tower were reasonable periods.

The FCC gave municipalities 30 days to review applications for completeness. I work with a planner in Virginia Beach, Va., who uses a form letter to deny applications that are incomplete. When he sees something is missing from an application, he sends the applicant a denial letter right away. At least that is clarity. With complete applications, municipalities now must comply with the shot clock ruling's deadlines.

Unfortunately, the FCC's ruling did not go so far as deeming applications approved in the event that a municipality does not strictly adhere to the deadlines; nevertheless, the shot clock ruling certainly is helpful in going through the process.

In January, the FCC shot clock ruling was upheld by the Fifth Circuit Court of Appeals in *City of Arlington v. Federal Communications Commission* (Case No. 20-60039). It's the first case in which a federal court has confirmed that the FCC has the authority to interpret the Act and that the shot clock ruling complied with the rulemaking requirements of the Administrative Procedure Act.

It was thought that the FCC's definition of prohibition would be helpful in the Mid-Atlantic region in the states falling under the jurisdiction of the Fourth Circuit Court of Appeals because the Fourth Circuit had previously ruled that the term "prohibition" did not preclude local governments from denying applications because one or more carriers already have coverage in a particular search ring. However, after and despite the *City of Arlington* case, the Fourth Circuit in two cases where prohibition was alleged later opined that it did not have to defer to the FCC's interpretation of the term "prohibition," rejecting arguments made by T-Mobile and AT&T in *T-Mobile Northeast LLC v. Fairfax County Board of Supervisors,* No. 11-1060, 2012 WL 664504 (4th Cir. Mar. 1, 2012), and in *New Cingular Wireless PCS, LLC d/b/a AT&T Mobility v. Fairfax County Board of*

Supervisors, No. 10-2381, 2012 WL 922435 (4th Cir. Mar. 19, 2012).

Harmful land use

From their perspective, municipalities are protecting citizens from harmful land uses. I represent people who develop and operate gas stations and all kinds of other land uses that some people don't like. Municipalities are not singling out the wireless industry. They see regulating land use as a way to keep us or anyone else from harming citizens. Thus, land use regulation starts from a place of "No." So from the municipal perspective, antenna site developers who ask for approval are asking for something that isn't available by right. It's not automatic. There's a healthy dose — some might say more than a healthy dose — of skepticism. Wireless facilities are typically conditional uses, special uses or variances, but in general, across the board, it's a land use that by its very nature is deemed to be incompatible with other land uses. Antenna site developers have to mitigate any potential effects through conditions or demonstrate that there aren't going to be any effects from the proposed use given the location, design, etc., in order to secure an approval.

Questions

The common questions fall on two sides. The first side involves technology. "Why do you need this antenna facility?" The question often is followed quickly by the demand, "Prove it." Local authorities hear about the possible coming use of smaller antennas and fewer antennas, and they want proof that carriers need what they say they need.

My answer to that is frequently to ask, "Would they have hired a lawyer if this wasn't something that's very important to their business plan?"

Local authorities are going to ask, "Are you done yet? How many more are you going to need? Why so tall? Why so many antennas? Why does it have to be *here*? Is it safe? And what are your long-term plans?" That's my favorite question. "Tell me what your network development needs are going be in the

next five or 10 years. What's the total number of towers that you're going to need in our jurisdiction? When will your network be complete?"

Some questions on the other side involving aesthetics, safety and noise are: "What's it going look like? Will I see it? Will I notice it? Will it hurt me, my family or my property?" People's lives have been affected by the weak state of the economy. You're asking them for their permission to construct a facility that the ordinance deems incompatible with their uses, and they really want to know how this is going to affect them. "Will it fall in heavy wind, an earthquake or a natural disaster?" some may ask.

In El Paso, Texas, part of a faux palm frond fell onto someone's car from a tower disguised as a palm tree. It nearly struck the driver. These types of incidents raise safety concerns.

People also may ask, "Will I hear noise? Is there a generator? Is the generator going to make noise?"

Local officials are well versed in analyzing planning and impact issues. They're less experienced with technology issues, the Telecom Act, the shot clock ruling, and even the wireless facilities provision in Section 6409 of the Middle Class Tax Relief and Job Creation Act. These are not aspects of land use decision making that they're necessarily going to know, and site developers may have to educate them.

Yet, education from the industry is typically ad hoc. If I go in with an application on behalf of a carrier client, I'll help to educate the local officials about the technology and what's going on. However, site developers, carriers and industry representatives normally only come before the local governments when they need sites approved. They usually are not around when it's time for ordinance changes, which is why we encourage our clients to stay involved, especially if they expect to develop sites in the future in a particular municipality. When it comes time to revise local tower ordinances, most municipalities are looking for industry input, and given the nature of the industry, that is often difficult to find. ■

This article is based on Lisa Murphy's presentation during an AGL Regional Conference session, "What We Must Teach Municipalities About Wireless," conducted at the Las Vegas Convention Center in collaboration with IWCE.

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July/August 2012

The New York City Subway boasts musicians who perform in the stations and artwork that decorates tunnels and platforms, not to mention 1.563 billion riders annually, many of whom want to use their wireless devices while underground.

Data Down Under: Wireless Voice and Data Come to New York Subways

Transit Wireless, AT&T and T-Mobile collaborate to bring the first wireless voice and data services to New York City Subway stations.

By Ernest Worthman

It was a long time coming, considering the almost ubiquitous proliferation of wireless voice and data in the 21st century, but wireless telecommunications service is becoming a reality in the New York City Subway. One of the last bastions of wireless isolation in America is about to fall.

Under a Metropolitan Transportation Authority (MTA) license agreement, Transit Wireless will contract with AT&T Wireless and T-Mobile USA to deploy wireless voice and data

communications capability in six New York subway stations as part of a pilot program. The remaining 271 stations are expected to be wired and operational by 2015. There are also plans to put RF in the tunnels, but for now, the plan is to serve only the stations.

The project is expected to cost $200 million, including the cost of New York City Transit (NYCT) workers to provide flagging, protection and other services. The project cost is shouldered by Transit Wireless and the wireless

carriers. Payments from carriers will be split evenly between the MTA and Transit Wireless. Carriers will receive their revenue from the traditional wireless voice and data model.

The issues

New York's subway poses unique challenges to wireless coverage compared with other subways. Most of New York's subway stations were built 100 years ago. They were built with heavy steel girders that block radio sig-
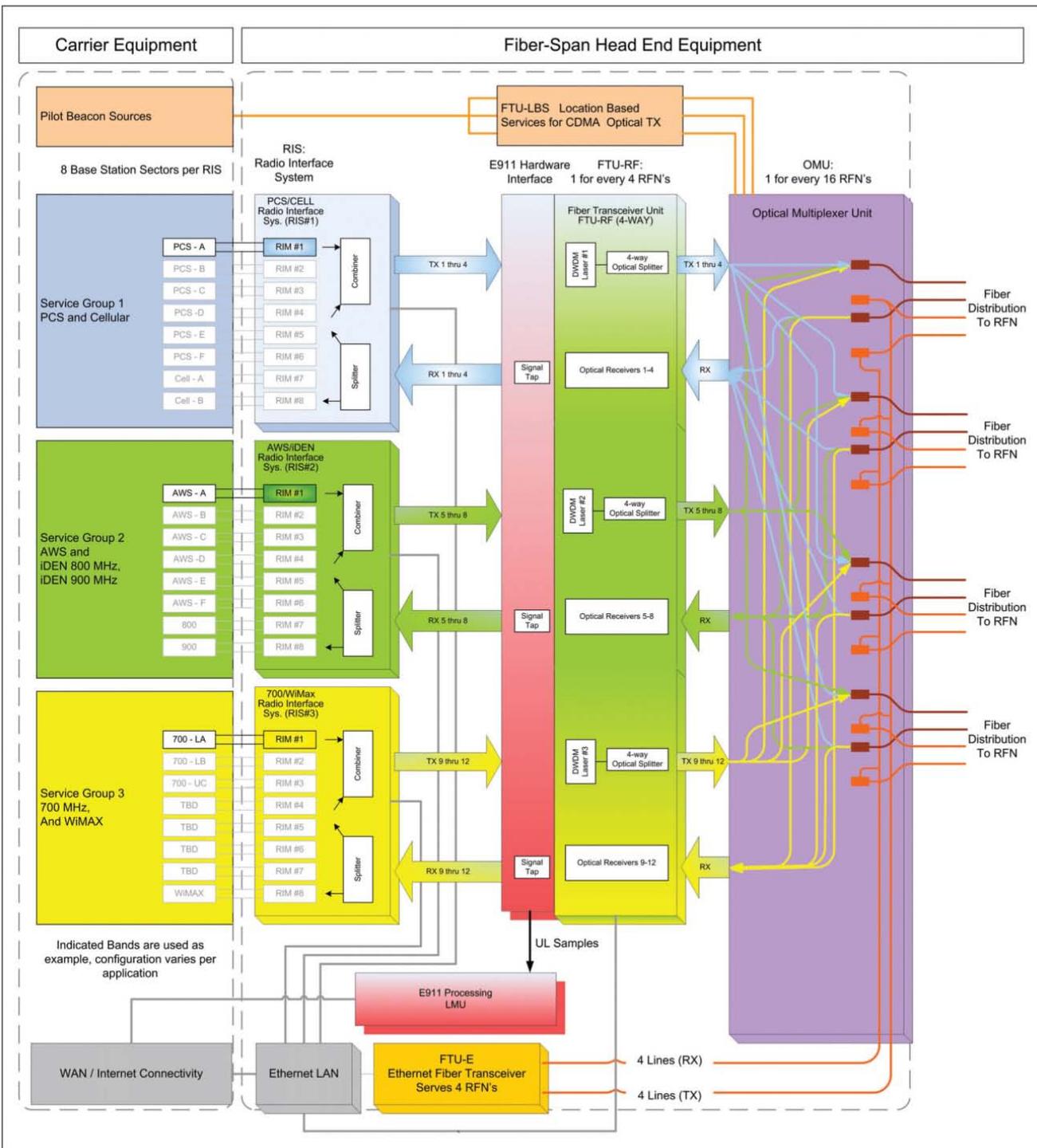
Figure 1. The wireless carriers' equipment and the fiber-span head end equipment share a base station hotel that posed less of a problem for system designers than the RF wave propagation and antenna aesthetics.

nals in some places and play havoc with propagation where they don't. The usual distributed antenna systems don't work well in the stations. Add to that the moving metal of the trains and it becomes nearly impossible to design a reliable and pervasive wireless system for use in such an environment. Steel is every-

where — even the steps in the staircases are covered in steel for durability.

And if that wasn't enough of a tough nut to crack, add nearly constant vibration and dust, mostly from train brakes. The combination causes problems for communications equipment. Dust multiplies the problems because if it

accumulates on ground plane surfaces, it can causes passive intermodulation (PIM) interference that further degrades signal integrity.

The solution

Extending cell phone service to the New York subway was a complex engi-

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distributed antenna systems

The antennas that hang from the ceiling resemble hanging lights, in effect hiding the antennas in plain sight.

Sealed enclosures protect remote fiber nodes from metallic dust ingress and thus require passive cooling — no ventilator fans.

Source: Transit Wireless

neering feat. Few off-the-shelf solutions were usable as-is. The useful off-the-shelf equipment needed re-engineering to meet the difficult environmental conditions.

For example, the remote fiber node with the integrated bidirectional amplifiers was intended to be mounted in public access areas. The integrated amplifiers had to be designed to handle seven frequency-band slots from 700 MHz to 2.7 GHz. Moreover, the box had to be specially designed to handle passive cooling because of the large amount of metal dust in the air. With ventilator cooling, the metal dust

One of the trickiest tasks was ensuring the cell site hand-off between underground and above-ground antennas as callers walked in and out of stations.

would be drawn into the unit and cause any number of failures. As a result, the boxes were designed to meet the IP66 specification for water and dust resistance. They also were designed for wall and ceiling mounting.

The infrastructure strategy involved routing fiber-optic cables along city streets and installing dozens of antennas. One of the trickiest tasks was ensuring the cell site hand-off between underground and above-ground antennas as callers walked in and out of stations.

Transit Wireless collocated the carriers' base stations with its optical distribution equipment in its fault-tolerant, environmentally controlled facility. Each carrier's base stations connect with Transit Wireless' radio interface and optical distribution system at the facility.

The technique combines the radio signals and converts them to optical signals for distribution on Transit Wireless' fiber-optic cables. These cables run throughout ducts under city streets to subway stations where the cables connect to multiband RFNs on every platform and mezzanine and at various points within public access passageways. Coaxial cable connects each remote fiber node and extends signals to strategically located antennas throughout each station. The elegant design distributes low-level radio signals everywhere to provide seamless coverage above ground near the stations to below ground. An integrated network management system monitors the service and if it detects a problem, it automatically dispatches a technician and logs the event.

The business side was equally tricky. Rather than let several cell phone companies put their antennas in the subway, MTA officials contracted with Transit Wireless to build the system and rent bandwidth to the cell providers. The company's major-ity owner is Broadcast Australia of Chatswood, Australia.

The two primary technological challenges involved RF wave propagation in an environment hostile to RF, and component (primarily antenna) aesthetics. The backbone equipment was less of a problem because it could be housed in a base station hotel, also known as a head end. Figure 1 is a block diagram of the head-end technology.

Camouflaged antenna

Some of the components integrated in this installation required a custom configuration. The antennas, for example, needed to be effective but somewhat inconspicuous when installed in the open. The approach was to hang them from the ceiling so they resemble hanging lights (see photo above left). Each antenna is fed by a 7/8-inch fire-retardant, low-smoke, zero-halogen (LSZH) coaxial cable. The vertically polarized antennas are either 2-dBi or 4-dBi gain omnidirectional units that handle up to 50 watts of RF input. The antenna intermodulation interference is rated at 140 dB.

The heart of the system

The remote fiber nodes — the heart of the system — on the platforms are highly flexible, modular, fiber bidirectional amplifiers that support seven frequency-band slots (see photo above right). The bands include 700 MHz (20dBm), 800/850/900 MHz (20 dBm),

and 2.7 GHz. The boxes offer three RF outputs, two ports at 20 dBm to 25 dBm, and a center port at −6 dB. Each port has a unique access point providing robust license-free bandwidth. The optical budget is 8 dBo, and support is provided for code-division multiple-access (CDMA), Global System for Mobile Communications (GSM), Long Term Evolution (LTE) and location-based services (LBS) technologies. Their service/ protocols are:

- 700 MHz (FDD/ Lower A, B and C, and Upper C)
- 800/900 MHz (FDD/rebanded spectrum)
- 850 MHz (FDD/cell band)
- 1.9 GHz (FDD/EPCS Band)
- 1.7/2.1 GHz (FDD/AWS Band)
- 2.4 GHz (three integrated access points)
- 2.7 GHz (planned for integrated picocell)
- 4.9 GHz (future for public safety applications)

- 5.8 GHz (future for miscellaneous applications)

The remote fiber nodes also include an unmanned switch providing a gigabit Ethernet link to and from the base station hotel to support Wi-Fi wireless connections and other time-division duplexing (TDD) technologies. The remote fiber nodes are connected to an external uninterruptable power supply to keep them operating should the AC power be interrupted.

The remote fiber node architecture forms a robust network management system using controller-area network bus (CANBus) technology. This design replaces conventional mobile wiring systems that have ungainly wiring, harnesses, relays and wiring joints with functional, solid-state network systems. The solid-state network components interface with

today's electronic mobile component. Meanwhile, CANBus systems are significantly more reliable and efficient, and drastically reduce the downtime for maintenance and fault-finding.

There are two types of fiber trans-

The remote fiber node architecture forms a robust network management system using controller-area network bus (CANBus) technology.

ceiver units in this system. One is for location-based services support, which allows a one-to-one connection of a pilot beacon with an individual remote fiber node to support CDMA geo-location to an individual platform, mezzanine or passageway. The other is for the licensed RF-to-optical conversion. The LBS location-based services fiber transceiver unit design is a feature-laden interface that provides geo-coding for handset-based CDMA mobiles. The optical signal is detected

distributed antenna systems

Figure 2. An optical management unit and communications controller round out the network management system that has a state-of-the-art, comprehensive and secure monitoring and control application. The network management system provides monitors, alarms and controls.

and routed to the appropriate band and amplified at −12 dB below the pilot signal at the remote fiber node.

Typically, there are three antennas per remote fiber node per subway platform. The remote fiber node is positioned in the center of a typical 600-foot-long platform along with an antenna, and two other antennas are placed 200 feet in each direction from the node. The antennas align with the

> **At the network management system, the display is a graphical user interface, so any user familiar with the Microsoft Windows interface can understand the data presented.**

ingress and egress points of the stations and thus minimize the amount of

additional infrastructure required.

Several other components, such as the optical management unit and the communications controller, round out the network management system (see Figure 2). It has a state-of-the-art, comprehensive and secure monitoring and control application. The network management system provides monitors, alarms and controls. The technology installed at the center includes servers running simple network management protocol Version 3 (SNMPv3). This protocol is the latest in interoperable standards-based protocols for network management. SNMPv3 provides secure access to devices by a combination of authenticating and

encrypting packets over the network. It provides both security models and security levels. A combination of a security model and a security level will determine which security mechanism is employed when handling an SNMP packet. What this all means is that the system can protect user data and provide a robust redundancy protocol for reliability via gigabit Ethernet and optical routing.

At the network management system, the display is a graphical user interface, so any user familiar with the Microsoft Windows interface can understand the data presented. All of this edge-of-the-envelope hardware, software and redundancy offers an exceptional link budget. The modular design allows components to be quickly and easily swapped out in case of a failure. In addition, the system

30 above ground level

Figure 3. Enhanced 911 services for GSM are integrated into the system by taking an uplink signal sample from each remote fiber node and assigning a unique location measuring unit port. Because the location of each remote fiber node is known, each location measuring unit port can be programmed and report into the E911 system to provide platform, mezzanine and passageway granularity.
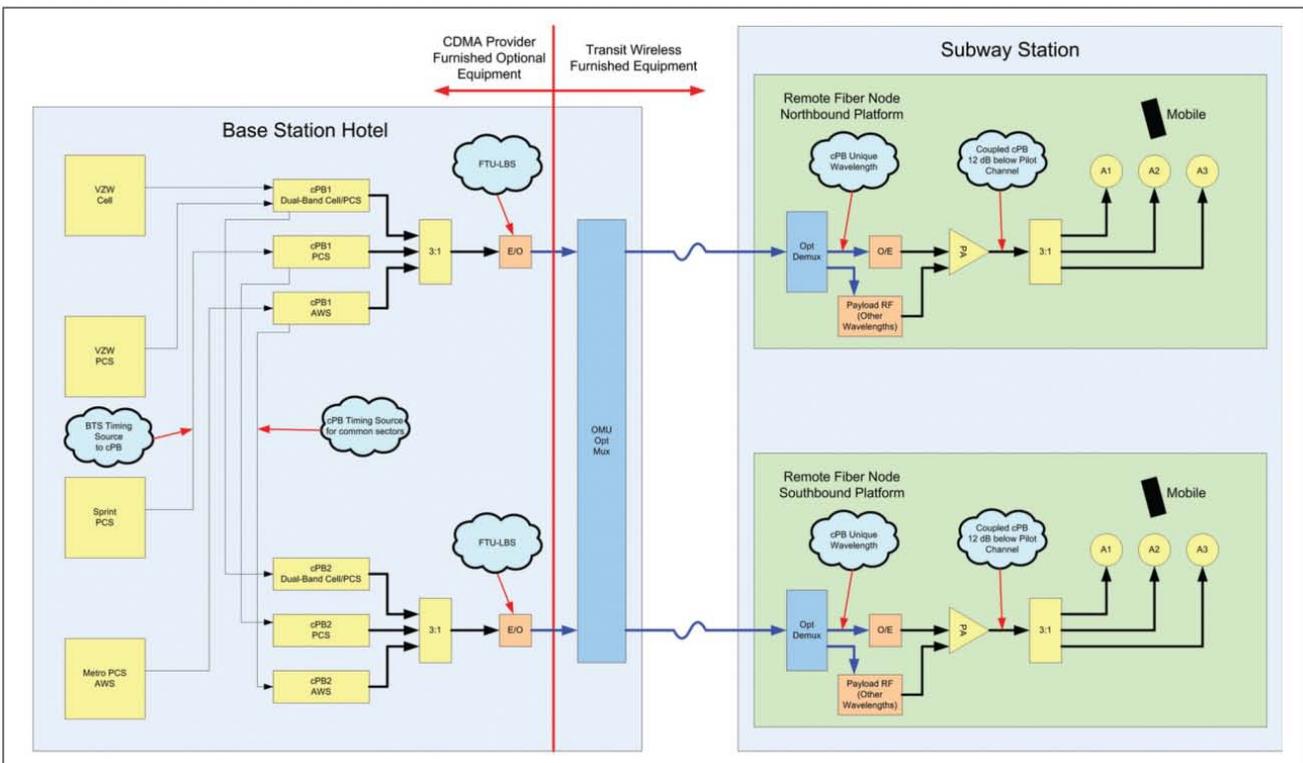
Figure 4. Enhanced 911 services for CDMA operate in reverse to that of GSM. A unique copilot beacon is generated for each remote fiber node that allows handsets to report their own locations.

distributed antenna systems

to be quickly and easily swapped out in case of a failure. In addition, the system is relatively future-proof so long as current frequency bands and frequency sub-bands remain the same. Redundancy features guarantee that the system will remain operational despite all but the most catastrophic failures.

Finally, enhanced 911 services are integrated into the system for both CDMA and GSM (see Figures 3 and 4). GSM is supported by taking an uplink signal sample from each remote fiber node and assigning a unique location measuring unit port. Because the location of each remote fiber node is known, each location measuring unit port can be programmed and report into the E911 system to provide platform, mezzanine and passageway granularity.

CDMA operates similarly but in reverse to that of GSM. A unique copilot beacon is generated for each remote fiber node that allows handsets to report their own locations.

A long time in planning and coming, the New York City Subway's mobile communications network is finally up and running. Although far from reaching the ultimate goal of ubiquitous wireless telecommunications interconnection from all points subterranean, the trial system is operating, despite a range of technical and political hurdles that no other subway system has had to overcome.

