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## CLIMBER SAFETY TRAINING FOR INDUSTRY LEADERS

### Special Tower Market Report Issue

Public Tower Companies' Financial Strength  
View from the Top  
Market Outlook for Small Cells  
Trends and Forecasts

September 2014 /// Volume 11 /// No. 09



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## ON THE COVER

Todd Schlekeway (right) of the National Association of Tower Erectors prepares to transfer to the tower face to perform a controlled descent, coached by Zach Johnson of Shenandoah Tower Service.

See article on page 16.

Photography by Rusty Oatman  
Cover design by Sara Bang

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# Climber Safety Training

Nine men and women received authorized climber training July 21–23 in Springfield, Virginia, when they participated in an activity arranged by the National Association of Tower Erectors. The heads of organizations active in the wireless infrastructure industry participated, many of whom never climbed a tower before. OSHA representatives participated, too.

The training brought together leaders who are in a position to promote safety for tower climbers. They learned the challenges and opportunities faced by those who climb towers as part of their jobs. AGL Media Group invited me to observe the training and share an account of it with you. Look for the story on page 16.

What we hope is that if you are not already convinced, this account and articles that will follow in future issues will convince you to take the best available training, use the best available safety equipment and follow best practices to prevent injuries and fatalities involving working on and near telecommunications towers.

If your role is to manage the men and women who climb towers or to lead the companies they work for or the companies that contract for their services directly or indirectly, use your role to ensure that they are trained well, provided with superior equipment and supervised properly. Take an authorized climber training course to obtain a perspective and understanding of tower climbing that will serve you well and that will help you to protect workers through better decision-making.

My thanks to the instructors, participants and sponsors for not only a memorable experience, but also one that will help me in selecting information to publish to help you, the reader, pursue a working environment that promotes safety and health. Look for the names of the instructors, participants and sponsors on page 29.



**Don Bishop, Executive Editor**  
[dbishop@aglmediagroup.com](mailto:dbishop@aglmediagroup.com)



During my time as an observer in a crane-operated personnel basket, Safety LMS President Gordon Lyman (right) explained the tasks carried out by authorized climber trainees. A crane held the basket at height near the tower for advantageous viewing. *Photo by Rusty Oatman*

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EDITORIAL COMMENT



# Towers That Mean Business

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# Fear of Heights



So, I'm afraid of heights. That's ironic for a guy in the tower industry, although I don't climb towers as part of my work. I was on one of the old AT&T monster microwave towers about 20 years ago, but it was for a short time, and it was too much like climbing a ladder to be called climbing a tower.

Covering the industry for as many years as I have, I felt a little guilty that I had not experienced the hard work of climbing. I thought I should know what it's like. Through the years, I've seen offers for inexpensive 10-hour OSHA courses and one-day tower climber certifications. Because I do a lot of amateur radio work, I often find myself watching someone else climb and wanting to be able to help.

I realized I didn't know a lot of the requirements, such as the OSHA regulations, insurance company requirements and how much training someone should have to feel comfortable about climbing. I've watched enough tower construction projects, cable and antenna additions and swaps and AM detuning skirt installations to have a good idea of how things work, but I didn't know what constitutes proper climbing equipment and how to use it.

I'm enough of a radio nerd to know how tedious it is to install connectors, weatherproof cables and connections, ground cables properly, orient and

adjust antenna angles, install DC power connectors and test for passive intermodulation (PIM) interference, all things that someone does when working at height on a tower.

When I would be where people were climbing towers, my fear of heights would cause me to sit in the car and close my eyes more than I would like to admit. Watching them made my skin crawl. However, with age 50 staring me in the eyes, it was time to face my fear. I needed to learn to climb.

Two industry leaders I know and respect are Todd Schleckeway, executive director of the National Association of Tower Erectors, and Jonathan Adelstein, president and CEO of PCIA. My crazy idea was that if the three of us had never climbed a tower, we should experience what it's like. I cornered Todd at the Wireless Infrastructure Show and asked him if he had ever been on a tower. His answer was no, but he was willing. Together, we asked Jonathan, and he said that he also had never climbed. The three of us decided to take a climbing class, although it turned out that Jonathan couldn't attend the class offered as part of the Industry Leaders Authorized Climber Training Event because of a previous obligation and a logistical conflict.