Outfitting trains

In the end, ingenuity, technology and perseverance won out. This means that future end-users can expect wireless voice and data throughout the station complex during the next few years. And as the stations are being wired for wireless, the engineers, planners, providers and politicians are busy developing and

Because the location of each remote fiber node is known, each location measuring unit port can be programmed and report into the E911 system to provide platform, mezzanine and passageway granularity.

discussing the technology that will put wireless telecommunications on the trains. Outfitting the trains will be a formidable undertaking, however, considering the propagation challenges in winding tunnels on moving trains made mostly of metal. But, that is what they once said about the stations. ∎

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LTE and the Future of Wireless Systems

LTE is going to be the dominant air interface technology. Each carrier will migrate at its own pace depending on the consumer devices it offers, the markets it serves and its particular price points.

From a presentation by John Celentano

John Celentano, a strategic marketing manager with Tessco Technologies, spoke at the AGL Regional Conference in Las Vegas, which was collocated with IWCE. Here are some of his remarks, edited for length and style.

LTE stands for Long Term Evolution, and they don't call it Long Term for nothing. The technology is in the early stage of deployment and development as a new standard in the industry for wireless.

LTE is important for a number of reasons.

First, it enables high-speed wireless Internet access. Earlier technologies such as code-division, multiple-access (CDMA) and Global System for Mobile Communications (GSM), are interfaces that were developed for and optimized for voice communications. By contrast, LTE is optimized for data, and voice becomes an app. It's an all-IP technology, and it promises to provide an access speed approaching 100 Mbps on the download.

Second, when it comes to transmitting video, LTE has an inherently lower latency compared with CDMA and GSM. With the proliferation of smartphones and other video-enabled devices, more and more video is being carried by wireless facilities today than ever before. We're not too far away from the picture-phone technology

Why LTE is Important

- Enables high-speed wireless Internet connections
- Provides high data throughput — nearly 100 Mbps D/L
- Offers low latency — important for video
- Boasts optimization for all-IP network — voice is an app
- Operates over different frequency bands (700/800 MHz, Cellular, PCS, AWS)
- Promises to be the air interface of the future
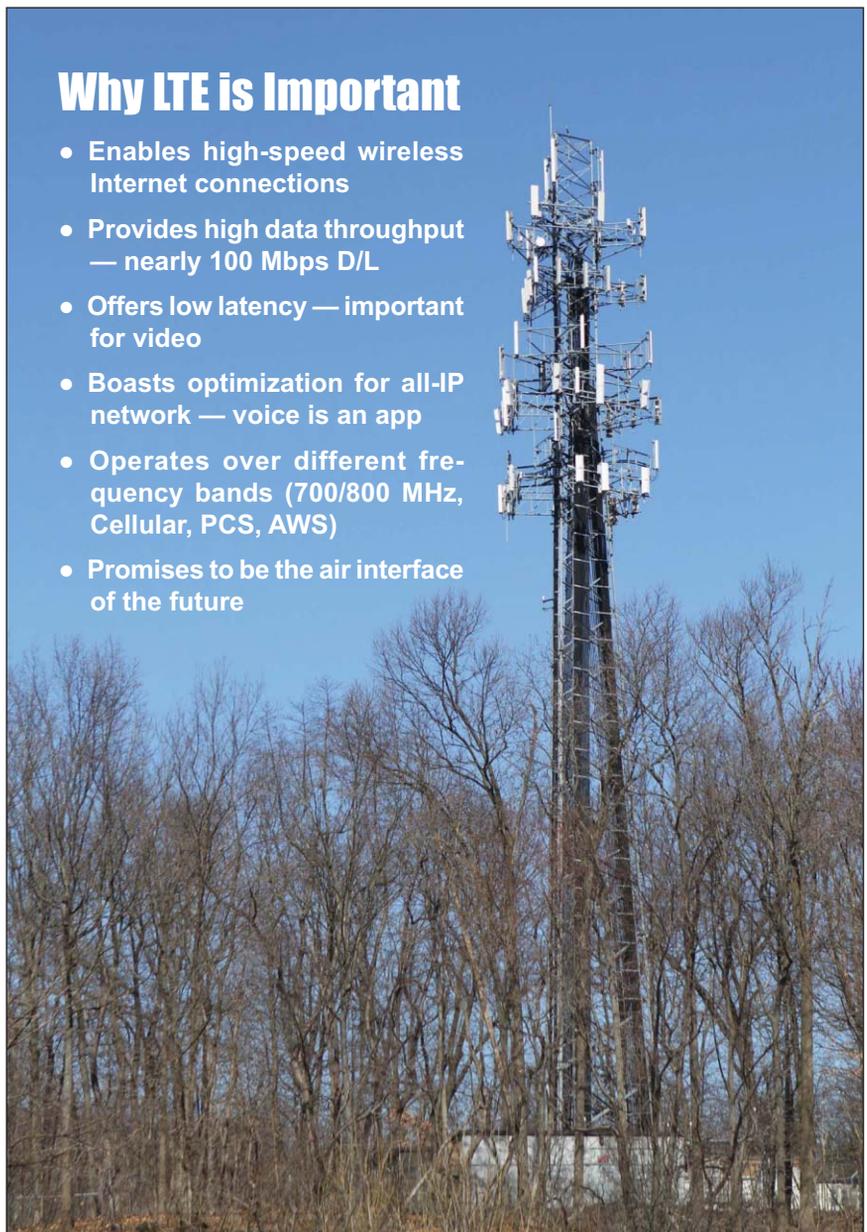
AGL Photo / Don Bishop

that AT&T talked about back in the '60s, but the problem at that time was insufficient bandwidth to make it feasible.

Third, LTE is optimized for all-IP networks. In the Internet age, all telecommunications services are IP-based, and LTE enables IP-based communications in a wireless environment.

Fourth, LTE is not frequency-dependent. On the contrary, it's frequency-agnostic. LTE deployments are planned across a number of frequency bands. We hear more about 700-MHz deployments because AT&T and Verizon use the band. But LTE is not limited to 700 MHz in particular. Other carriers are exploiting LTE in Advanced Wireless Services (AWS) bands, and even in the 1900-MHz cellular bands. Depending on the frequency available to the carrier and the customers that they're serving, LTE will find its way across multiple frequencies.

Thus, LTE is the air interface of the future. All networks ultimately will evolve to LTE. The timelines for the evolution and the amount of investment required will
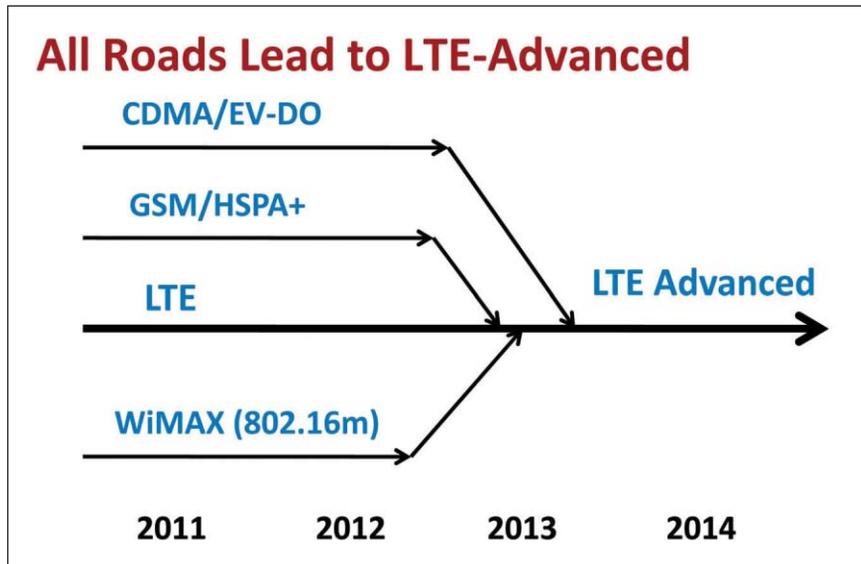
Figure 1. Standards provide a migration path for carriers using other technologies to move toward and adopt LTE as their long-term platform for delivering high-speed services over their networks.

vary by carrier and by markets served. The degree of adoption of LTE also depends on the availability of devices that can support multiple air interfaces. Carriers that are in the business today and that are considering LTE already have other services available on an installed base.

Migration by all carriers could take

technology

AGL Photo / Don Bishop

John Celentano: "LTE is the air interface of the future. All networks ultimately will evolve to LTE. The timelines for the evolution and the amount of investment required will vary by carrier and by markets served."

place in a few years, but it will happen because the standards defined in the various air interfaces that the carriers use all converge in LTE and shortly thereafter, LTE Advanced (see Figure 1). The standards provide a migration path for carriers using other technologies to move toward and adopt LTE as their long-term platform for delivering high-speed services over their networks.

Figure 2 lists some LTE projects that are under way. Progress varies by carrier. Verizon is moving from 3G CDMA, and its current technology is Evolution-Data Optimized (EV-DO). Verizon is adding LTE as an overlay. It won't be long before Verizon will figure out how quickly it wants to move its CDMA customers to LTE.

Prudent deployment

AT&T has lagged a little bit, in part to see how LTE plays out, and also pending the availability of the devices. The experience that Verizon has gone through with a few network outages suggests it is probably prudent to take a little more time to figure out how this technology works, how it ought to be deployed, over what time frame and in what markets. AT&T comes at LTE from a different di-

rection: GSM-based technology. AT&T has high-speed packet access (HSPA) deployed today, and then again, AT&T is overlaying its network with LTE.

Sprint, with its Network Vision project, is using multiple technologies — CDMA and EV-DO for its primary customers, and it has customers using iDEN that it wants to migrate away from iDEN as part of its Network Vision project. The iDEN customers ultimately will be rolled into LTE.

Clearwire started with WiMAX. The company indicated that it will deploy LTE in markets where its network already is up and running.

The secondary- and smaller-market carriers, MetroPCS, US Cellular, and C Spire, are CDMA and 1x carriers today, sometimes called 2.5G, but they're talking about using LTE. These companies bought spectrum in the 700-MHz band at the auctions that took place a few years back.

T-Mobile is in the mix for migrating its network from its HSPA deployment

Major U.S. LTE Initiatives (2011–2015)

- **Verizon — 3G (EV-DO) + LTE**
- **AT&T — 3G (EDGE/HSPA+) + LTE**
- **T-Mobile USA — 3G (HSPA+) + LTE**
- **Sprint — 3G (EV-DO) + iDEN + LTE**
- **Clearwire — 4G (WiMAX) + LTE**
- **MetroPCS — 2.5G (CDMA/1xRTT) + LTE**
- **US Cellular — 2.5G (CDMA/1xRTT) + LTE**
- **C Spire — 2.5G (CDMA/1xRTT) + LTE**

Figure 2. U.S. carriers have projects under way to migrate their networks to LTE technology. The pace of LTE build outs varies by carrier and by market.

to include LTE.

There is a lot of movement among the carriers involving LTE, and LTE is going to become the dominant air interface technology. But it's going to take some time. Each carrier is going to be moving toward LTE at a slightly different pace. The speed of each carrier's LTE deployments will depend on what

consumer devices it offers, the markets it chooses for its network upgrades, and its price points.   ∎

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standby power

Understanding Load Factor Implications for Specifying On-site Generators

The maximum permitted average load factor varies depending on the generator set's rating, the specific application and the manufacturer's recommended guidelines.

By Brandon Kraemer

One of the important steps in sizing generator sets for any application is to determine the application's average load factor. Understanding this parameter is essential not only for proper power system sizing but also for operability and reliability.

ISO-8528-1 limits the 24-hour average load factor on most standby generator sets to 70 percent of nameplate capacity. For utility outages lasting a few minutes or a few hours, one or two times a year, standby generator sets are designed to be loaded to 100 percent of nameplate capacity for the duration of the outage. However, if an outage lasts days instead of hours and the standby power system is loaded to 100 percent of its nameplate capacity, it is likely that the 24-hour average load will exceed the power system's design parameters.

While running a generator set at an average load factor over 70 percent is unlikely to result in a catastrophic failure of the standby power system, it may jeopardize engine warranties, reduce reliability and shorten the useful life of the generator-drive engines. It may also jeopardize the operation of mission-critical facilities where load factors are often high and constant. The following information reviews the concept of average load factor and the calculations used to determine an application's average load factor. It

Emergency standby generator sets capable of an 85 percent average load factor have distinct advantages in critical data center applications. (Photo courtesy of MTU Onsite Energy)

also suggests strategies to ensure backup power availability during extended utility outages and in applications with minimal load profile variability.

Average load factor

The average load factor of a power system is determined by evaluating the amount of load and the amount of time the generator set is operating at that load. Because the loads are normally variable, the result is found by calculating multiple load levels and time periods.

In Figure 1, a graph of a hypothetical standby load profile, the 24-hour average load factor is derived from the formula shown under the graph, where P is power in kilowatts and t is time. Although the generator set is loaded to 90 percent of its standby rating for a por-

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tion of the time, the average load factor over time is only 70 percent because of the natural variability of the building load. In practice, it would be unlikely that a standby power system would be initially sized so small as to require operating at 100 percent of capacity at any time during an outage. However, electrical loads are often added, and growing power needs may begin to tax the capacity of a standby power system. Any time that the generator set is offline does not count toward the 24-hour average load factor.

High mission-critical load factors

For most facilities with properly designed emergency standby power systems, the possibility of exceeding a power system's 24-hour average load factor limitation is remote. This is because most commercial facilities have variable load profiles that reduce the likelihood that a power system's 24-hour average load factor limitation will be exceeded, even during an extended outage. Many facilities also have noncritical loads that can be taken offline during extended outages to reduce the average load factor on the standby system, if necessary.

However, many mission-critical facilities have large, less varying loads that can severely stress standby power systems during an extended power outage unless steps are taken during system design to accommodate the potential for a higher average load factor. Two examples of mission-critical facilities with high load factors are data centers and semiconductor manufacturing. In data centers, the computer servers and HVAC equipment create high electrical

$$ALF = \frac{(P_1 \times t_1)+(P_2 \times t_2)+(P_3 \times t_3)+(P_4 \times t_4)+(P_5 \times t_5)+(P_6 \times t_6)}{t_1 + t_2 + t_3 + t_4 + t_5 + t_6}$$

$$ALF = \frac{(90 \times 4)+(70 \times 4)+(80 \times 4)+(50 \times 4)+(60 \times 4)+(70 \times 4)}{4 + 4 + 4 + 4 + 4 + 4}$$

$$ALF = \frac{360 + 280 + 320 + 200 + 240 + 280}{24}$$

$$ALF = \frac{1680}{24} = 70\%$$
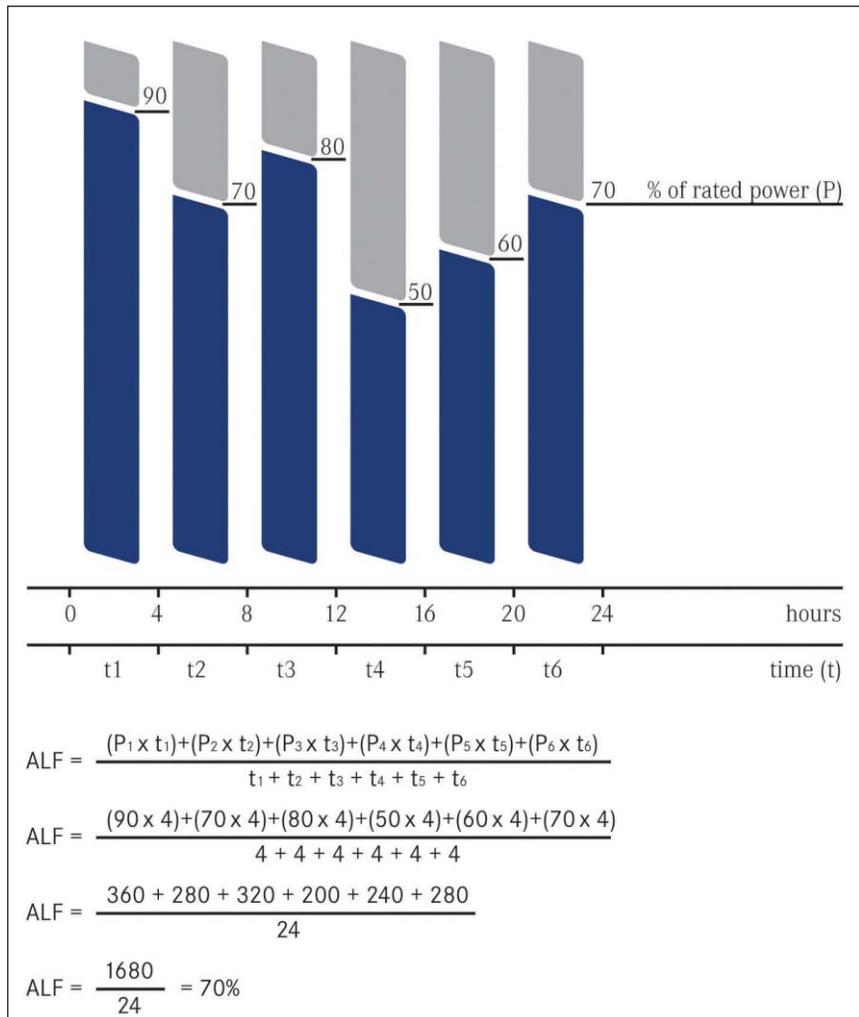
Figure 1. The 24-hour average load factor (ALF) is derived from the formula shown under the graph, where P is power in kilowatts and t is time, in this hypothetical standby load profile.

loads that can vary little over time. Similarly, very high load factors are found in semiconductor foundries, where electric furnaces cannot be shut down without destroying large amounts of product.

As a result of these large, steady electrical loads, the load profile in a mission-critical application is likely to have less variability, in turn putting a more constant demand on the standby power

standby power
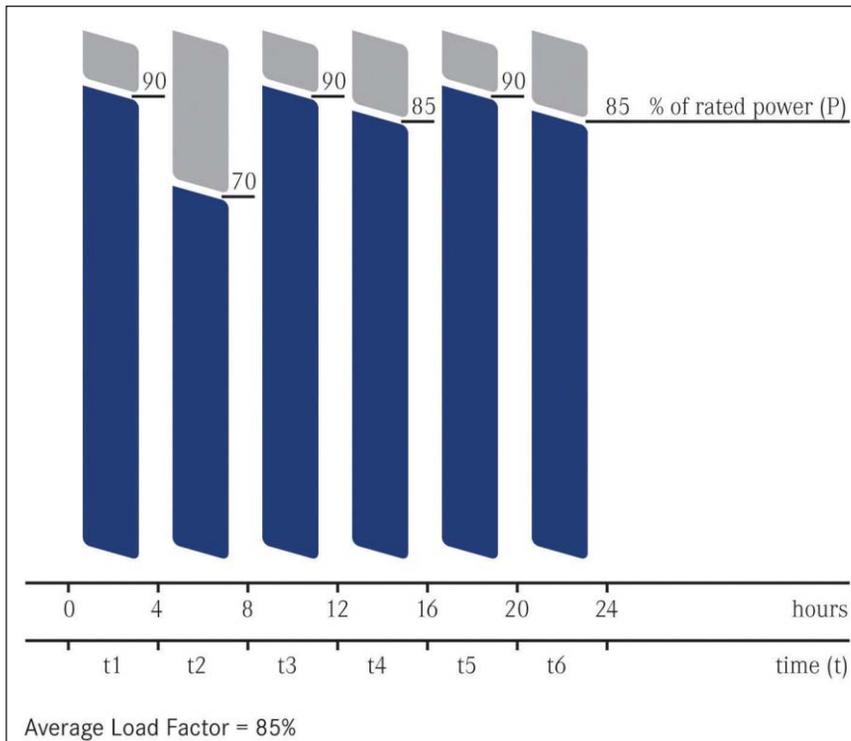
Figure 2. Although the generator sets are not loaded to 100 percent of their standby rating at any time, the average load factor during an outage in this example is near 85 percent.
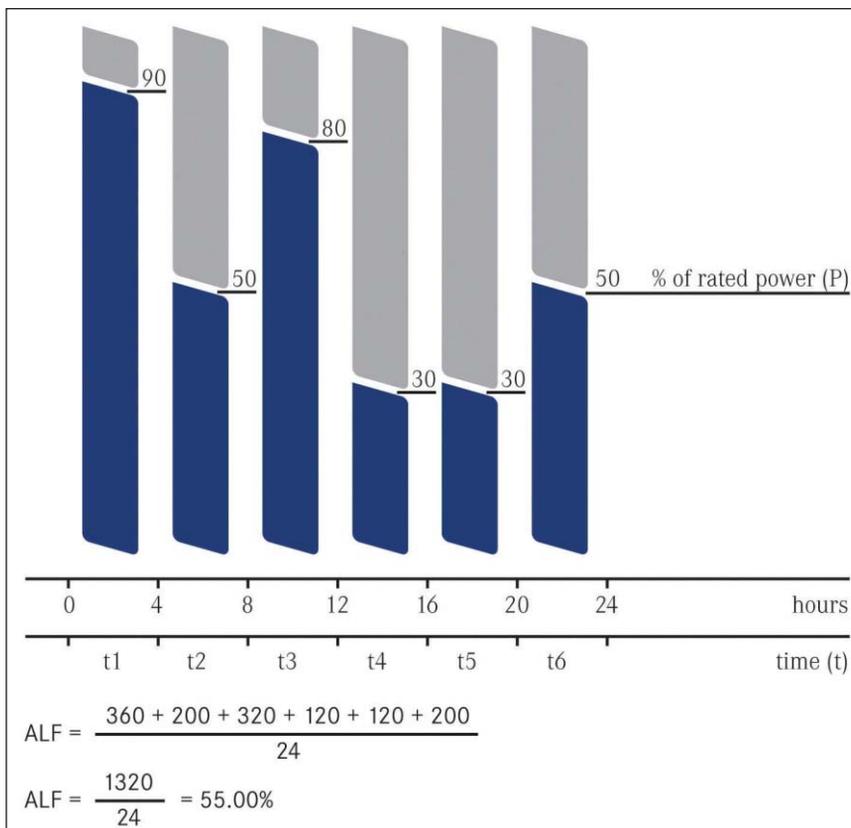
Figure 3. A typical load profile for an ESP-rated generator set. The emergency standby (ESP) rating is the maximum amount of power that a generator set is capable of delivering, and it is normally used to supply facility power to a variable load in the event of a utility outage.

system. Less load variability results in a higher average load factor that will require either specifying a system with larger or more generator sets capable of a 70 percent load factor, or specifying generator sets capable of higher than a 70 percent load factor.

Figure 2 shows that although the generator sets are not loaded to 100 percent of their standby rating at any time, the average load factor during the outage is near 85 percent. In this case, the customer has taken advantage of generator sets capable of an 85 percent load factor that can deliver more than 20 percent additional kilowatts than generator sets rated to only a 70 percent average load factor.

Defining genset standards

Standards that apply to all generator sets are those established by the International Organization for Standardization (ISO). ISO defines how to measure and rate many quality and performance parameters. All major generator set manufacturers utilize this standard to communicate their generator set ratings to their customers. In particular, ISO 8528-1 describes how to establish generator set ratings, measure performance and evaluate engines, alternators, controls and switchgear.

ISO-8528-1 sets a maximum 24-hour average load factor capability of 70 percent for both standby- and prime-rated generator sets, unless a higher average is agreed to by the engine manufacturer. This means that a 3,000-kilowatt generator set meeting this standard must be able to provide an average of 2,100 kilowatts per hour over a 24-hour period. In emergency standby applications, this means that the average load factor that can be sustained by most generator sets over an extended outage of 24 hours or more cannot exceed 70 percent of the nameplate standby rating, a factor that affects generator set sizing. In contrast, MTU Onsite Energy allows an 85 percent average load factor on emergency standby rated generator set models above 200 kilowatts. For example, an MTU Onsite Energy 3,000-kilowatt generator set can deliver a 24-hour average of 2,550 kilowatts — a difference of

450 kilowatts. For certain applications involving multiple generator sets, this higher average-load-factor capability may reduce the number of generator sets needed to supply the load.

ISO-8528 defines categories of generator set power output ratings:

Emergency standby (ESP) rating — The ESP rating is the maximum amount of power that a generator set is capable of delivering, and it is normally used to supply facility power to a variable load in the event of a utility outage. No overload capacity is available for this rating. ISO-8528-1 limits the 24-hour average output to 70 percent of the nameplate ESP rating unless the manufacturer allows a higher average load factor. Figure 3 shows a typical load profile for an ESP-rated generator set.

Prime-rated power (PRP) — A prime-rated generator set is available for an unlimited number of hours per year in a variable-load application, as long as the average load factor does not exceed 70 percent of the nameplate rating, unless the manufacturer allows a higher average load factor. This rating allows an overload capacity of 10 percent, but that additional capacity should not be used for more than one hour in every 12. The prime power rating for a given generator set is typically 10 percent lower than the standby rating. Figure 4 shows a typical load profile for a PRP-rated generator set.

Continuous power rating (COP) — The continuous power rating is used for applications where there is no utility power and the generator set is relied upon for all power needs. Generator sets with this rating are capable of supplying power at a constant 100 percent of rated load for an unlimited number of hours per year. No overload capability is available for this rating. The continuous power rating for a given generator set is typically 25 to 30 percent lower than the standby rating. Figure 5 shows a typical load profile for a COP-rated generator set.

Effects of load factor

Specifying standby generator sets with a higher-than-average load factor capability can sometimes be a benefit in mission-critical applications. System designers

July/August 2012

standby power

Figure 4. A typical load profile for a PRP-rated generator set reflects the common practice that the prime power rating (PRP) for a given generator set is typically 10 percent lower than the standby rating.
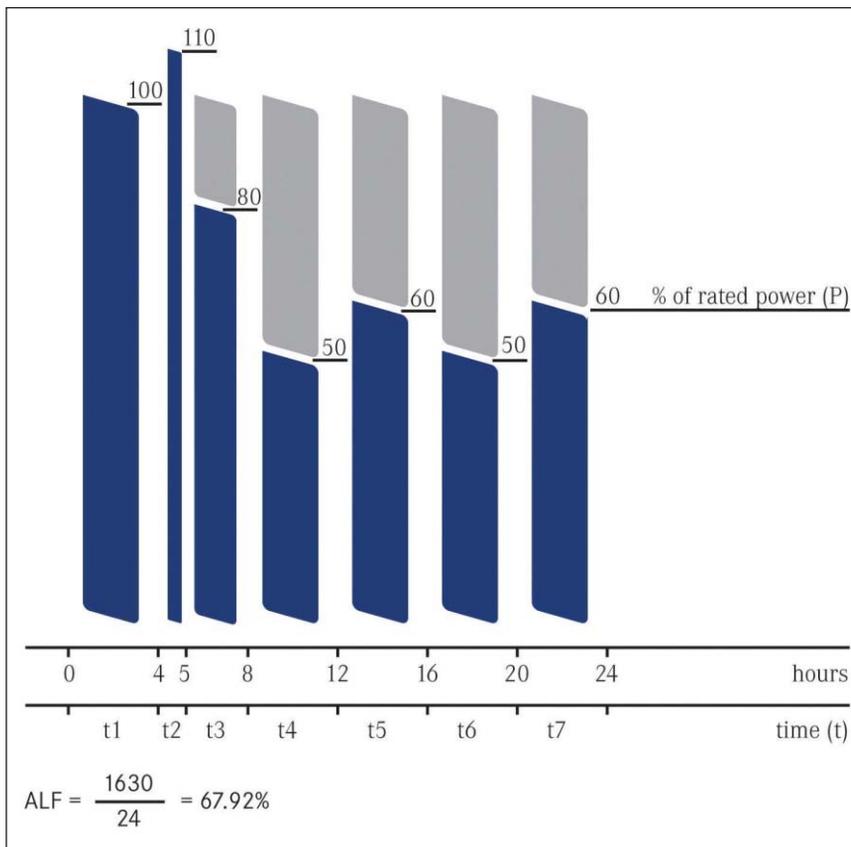
Figure 5. A typical load profile for a COP-rated generator set reflects the common practice that the continuous power rating (COP) for a given generator set is typically 25 to 30 percent lower than the standby rating.

may be able to reduce the size or number of generator sets by using units approved for 85 percent average load factor, as opposed to the 70 percent average load factor. For example, to design a standby power system to supply an average load of 11,000 kilowatts at a 70 percent average load factor would require eight 2,000-kilowatt generator sets. At a 70 percent average load factor rating, each generator set would be able to deliver up to a 1,400-kilowatt average, for a total capacity of 11,200 kilowatts over an extended outage of 24 hours or more.

$$8 \times 2{,}000 \text{ kW} \times .70 = 11{,}200 \text{ kW}$$

Using generator sets with an 85 percent average load factor capability would require only seven 2,000-kilowatt units. Each generator set would be able to deliver up to a 1,700-kilowatt average, for a total average of 11,900 kilowatts over an extended outage of 24 hours or more. That amounts to an extra 2,100 kilowatts of effective generating capacity for extended outages and a reduction by one in the number of generator sets needed.

$$7 \times 2{,}000 \text{ kW} \times .85 = 11{,}900 \text{ kW}$$

Conclusion

The load factor of any application affects the design and sizing of the standby power system, but for mission-critical applications, particular attention must be paid to load factors because of these facilities' minimal ability to reduce their electrical loads during extended outages. Although all major manufacturers of generator sets utilize ISO-8528-1 (which sets the average 24-hour load factor at 70 percent) as their standard, system designers can choose equipment that offers a higher average 24-hour load factor, which may, in turn, result in a system with smaller or fewer generator sets. In any case, specifiers of standby power systems for mission-critical applications need to understand average load factor and its implications for business continuity in the face of natural or man-made disasters. ∎

Brandon Kraemer is an application engineering supervisor with MTU Onsite Energy.

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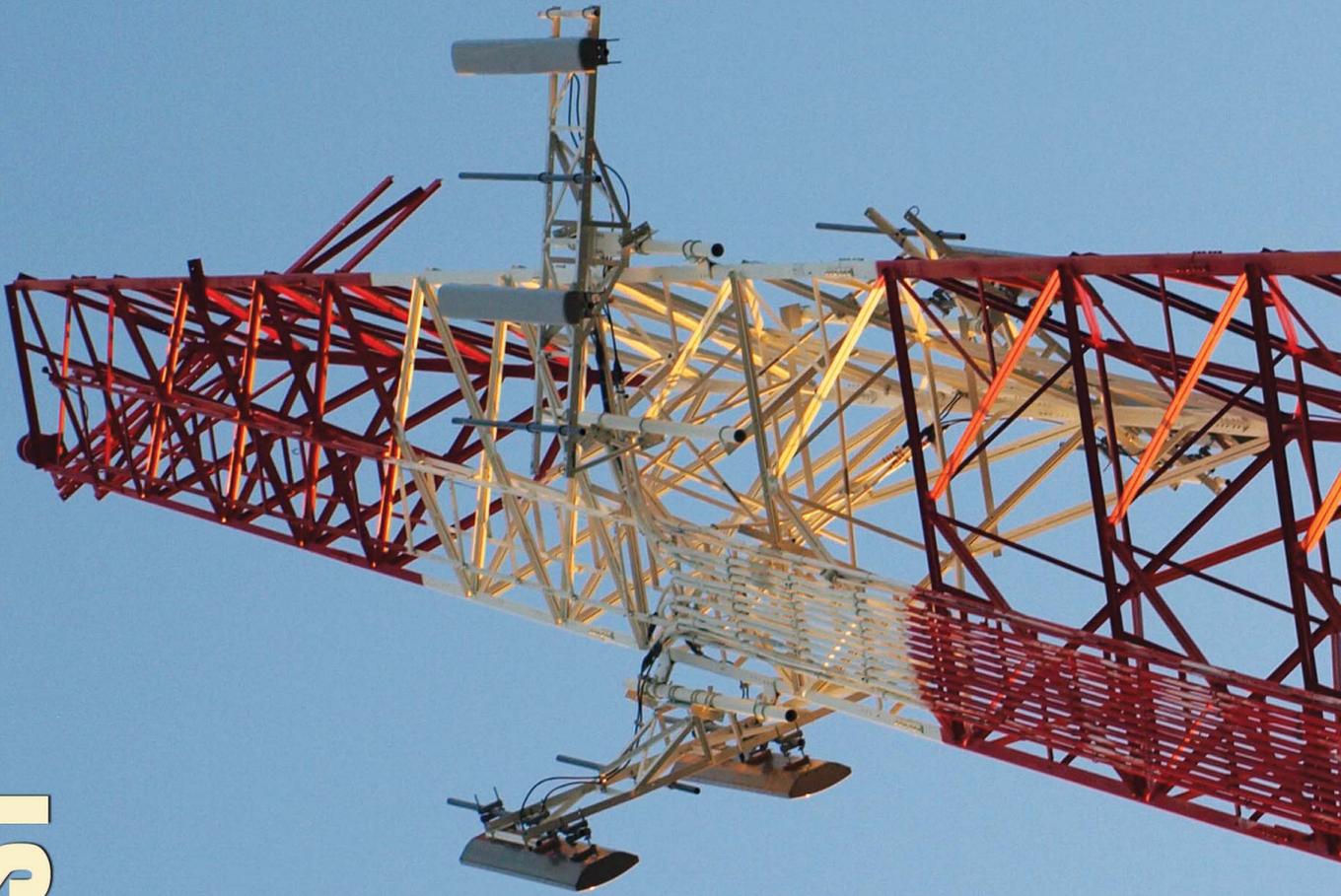
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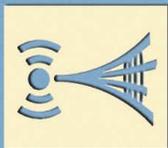
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AGL TOWER OF THE MONTH

SITE NAME
Cimme Avenue

TOWER OWNER
Verizon Wireless

TOWER TYPE
Self-supporting

HEIGHT
268 feet

YEAR BUILT
1992

LOCATION
Cedar Rapids, Iowa

tower market report

Operating and Financial Trends

Investing in towers is a technology-neutral way to play wireless capex. Whether a carrier's technology is WiMAX, HSPA or LTE, when new gear goes on the tower, it doesn't matter who's deploying it or what the standard is, the tower company benefits.

From a presentation by Jonathan Atkin

Jonathan Atkin, an equity analyst with RBC Capital Markets, made a presentation to an audience at the AGL Regional Conference conducted in Las Vegas, collocated with IWCE. Edited for length and style, these are some of his remarks.

Carrier build out plans and operating trends involving technology overlays and leasing amendments, master lease agreements, new cell site additions and distributed antenna systems affect the prospects of tower companies. The tower segment is among four that I focus on; the other three are data centers, wireless network operators and incumbent telephone companies.

Data centers include wholesale and retail operators along with Web hosting companies, so there is more variation within that universe of companies than there is within the tower or wireless model.

Towers have attractive drivers. Site leasing demand is fundamentally decoupled from what's happening in the broader economy. For example, in late 2008 during the recession, carriers still had to deploy what was left of their 3G build outs and get started on 4G and to keep growing their wireless businesses. And the wireless customers — they're unhappy with the service. So carriers have to continue to invest in infrastruc-

ture, and wireless capex never went down. Wireless carriers have top-line revenue growth trends, but the towers never went down during that cycle. So towers have a very robust model with very predictable growth. Wireless capex tends to fluctuate by operator from year to year. But in aggregate, the industry spends about $20 billion a year and that hasn't changed for quite some time. And

it doesn't look like it's going to change.

Wireless operators may be less attractive investments because of slowing growth rates, competitive pressures with penetration exceeding 100 percent, and most of the growth is coming from prepaid subscribers who represent less-profitable growth. Postpaid still dominates, which makes the United States a little bit different from Europe. The U.S.

U.S. Telecom Basics

U.S. Wireless Penetration: 100%
- Postpaid percentage of base: 78%
- Prepaid percentage of base: 22%
- Smartphones as percentage of postpaid base: 46%

Broadband
- Cable vs. telco share of broadband base: cable 55%, telco 45%
- Cable vs. telco share of subscriber gains: cable 80%, telco 20%

Video
- Relative share of video base: cable 55%, satellite 37%, telco 8%
- Telco vs. satellite video subscriber gains/(losses): cable 525K losses, telco 297K gains, satellite 216K gains

Landline Voice
- Relative share of voice base: Telco 80%, cable 20%
- Voice subscriber gains/losses 2011E: Telco 8.5M losses, cable 1.3M gains

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How Towers Are Positioned Within the Broader Investment Landscape

Internet/Datacenters (higher risk, higher reward)
- *Positive* — favorable demand/supply imbalance continues for most collocation providers
- *Negative* — capital intensive
- EBITDA multiples in high single digits to mid-teens, reflecting higher growth prospects

Towers (lower risk, modest upside)
- *Positive* — strong operating leverage due to fixed costs
- Accelerating site-leasing demand robust on strong wireless capex spending, 3G overlays, 4G build outs, aided by future spectrum build outs
- *Negative* — finite number of tenants; slowing growth once 4G build out complete
- EBITDA multiples in the mid/high teens. Free cash flow generative.

Wireless
- *Positive* — sector generates positive free cash flow
- *Negative* — subscriber growth slowing (or, at some carriers, reversing), device subsidies impede margin expansion
- EBITDA multiples in the mid-single digits

Incumbent Telcos
- *Positive* — stable dividends
- *Negative* — typically underperform in a stabilizing/improving economy
- EBITDA multiples in mid-single digits

Wireless Players and Growth Drivers

Postpaid Share

- Verizon 39.7%
- AT&T 31.4%
- Sprint Nextel 15.1%
- T-Mobile 11.5%
- US Cellular 2.4%

Prepaid Share

- Verizon 6.5%
- AT&T 10.4%
- Sprint Nextel 21.1%
- Leap Wireless 8.3%
- MetroPCS 13.1%
- T-Mobile 12.0%
- Tracfone 28.5%

Net Adds Mix

	1Q11A	2Q11A	3Q11A	4Q11E	1Q12E	2Q12E	3Q12E	4Q12E
Postpaid net adds	~425	~1,100	~925	~1,900	~1,125	~1,100	~1,000	~1,575
Prepaid net adds	~3,000	~1,400	~1,875	~2,625	~2,375	~1,500	~1,725	~2,575
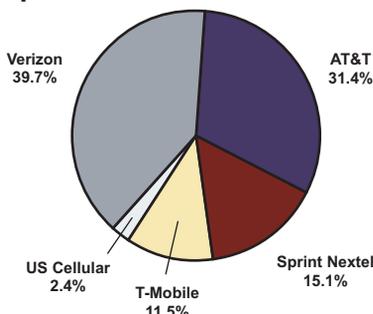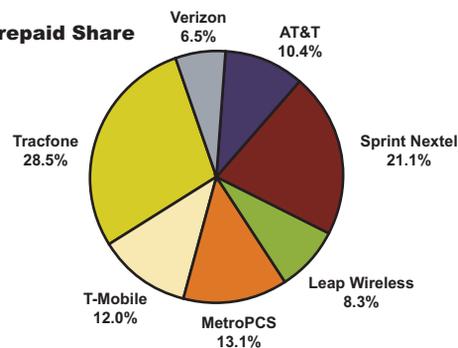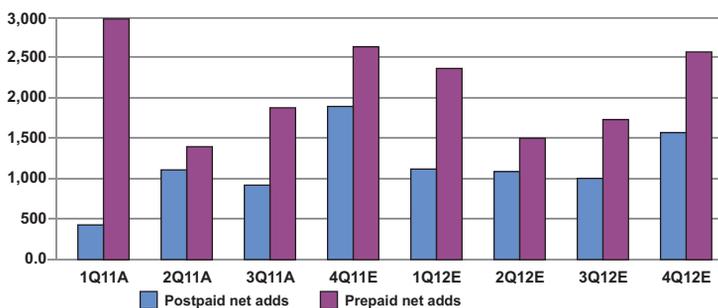
Drivers of Revenue Growth

% from postpaid subscriber growth	31.1%
% from postpaid ARPU growth	37.7%
% from prepaid subscriber growth	30.0%
% from prepaid ARPU growth	1.1%

Source: RBC Capital Markets

Source: RBC Capital Markets estimates, company reports

Figure 1. Postpaid is still the key, despite greater subscriber growth in prepaid.

tower market report
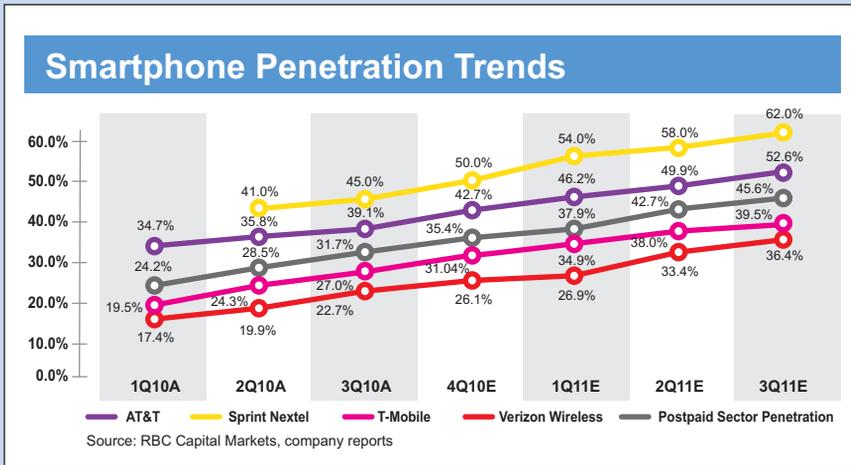
Figure 2. Smartphone penetration trends for postpaid carriers.
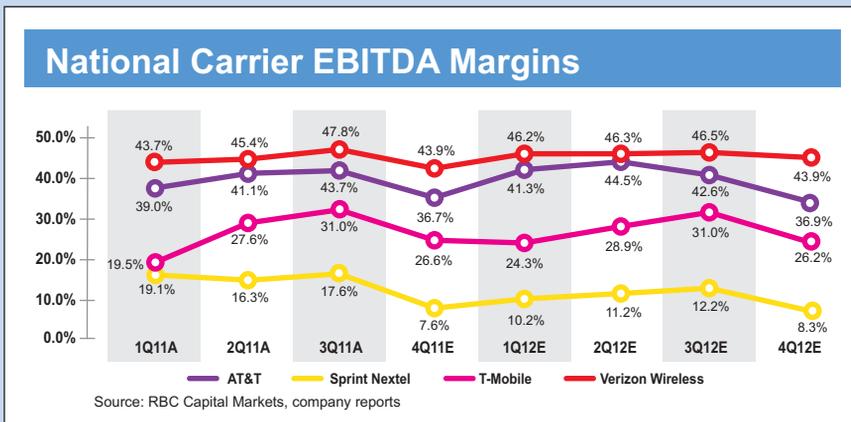
Figure 3. National carrier EBITDA margins.
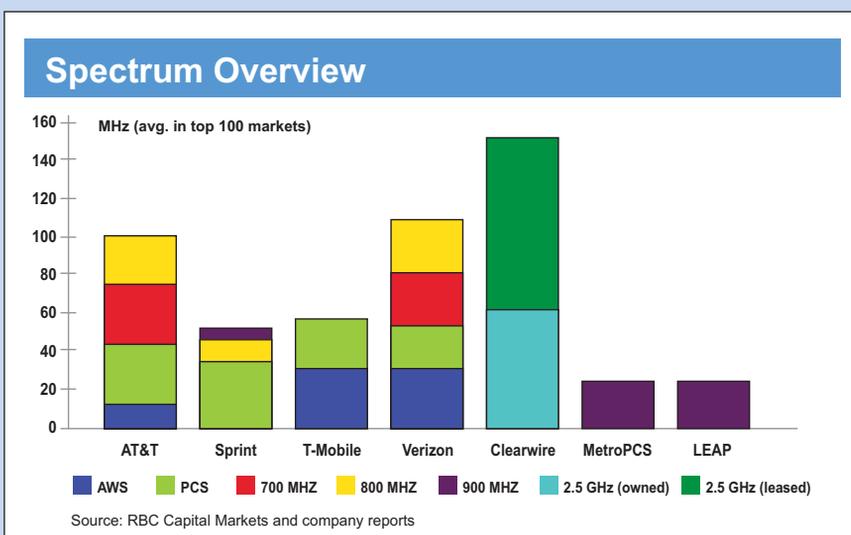
Figure 4. In a high-data-use market, a carrier may exhaust as much as 10 megahertz of spectrum per year. Unused private-market spectrum is available, such as spectrum owned or controlled by Clearwire and Dish Network. The potential exists for future auction of broadband licenses and further Advance Wireless Service licenses.

operators did a better job of growing in a postpaid-centric fashion. But for the past two and a half years, prepaid has outgrown postpaid subscriber volume.