I don't have the space here to properly thank everyone who was involved in the amazing experience; however, AGL Media Group's executive editor and associate publisher, Don Bishop, covers the event in this issue and details everyone's involvement

(see page 16). Being placed at the end of a rope, dangling from a tower, and seeing a familiar face there to help, put John Paul Jones of Safety LMS, the instructor, in a special category for me.

Until you've done it, you ain't done it. I expect a lot of professional climbers are going to give me a hard time about this activity; however, I wanted to get an idea of what climbing towers was really like. I got the idea, not the details. And I could never do it on a sustained basis, but at least I got off the keyboard and saw a bit of what it's like. To the people on the towers every day, my hat is off to you. It is a hard, hard job.

I was totally surprised and so very pleased and grateful to the OSHA folks who joined us: Regulatory Analysts Jessica Douma and Erin Patterson and Occupational Safety and Health Specialist Eric Kampert, P.E.

Tower climbing. Until you have done it, you only think you know how it should be. How it actually is, is totally different.

We need to do our best to make the wireless infrastructure industry safer. Everyone deserves to go home every night. OK, or to a nice hotel room (heck, this is wireless) and to be safe in the jobs they do.

**Rich Biby, Publisher**  
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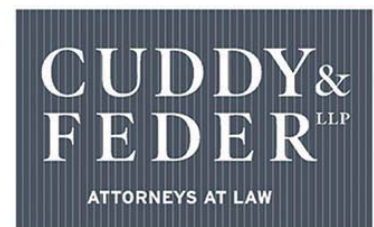
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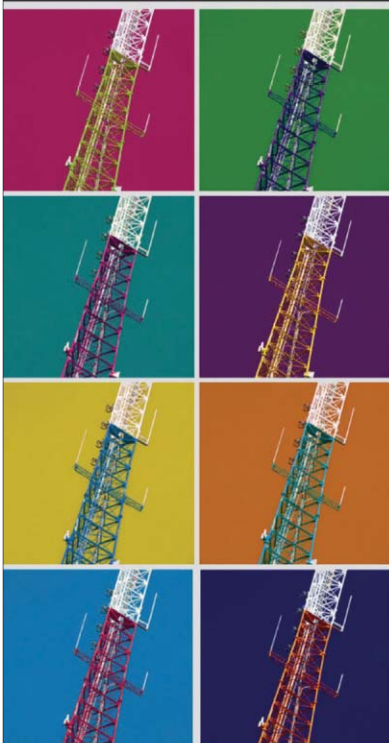
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Standing, from left: Jim Goldwater, Todd Schlekeway, Rich Biby, Phil Larsen, Eric Kampert, Kelley Dunne, Erin Patterson, Jessica Douma, Pat Cipov and Gordon Lyman. Kneeling, from left: Dave Anthony, Sean Cooper, Tara Dunne, Leslie Thornton and John Paul Jones. The group includes training participants and observers. *Photo by Don Bishop*

## Industry Leaders Receive Authorized Climber Safety Training

Nine participants from OSHA, NATE, PCIA, Warriors 4 Wireless, Washington Gas and AGL Media Group received instruction and training to qualify as authorized climbers of telecommunications towers.

By Don Bishop

**I**t began with a conversation between Rich Biby, P.E., and Todd Schlekeway.

“Have you ever climbed a tower?” asked Biby, the CEO and publisher at AGL Media Group. “No. Have you?” asked Schlekeway, executive director of the National Association of Tower Erectors (NATE). “Maybe we should

learn what it’s like,” Biby said. NATE members employ telecommunications tower construction and maintenance workers and technicians, and NATE promotes safety. Among other themes, AGL Media Group covers tower construction and maintenance subjects along with safety topics.

Schlekeway and Biby embarked on

a project that drew many participants and sponsors and that culminated in the July 21–23 Industry Leaders Authorized Climber Training Event. John Paul Jones, vice president of Safety LMS, conducted the training in Springfield, Virginia, using a classroom and a telecommunications tower at the headquarters of Washington Gas,





In a simulated rescue as a training exercise, instructor JP Jones watches Tara Dunne use two fall-arrest ropes and a descent rope with a descent controller to lower her husband Kelley Dunne to the ground. Kelley is playing the role as a victim of a fall that was arrested by his safety harness. The yellow crane basket carries observers and is available for actual rescue if needed. *Photos by Don Bishop*



Dave Anthony of Shenandoah Tower Service selected this Washington Gas telecom tower as a site for training conducted by John Paul Jones of Safety LMS because the tower configuration with wide bracing members and climbing pegs at the lower level gave trainees more difficulty to overcome than a tower that could be climbed like a ladder.





Rich Biby dangles from his safety harness's dorsal D-ring during a rescue training exercise in which he plays the role of a climber who needs rescuing.



Rich Biby dangles from his safety harness's dorsal D-ring during a rescue training exercise in which he plays the role of a climber who needs rescuing.



Biby makes three loops in his fall-arrest rope to anchor his foot. Then, he will push his body upward to reach for the rope lock.



In the heat of the day, Biby can't quite muster the strength to lift the handle to unlock the fall-arrest mechanism. Jones directed him to maneuver over to the tower. *Photos by Don Bishop*

a utility that supplies natural gas to the District of Columbia and the surrounding region.

### Trouble at Height

A training exercise challenged Schlekeway's erstwhile college athleticism when he played the role of a climber needing rescue by a coworker. During the exercise, he dangled from a dorsal D-ring on his safety harness for too long. He experienced fainting symptoms and a feeling of impending nausea that led Jones to have Schlekeway lowered to the ground by a crane-operated personnel basket instead of continuing the training exercise and coming down on a rope with a controlled-descent device operated by a rescuer. Suspension from a dorsal D-ring while in a safety harness can cause a condition that restricts blood circulation. Avoiding injury calls for speedy rescue.

Another training exercise, one in which a climber rescues himself from the dangling position, taxed Biby's strength in the heat of the day. As a result, Jones directed Biby to use access to the tower to lift himself enough to release a locking mechanism on the fall-arrest rope instead of using the descent rope in a strenuous maneuver to do the same.

As one of the shorter trainees, Leslie T. Thornton, vice president and general counsel of Washington Gas and its parent, WGL Holdings, found that her limited reach worked against her. She had difficulty using widely spaced pegs to climb a section of tower leg below a permanent ladder that started about 20 feet off the ground. She completed one of her training exercises at a 10-foot

elevation instead of a 60-foot elevation because of the obstacle the climbing pegs presented.

Dave Anthony, president and CEO of Shenandoah Tower Service of Staunton, Virginia, a NATE member, selected the Washington Gas location for the authorized climber training. "I wanted a neutral location," Anthony said. "This tower isn't owned by a tower company or a wireless carrier." Anthony has served on NATE's board of directors. He takes steps to promote safety for his workers and for workers at other companies, and he watches intently, too. For example, when I stood with a tripod-mounted camera near a vehicle entrance close to the tower, Anthony walked over to me and moved traffic cones into position nearby to improve my visibility for drivers.

### Key Shenandoah Roles

Shenandoah Tower Service provided a crane and a personnel basket to elevate observers to heights alongside the tower. In addition to Anthony, the company brought Sean Cooper, quality assurance manager, who assisted Jones in instructing trainees on the tower. Zach Johnson, safety and training director, rigged ropes on the tower for the training exercises. Eric Severs operated the crane, and Brandan Hardy monitored its operation and warned people away from the area beneath the personnel basket when Severs moved it near the tower.

Trainees included Schlekeway and Biby, along with representatives of the U.S. Occupational Safety and Health Administration, PCIA – The Wireless Infrastructure Association, Warriors 4 Wireless, Washington Gas and the Bob Lawrence & Associates



government relations firm.

One of the trainees, Eric J. Kampert, P.E., occupational safety and health specialist for construction services in the OSHA Directorate of Construction at the U.S. Department of Labor, said he had some previous experience climbing towers. "I did some inspection work for an engineering firm, and that involved some different types of tower climbing experience, along with bridges," he said. At OSHA, Kampert deals with the enforcement side of construction standards. Inspecting towers and investigating injuries and fatalities come within his office's responsibility.