The wireline business is stagnating. People are disconnecting voice lines, and that reduction is offset a little bit by broadband growth. The business is either a duopoly or a three-way competition depending on the sector: cable, satellite and telco.

As for capital expense (capex) spending among wireless carriers, we have been seeing roughly low twenty-billion-dollar levels of spending during the past couple of years, and it is expected to continue. Beyond next year, AT&T and Verizon are likely to reduce spending as they finish their LTE build outs. But then, that will be taken up by T-Mobile USA starting its LTE effort. Clearwire will be doing an overlay with LTE within its footprint. And then you can look forward to Sprint Network Vision really going full swing next year. It's already happening to some extent, but in 2013, Network Vision will have a full year of impact.

Majority postpaid

Figure 1 shows that growth of prepaid volumes exceeded postpaid volumes even though postpaid still comprises the majority of subscribers and by far the largest majority of cash flows. The three primary drivers are data growth among existing postpaid customers, an equal contribution from the remaining postpaid growth for Verizon and AT&T, and for Sprint, the iPhone. Even though prepaid average revenue per user (ARPU) is lower than postpaid ARPU, prepaid volumes are growing to such an extent that for carrier top-line growth, they probably contribute equally with postpaid ARPU growth and postpaid volume growth.

Smartphones form the majority of devices sold by the postpaid carriers (see Figure 2). The prepaid side is becoming more indexed toward smartphone sales, principally Android and maybe someday the iPhone.

Wireless margins have been flat and sometimes down (see Figure 3).

Device-makers have much power over the wireless industry. Everybody wants the hottest device, and for a long time, the American consumer has been accustomed to getting a subsidized phone — and even a relatively high-end phone — without having to spend more than $200 to $300. As a result, every time Verizon, AT&T or Sprint sells a smartphone, they are about $300 in the hole in terms of the subsidy. It takes them more than half a year to make up that investment. The subsidy on the device coupled with, in some cases, a sales commission is a real drag on margins, and it's prevented the wireless carriers from making much headway on margins.

Spectrum hunger

Figure 4 shows which company has which radio-frequency spectrum — it assumes that Verizon will be be successful in acquiring SpectrumCo. It reflects AT&T's recent loss of spectrum to T-Mobile. Those are the two leaders, which you would expect, because they also have the most subscribers. Sprint and T-Mobile probably will need more spectrum sooner. Sprint may choose to leverage the Clearwire relationship. And T-Mobile will use the licenses it obtained from AT&T, but during the next several years, T-Mobile will have to address its spectrum deficit perhaps through refarming some of its existing spectrum or making an acquisition.

In a large market such as Chicago, San Francisco or New York, a carrier such as AT&T typically will burn through 10 megahertz of spectrum in a year. The need for spectrum continues despite the many spectrum deals that have been announced. Carriers with growth that increasingly depends on data and broadband will be on a continual hunt for spectrum. Spectrum auctions probably will take place near the end of 2013 or in early 2014 for broadcast licenses that will be quite attractive. Some AWS spectrum, about 20 megahertz worth, remains, and it may come up for auction as well.

For carriers that can't wait for auctions, there's always Clearwire. Con-

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Tower Business Model Basics

Technology-neutral, carrier-neutral play on wireless network investment in response to data growth

- Top-line growth high single digits, cash flow growth teens or higher.

- Drivers: continued capacity and coverage expansion, 4G and even remaining 3G deployments.

- Fixed cost model – nearly 100% conversion from revenues to EBITDA to operating FCF.

- 2012 prospects promising. Growth drivers: Verizon/LTE, AT&T/LTE, and Sprint Network Vision, Growing T-Mobile and Clearwire contributions. Possibly DISH/S-band or new spectrum licenses longer term.

- EV/EBITDA multiples mid/high teens, below peak valuations in high teens/low 20s.

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tinuing discussions question whether somebody is going to lease or buy spectrum from Clearwire.

And the other interesting potential spectrum swap involves Dish Network's 48 megahertz of contiguous 2-GHz S-band spectrum. It has no GPS interference issue, as there was with Light-Squared. The spectrum may require a small guard band, but probably 38 megahertz of the 40 megahertz is fully deployable and contiguous, and it has relatively attractive propagation characteristics. It is not as attractive as broadband spectrum, nor the broadcast spectrum, but it's available now for the right price. So, all eyes are on Dish to see whether the company wants to build its own broadband network or lease or sell the spectrum.

Tower model

The business model for tower ownership is so powerful because of fixed-cost economics. Rent levels are known and well-established, and they typically escalate at 3.5 percent a year. It's a technology-neutral way to play wireless capex. It doesn't matter whether a carrier's technology is WiMAX, HSPA, LTE or whatnot, all of that requires new electronics or new software. And when new gear goes on the tower, it doesn't matter who's deploying it or what the

standard is, the tower company benefits. A fixed-cost model is quite attractive from a ground lease perspective and the other costs that go into operating expense (opex), which is probably less than $15,000 per site. If a tower has more than two tenants and has the potential for three tenants (the average public tower company has an average of 2.75 tenants per tower), a tower company basically maintains money. The question then becomes not only is the tower business viable or attractive, but also what does it do with all the cash it generates? Buy land? Buy more assets? Buy back stock? Pay a dividend? And so forth.

American Tower went the dividend route when it converted to become a real estate investment trust (REIT) on Jan. 1, 2012. It looks as though Crown Castle International may convert to a REIT in a couple of years, and then SBA Communications a couple of years after that.

In 2011, Verizon and AT&T built out their 4G infrastructure. That continued in 2012. What's new this year that's incremental is Sprint Network Vision. And we may see the beginning of T-Mobile's LTE infrastructure deployment. There will be some modest contribution from Clearwire's LTE overlay. Some of what Clearwire is doing is not very invasive and doesn't trigger rent amendments.

tower market report

American Tower		Crown Castle		SBA Communications	
Domestic wireless	81%	Domestic wireless	96%	Domestic wireless	96%
- AT&T Mobility	20%	Sprint Nextel	20%	AT&T Mobility	22%
- Sprint Nextel	13%	AT&T Mobility	23%	Sprint Nextel	22%
- Verizon Wireless	12%	Verizon Wireless	20%	Verizon Wireless	16%
- T-Mobile	7%	T-Mobile	11%	T-Mobile	11%
Domestic (other)	15%				
International wireless	29%				
Domestic Broadcast	4%				

Source: RBC Capital Markets and company reports

Table1. The tower operators' exposure by carrier — Sprint leasing exposure is more iDEN-centric for American Tower because of its SpectraSite acquisition and more CDMA-centric for Crown Castle and SBA Communications. Apart from the commercial providers, tower tenants include federal, state and local government agencies, and businesses such as utility, construction, courier, taxicab and private transportation companies.

Towers: Carrier Site Leasing Trends and Outlook

RBC Capital Markets Wireless Cell Site Addition Estimates as of Dec. 13, 2011
(data includes site-equivalents from amendments/overlays)

Carrier	2004 adds	2005 adds	2006 adds	2007 adds	2008 adds	2009 adds	2010 adds	2011 adds	2012 adds
AT&T new sites	2,950	3,900	2,900	930	1,454	1,889	1,822	2,450	1,500–1,800
AT&T lease equivalents added from overlays	860	2,200	6,500	1,875	2,500	1,400	2,200	6,200–7,600	4,100–5,700
T-Mobile new sites	2,095	3,500	3,299	2,500	3,359	3,062	2,236	1,000	1,100
T-Mobile lease equivalents added from overlays				2,000	2,000	2,792	1,381	750	1,400
Verizon Wireless new sites	1,500	2,647	2,642	2,418	2,426	1,600	327	1,100	1,050
Verizon Wireless lease equivalents added from overlays	2,500	2,500			200	1,750	2,400	2,500	2,500
Sprint Nextel new sites	5,875	4,900	3,400	1,450	920	175	230	400	300–600
Sprint Nextel lease equivalents added from overlays				1,338	420		125	500	3,250–5,100
Alltel	550	500	600	300	500			100	
Cox						200	150		
US Cellular	672	572	500	420	400	402	366	500	300
Clearwire new sites	200	400	783	1,045	1,000	4,175	9,500	1,500	
Clearwire lease equivalents added from overlays						130	150	300	1,300
Leap Wireless	100	2,800	3,600	700	2,700	2,200	150	100	100
Metro PCS	460	315	500	1,100	1,850	1,100	150	300	200
Metro PCS lease equivalents added from overlays							150	150	200–400
LightSquared									
Total	17.8K	24.2K	24.7K	16.1K	19.7K	20.9K	21.3K	17.9K–19.3K	17.3K–21.6K

Note: Lease equivalents from overlays are based on assumptions that UMTS and LTE overlays trigger partial leases based on additional or replacement antennas and additional cabling. Source: RBC Capital Markets estimates and company reports

Table 2. Wireless carrier site leasing activity includes data from prior years and a projection of leasing activity for 2012.

Carrier 4G Activity Timelines

Carrier	2010	2011	2012	2013
Verizon	LTE networks launched covering 110 million POPs	LTE network expanded to 200M POPs	Nationwide LTE coverage complete	
AT&T	Initial LTE trials	LTE market launches covering 75M POPs	Doubling of POP coverage to 150M by year-end	Nationwide LTE build out by YE13
T-Mobile	HSPA+21 covered 200 million POPs	HSPA+42 begun, covering 140M POPs by YE11	HSPA+84 under consideration. Initial contours of LTE overlay are taking shape, triggering large-scale lease amendments.	
Clearwire	WiMAX coverage to 118M POPs	WiMAX coverage expanded from 118M to 130M POPs	Overlay of 8,000 cell sites with LTE over two-year period 2012–2013. Initial focus on 5,000 sites.	
Sprint	Resell of Clearwire WiMAX capacity	Network Vision: announced in Dec 2010, plans to spend $5B, anticipate completion by 2016	Six initial LTE markets to launch mid-year	
Metro PCS	LTE deployed in Las Vegas, Dallas/FW, Detroit, L.A., Philadelphia in 2H10	LTE launched in all major metro markets	Introduction of voice-over-LTE handsets	
Leap Wireless		LTE launched in Tucson, Ariz.	25M POP coverage with LTE planned by year-end	2/3 LTE footprint coverage planned (~60M POPs)
US Cellular		Initial market completed in 4Q11	Initial 4G LTE device (tablet) to launch 1Q12. Market rollouts expected in select cities in Iowa, Wisconsin, Maine, North Carolina, Texas and Oklahoma.	

Source: RBC Capital Markets, company data

Table 3. Wireless carrier site leasing activity includes data from prior years and a projection of leasing activity for 2012.

Depending on the vendor and depending on the market, some of what Clearwire is doing triggers a swap out of equipment or additional equipment on the site.

Table 1 shows public tower company exposure by carrier. For American Tower, the T-Mobile exposure is 7 percent, and 11 percent for Crown and SBA. SBA's acquisition of 2,300 towers from Mobilitie, which has a healthy exposure to T-Mobile, will send the T-Mobile percentage of revenue for SBA upward just in time for T-Mobile to start its build out and begin to move the leasing needle. Thus, T-Mobile's future LTE overlay may position SBA quite well, partly as a result of its existing T-Mobile business and partly as a result of the T-Mobile revenue that it obtains via the Mobilitie transaction.

Wi-Fi offload and femtocells could mute growth in traffic carried by macro sites, but they are likely to have little effect on leasing demand.

The use of nontower infrastructure such as distributed antenna system (DAS) networks will continue for both outdoor and indoor coverage. Tower company interest in this business segment was highlighted by Crown Castle's acquisition of NextG Networks and Newpath.

Additional income

Ground acquisition by tower companies provides them with additional real estate-based income and lessens exposure to a single owner. It provides a form of currency with ground owners.

The tower operating model compares favorably with most REIT categories, despite a lack of majority ground ownership. American Tower converted to a REIT on Jan. 1, 2012, and Crown Castle is contemplating a conversion around 2015. The principle reason is tax strategy.

A deal on the spectrum side that is a little bit below the radar is the Dish Network E Block licenses. The 700-MHz licenses that Dish owns are geographically complementary to licenses AT&T already owns. I would expect an AT&T-Dish transaction for 700-MHz band licenses to happen relatively soon and without much regulatory scrutiny. It involves only 6 megahertz. The licenses cover only part of the country, so it's more of a tuck-in transaction that seems fairly intuitive. And that would be in contrast to buying S-band spectrum, which is 40 megahertz and which would have more procedure barriers.

Table 2 shows carrier site leasing activity from 2004 through projections for this year. Four or five years ago, when EV-DO became highly relevant, HSPA analysis started to become more

tower market report

Sprint Network Vision – Market Timeline

City	Estimated Completion Date
San Antonio	early 3Q12
Dallas/Fort Worth	late 3Q12
Atlanta	early 3Q13
Baltimore	late 1Q14
Houston	late 1Q13
Kansas City, Mo.	early 4Q12
Washington	late 4Q14
Los Angeles	late 4Q14
Boston	late 3Q14
New York	late 4Q14
Chicago	early 2Q13
San Francisco	early 3Q13

Source: RBC Capital Markets research, based on industry sources

Table 4. Major markets where Sprint Network Vision will be a big incremental driver for site leasing activity this year have completion dates extending into 2014. The initial six LTE market launches do not represent complete markets. Instead, 50 to 60 percent coverage is likely to be reached in most markets when they launch at mid-year 2012. Partial coverage raises possible battery-life issues with wireless devices.

granular, not only for new sites but also for overlays because some overlays trigger meaningful lease amendments. The figure reflects calculations to cast amendments in broadband-equivalent (BBE) terms or the lease equivalent of an overlay, which is typically a quarter to a third of a lease. In a healthy year, you'll see 20,000 new sites or lease equivalents added by the entire wireless industry. And in a mediocre year like we had last year, it might be more mid-teens.

We expect more leasing this year compared with last year because of Sprint as an incremental driver and AT&T and Verizon as the dominant drivers. Next year, AT&T and Verizon leasing will wind down a bit, and Sprint will be contributing the full year's worth of Network Vision site leasing. T-Mobile will have a full year of site leasing, and then we'll have to see what happens with the S-band. Whether Dish builds out on its own or whether somebody else builds out those licenses, the build out for S-band licenses will deliver significant revenue for the towers.

Table 3 places carrier 4G activity on a timeline. Verizon is in first place, and it will have the majority of the major

population and even secondary population centers covered by the end of this year. Sprint expects to cover 120 million pops by the end of this year and maybe 100 million pops by the time the next iPhone refresh happens, which might occur in the fall or in the early winter. With those two bookends, Sprint may end the year at 120 million pops. We have Verizon ending the year at mid- to high-200-millions of pops. AT&T will be somewhere in between, and T-Mobile would bring up the rear. I don't know if T-Mobile will have any markets launched, but it probably will be deep in deployment mode by that point.

Clearwire already covers its footprint, which is 130 million pops, with WiMAX. It's not going to expand its markets but it's going to overlay its larger cities within existing markets with LTE. That's probably 100 million pops worth of LTE overlay activity by Clearwire, some of which triggers lease amendments and some of which doesn't. It depends on the vendor.

US Cellular is a secondary or tertiary driver, and Metro and Leap as well. Leap is going to end the year at about 20 million or 25 million pops.

Sprint Network Vision is the big incremental driver this year. Table 4 lists major markets and when they are going to be constructed. Six are set to be launched in the middle of the year. But LTE will not be launched on fully deployed networks. Perhaps 50 or 60 percent of the cell sites will be deployed with LTE. The completion date is post-launch because Sprint wants to satisfy customer demand and to some degree investor demand to launch markets when their deployment passes the 50 or 60 percent mark for coverage.

LTE and battery life

There are different philosophies involving LTE's effect on battery life. Early Verizon users with Android phones that are LTE and EV-DO capable saw battery life really go south on those multimode phones. Last year, AT&T launched a number of markets mid-year and in the fall. Its philosophy was to launch on a more mature network. The company actually delayed some commercial launches of LTE to wait for 75 to 85 percent cell site coverage because experience showed that when the phone cycles back and forth between 3G and 4G, that's what drains the battery as much as anything. By waiting, AT&T minimized the risk of disappointing customers about device battery life.

By the time Sprint launches in mid-2012, it will be interesting to see whether the company repeats Verizon's mistake and its customers have battery-life problems because the Sprint markets will be only 50 to 60 percent deployed or whether advances in device technology will overcome the problem.

On balance, national tower companies have towers where you would expect them, to follow population distribution. But for historical reasons, because many tower companies started in certain regions where they acquired towers from carriers, the results of those transactions gave them an overweighting. Crown and SBA are a little bit more indexed toward the Southeast but clearly they're both national companies as is American Tower. ∎

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tower market report

Show Me the Money: How Much Is My Tower Worth?

Among other things, tower valuations depend on capital availability, interest rates, ground lease control, lease-up potential, lease language and documentation. Current factors favor overall high valuations.

By the AGL Staff

Representatives of an investment bank, a private equity fund manager and two companies that own and operate towers spoke at the Tower Technology Summit in New Orleans. Here are some of their remarks, edited for length and style.

Clayton Funk: Where do you see valuations in the marketplace?

Larry Harris: The market has been very strong. The year 2011 probably is a year I would like to forget because with the overhang from the AT&T/T-Mobile USA merger there were many reasons not to do a deal. Almost the instant the merger was called off, our perspective on buying was transformed. During 2011, we had to be a lot more selective because of the potential risk of some of that overlap, even though no one knew exactly how the merger would play out.

The iDEN overhang remains, but a lot of the rest of the uncertainty is behind us, and the market is strong. If you have sites, if you have markets to build, you can find a large aggregator that is interested in buying them at or near historic high valuations.

Clayton Funk: Howard, you have had some exits from some of Peppertree Capital's investments and portfolio companies. How do you see the valuations?

Larry Harris: "If you have a tightly zoned site with a single tenant, as you add tenants, you're going to see multiples come down because then much of the growth is behind that site. If it is a four-tenant site and it has two tenants on it, it already has achieved 50 percent of the potential that it could ever have."
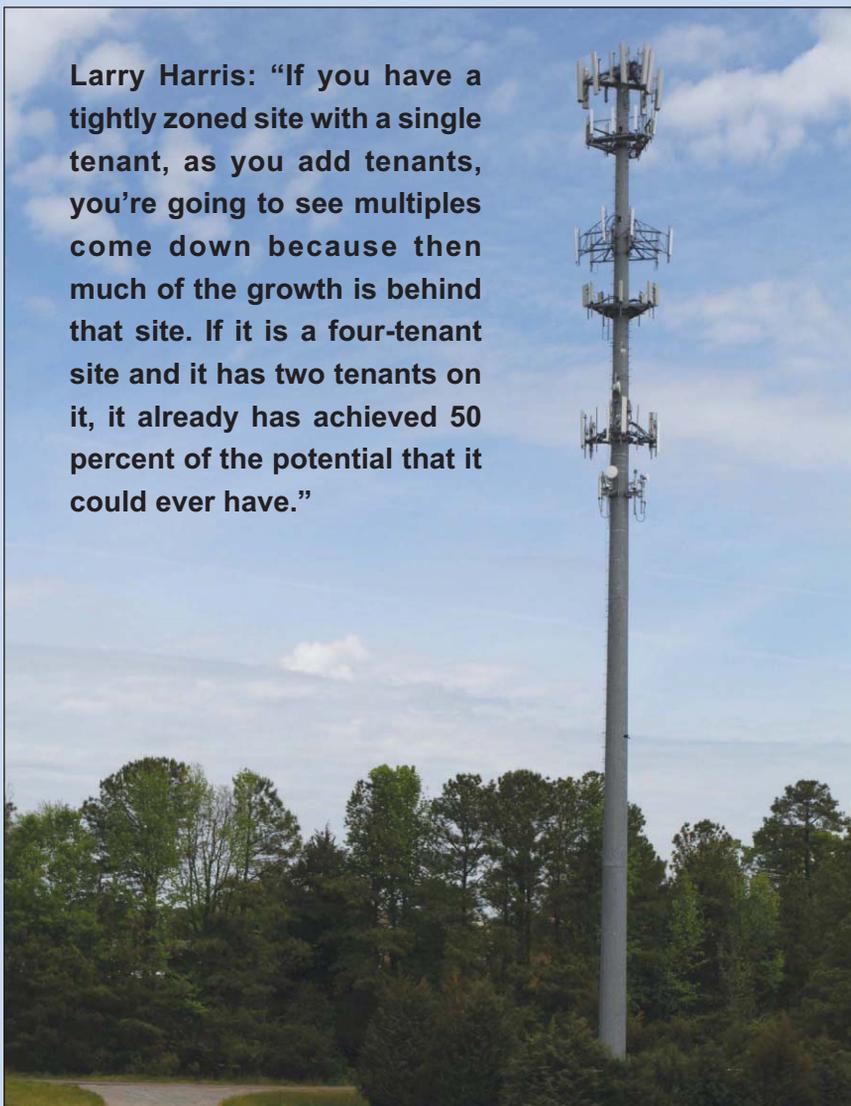
F. Howard Mandel: "The prices that folks like Larry pay now are almost irrelevant because the way the market values assets is in hindsight. We're going to look at that asset three years down the road and say, 'We picked up two tenants, so we didn't pay 24 times cash flow. In hindsight, we only paid eight times cash flow for that asset.' If he can drive anything down into that kind of range, it's going to be hugely accretive."