### Simulated Rescue

Another trainee from OSHA, Jessica Douma, is a regulatory analyst in the same directorate with Kampert. She



A sponsor of the Industry Leaders Authorized Climber Training Event, Shenandoah Tower Service, brought a crane and a personnel basket to lift observers to heights alongside the tower and to use for actual rescues if necessary. *Photos by Don Bishop*

writes and interprets safety and health regulations for the construction industry. She previously observed tower construction in Cove Point, Maryland, performed by Shenandoah Tower Service. A marathon runner who also lifts weights and conducts fitness classes, Douma seemed to have no difficulty carrying out the training exercises. In one of them, she played the role of rescuer while

Kampert played the role of a climber being rescued.

"It's not the most comfortable thing," Kampert said of being rescued. "It's a little nerve-wracking, hanging there. Jessica did a good job. She performed a flawless rescue, very timely, which is important. You don't want to be hanging there for too long, especially if you are injured. She got me down to the ground quickly, which



When the widely spaced pegs on the tower leg proved to be a climbing obstacle, crane operator Eric Severs used the personnel basket to lift Leslie T. Thornton to an elevation that allowed her to participate in a companion rescue exercise. Here, she plays the role of a victim who needs to be lowered from the tower to the ground. *Photo by Binh "Alex" Nghe*



Thornton, vice president and general counsel, WGL Holdings and Washington Gas, completes a training exercise as she leans back in her safety harness and lets go of the tower. A lanyard connects the dorsal D-Ring on her harness with a locking mechanism on the yellow safety rope to provide fall-arrest protection. *Photo by Don Bishop*



/ FEATURES /



Eric Kampert, P.E., an occupational safety and health specialist for construction services in the OSHA Directorate of Construction at the U.S. Department of Labor, completed a training exercise by climbing to height while connected with a fall-arrest rope and placing another rope around the tower leg to secure his position. *Photo by Don Bishop*

is all I could ask for.”

Kampert said a climber left hanging in fall-arrest apparatus for too long can suffer suspension trauma, which can lead to further injury and possible death. In the classroom, Jones detailed suspension trauma, also known as orthostatic shock while suspended and harness hang syndrome.

“I was suspended for five minutes,” Kampert said. “The harness I wore was new to me, so I didn’t have it fine-tuned, and I felt some choking around the neck and constriction around the groin, so it was not the most comfortable. My breathing was fine, but I felt blood circulation cut off a little bit in my arms and legs.” Constriction of the femoral arteries that deliver blood to the legs accounts for a substantial portion of the risk posed by suspension trauma.

**Controlled Descent**

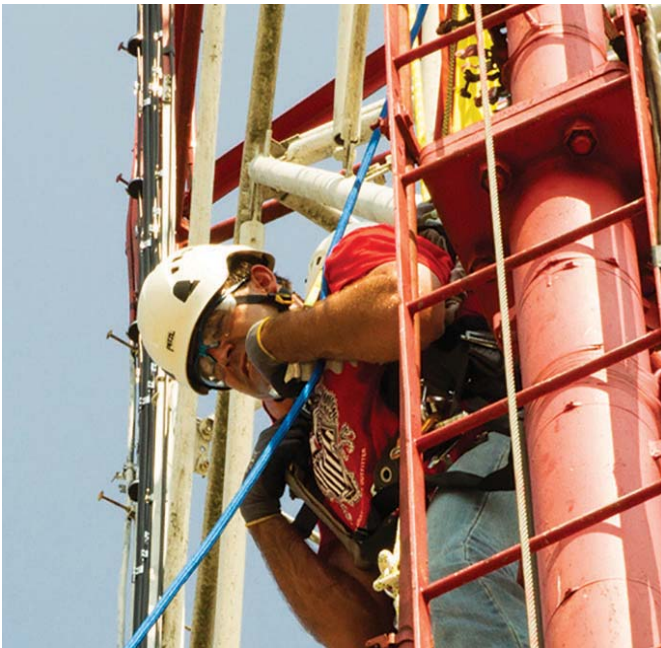
Douma said that using the controlled descent device for the simulated rescue was a little nerve-wracking for her, too. “Even though we had people who could jump in and take over if something went wrong, you still feel very responsible for the person who is limp and attached to your apparatus, and you need to get them down to the ground safely,” she said. “There’s a lot of steel you’re swinging around because of the wind, and you try to keep them from getting knocked too much. It’s a lot to think about all at once. Eric was a good victim. He remained limp and didn’t help out.”