Howard Mandel: Valuations are strong now. There was a lull in the market just because of the ambiguity when the AT&T/T-Mobile USA merger was pending. The markets are at a big number. We are pleased with where they are.

Clayton Funk: How long are the high valuations going to continue?

Larry Harris: The multiple is a function of growth. If you're listing a single-tenant tower with opportunities for future lease-up, you're going to get a multiple that doesn't make sense in any other industry. But we all know the dynamics of this business. You build one tower with the first tenant on it and you suck wind until you get your second tenant, and all of a sudden you have to contemplate whether to hold on to the tower or sell it because now, for the initial investment made, it is a very attractive return.

Carriers have their choice, and developers have to be patient. You can figure it out in zoning. You know they are going to have to have this site, so you get out in front.

If you have a tightly zoned site with a single tenant, as you add tenants, you're going to see multiples come down because then much of the growth is behind that site. If it is a four-tenant site and it has two tenants on it, it already has achieved 50 percent of the potential that it could ever have.

If your friend who sold a tower got a different multiple, there is a reason. The price is a factor. It is harder to grow a million-dollar asset than a $250,000 or $300,000 asset.

Clayton Funk: Howard, what do you think about valuations in the next six months to a year?

Howard Mandel: The prices that folks like Larry pay now are almost irrelevant because the way the market values assets is in hindsight. We're going to look at that asset three years down the road and say, "We picked up two tenants, so we didn't pay 24 times cash flow. In hindsight, we only paid eight times cash flow for that asset." If he can drive anything down into that kind of range, it's going to be hugely accretive.

It goes back to the huge macro trends of how much data capacity it will take for the mobile networks to serve their customers. We've all seen the AT&T chart and know what that looks like. If you believe the chart, the multiple you're paying for towers is almost irrelevant. Whether you pay 24 times or 26 times cash flow, if you don't believe in this, then you shouldn't be paying the 24 times or 26 times. You'll end up with the same result.

Clayton Funk: Bill, your company had a recent sale of towers. How would you see the valuations of various sites differing from one another? When you sold your portfolio, did you see certain types of sites being valued higher than others?

William Wade: We spent much time leading up to our sale wondering whether intrinsic stick value or the cash-flow multiple was the driver. It

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R. Clayton Funk

Session Moderator
Managing Director
Media Venture Partners

Larry Harris

Vice President
Mergers and Acquisitions
SBA Communications

F. Howard Mandel

President
Peppertree Capital

William Wade

President and
    Chief Legal Officer
Central States Tower

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Larry Harris: "What's important to know if you're a tower owner or tower operator, or if you aspire to be a tower developer or own a tower, is that with the contracts you write with the carriers, you want to be as equipment-specific and frequency-specific as you possibly can."

ends up being both. We tried to have a portfolio with a blend. It happens almost by default; it is what you end up with after 18 to 36 months of building the portfolio. At certain times, there was a high amount of cash flow that helped to drive the cash-flow multiple, and then there are certain towers that have a lot of lease-up potential that helped to determine the value of the tower.

Everyone seems to have their own formula for assessing value. They all tend to roll to the same point, but they get there by different methods.

Clayton Funk: Valuations are tied to interest rates. As interest rates go up, valuations go down. Do you have predictions on when that would happen?

Larry Harris: If interest rates go up and we are locked in at 3 percent on our escalators, there could be confusion in the markets. There definitely is better access to capital among the aggregators and at much lower rates than we have ever seen. You're seeing many investors trying to get into the business. We probably can fund more opportunities than we can get our hands on. Because of that access to capital and because many investors are interested in the tower business, we're in one of those periods when we cannot do a lot that is wrong. Deals get announced, and the public companies are rewarded for them.

It's difficult to look back on a deal and say, "I really shouldn't have done that deal," because time has proven that these deals did justify the valuations. Availability of capital and interest rates has caused investor desire to get into the business. That is why we see the valuations supercharged right now.

Howard Mandel: It's the cost of capital and we're concerned about interest rates, but even more so the thing that keeps me up at night is concerns about inflation. The beauty of this industry is that if we don't add tenants — and we do add tenants — we know we are going to make 3 percent more next year. That's great, unless our dollars are worth 4 percent less next year. If there is a thing that could really mess the thing up, it's those macro things you see in the market right now with the government spending too much money and things that cause inflation.

Clayton Funk: Fifteen years ago, many leases were written with carriers that had a fixed escalator or the consumer price index, whichever was higher. Does that ever enter into negotiations with carriers?

William Wade: Most of the language dealing with building towers has something in there. Absolutely, the CPI is still out there and is a factor.

Clayton Funk: Would it be something for tower owners to start looking at putting back into leases if they can?

William Wade: We almost prefer the flat percentage because administratively it is difficult to constantly try to keep track of, first, what leases have a CPI escalator clause, and then, what it is for that particular part of the country. We're comfortable with a flat percentage. There are occasions when maybe we have left money on the table and could have benefited from it, but for our side it makes sense for us just to get the flat increase.

Howard Mandel: In the past, you had not left money on the table. In our company standard leases, we ask for a CPI escalator and almost never get it, for the reasons you're citing. It's too much of an administrative burden for the tower companies and for the carriers. I would suggest that if people can include as an escalator clause the higher of 3 percent or CPI, or 15 percent over five years or CPI, they should.

Clayton Funk: The tower market is hot. Valuations are at historic highs. It has been on a run like this for a little bit with a bit of a blip last year. I don't know if anyone else had the deer-in-the-headlights look last year on Sunday after the announcement of the AT&T/T-Mobile USA merger, but the announcement caused a drop in valuations for a little while. How have things changed from last year? What are the lessons learned from that period of threats of decommissioned

tower market report

William Wade: "For smaller tower companies, writing into the leases specific clauses about equipment and frequencies is difficult. ... Half of the time, we're just happy to have the opportunity to build a tower, and if we start trying to drive a harder bargain and dictate terms, many times the project won't happen and opportunities go away."

sites and overlap risk?

Howard Mandel: We once were called flippers, meaning our companies don't hang on to towers for our grandchildren. If you don't fall in love with the assets, then you have less of a concern like that. Our companies sell towers along the way. Don't put all your eggs in one basket. You don't have to have 1,000 towers. You could sell 10, you could sell 50, and not bear that risk; let Larry bear that risk.

Larry Harris: What's important to know if you're a tower owner or tower operator, or if you aspire to be a tower developer or own a tower, is that with the contracts you write with the carriers, you want to be as equipment-specific and frequency-specific as you possibly can.

When AT&T and T-Mobile announced a merger, we looked at which sites we were acquiring that had an overlap with the tenants. If the

developer who owned the tower had leases configured such that the tenant could not remove an array of antennas under one lease and put it back under another lease, everything was good. We would enforce the lease, and even though they may merge, as a company they have to come back to me and say, "I want to take this one down and integrate it into these."

Mobile network operators usually don't take down antennas. They usually turn six antennas into nine or nine antennas into 12 before they take the other antenna array down, so you get some kind of amendment. If the leases are equipment- and frequency-specific, you don't have that worry.

When leases are not equipment- and frequency-specific, changes to the mobile network are a concern. You've heard of Sprint Network Vision. The equipment-makers are marketing new equipment to Sprint that allows more than one technology to operate on the same antenna at different frequencies. That's not good for the tower owners in general unless you have something in your lease that specifically restricts their ability to do that. It took a lot of forethought to write that into a lease 10 years ago before the technology materialized. That kind of language might not be there in older leases. But it is something you can look to put in leases from now on to make sure carriers don't have the ability to sublease your tower space through their extra-turbocharged, highly technologically efficient antennas.

De facto subleasing is a real business risk. Sprint, through its partial ownership of Clearwire, through its iDEN, through its CDMA, and through LightSquared, was putting four technologies on one array, when those were four separate leases before. It is something to defend against the best you can.

Clayton Funk: Bill, did the AT&T/T-Mobile merger announcement change your investors' view when looking at developing towers?

William Wade: It did. Our first reaction was, "Phew." We sold towers

in December 2010, and the proposed merger was announced in March 2011. We came to terms with it. We understood that there might be one less national carrier. It may have adjusted the overall upside on the exit,

but I don't believe it lessened any one of our investors' opinions about the tower industry.

As I learned during nine years with AT&T Wireless, even when we acquired new networks, the RF engi-

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From left: F. Howard Mandel, Peppertree Capital; William Wade, Central States Tower; Larry Harris, SBA Communications; and panel moderator R. Clayton Funk, Media Venture Partners.

neers didn't like to give up cell sites. Where proposed merger partners had towers in close proximity to one another, I remember the expectation from Wall Street was that there would be a decommissioning of a lot of towers — after Cingular and AT&T merged, for example. There was disappointment that there were still more towers in the portfolio than they expected, because the operating expense hadn't come down.

But it was largely because — and wisely so, looking back now — there is just always a need for more sites, whether it's a capacity issue, or an offload issue or maybe now a Wi-Fi offloading issue. So the AT&T/Cingular merger, to my knowledge, didn't cause the decommissioning of the number of towers that many expected it to.

T-Mobile and AT&T did have some significant coverage overlap, but in instances where they each had antennas on separate towers in somewhat close proximity, we didn't expect decommissions at the rate others might have. Where T-Mobile and AT&T had antennas on the same structure, there may have been reason to expect more decommissioning, but it still was not a given.

Howard Mandel: Our companies don't charge for tower space by the carrier, they charge by the radiation center. One of our companies has a tower in Florida where AT&T has three rad centers on it. They get charged three rents. Whether it's AT&T, or AT&T and T-Mobile together, or AT&T and T-Mobile apart, they still have to have enough equipment to cover their subscribers. And all of their subscribers were complaining about their service before the merger. Afterward, magically, the equipment they have on one of their systems isn't going to cover it.

Clayton Funk: We covered interest rate risk and merger risk. Do you see any other risks to current valuations?

Larry Harris: The antenna sharing is something to be cognizant of. Carriers are just starting to deploy that technology. I wouldn't imagine that AT&T and Verizon are that interested in sharing their networks with anyone because they have a big lead. I would expect — and we're seeing it with Sprint as it plays catch-up — ways to lower operating cost by having more efficient antennas that can do more and maybe even sublease them.

You would hope that carriers are more interested in building out their networks and meeting their customer demand than trying to squeeze every last dime out of their tower leases. But that is a broad risk.

iDEN churn is a broad risk. It is something we look at when we price deals.

With the availability of capital, many more people are coming into the business who are willing to invest in towers, and that makes it a strong business.

Now, when carriers sign leases, they make sure they get their 4G equipment. If Bill were building towers for Verizon or AT&T five years ago or three years ago, they didn't have their 4G strategy fully formulated. They didn't know what their arrays were going to look like, what brand of antennas they would use and how many dishes they might need. They know that, now.

If you're doing a build for a carrier today and they are signing that lease at the same rate, say an average of $1,850 a month for an anchor tenant on a new tower developed for them, that $1,850 also gets them their 4G equipment. If you built that tower five years ago, $1,850 got their 2G and 3G equipment on it and they since have amended that lease, maybe now it is $2,200 a month instead of $1,850.

Thus, when you build a tower today, you lose out on the opportunity that you had before.

William Wade: There was a quick learning curve as the carriers got hit with all of the modifications as they went back and expanded first to 4G and then to LTE. Now, the lease request is for everything in the world

REMEMBER

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We'd spend afternoons together with the kids, outside.
You'd get the satisfaction of planting each seed, watching
us grow, then making us into something the whole family
would enjoy. I miss that. I just need some fresh seeds and
a little care... Please? Teaching kids to plant is fun and healthy!

P.S. I heard planting a garden is coming back in Indian Country.

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tower market report

right out of the gate. We affectionately call them surfboards, the size of the antenna they want to install.

We don't mind it as much if we know about it when we are building the tower because we can structure the tower for that. It's different when a second tenant comes onto the tower as a collocator. There is room to negotiate a better lease with that second tenant because we didn't build the tower specifically for the second tenant.

No one saw 4G coming. Maybe there is something more coming that no one anticipates insofar as equipment on the tower is concerned. There may be that sort of an opening as well, two or three years from now, with the next iteration of different technology.

Clayton Funk: What are some things tower owners could be doing now to enhance the value of their sites?

Howard Mandel: The legal documents matter. The aggregators sometimes come across minor issues when buying towers that indicate the tower developers could have done it better. We could have put a right of first refusal in the ground lease so when the pirates come and try to buy up the ground, our guys have the right to try to buy it. That's valuable to the aggregators.

We used to ask for a 25-year lease, including all of the renewals. We used to think 25 years was plenty because the business was a two-year play — we would be long gone by then. But now, we ask for 40- and 50-year leases. The ground owners don't blanch at all. Why not ask for it? Whether they are giving the lease for 25, 40 or 50 years, it is all the same thing.

Larry Harris: The equipment compound is important, although some of the equipment is beginning to get smaller and smaller with grounding rings and fiber to the tower. There always is a need for more space. If you build a four-tenant tower, make sure there is enough land to put four tenants there.

Howard Mandel: If your ground owner has a third-party lender, you want to obtain consent from that third-party lender such that even if your ground owner defaults to him, you can keep your tower there. This used to be relatively unimportant. It became highly important when the real estate market crashed a few years ago and suddenly many properties were not only under water [valued at less than their mortgage balances] but grossly under water. If you prepaid the rent of if your rent was low, you have a mortgage-holder to your landlord who now has a mortgage with a balance higher than the land value. There is every chance the mortgage-holder will foreclose and kick you off the property.

We've never seen it happen. No one would put a tower on the property if there were a better use for the property. Towers are beautiful, but property owners tend to put a McDonald's restaurant or a shopping center or an office building on their properties when they can, but even still, it is important at the outset to obtain a subordination, nondisturbance and attornment agreement from the land owner because it will hurt you on the tower value on the

back end if you don't have it.

William Wade: For smaller tower companies, writing into the leases specific clauses about equipment and frequencies is difficult. We hear that advice from the aggregators and other potential buyers of our towers. Half of the time, we're just happy to have the opportunity to build a tower, and if we start trying to drive a harder bargain and dictate terms, many times the project won't happen and opportunities go away.

Don't feel like you're falling down as a tower developer if you're struggling with those terms because you are going to be spoon-fed some of the contract language in exchange for the opportunity.

Regarding tower valuations and how to improve them, the subordination, nondisturbance and attornment agreements are important, and we've experienced every one of the risk items that were mentioned.

Secure a big lease area so the buyer of your tower doesn't have to go increase his ground rent to add a second, third or fourth carrier. Get as big a space as you can.

Where we could buy the land or obtain a 99-year easement on the land, it really made a big difference on particular sites in our first selling of towers. That may be obvious, but I can't emphasize it enough. The low operating expense on the site makes your tower much more attractive to a buyer. If you can take the extra time to work with your landlord on that or set up a lease with an option to purchase, that really helps.

Strong, clean leases are important. Documentation is important when you present your portfolio for sale. Buyers appreciate it. If you can show exactly what you own and exactly why it is valuable, exactly what the benefits of that location are and present it in a nice box with a bow on it with every document they would ever ask for, that helps. The way you present your portfolio and your tower company — the more professional, the more docu-

mented and the more thorough — only benefits you.   ■

Tower Technology Summit, which includes a conference and exhibition collocated with CTIA Wireless, is produced by Light Reading, a technology and financial analysis source owned by UBM TechWeb, a part of UBM, a global provider of news distribution and specialist information services. *AGL* produced the conference programming for the Summit. For more information about the Summit, visit *www.towersummit.com*.

Photographs for the article were taken by Don Bishop.

tower market report

Trends and Forecasts for the Wireless and Tower Industries

Shared wireless infrastructure has become the rule, as carriers focus on customer demand to provide the best coverage and quality of service. Demand for cell sites continues to flourish, as carriers actively seek to modify and amend their existing leases and seek new sites to collocate on in order to meet the growing need for capacity and ubiquitous coverage.

By R. Clayton Funk and Jason Nicolay

The wireless industry and its related wireless infrastructure subsector have seen significant changes during the past year; however, much has remained the same. The shared wireless infrastructure industry continues to be well positioned for future growth as existing voice and increased data and mobile video use strain network capacity. Cisco Systems forecasts wireless network data usage will grow more than 78 percent annually from 2011 to 2016 (see Figure 1). We'll examine what has changed during the past 12 months and discuss some new developments that are likely to affect the shared infrastructure and the wireless industries.

Towers, rooftops, DAS and backhaul

Several specific niches make up the shared wireless infrastructure industry. The first niche, towers, includes vertical real estate for wireless telecommunications carriers and broadcasters. A second niche, rooftops, uses existing commercial and, occasionally, multiple-unit residential buildings in strategic locations to bear the placement of antennas. A third niche, distributed antenna system (DAS) networks, represents what historically was a last-resort technology. Many carriers now view DAS as just one more method in the toolbox for achieving desired coverage and capacity. Backhaul represents a fourth niche for shared wireless infrastructure, including wireless backhaul (microwave) and

Wireless / Towers: Then vs. Now

Global Mobile Data will Increase 18x from 2011 to 2016

78% CAGR 2100-2015
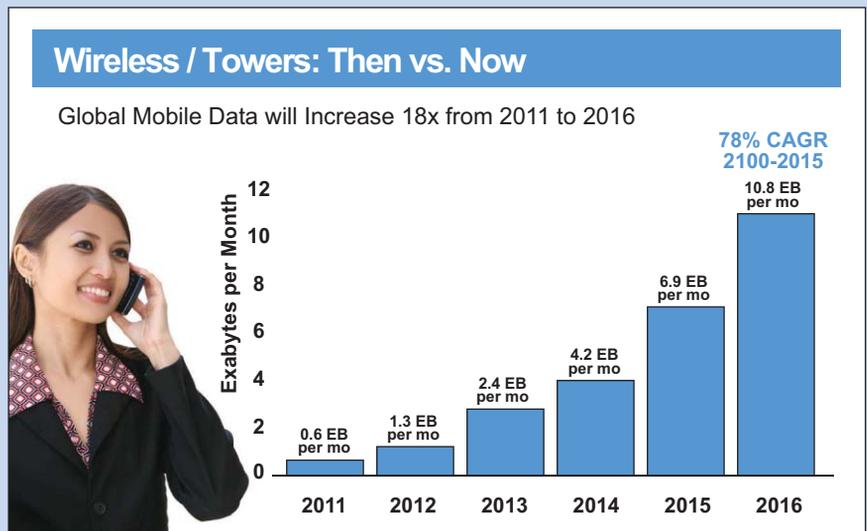
Figure 1. Mobile data is expected to increase by a factor of 18 during the next five years, according to Cisco Systems' latest estimates.

wired backhaul (fiber to the tower).

Originally, almost all of today's shared wireless infrastructure niches started as single-use facilities. Speed to market and consumer demand for wireless services are the catalysts for installing more shared facilities. More niches, such as small cells (femtocells, picocells, etc.) in the wireless infrastructure industry are expected to flourish as technologies evolve and adapt to consumer needs and demands.

Over the years, one aspect that has not changed is that the shared wireless infrastructure industry attracts investors for five reasons:

- Investment-grade customers such as AT&T, Verizon and others commit to long-term contracts that generate recurring revenue streams.
- The owners of the infrastructure can financially and operationally leverage their assets.
- The businesses are capital-intensive for investors to continue to commit capital that will ideally earn an attractive return on investment.
- The industry has barriers to entry.
- Ownership remains fragmented.

Carriers and tower owners publicly decry difficulties with zoning approval for antenna sites and changes to existing sites. They chafe at the limited access to prime locations to serve as coverage or capacity sites. However, for investors in tower ownership, those same barriers to entry assist in protecting asset value by restricting competition.

Meanwhile, carriers themselves have to overcome their own barriers such as access to radio-frequency spectrum often acquired through FCC auctions and the FCC-license build out requirements. Those expensive and lengthy processes limit the carriers' competition. Simply building out a network, even on a limited scale, can cost millions and even billions of dollars, so access to and the availability of capital is yet another factor that limits who owns spectrum utilized for commercial service.

Tower owners have an ability to leverage their assets because of the recurring,

contractual cash flow the towers generate. The long-term agreements with national wireless operators provide stability. The barrier to entry represented by zoning approval and access to capital helps to keep the churn rate among their renters low. And compared with many other industries in the country, access to both debt and equity capital for tower owners tends to be easier and more abundant.

Acquisition pool

Fragmented ownership in the various shared infrastructure niches typically includes two or three larger companies and a large number of smaller entities. With more and more companies establishing themselves in these niches, a deeper pool of potential acquisition targets results. These targets attract entrepreneurs with private equity backing who can foresee an exit to a larger consolidator at a future date.

The abundance of capital to invest is favorable for entrepreneurs who are encouraged by the fact that the wireless industry's fundamentals continue to be sound.

During the past year, U.S. consumer confidence has continued to strengthen, although economic turmoil in the European Union has been growing. As the U.S. economy continues to rebound, it benefits

from an improving housing market — the housing market's downturn affected lenders across many sectors— and low interest rates. These favorable conditions have translated into more businesses and industries having improved access to credit and at lower rates. In a fashion similar to their peers in many industries, the tower and DAS industries were not immune to the uncertainty and tight credit of the most recent recession; however, unlike many of their peers, investors and lenders saw that shared wireless infrastructure was and is more resistant to swings in the economy. As a result, several tower owners were able to secure new credit facilities. Access to inexpensive credit has allowed many of the players within the shared wireless infrastructure arena the opportunity to explore mergers and acquisitions along with organic growth opportunities.