Asked what it felt like to conduct a rescue, Douma said she felt a sense of urgency. “He wasn’t suffering from any injuries, but I still wanted to get him down quickly and without any



As Zach Johnson, safety and training director at Shenandoah Tower Service, looks on, Jessica Douma, a regulatory analyst in the OSHA Directorate of Construction, prepares to descend. She is using a controlled descent device on the red rope while connected with fall-arrest apparatus on the yellow rope. *Photo by Rusty Oatman*





While playing the role of a climber to be rescued in a companion rescue training exercise, Todd Schlekeway said he began feeling faint. Dangling from the dorsal D-ring on his harness as a victim would, Schlekeway lacked the support the harness seat provides, allowing the harness to constrict his neck and groin. Instructor John Paul Jones called for the crane-operated personnel basket to lower Schlekeway to ground level. *Left photo by Don Bishop. Right photo by John Paul Jones via helmetcam.*

incident,” she said of the victim played by Kampert. “Individually, I performed the same type of descent yesterday using the descent-control device, but it actually felt a lot easier this time. I felt more comfortable with it, and I imagine that if I were using it on a regular basis, I would feel very comfortable with that aspect of it. It’s easier when it’s just yourself than it is when you have someone attached to your apparatus, too.”

Erin Patterson, a regulatory analyst with OSHA’s Directorate of Construction, attended the classroom instruction and observed the training conducted at the tower. As part of her work, Patterson helps employers interpret OSHA regulations and understand how the regulations apply to the work they do. Her department creates new regulations and updates existing regulations and standards to be more current.

“This is valuable training in terms of getting real-world experience from people who are in the industry,” Patterson said. “That’s value I always find when I’m working with people who do this type of work day in and day out. They have the experience, the knowledge and the stories to illustrate why safe practices are implemented the way they are. We can always learn new things by talking with folks like this.”

### Importance of Hydration

Schlekeway’s experience playing the rescue victim did not go as smoothly as Kampert’s. “I experienced some fainting symptoms,” he said. Schlekeway initially attributed his symptoms to dehydration, saying, “We talk all the time about hydration and how important that is in our industry, and this is Exhibit A for why that’s

important. Summer is the peak time in our industry, and that’s when crews tend to be the busiest. This is the real deal, and the classic takeaway is to make sure you’re hydrated. It’s not just a talking point that you cover during your daily tailgate meetings before you do your work. It’s the real deal. Stay hydrated.”

Reflecting upon his experience later, Schlekeway concluded that it probably was reduced blood circulation caused by the harness constricting his legs that caused his symptoms. Jones said he observed that Schlekeway started getting weak about five minutes into the rescue exercise. “By the seven-minute mark, he was in trouble,” Jones said. “He was in the personnel basket at the nine-minute mark. It shows just how fast a person can get into trouble, especially when the weather is hot.” Jones called for the crane-operated



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The personnel basket manned by Jim Goldwater and Zach Johnson approaches. Schlekeway is at a level below Rich Biby (foreground), and his harness is attached to Biby's. Biby will swing Schlekeway over to the basket.



Schlekeway was maneuvered into the basket, and Biby disconnected his harness from Schlekeway's and swung away. The door will be closed, and the basket will be lowered to the ground. *Photos by John Paul Jones via helmetcam.*

personnel basket to be used to lower Schlekeway to the ground.

"I had a queasy feeling, and I recognized it as a warning sign," Schlekeway said.

Biby, who played the role of Schleke-

way's rescuer, said it took time to descend from his starting position above Schlekeway. "It took some time for me to get into the spreader bar. When I made it down to Todd's position, everybody was having some fun. We

had a request go out for a bottle of water, and then Todd wasn't being quite as funny, and it became clear that he was not having a good time. We had the man basket available, and JP Jones said, 'It's time to get him off the tower.' We brought the basket over, and it took all kinds of arms and legs and folks to wrestle a 6-foot, 2-inch, 200-something-pound guy into a man basket, but it was there and got him down, and he was fine a couple of minutes later. A simulated rescue turned into a real rescue."