Wireless trends

Despite broader macroeconomic trends, there are key areas to watch as one attempts to forecast where the shared wireless infrastructure industry is headed. First, continue to watch the performance and projections of the wireless carriers. Key metrics include their subscriber growth, the average revenue per user (especially the growth

What Attracts Investors

- Investment-grade customers
- Financial and operational leverage
- Attractive return on investment
- Barriers to entry
- Fragmented ownership
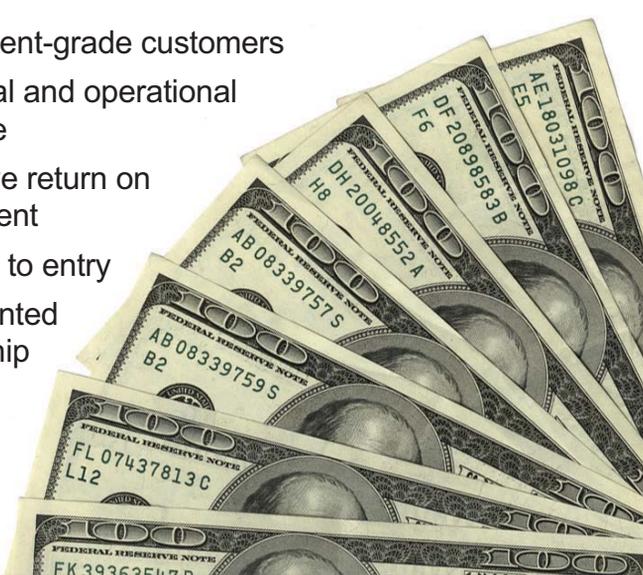
tower market report

Wireless / Towers: Then Versus Now

Wireless	Then December 2000	Now December 2011
Subs (in millions)	109	332
Penetration	38.9%	104.6%
MOUs/Month/Sub	309	595
MBs/Month/Sub	NA	761
ARPU	$52	$47
EBITDA Margin	26.7%	29.8%

Towers	Then December 2000	Now December 2011
Cell Sites (Estimated)	104,288	283,385
Tenants Per Tower	1.5	2.4
EV/EBITDA	28.6x	18.0x
Leverage	10.4x	6.8x

Sources: Media Venture Partners and CTIA

Table 1. In comparing today's wireless/tower industry with the industry as it was in 2000, it is important to keep in mind that there are large fundamental differences between the characteristics of the industry of today and the characteristics of the industry of more than a decade ago.

of revenue from data plans) and capital expenditures. Recent moves by AT&T and Verizon to phase out unlimited data plans should ultimately help carriers grow their revenue per user, especially among their heavy-data-using subscribers. Second, continue to watch the credit markets and take note of the availability of credit and the pricing of that credit. Solid cash flow from high-quality tenants who are under long-term contracts underpins the trend for shared wireless infrastructure companies, such as tower and DAS owners.

Wireless carriers continue to see their own headwinds in growing their businesses as they relate to voice telephone calls. With the mobile phone market nearly completely saturated for voice-only subscribers, price-cutting has intensified for voice plans. However, data plans continue to remain stable with ample growth opportunities as carriers move away from unlimited offerings in favor of tiered data plans. Less-expensive prepaid wireless services that do not require contracts have been increasingly in favor, at the expense of the postpaid sector dominated by Verizon and AT&T. Given the continued explosion in the

usage of smartphones and the increased number of consumers turning to tablets and e-readers, carriers who can offer reliable, fast networks for data usage have been able to grow their market shares. Given that AT&T and Verizon are the two largest wireless companies, their operational and financial performance is a good barometer for the wireless industry.

Subscriber additions

First-quarter 2012 results had AT&T adding 726,000 net wireless connections for a total of 103.9 million total connections, while Verizon added 734,000 net wireless connections for a total of 93 million retail customers. AT&T reported postpaid net additions were just 187,000 to reach 69.4 million, while Verizon reported 501,000 retail postpaid net additions during the quarter, growing its postpaid subscriber base to 88 million. Connected devices such as e-readers like the Kindle and Nook in addition to iPads continue to boost both AT&T's and Verizon's net additions and served to attract new subscribers desiring access to the latest consumer wireless devices.

Carriers will continue to need additional revenue from sources other than voice customers if they are to grow or maintain their average revenue per user. The good news is that 61 percent of AT&T wireless postpaid smartphone subscribers were on tiered data plans as of March 31, 2012, an increase of 16 percent over last year. AT&T said in its most recent quarterly report that approximately 42 percent or $6.1 billion of its wireless revenue is derived from data services, an increase of nearly 20 percent from the prior year. Verizon reported that data revenue was up over 21 percent since last year to $6.6 billion, and data revenue now accounts for 43 percent of its service revenue. These metrics indicate that both AT&T and Verizon continue to shift away from their dependence on voice for revenue, which is further supported by the fact that more than 9 percent of Verizon's subscribers have an LTE service plan.

AT&T/T-Mobile merger

On March 21, 2011, industry heads turned and mobile devices lit up as a result of the proposed merger announcement for AT&T and T-Mobile, the nation's second- and fourth-largest carriers, respectively. Despite all the detailed benefit analyses and political jockeying, neither AT&T nor T-Mobile was successful in gaining traction against the headwind created by the FCC and the U.S. Department of Justice. As a result, on Dec. 20, 2011, AT&T announced it was abandoning the merger and as a result would provide T-Mobile break-up concessions of $3 billion in cash, Advanced Wireless Service (AWS) spectrum worth an estimated $1 billion and a favorable nationwide roaming agreement.

With the failed merger between two of the largest wireless operators behind it, the wireless industry turned its attention to new headline-grabbing deals and speculated mergers. Most notably, wireless operators and industry vendors, including tower owners, are awaiting the outcome of Verizon Wireless' recent transactions with Leap and its subsidiar-

ies, whereby Verizon traded its Chicago 700-MHz A Block license for select PCS and AWS spectrum. Verizon followed that deal with two transactions for additional AWS spectrum from SpectrumCo (Comcast, Time Warner and Bright House) and Cox Communications, providing a nearly nationwide footprint for $3.9 billion, collectively.

This latest round of carrier spectrum activity was followed by Sprint's announcement of failed merger discussions with MetroPCS in February 2012. Further adding more drama to the "who's next?" speculation on the merger front were rumors of merger discussions between T-Mobile and MetroPCS. Despite the lack of a formal acknowledgement of merger discussions between the two carriers, it is not unrealistic to believe there will be further consolidation among the Big Four wireless carriers and the national pay-as-you-go operators and local wireless carriers. Future consolidation will provide carriers with additional access to much-needed spectrum and support the need for additional wireless network capacity, especially in urban markets.

The overall good news is that today's fundamentals for the wireless infrastructure industry differ widely when compared with fundamentals from nearly a decade ago (see Table 1 and Figure 2).

LTE (Long Term Evolution)

With the Big Four (AT&T, Sprint, T-Mobile and Verizon) wireless operators choosing to move down the 4G path with LTE, carriers are racing to be the first to launch the fastest networks to handle the growing number of data-intensive applications. New applications are being created daily that are bandwidth-intensive, putting strain on and bringing attention to the wireless carriers' networks. Verizon is using 20 megahertz of unencumbered radio-frequency spectrum in the Upper 700-MHz band for LTE or 4G wireless technology deployments. If Verizon receives FCC approval to acquire a nearly nationwide AWS footprint, it will have an additional 20 megahertz of spectrum
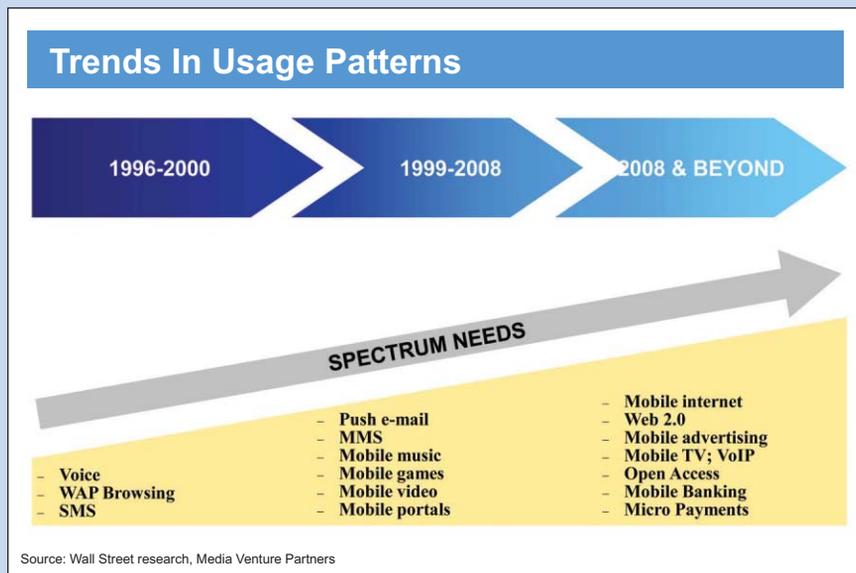

Figure 2. The trends in wireless telecommunications use patterns show an ever-increasing need for radio-frequency spectrum as users demand more from their handsets.

to augment its LTE network.

AT&T is deploying its LTE network on 20 megahertz of Lower 700-MHz spectrum. The company has been actively acquiring additional 700-MHz spectrum to fill in markets where it lacks either Lower B or C Block 700-MHz spectrum or both. Commercial deployment by both Verizon and AT&T has commenced. Both are expected to have a nationwide LTE network by the end of 2013. Other carriers including Sprint, T-Mobile, Clearwire, Leap, US Cellular and C Spire, have announced plans to build LTE networks. MetroPCS completed its LTE network in 2011. See Figure 3 for a summary of major wireless operators' build out plans.

The tower deal environment

Consistent with the last couple of annual *AGL* Tower Market Reports, the merger and acquisition market for shared wireless infrastructure, especially towers, has been incredibly robust for valuations. Nearly every tower company is showing strong interest in acquiring high-quality assets ranging from towers to DAS networks to portfolios of underlying ground leases. The deal environment remains extremely competitive with more buyers trying to acquire towers than there are sellers.

Limited acquisition opportunities are driving strong demand for nearly all types of tower portfolios.

Every deal is different, and various types of towers will be valued uniquely, depending on a variety of factors. Although circumstances can vary for each transaction, as a general guide, most deals for telecom towers these days are getting done at historically high multiples of tower cash flow, roughly between 15x and 18x, and upward of 20x or more in many instances. Broadcast towers, government-owned towers and older, more rural microwave towers tend to trade at multiples below where telecom towers are bought and sold, but even those are achieving historic highs.

During the past 12 months, only a handful of tower deals involving more than 100 sites have been reported, but dozens of smaller acquisitions have been closed. Cox Communications contributing its tower assets to InSite Towers, NextG Networks selling its DAS networks to Crown Castle, Mobilitie's transaction with SBA Communications, Plateau Wireless entering into a sale-leaseback with American Tower, and Leap entering into a sale-leaseback with Global Tower Partners comprised the largest announced transactions. Other notable recent transactions related to the

tower market report
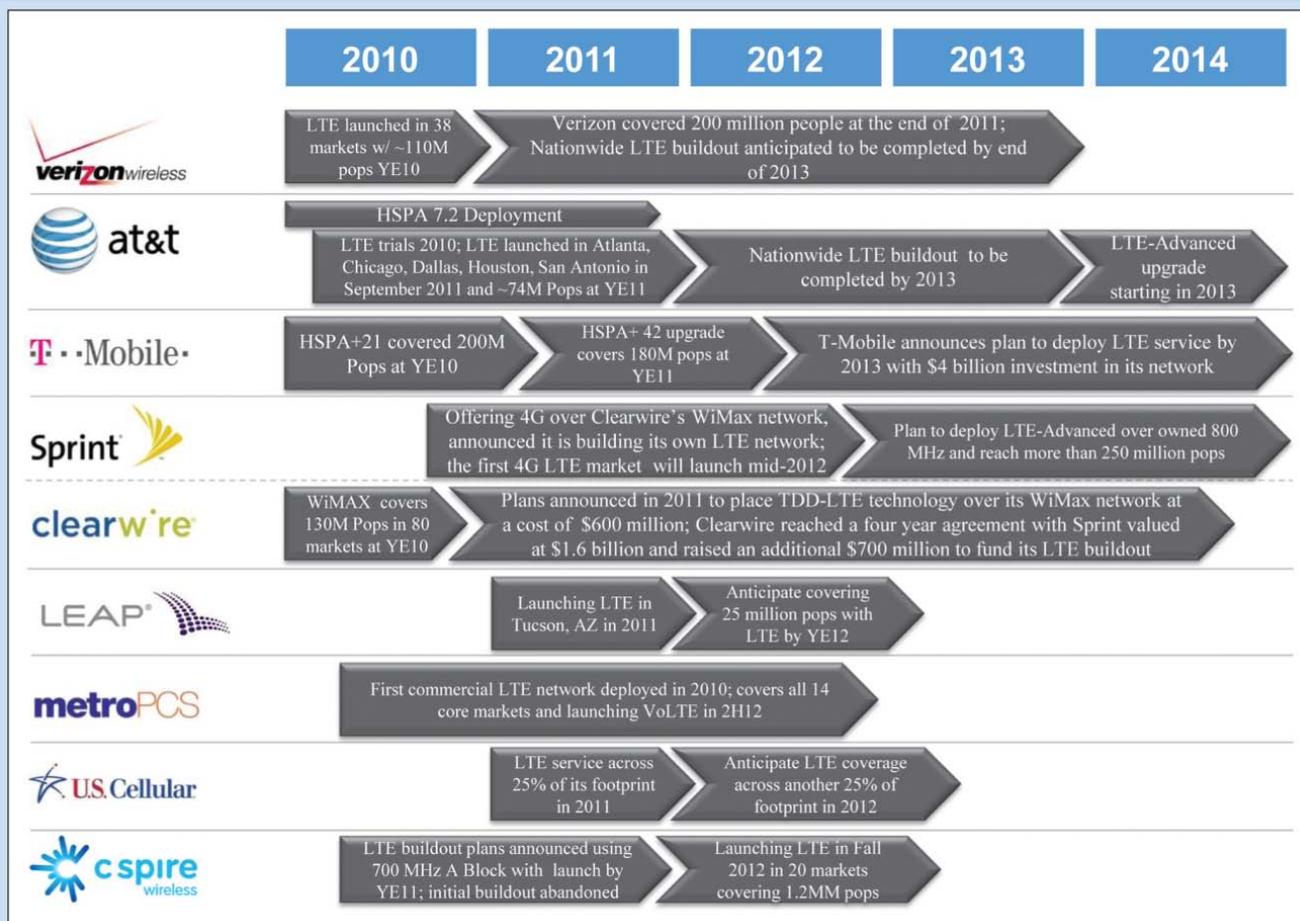
Figure 3. The Big Four and other major wireless carriers are launching their 4G and HSPA+ rollouts and many are expected to have nationwide coverage by the end of 2013.

tower and shared wireless infrastructure industries include the sale of portfolios of underlying ground leases or carrier leases, such as American Tower acquiring Unison Holdings, Crown Castle buying Wireless Capital Partners and Global Tower Partners purchasing GS Cell Site Holding.

Public tower companies had traded over 20x forward EBITDA (earnings before interest, taxes, depreciation and amortization) for a few years. Although publicly traded multiples came under pressure for a brief period largely due to macroeconomic conditions in 2008, private tower transactions continued to receive strong multiples above where the public tower companies have been trading recently (see Figure 4). Since their brief dip in valuations, tower companies have rebounded in their valuations and continued to be acquisitive.

Compared with last year at this time and even earlier in 2010, public tower company valuations have seen substantial recovery. As of May 18 this year, tower stocks are trading at 92 percent of the 52-week highs and have increased by more than 20 percent since Jan. 1, 2011. As of May 18, public tower companies traded at an average of 18x 2012E EBITDA (see Figure 5 and Table 2).

American Tower, SBA Communications and Crown Castle International have "buy" or "overweight" ratings from 96 percent, 68 percent and 86 percent of stock analysts, respectively.

Capital expenditures by wireless carriers continue to drive growth for tower and other shared infrastructure companies. Both public and private tower companies as well as the general market are consistently watching wireless carriers for any signal of decreased

capex spending. Publicly traded wireless operators are projecting capex of more than $25 billion during 2012, which will largely support the carriers' continued 4G network build out. As a result, tower companies, both public and private, have seen a significant increase in the number of amendments and modifications to their sites, especially in urban and suburban markets where the carriers are initially focused on building their 4G networks and securing additional capacity. Strong demand for new coverage and capacity sites is expected once carriers successfully deploy in the core population centers.

Verizon launched its first 4G LTE markets in December 2010 and covers more than 209 million pops in more than 230 markets. With its first-quarter 2012 results, the carrier announced it spent $1.9 billion on wireless capital expen-

Historical Enterprise Value to EBITDA (12 Months Forward)

Source: Media Venture Partners and Wall Street research
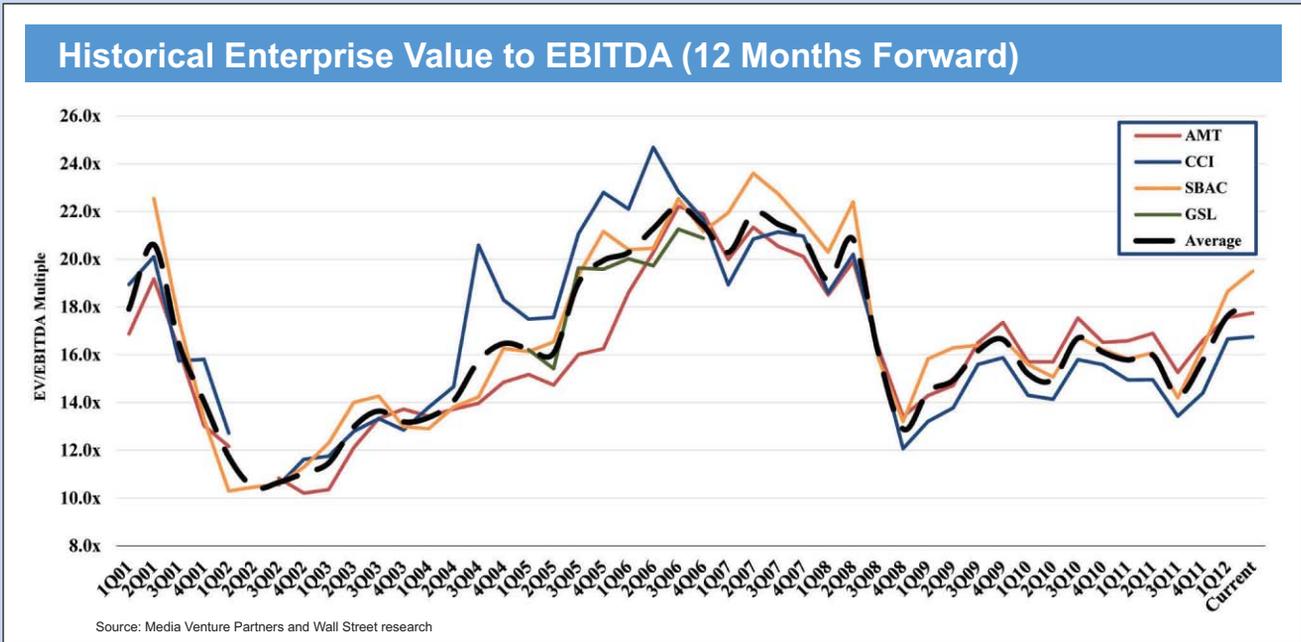
Figure 4. The historical enterprise value to EBITDA (12 months forward) shows how the multiples for four tower companies have fluctuated during the past decade. Companies represented include American Tower (AMT), Crown Castle International (CCI), SBA Communications (SBAC) and Global Signal (GSL).

ditures or 53 percent of the company's first-quarter capex total. Verizon's wireless capex dollars are largely spent to enhance its current network and to further expand its use of LTE technology throughout its entire 3G footprint by the end of 2013.

AT&T announced in its first quarter results that it plans to spend nearly $20 billion in total capital expenditures during 2012. As of March 31, AT&T had already spent nearly $2.3 billion or 12 percent of its total capex on wireless-related capital expenditures. AT&T's wireless capex dollars are being used for network capacity and expansion and for the company's 4G LTE deployments. The carrier has used the capex dollars to cover more than 260 million pops with its 4G network, which includes a mix of both LTE and HSPA+ services.

T-Mobile announced a refocus of its Challenger Strategy in February 2012 after it failed to merge with AT&T. The company's most significant focus and progress have been toward its $4 billion network modernization and 4G evolution effort, which will improve the carrier's voice and data and will push it toward LTE service in 2013. T-Mobile

has signed agreements with two vendors to deploy LTE-capable equipment at 37,000 cell sites during 2012 and 2013. During the first quarter of 2012, the company spent $747 million in capex toward the network goals.

Sprint continues to focus on its Network Vision project, which consolidates network technologies (CDMA and iDEN) while reducing the number of sites the company uses. During the past year, Sprint selected LTE for its 4G migration path. The company's LTE network is expected to be launched in 2012 and to cover more than 123 million pops. Sprint will add coverage in 2013 to reach between 250 million and 270 million pops by the end of the year, a step that will be further enhanced with Sprint's access to Clearwire's LTE network. The company projects it will spend $6 billion altogether in capital expenditures in 2012. During the first quarter, Sprint spent $710 million in wireless capex, which was 89 percent of the company's overall capex for the period.

Clearwire, which first built out a WIMAX network in conjunction with Sprint, has announced it plans to deploy a TDD-LTE network that is expected to

be launched in June 2013. The company, which provides wholesale services for Sprint and Leap, expects to deploy its LTE and VoLTE equipment at 5,000 base stations by next summer in New York, San Francisco, Los Angeles, Chicago and Seattle.

Leap stated in its first-quarter earnings announcement that it spent $146.3 million in capital expenditures so far in 2012. The company estimates it will spend between $600 million and $650 million in capex for the full 2012 calendar year. Leap is using its capex dollars to maintain and develop its current operating footprint. The company said it is happy with its LTE launch in Tucson, Ariz., and it plans to deploy LTE for about two-thirds (or roughly 25 million pops) of its network in the next two to three years. At an estimated cost of less than $10 per covered pop, Leap estimates it will cost about $250 million to build out its LTE network.

MetroPCS, the first wireless carrier to launch LTE, has largely completed its LTE deployment throughout its 14 markets. Despite nearly completing its 4G network build out, the carrier estimates spending $900 million to $1 billion in

tower market report

Historical Share Values From January 2008 to May 2012
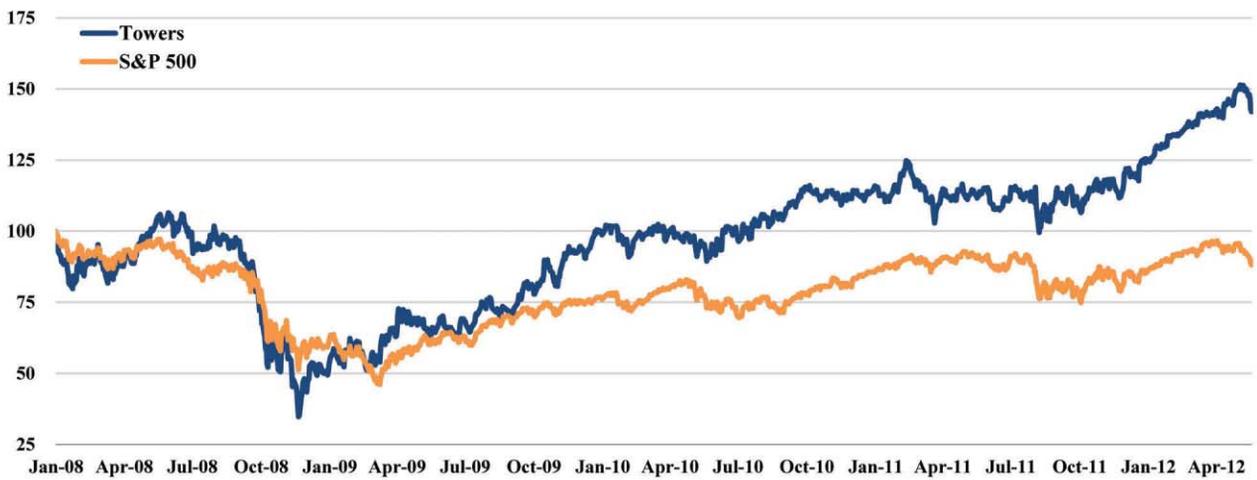
Source: Media Venture Partners and Yahoo! Finance

Figure 5. The value of shares in the public tower companies has significantly rebounded since the most recent recession, which hit its bottom during the fourth quarter of 2008. As of May 18, 2012, the value of public tower company shares has completely rebounded and meaningfully exceeded their pricing in mid-2008 prior to the credit crunch.

capital expenditures during 2012, of which more than $144 million was spent during the first quarter.

US Cellular, during its first-quarter earnings announcement, stated it expects to spend $850 million during 2012 on capex. It already spent $201 million during the first quarter. The company's completed LTE Phase I rollout covers 25 percent of its subscribers. US Cellular's Phase II LTE rollout, which will increase its 4G coverage to 50 percent, is on track to be completed during 2012.

C Spire (formerly Cellular South), a regional wireless operator in the South, announced in March 2012 it will be launching its 4G LTE network in September 2012. The company plans to spend $60 million for its initial LTE deployment, which is anticipated to cover more than 1.2 million pops in 20 markets throughout Mississippi.

Out with the old, and in with the new. **LightSquared,** prior to its recent bankruptcy announcement, was the most watched and highly anticipated new wireless entrant. **Cox Communications,** the third-largest cable provider in the United States, decided to fold its wireless efforts and has since sold almost its entire spectrum portfolio. **Open Range,** which operated on unlicensed

spectrum, went through bankruptcy and sold all of its assets.

Despite the loss of those prospective tower tenants, new companies are emerging as potential new tenants. **CenturyLink,** the third-largest U.S. telecommunications operator, was an active acquirer of 700-MHz spectrum in FCC Auctions 73 and 92 and thus has wireless spectrum assets in its existing wireline footprint. Although CenturyLink has not announced plans to deploy service using its spectrum assets, the company will need to at least minimally build out its licenses in order to meet FCC coverage requirements. **Dish Network** has been actively lobbying the FCC for authority to use its 40 megahertz of satellite spectrum for wireless broadband services. Although the future of Dish's terrestrial LTE-Advanced network remains uncertain, the company recently stated it would be unable to launch its network until 2016 or later.

Overall, rapid growth of data use is forcing carriers to upgrade network capacity and start planning for the next generation of networks and various deployment timelines. Towers are the direct beneficiary of any build out. See Figure 3 for a timeline of select carriers'

scheduled 4G network build outs.

Credit environment

Although the latest recession was challenging for most industries, access to the credit markets for the public tower companies reopened by mid-2009 and has remained robust during the past few years. Since June 2011, public tower companies have secured $1.2 billion in senior debt capital and more than $4.1 billion in new credit facilities.

American Tower obtained more than $1.2 billion in senior unsecured debt and $1 billion in a new credit facility during the past 12 months. In October 2011, American Tower priced $500 million of 5.9 percent senior unsecured notes maturing in September 2021. Again, in March 2012, the company priced another $700 million in 4.7 percent senior unsecured notes due in March 2022. The company also secured a new $1 billion, five-year credit facility in January 2012, of which $700 million is outstanding. American Tower utilized the proceeds to repay certain senior notes, to fund acquisitions and for general corporate purposes.

Crown Castle, which has not issued any new senior debt during the past 12 months, completed a new $3.1 billion

($ in millions, except share price and per tower amounts)

Company	Stock Price 5/18/2012	% of 52-Week High	Equity Value	Enterprise Value	Enterprise Value /				Owned Towers
					2012E Revenue	2013E Revenue	2012E EBITDA	2013E EBITDA	
PUBLIC TOWER COMPANIES									
American Tower[1][2][3]	$64.42	94%	$25,532	$32,520	11.4x	10.4x	17.7x	16.1x	702,246
Crown Castle[4]	52.86	91%	15,998	24,356	10.8	10.2	16.7	15.5	1,022,921
SBA Communications[5][6][7][8]	49.88	89%	7,571	10,727	12.1	10.8	19.5	17.0	1,006,181
TOWER AVERAGE		92%			11.5x	10.4x	18.0x	16.2x	$910,450

Sources: Media Venture Partners, LLC, company reports, and consensus estimates.
(1) Pro forma for the $12.5 million purchase of 55 towers from Telefonica, subsequent to March 31, 2012
(2) Pro forma for the $1.6 million repurchase of 24,700 shares, subsequent to March 31, 2012
(3) Pro forma for the company's distribution of $82.9 million through a cash dividend, subsequent to March 31, 2012
(4) Pro forma for the $1.0 billion acquisition of Next G, subsequent to March 31, 2012
(5) Pro forma for the purchase of Mobilitie for $850 million in cash and 5.25 million shares, subsequent to March 31, 2012
(6) Pro forma for the $10.4 million purchase of 25 towers, subsequent to March 31, 2012
(7) Pro forma for the $284.0 million increase in its revolving credit agreement, subsequent to March 31, 2012
(8) Pro forma for the $4.6 million receiving as result of the Lehman Brothers sell of the stock, subsequent to March 31, 2012

Table 2. Tower stock prices have grown by more than 20 percent since the beginning of 2011. As of May 18, 2012, shares in publicly traded tower companies were, on average, trading at 92 percent of their 52-week highs and 18x 2012E EBITDA.

revolving credit facility and term loan in January 2012. The company has outstanding $2.1 billion of the credit facility. Crown Castle has used a portion of the credit facility to repay certain notes, to fund recent acquisitions and for general corporate purposes.

SBA Communications has not issued any new senior debt or entered into any new credit facilities during the past 12 months. Alternatively, the company utilized the public equity markets in a

tower market report

secondary public offering in order to fund recent acquisitions.

With access to the overall credit market continuing to ease and the Federal Reserve Board announcing that rates will remain low until at least 2014, pricing remains higher than it was before the credit crisis, with many lenders seeking higher upfront fees, floors on LIBOR-based loans, and 100 to 200 basis points in increased spreads. Public tower companies are continuing to utilize their access to the capital markets to issue new notes and repay older ones nearing maturity in order to extend maturity dates.

The future

The wireless industry endured the latest turbulent macroeconomic period well, as consumers have come to view wireless communications as a necessity instead of a luxury or option. The tower market was and will continue to be a direct beneficiary of the wireless industry's strong staying power and, as a result, it has proved to be fairly insulated from macroeconomic issues. The volume of tower deals, although slightly sluggish during the past 12 months, was able to make up ground with sizeable transactions, including a number of portfolios for underlying ground leases, a major DAS network provider and one of the largest private equity-backed tower providers. However, 2012 could shape up to be an extremely robust year for transactions as sellers start to weigh the threat of capital gains taxes increasing at the beginning of 2013. Tower owners considering selling some or all of their assets in 2012 have the benefit of being in a seller's market because of the limited inventory on the market and the deep pool of interested buyers. The wireless industry, overall, has the underlying characteristics of being a long-term winner as wireless voice, data and mobile video use do not show any signs of decline.

Trends continue to show a move toward everything wireless. There is a growing market for companies developing products specifically for wireless users, including mobile apps and dynamic mobile Web content. Popular handheld devices, such as iPhones and Androids, are being designed for multiple networks. Demographics show younger adults continuing to favor wireless service over wireline service with about 32 percent of households now being wireless-only. Wireless communication is an everyday part of life in the United States. It is not going away, nor is it threatened to be replaced by any new modes of communication. We are quickly headed toward a day when a majority of people will only access the Internet via mobile devices, such as a smartphone or tablet.

Although subscriber penetration is completely saturated with a nearly 105 percent penetration rate, minutes of use remain high and data as a percentage of revenue has been growing by approximately 20 percent at the two largest wireless operators during the past year.

Although the FCC does not have any new spectrum auctions scheduled that could have identified new entrants into the wireless world and potential new towers tenants, the past year has seen a shakeup of possible new tenants. Several companies with large spectrum positions or operating businesses are no longer viable future tenants — SpectrumCo and Cox Communications both have agreed to sell their respective AWS spectrum to Verizon, Open Range and LightSquared both filed for bankruptcy, and several local wireless operators have sold their operations to national carriers.

However, there are several prospective new tenants to keep an eye on, including CenturyLink, which actively acquired 700-MHz spectrum in FCC Auctions 73 and 92; Dish Network, with its 40 megahertz of satellite spectrum and 6 megahertz of 700-MHz spectrum, could become a new wireless operator; and with the recent financial support of Sprint, a healthier Clearwire could become a more active operator looking to quickly expand its new LTE network. Despite the industry losing a few participants that were previously viewed as potential tower tenants, new and healthier participants have sprouted in their place.

Shared infrastructure will continue to evolve as it becomes the rule, rather than the exception, as carriers respond to consumer demands. Cell site build outs will continue to flourish while being complemented more and more by alternative sites, such as femtocells, picocells and distributed antenna systems. Backhaul demand, whether for fiber to the tower or microwave links, will continue to increase significantly as wireless subscribers use mobile devices for increasingly data-intensive applications, such as mobile video streaming and data services, rather than just voice. ∎

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tower market report

AGL *2012 Tower Market Analysis and Survey*

By Jim Fryer

The following survey results reflect answers given by 215 *AGL* subscribers (144 owners of towers of varying sizes and 71 service providers to the tower industry) collected in April and May 2012 using Zoomerang online surveys. Some open answers were edited. Although conclusive empirical data points cannot be derived from a 5 percent sampling, this work nevertheless represents the largest known survey of tower owners. The varied responses reflect an industry struggling to cope in an environment of slowed growth, new technologies, increased government regulations, and new and challenging barriers to entry.

Question 1.

Are you a tower owner or manager?

NO 33%
YES 67%
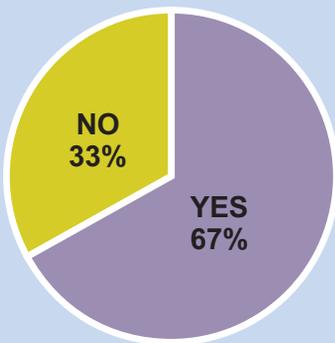
Question 2.

If so, how many towers do you own or manage?

501 to 1,000 — 8%
251 to 500 — 5%
101 to 250 — 2%
1,000 or more — 2%
11 to 100 — 25%
1 to 10 — 58%
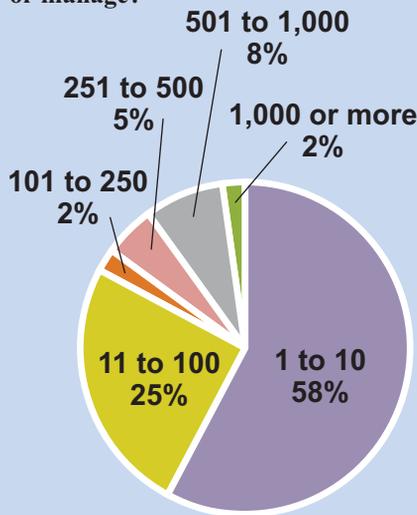
Question 3.

Tower(s) are located in what region, in general?

Northwest 2%
Southwest 10%
Northeast 32%
Midwest 29%
Southeast 27%
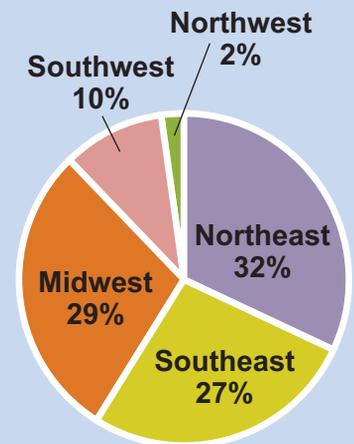
In addition to the regional distribution, 12% of respondents indicated that their tower operations have a nationwide presence.

Question 4.

What's the biggest challenge your tower will face in the coming year(s)?

Analysis: Carrier consolidation and a dearth of new entrants as long-term paying customers seems to be an underlying concern that stands in the way of growth in the year to come. Yet, this is still far from a dominant answer to the question. Given the diversity in inventory size of the respondents, the bigger tower companies tend to take the macro view (government intervention and consolidation).

Meanwhile, as you travel down the line to mom-and-pop tower companies, the concerns become more detailed (salt water, copper theft, financing, lease optimizers and physical maintenance). Maintaining the structural integrity of the tower has long been the *modus operandi* of the smaller tower owner, many of whom hand-built the structures they own and operate, versus the "buy it and leave it alone" mentality of some larger tower aggregators.

The following are responses from individuals who took the survey, in no particular order.

- □ Smaller tenants with no clue
- □ Replacement
- □ Keeping it structurally sound
- □ Salt water
- □ Remaining fully leased
- □ Government regulation
- □ Zoning
- □ Maintenance. It's 30 years old.
- □ Structural integrity
- □ Overcrowding and lack of space for revenue growth
- □ Physical maintenance
- □ Soaring energy costs
- □ Finding a reasonably priced site

- □ New business
- □ Permitting new towers
- □ Integration of new service(s) and associated installation tasks
- □ Capacity
- □ Funding
- □ Carrier budgets
- □ Carrier consolidation
- □ Finding paying carrier customers
- □ More regulations dealing with wireless providers and lease optimizations
- □ The installation of fiber to the tower, also, no new technology coming out for more amendment work
- □ Finding new carriers that will survive the duopoly/triopoly as viable competitors
- □ Excessive government regulations
- □ Government requirement to evaluate every new antenna going on tower
- □ Loading
- □ Structural concerns due to 4G modifications
- □ Slowing growth of new sites
- □ New tenants
- □ Additional lessees
- □ Tenants
- □ Shrinking number of potential tenants
- □ Mergers between cellular companies that will result in the loss of a carrier
- □ Zoning regulations
- □ G standard
- □ Decrease in available tenants
- □ Carrier consolidation and DAS
- □ 222-G reclassifications and ongoing theft of copper
- □ Paint
- □ Consolidation and technology
- □ Funding

- □ Capacity
- □ Growth
- □ Cellular tenants
- □ Finding additional renters
- □ Loss of revenue from merging carriers
- □ Corporate mergers
- □ Overloading
- □ Don't really have any
- □ New lease-up opportunities
- □ Invoice issues and administration
- □ Where to build
- □ Advances in technology
- □ Regulations
- □ Carrier consolidation
- □ Aging structure maintenance
- □ Adding tenants. Our 400-foot self-supporting tower has considerable capacity and although we do have several good carriers, we are continually trying to coax one or two to relocate. Not an easy sell, though.
- □ Increasing interest rates
- □ Getting new clients, keeping existing clients, watching for the existing clients combining or adding without our knowledge
- □ Getting approval for height increases and modifications
- □ FASB rule changes on operating versus capital leases, providing services and backup generation to clients, land and access improvements
- □ Meeting the structural requirements for the new equipment

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Question 5.

What is your average monthly rental rate for broadband?

$2,001 – $3,000
15%

Not applicable
8%

$1,000
31%

$1,501 – $2,000
36%

$1,001 – $1,500
10%
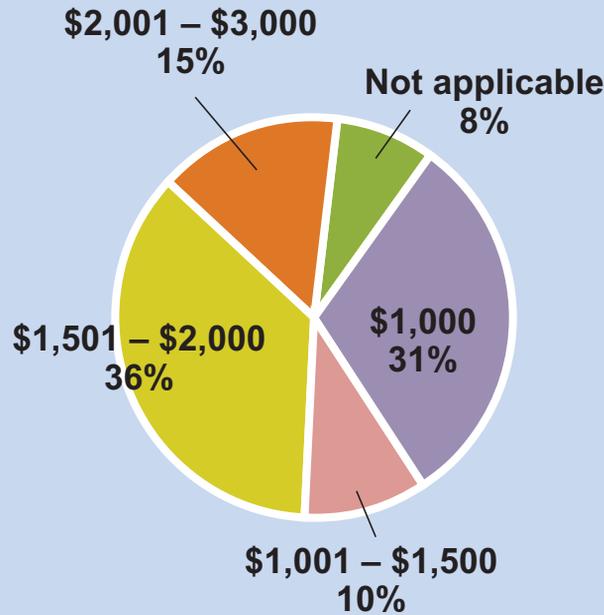
Question 6.

Are you a member?

Analysis: The groups posting the biggest gains over last year's survey are state wireless associations as they gain in popularity by offering more services and events that can focus on regional customers and issues. It's not all golf tournaments and mixers as the associations are rolling up their sleeves to put forward and champion agendas that are favorable to the wireless industry at a state level and to host well-attended and informative seminars.

The more telling statistic is that 41 percent of respondents do not belong to any organization. Next year, we'll have the foresight to ask "Why not?" But an unofficial survey of a small sampling of nonjoiners came up with the triad answer: (1) Dues are too high; (2) They don't represent me as a tower owner (they're more in the carrier's pocket); and (3) I already know everyone I need to know — except the carriers, and they never show up.

Finding the small tower owner at the big trade show, a common occurrence in years past, is now a rarity. Tighter economics meant the end for many to traveling with the wife or partner to a "destination event," seeing the same old faces peddling the same old products. How many more stress balls do you really need, anyway?

Here is a list of associations to which respondents said they belong. The percentages add up to more than 100 percent because some respondents said they belong to two or more groups.

CTIA – The Wireless Association	9%
PCIA – The Wireless Infrastructure Association	20%
National Association of Broadcasters	11%
State wireless association	35%
National Association of Tower Erectors	17%
APCO	7%
Rural Cellular Association	7%
None of the above	41%

Some respondents said they belong to ARES/RACES, the county office of emergency services, the CCIM Institute, the Building Owners and Managers Association, the American Institute of Certified Public Accountants, the American Land Title Association, and state broadcasting associations.

Question 7.

How do tenants find your site? (1 being most likely source; 9 being not at all)

Analysis: It's still an old-school windshield-tour-world for site acquisition in the eyes of tower owners despite wonderfully advanced data products for finding sites offered by commercial companies and tower aggregators alike. The FCC tower file, byzantine as it is, is still the perceived primary resource for tenant A to find tower B.

The role of the site acquisition consultant has also grown since past surveys were conducted as carriers rely more and more on regional experts to find the pockets of opportunity, determine whether a new site can be built, and help navigate it all through the twin quagmires of zoning and lease negotiations.

Faith in their own websites, although none see it as the "most likely" choice, is still a perceived tenant-grabber, although it ranks below "word of mouth" in this close-knit industry. Newer social media outlets, specifically LinkedIn, have helped increase visibility for the smaller players contributing to building and forming a network of site owners that may have previously avoided joining associations or making trade show appearances.

	Most likely	2	3	4	Moderately	6	7	8	Not at all
Drive by	22%	30%	22%	19%	4%	4%	0%	0%	0%
Word of mouth	19%	33%	14%	10%	10%	5%	5%	5%	0%
Our website	0%	43%	21%	0%	0%	14%	21%	0%	0%
Their own internal resources/database	18%	9%	14%	18%	27%	9%	5%	0%	0%
Site acquisition consultant	30%	22%	22%	13%	4%	4%	4%	0%	0%
Media advertising	0%	0%	0%	11%	0%	22%	22%	22%	22%
Tower database (commercial)	24%	6%	0%	29%	6%	12%	12%	12%	0%
FCC database	48%	19%	15%	7%	7%	0%	0%	4%	0%
None of the above	20%	0%	10%	0%	0%	0%	0%	20%	50%

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Question 8.

Where will additional growth come from (if at all)?

Analysis: The hope for new technology to grow revenue via 4G, LTE, DAS and wireless broadband is offset here by a gloomier no-growth view. Owners of smaller portfolios of towers know it's on their own backs to know the local markets, find the pockets where service is in demand through local contacts, and create the growth themselves. The odd build-to-suit project falling in their laps is far less likely than in years past. The focus has shifted from dewy-eyed growth fantasies to maximizing revenues on existing inventory either through increased

NEW BUILDS/FCC Data File (towers 190 ft. and larger)		
year	total built	avg height
2000	8,730	221
2001	7,912	222
2002	4,538	219
2003	4,721	217
2004	5,147	220
2005	5,149	212
2006	5,708	200
2007	4,145	206
2008	4,321	215
2009	4,242	221
2010	4,540	208
2011	3,207	199
2012*	2,343	202

*(projected)
Source FCC ASR file, Fryer's Data Services

capacity, belt-tightening (bye-bye Vegas trade show) or providing better backhaul to tenants.