"That's the bottom line," Schlekeway said. "This is reality."

**Experienced Climber**

The trainee with perhaps the most experience climbing towers, Phil B. Larsen, director of education and training at PCIA – The Wireless Infrastructure Association, came from the field and worked his way up to the management levels, and now is



Helped by Jim Goldwater (left) and Gordon Lyman, Schlekeway exits the personnel basket used by crane operator Eric Severs to bring him to ground level. *Photo by Don Bishop*

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Phil Larsen, left, director of education and training at PCIA and a trainee with substantial prior tower climbing experience, helps Rich Biby with his controlled-descent device. *Photo by Rusty Oatman*



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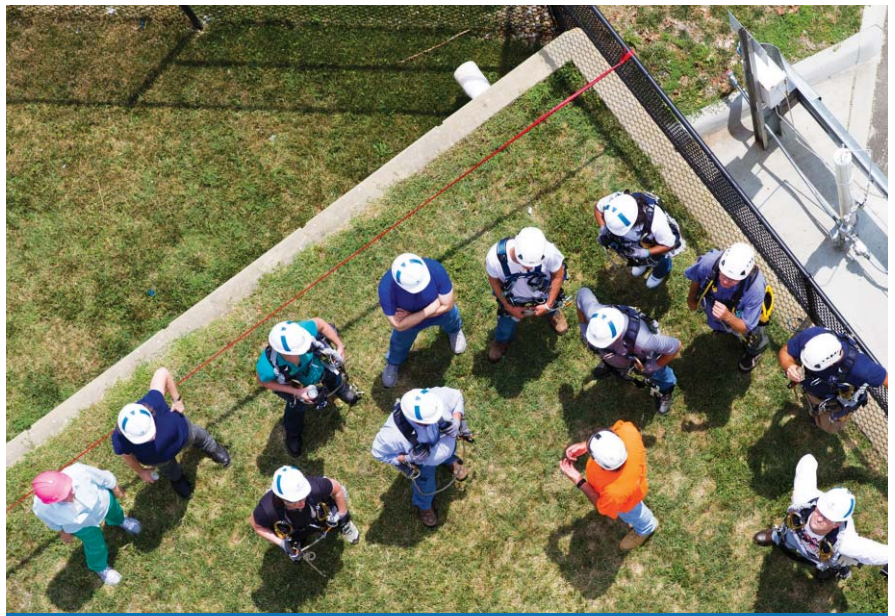
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Jim Goldwater, a lobbyist with Bob Lawrence & Associates who represents NATE, makes his way up the tower while connected with a safety rope. *Photo by Don Bishop*



John Paul Jones (orange shirt), vice president of training at Safety LMS, gives instruction to authorized climber trainees. *Photo by Don Bishop*



Eric Severs from Shenandoah Tower Service operated the crane. Brandan Hardy monitored the crane and personnel basket, keeping people away from the area beneath the basket. *Photo by Rusty Oatman*

involved with the training aspect himself. “First-time climbers can expect to be overwhelmed,” he said, before the training exercises at the tower began. “They will be excited and at the same time scared, especially when they put on the harnesses and it becomes a reality. When they start climbing, they’ll be frightened and yet eager. They’ll be worried about ratings and riggings and the positioning of their feet and hands.”

**NATE Washington Rep**

Jim Goldwater, a lobbyist with Bob Lawrence & Associates, represents NATE in Washington. He said he participated in the training as a way of showing a commitment to the tower workers who make up the National Association of Tower Erectors. “It’s good to learn firsthand what they do,” he said. Goldwater, who never climbed a tower before, said before the training at the tower began that the climbing might be challenging.

Goldwater said worker fatalities caused by falls from towers mean everything to NATE. “There were 13 fatalities in 2013,” he said. “There are some tower industry employers who are not members of NATE and therefore not getting as much training and education as they could and therefore putting their workers at risk.”

Goldwater said what brings him hope for tower workers is that there is so much broadband telecommunications capacity to be built and so much technological advancement that the workers that make up the telecommunications tower industry are doing much for the economy, for U.S. competitiveness and for homeland security. “There is much to be gained by tower work,” he said.

**Warriors 4 Wireless**

Two representatives came from Warriors 4 Wireless, a nonprofit organization. Kelley Dunne, president and cofounder, and his wife Tara

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From left: Kelley Dunne, CEO and cofounder, Warriors 4 Wireless; his wife Tara Dunne, senior recruiter for the organization; and Jessica Douma of OSHA in the classroom used for the Industry Leaders Authorized Climber Training Event at the Washington Gas headquarters in Springfield, Virginia. *Photo by Don Bishop*



Erin Patterson, regulatory analyst, OSHA Directorate of Construction, helps employers interpret OSHA regulations and understand how the regulations apply to the work that they do. *Photo by Rusty Oatman*

Dunne, senior recruiter, participated in the classroom and tower training. Warriors 4 Wireless provides training, certification and transitional support for military veterans to become wireless technicians as civilians. Some of the potential jobs include work that would require tower climbing.

Warriors 4 Wireless was originally incubated inside of Dynis, but then was set up as an industrywide organization after it was launched at the White House in November 2013. MasTec Network Solutions, which acquired Dynis in January, has become a lead supporter of the organization, along with PCIA, American Tower, NSN, Crosby and several other key industry players, Kelley Dunne said.

"I'm here because it's important for industry leaders to go through the authorized climber course and understand how people are being trained to do things the right way for both the challenges and opportunities in the wireless industry," Dunne said.

"I've always believed that well done is better than well said, and it's important to seek to understand what you're asking others to do. This is an opportunity to see the industry from the top down. I would highly encourage other industry leaders to do it."

He said the experience would allow Tara and him to speak with possible job recruits from a better frame of reference.

Speaking of the training, Dunne said, "I thought JP Jones and Gordon Lyman did a phenomenal job. They did the right mix of content material and stories and industry experiences that made it all real, and then carried it from the classroom out here to the tower. It probably is one of the better training events that I've been to."

### Serious Business

Jones, who instructed the trainees, said he has been in the tower construction and maintenance business for 39 years. "Along the way, I've lost several

friends in fatal accidents involving tower work," he said. "I became heavily involved in tower safety training about 18 years ago. I conduct a lot of forensic investigations for tower accidents. I want to make a difference, and I want the industry to change. We have to get our fatality rate under control."

The Safety LMS executive said that growth in the wireless telecommunications business is not going to slow down and, if anything, the rate of infrastructure improvement is going to increase. The only way to eliminate fatal accidents is through training and safety, he said.

"Preventable accidents are the worst," Jones said. "We've had some rigging accidents this year with catastrophic failures, structural failures of the tower, with men on them, working. A lot of times, for the most part, they are preventable."

Asked what brings him hope for the tower workers, Jones said, "The



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## Authorized Climber and Authorized Rescuer Course

The two-and-a-half-day course includes a day of classroom instruction, a final exam and one and a half days of on-site instruction in basic climbing, rescue procedures and equipment use. Although new climbers cannot write a rescue plan, every climber should be exposed to rescue procedures. Upon successful completion of the final exam and demonstration of skills in the field, the student will be issued a certificate of completion and a wallet card.

Some topics covered include regulations and standards; anchorages and anchorage connectors; snap hooks and carabineers; full body harness; energy-absorbing lanyards; work-positioning lanyards; vertical lifelines and rope grabs; self-retracting devices; ladder climbing devices; inspection, care and maintenance; and horizontal lifelines.

new wind that's blowing through the industry is the fact that we have organizations like Warriors 4 Wireless and the Wireless Safety Task Force, and the tower training apprenticeship program, and that company owners are finally beginning to realize that training takes time. Time is money, and an efficient crew is a safe crew, a safe crew is a profitable crew, and it all comes back to them in the end."

### The Need for Training

The president of Safety LMS, Gordon Lyman, attended the course as an observer. An experienced climber himself, Lyman said that the biggest problem with the industry always has been a lack of training. "I truly believe that for training, whether it's fall protection, rigging, RF safety or capstan operation, there never has been a foundation of training in our industry for people to learn from the grass-roots so everyone has the same basic understanding," he said.