According to the FCC, actual new builds of larger towers (by its definition of 190 feet tall and higher) accounted for fewer than 3,300 towers built in 2011 — a precipitous drop from the 8,700 built in 2000 — and fewer than 2,500 projected for 2012 based on first-quarter statistics. A look at the average AGL (height above ground level) shows a trend downward as dynamics shifted toward a shrinking infrastructure both in growth and height since the turn of the century. Carriers and their accompanying technological requirements dictated the shift to tree line-hugging sites, generally in the form of monopoles that not only delivered the goods but also created less visual impact and a smoother ride through zoning. By literally staying under the FCC/FAA radar with their height requirements, carriers and commercial tower developers alike opted for speed to market over ponderous government intervention and the NIMBY carnival that a tall tower leaves in its wake.

The overall number of new builds therefore is much larger than shown, yet it is unsubstantiated because it accounts for monopoles and sites shorter than the FCC's 190-foot filing requirement. Using CTIA-based cell-site growth numbers that inversely relate to tower growth numbers, loosely compiled industry growth numbers from NATE and PCIA, and new build data from the publicly traded tower companies, the total number of new towers built appears to be triple the number indicated by the FCC record file.

The following are responses from individuals who took the survey, in no particular order. According to respondents, new growth will come from:

- □ LTE
- □ Backhaul
- □ Sudden opportunities
- □ Only if requested, limited growth potential
- □ We are planning additional towers.
- □ I don't know.
- □ None. The tower is maxed out.
- □ Amendments, T-Mobile expansion
- □ 4G expansion
- □ Broadband

- □ Our own company
- □ 10 percent organic, 15 percent acquisitions and new development
- □ Additional build plans once the LTE craze is finished
- □ National broadband build out for public safety
- □ Not sure
- □ Provision of relay/weak signal reception capability in multiple bands
- □ Cell (new and expansion)
- □ Building out a new radio system
- □ Capacity
- □ Cellular carrier LTE applications for 4G
- □ Carrier tower configuration needs.
- □ 4G LTE broadband
- □ Continued amendment work for LTE, minor fill-in new build work
- □ Upgrades to LTE expansion to rural areas
- □ Relationships with carriers
- □ Possible advertising
- □ Capacity and fill-in sites, some new coverage
- □ More cell companies
- □ LTE 4G in-fills
- □ Promotion of radio applications that require one or more sites, directly to industrial users
- □ Broadband, backhaul midpoint, etc.
- □ 4G deployments, cell splitting (capacity), rural carrier expansion
- □ Cell site backhaul
- □ Narrowband and broadband
- □ Federal and state government build outs
- □ Lease-ups
- □ Capacity
- □ Verizon and Sprint

- □ Wireless broadband and TV

- □ LightSquared

- □ None

- □ Not at all

- □ Utility

- □ New site development

- □ DAS and public safety systems

- □ Broadband and the need for more spectrum

- □ Law enforcement

- □ Verizon fill-in, Metro PCS

- □ Government users as alternate site

- □ Cellular carriers

- □ Unknown

- □ Not expecting any

- □ Don't see much

- □ Land mobile and broadcast radio — some broadband

- □ Smartphones killing existing networks

- □ New construction and acquisition

- □ New tenants and antenna swap-outs

- □ Data

- □ "If at all" is correct. Very slow.

- □ New broadband carriers

- □ Do not expect very much growth

- □ Commercial two-way radio, microwave and state and local government installations. Additional carriers?

- □ Additional traffic

- □ DAS

- □ Trying to figure that out

- □ Digital TV, provided structures can support loads and have overall height

- □ FM translators for AM stations and possibly new LPFMs

- □ The carriers filling in coverage gaps and the increased capacity requirements

- □ Maybe a little broadband

Question 9.

What is your most effective strategy in a zoning hearing?

Analysis: If a separate question were posed, asking the surveyed which they prefer, a zoning hearing or root canal, there is little doubt what the choice would be. The dentist visit is less expensive and less painful in almost every case. Honesty seems to be the best policy when facing down the NIMBY hoard because there is no amount of sugarcoating that will turn a 200-foot structure into the community's pride and joy. Who will benefit, and why? Yes, it will stick out above the landscape, not because of greed, but because it *has* to in order to work. And it doesn't hurt to have the respective police and fire chiefs at your side, solemnly nodding in agreement, during your presentation.

- □ Need for the tower

- □ The RF is not a factor

- □ Our towers are built in underserved areas and we emphasize the need for communications services.

- □ Never been to one

- □ We are a local, very small business.

- □ We are an electric utility and we use that as our main point, that the tower is necessary for our infrastructure.

- □ Show a need for the carrier.

- □ Collocation minimizes tower growth.

- □ Local support

- □ Be fully prepared before addressing the board. Give the board ample time to look at everything before you go before the board.

- □ Be nice.

- □ Bring the police chief and fire chief to the meeting. We do only public safety towers.

- □ Critical infrastructure

- □ N/A (or emergency communications capability reference)

- □ Collocation

- □ Have none — all towers are on county property.

- □ RF testimony followed by excellent land planning testimony

- □ Improved cellular coverage

- □ Coverage increases income for home-based business.

- □ Meeting with the people as they have issues

- □ Knowledge

- □ Stress safety and coverage

- □ Prove the need for coverage; press the benefits of a tower. Show how the home phone is now the cell phone for 30 percent of us.

- □ None

- □ Varies

- □ Service for the community

- □ Honesty

- □ Collocation, collocation, collocation

- □ Making sure you know all the objections prior to the hearing and being ready to respond

- □ Let the carrier handle it.

- □ Honesty

- □ Don't go.

- □ Lead with your EMF consultant.

- □ Good site acquisition

- □ Telecommunications Act of 1996

- □ Hold community meetings prior to going to zoning to learn about potential adversaries and issues that can be addressed at that early stage.

- □ Grandfathering

- □ Pre-hearing preparation

- □ Being able to answer questions and look professional

- □ Tenants do their own.

- □ Being informed and making sure the zoning boards know we will follow all of their rules and regulations

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□ Collocation

□ Share facility with government and disaster recovery clients

□ Time

□ Has not been an issue to date

□ Open tower to public safety

□ Honesty

□ Our ability to pick sites with the least amount of impact to residential lots

□ We are not adding any sites.

□ Existing locations versus new builds

□ Finding locations where they are not necessary

□ Proof of need

□ Public safety concerns

□ FCC rules and regulations

□ Broadband growth, wireless user increase

□ Flexibility

□ RF testimony

□ Start long before the hearing in getting support from local authorities and populace. Pick the right spot!

□ Confine location of structure to areas for permitted use and give the jurisdiction space on structure.

□ Shop the area for land already zoned industrial. Works best. Convince the planning commission staff that it makes sense. Go door to door talking to neighbors. Pray a lot.

□ As a utility, almost all of our work is collocations on existing structures, which eliminates some of the zoning issues.

□ Have the A/E attend.

Question 10.

Additional comments about the market are encouraged.

□ The market is changing and many owners of small portfolios of towers don't understand the market dynamics. Carriers have more options than they had before in urban areas — fewer in suburban areas — and about the same in rural areas. DAS is here, and along with small cell technology, DAS will affect future growth on towers in urban/ suburban areas, both positively and negatively.

□ Bank financing is becoming easier.

□ *AGL* provides essential information for the tower marketplace. The technical, commercial and regulatory factors are fully covered.

□ Cellular equipment upgrades currently are occupying most of our time, which would otherwise be spent on marketing efforts.

□ The current BTS model that is being used (for pricing anchor tenants) is grossly out of date and will ultimately fail because it is still based on there being four to seven carriers that will use a site. If the strong carriers truly want capital infrastructure partners, they must adjust their reality of what an anchor BTS should pay for a site so that they have a long-term outlook on their communications backbone. Many new tower companies will fail, based on their current terms and pricing.

□ There may come a resurgence of repeaters after a significant earthquake, because too many critical services depend upon cellular service, which is likely to fail when needed the most.

□ We have not completely made up for revenue lost after the collapse of the paging industry, but wireless upgrades (LTE and 4G) are slowly making up the difference.

□ Offer state, regional, and local governments very low-cost space for remote receivers, for their wide-area systems. Established relationships grow over time.

□ Towers are becoming obsolete as technology gets smaller. It is tough for small independents because the big guys have things under control.

□ The RF site industry must stay focused on new customers and how to service the existing customers with consolidation and financial times being tough.

□ It is almost impossible to get permits for new sites, between extreme government interference and residents who think blinking tower lights will affect their menstrual cycles (actual case — I lost). It took over two years to obtain a permit for a third tower in between two existing towers.

Question 11.

As a service provider to the tower industry, are you anticipating growth in your business from that sector?

No 26%

Yes 74%
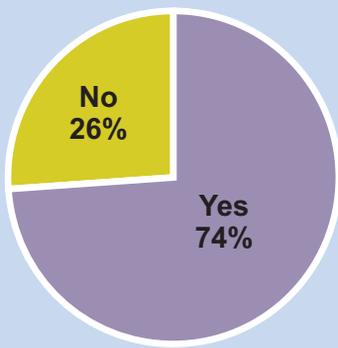
Analysis: Service providers have been optimistic, and increasingly so, compared with previous surveys. And why not? As tower owners focus inward on developing existing site infrastructure, capacity and utility over new growth, the service sector not only lives on but also thrives. Increased government legislation concerning new and existing sites has helped bring new service providers to the fore as well. Environmental consulting firms, legal services, site maintenance companies, site acquisition experts all still make a buck and then some on an industry with relatively stagnant growth but a high level of activity.

☐ Hopefully, many more towers to produce revenue

☐ We continue to see growth in the overlay and modification upgrading networks

to 4G. All site development disciplines are experiencing growth based on these network upgrades.

☐ I anticipate at best a stable environment this year. The Verizon purchase of Alltel took a substantial amount of my work away.

☐ Yes, especially in data

☐ 2012 looks to have moderate growth possibilities and same for next year.

☐ No

☐ Due to 4G

☐ No, but we don't see it going down either — a steady pace of work and clients.

☐ Much uncertainty due to consolidation

Question 12.

As a service provider, what is the biggest issue that may affect the growth of the tower industry in the coming years?

☐ Out-of-state crews undercutting pricing

☐ Consolidation

☐ Zoning

☐ Carrier consolidation; carriers hoarding spectrum

☐ If funding is put into maintenance. From what I have seen, maintenance is a low priority, especially on government-owned towers.

☐ Broadband consolidation

☐ Carrier site release money and plans

☐ Finding reasonably priced sites

☐ Zoning — it's always zoning.

☐ Cost of capital, i.e., interest rates go higher and the question of how carriers fill in the holes once the 4G networks are deployed. Do they go with micro sites/DAS, or will they continue to rely on macro sites, i.e., traditional towers?

☐ BLM and FWS rules on new towers and tower siting, including access road

☐ Economic concerns and the release of capital for infrastructure; siting and zoning issues

☐ Banks to release funds for growth

☐ Locating additional towers on county property

☐ Zoning and DAS

☐ Economic downfall. There is also the issue of continual consolidation of tower owners and service providers.

☐ Excessive government regulations

☐ Continued competition

☐ Tightening of belts

☐ The need for new site tower builds has drastically slowed due to the upgrade projects. The wireless carriers are currently deploying their capex dollars to these upgrades as opposed to new site development.

☐ Inconsistent carrier build plans

☐ Technology improvement, alternate micro solutions to improve wireless coverage

☐ Slowing growth, consolidation, shared networks

☐ The government's continued intervention in the equity markets, and the government's anti-business climate

☐ Implementation of 700 MHz at high-elevation sites

☐ Budgets

☐ Large mergers with the Big Two carriers change the landscape of smaller service providers. They want to sign nationwide or turf agreements, and then one vendor gets the majority of the work.

☐ Unruly restrictions

☐ Consolidation and new spectrum auctions

☐ Further industry consolidation technology (lightRadio cube-type technology)

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- Large national contracts squeeze out smaller companies.
- Crummy economy — it affects providers and consumers alike.
- Not sure at the moment
- RF noise, remote radio head deployment
- Funding

- Lack of build-out capital, mergers
- Local government requirement for permit for any new antennas
- NIMBY
- Cellular leases
- Loss of two-way users due to narrow-band changes

- Local zoning and no one wanting towers in their backyard
- Carrier mergers, less competition
- Public outcry on too many towers
- Irregular work flow
- Mergers
- The government
- Efficiencies in carrier network upgrades and lack of new carriers
- Smaller cells
- Technological advances
- FCC wireless initiative
- DAS, microcells
- On the negative side? Mesh systems that do not require towers. On the positive side? More sites needed for 4G.
- Potential interference issues, land use/zoning, aging tower
- Cost of capital across the board — more expensive capital/debt equals falling tower M&A prices, making it more difficult for tower owners to build towers at previous prices. Wireless carriers have a more expensive time building their networks, which equals fewer sites getting deployed. It is the biggest factor we track.
- The equipment requirements of the carriers and zoning requirements
- Technology confusion
- More services being offered to customer will increase the use of towers and create a need for both additional traditional towers and rooftop antennas.
- New technology that will decrease the number of towers being built that will require our product offering
- Cheapo tenants
- Difficult zoning, shrinking number of tenants due to mergers, increased loading by existing tenants, overloading structural capacity ■

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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.

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product showcase — site security systems and equipment

Tamper-resistant Nuts
SpiNut from **SSC** is a locking device for industrial-level hardware bolting systems, which makes a tower site tamper-resistant. The nut, with spin collar and matching socket, is specifically customized for each application. A secure database catalogs each proprietary design. A SpiNut socket fits any standard drive type, and it is recognized by the U.S. Department of Homeland Security for increasing risk prevention.
www.selectivesite.com

Site Monitoring
PageTek has introduced the ProTek jr+ IP to meet the remote site monitoring needs of cell sites. This monitor provides all the monitoring capabilities of the company's standard units, but adds IP to enhance alerting options. IP capabilities include TCP Messaging to a computer or to the PageTek SiteManager and SNPP Messaging, which allows paging over the Internet and SMTP messaging to send alerts as email. The modem option is still available allowing all forms of digital and voice paging.
www.pagetek.net

Perimeter Intrusion Detection
Smarter Security has launched SmarterBeam CLR500+, the latest model in its line of passive infrared motion detectors. The unit improves upon the company's current long-range detector by increasing the detection area near the unit's mounting. It also features three alarm outputs to enhance alarm response. The 500-foot-long detection field is separated into three zones, which are divided at distances of 60 and 165 feet with three distinct alarm outputs by zone-enabled security cameras to better focus on the intrusion area. This improves the speed and effectiveness of response by more accurately identifying the breach area.
www.smartersecurity.com

Video Security
Videofied is a cost-effective wireless video security system that needs no AC power or Internet or phone lines. Outdoor cameras secure electrical infrastructure, rooftop air conditioners, cables, and building materials. Indoor cameras secure copper plumbing and wiring. The copper theft kit is a video security system designed to apprehend the perpetrators. Motion activates the integrated night vision camera and sends a 10-second video of the intruder over the cell network to the monitoring station and the site manager. Features include up to 24 cameras on a single system, which operates for months on one set of batteries, and indoor and outdoor cameras. Accessories include HID iClass contactless card arming/disarming station, outdoor siren/strobe and key fob arming device.
www.videofied.com

Site Monitoring
ITL Network Operations Control Center, iNOCC, based in Nashville, Tenn., provides around-the-clock tower site monitoring, notification and support of a broad range of tower lighting systems. ITL provides technical support staff experienced with all major tower lighting systems, automatic daily email reports of site portfolio status, complete NOTAM management, filing and maintaining of NOTAMs with the FAA, automatic daily notification of active NOTAMs with history, marker/sidelight alarms and sites with no alarms, extensive logging and reporting of historical data, remote control and diagnostics of tower lighting systems.
www.itl-llc.com

Site Access Management

The Facility Access Management System (FAMS) from **Mi-Jack Systems and Technology** provides a system for managing telecommunication stations and other remote facilities, using keyless technology and management software to deliver the control and security. FAMS uses programmable RF key fobs that allow entry by activating the GateCuff locking device. Each key fob has a unique code that allows the administrator to track and manage that user's access to the facility. In addition to access management, FAMS is a fully integrated system that allows the administrator to control and monitor the facility remotely. FAMS is compatible with most camera and alarm systems, providing the user with real-time visibility over the site and reducing labor requirements.

www.mjst.com

Gate Locking Technology

The GateCuff is a reinforced lock from **Mi-Jack Systems and Technology** that is securely mounted on any fencing or gate, providing a strong and secure lock for any facility. Instead of keys or combinations, GateCuff uses programmable RF key fobs, which eliminate problems associated with traditional entry systems and allow greater control and tracking. Each designated employee and contractor is issued a key fob with a unique code to track and manage that user's access to the GateCuff, and access can be easily disabled in the event of a lost key fob or personnel change. When an authorized user requires access to the facility, he will use the key fob to activate the GateCuff for access. This entry system virtually eliminates unauthorized entry and lock failure and allows the facility manager to more precisely control who accesses the location and when they may do so.

www.mjst.com

Site Monitor

The DM-900 site monitor from **Hark Systems** has eight inputs that can be configured for contact closure or voltage alarms. These inputs can be configured as alarm, event or normal for both the normally closed and normally open conditions. Using any of the backhaul options, this product can deliver alarms to an alphanumeric pager or a PC located at a network operations center (NOC). The DM-900 has a built-in photocell monitor that works with 110-volt AC photocells and has selectable day/night alarm timers and logs when the photocell changes from day to night and back to day. The cabinet door is monitored and can be used to generate an alarm for quarterly tests or for tamper detection. When there is a power loss, an on-board circuit monitors the battery discharge, disconnecting it before damage occurs to the backup battery.

www.harksys.com

Remote Monitoring

The **TASC Systems** siteRSM remote monitoring system provides field personnel with the information needed to determine if there is a problem with the radio site. The system is an industrial temperature-rated, robust, low-power device that allows effective site monitoring and control in many industrial and commercial applications. The system is a flexible solution for monitoring device functionality and the communication backbone for its connectivity. TASC remote monitoring interrogates a site and backhauls the data in a number of ways including Ethernet, FFSK/4- wire, PSTN, cellular, Kenwood FleetSync and Nexedge technology, serial (RS-232) communications, two-way radio and packet radio.

www.tascsystems.com

Busbar Theft Deterrent

The Universal Bus Guard is designed by **Mi-Jack Systems and Technology** specifically for the purpose of deterring busbar theft. The simple but highly effective guard provides a steel encasement that turns away unwanted intruders, while still allowing full functionality and access to the busbar for maintenance personnel. The guard is adjustable from 10 inches to 20 inches to accommodate most any busbar.

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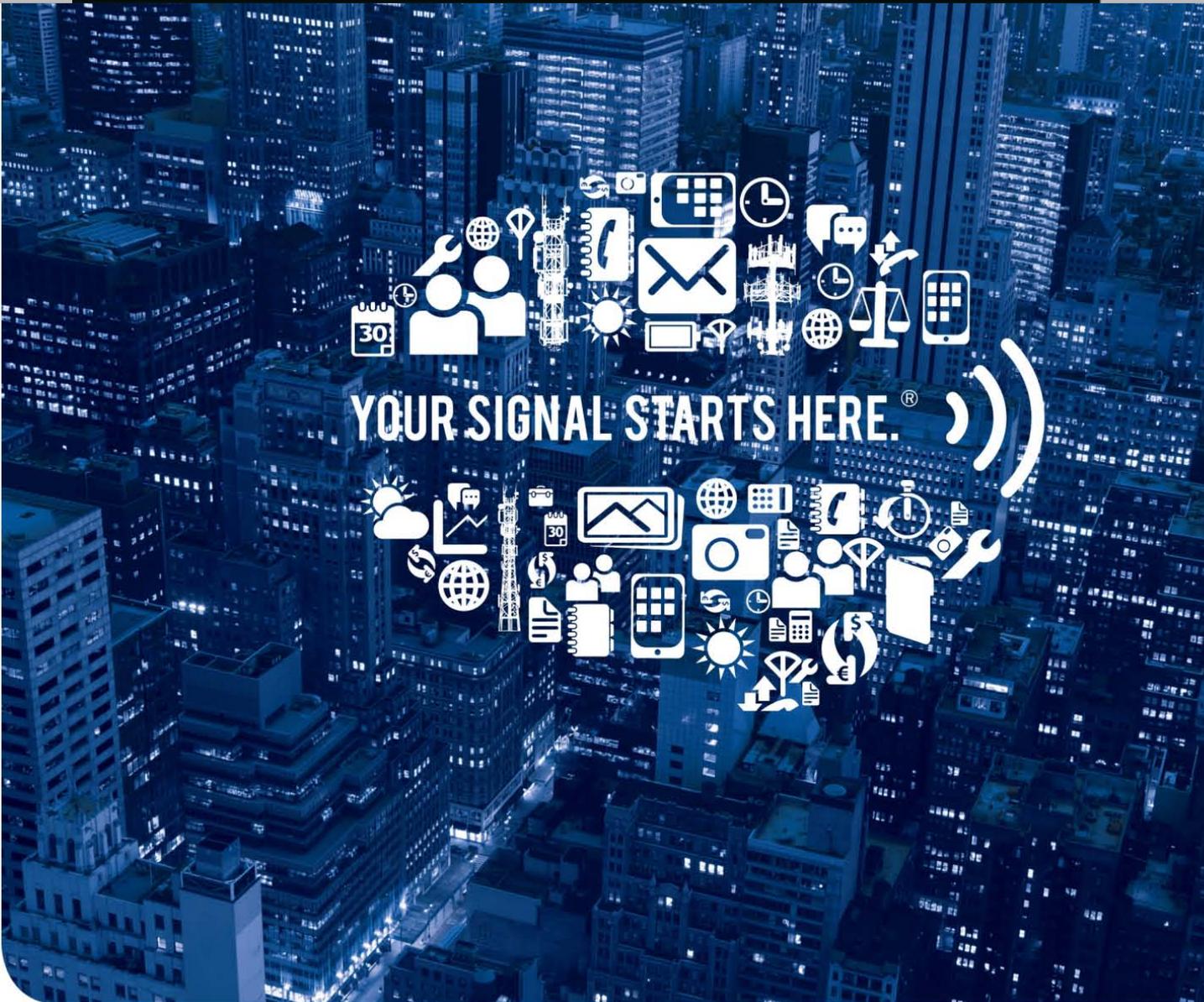
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