"I'm encouraged that we have tower owners, end users and large general contractors talking about training and setting a baseline for our industry," Lyman said. "This won't happen overnight. We have some good documentation of risk analysis and the parties are talking, but it could take another year to solidify the process."

Lyman said much of the tower construction and maintenance industry is made up of small companies. Conveying the need for training through vendors, companies such as AT&T and Verizon Wireless, and tower owners such as American Tower and Crown Castle will help to reach the small contractors, he said.

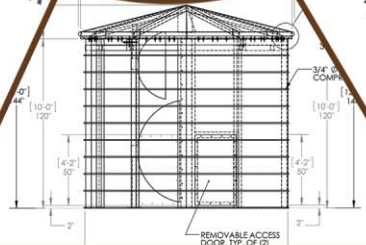
"AGL Magazine has the means to get to the small contractors," Lyman said. "Many of the small contractors don't really know everything they need to know about safety. There are many good contractors. Whether small or large, many contractors just



From the vantage point of the personnel basket held at height by a crane, Gordon Lyman looks over at Todd Schlekeway as he pauses during his ascent of the tower on the first day of training at the structure. *Photo by Don Bishop*

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Pat Cipov, president of Cipov Enterprises and chairwoman of NATE, watches trainees on the tower. "What thrills me is that all industry stakeholders are finally realizing the worth of the training, and you're seeing a lot more of it," she said. *Photo by Don Bishop*

don't know. If we can overcome that, this industry will progress."

Asked about the participation by OSHA representatives in the training conducted at the Washington Gas facility, Lyman said, "OSHA just being here is a step in the right direction. Some in the construction industry think of OSHA as this big monster and they really don't care. But in reality, OSHA does care. They do have a job to do. OSHA having representatives here shows that they're interested in our industry. From my point of view, I want them to be interested in our industry so our industry can improve."

### Training Availability

Pat Cipov, president of Cipov Enterprises and chairwoman of NATE, also observed the training. Her company is a small family business that builds and maintains communications towers. She climbed towers for many years before becoming a hoist operator. "Now, I've been around long enough, they let me stay in the office," she said.

"Lots of manufacturers have come up with new devices and tools that are very helpful for tower technicians," Cipov said, speaking of what gives her hope for the safety of tower climbers. "The training classes not only have improved quality and value, but the number of classes offered all over the country has increased. What thrills me is that all industry stakeholders are finally realizing the worth of the training, and you're seeing a lot more of it."

### Training Conclusion

As the training neared its conclusion, Dave Anthony said it was an enjoyable experience, watching industry veterans



Todd Schlekeway, executive director of the National Association of Tower Erectors, descends from the tower using a controlled-descent device. "We wanted to demonstrate leadership in participating in the course from beginning to end. We're putting our money where our mouth is," he said. *Photo by Rusty Datman*



Sean Cooper, quality assurance manager at Shenandoah Tower Service, assisted JP Jones with instruction on the Washington Gas telecommunications tower. Photo by Don Bishop



Instructor John Paul Jones: "Time is money, and an efficient crew is a safe crew, a safe crew is a profitable crew, and it all comes back to them in the end." Photo by Don Bishop



Dave Anthony, speaking of the trainees: "I think they've done amazingly well," he said. "They showed fortitude. They stuck with it. They've been attentive." Photo by Don Bishop

## Industry Leaders Authorized Climber Training Event

### Trainees

- **Todd Schlekeway**, executive director, National Association of Tower Erectors
- **Jim Goldwater**, senior vice president, Bob Lawrence & Associates (representing NATE)
- **Phil B. Larsen**, director of education and training, PCIA – The Wireless Infrastructure Association
- **Richard P. Biby, P.E.**, CEO and publisher, AGL Media Group
- **Leslie T. Thornton**, vice president and general counsel, WGL Holdings and Washington Gas
- **Kelley Dunne**, president and cofounder, Warriors 4 Wireless
- **Tara Dunne**, senior recruiter, Warriors 4 Wireless
- **Eric J. Kampert, P.E.**, occupational safety and health specialist, construction services, OSHA Directorate of Construction, U.S. Department of Labor
- **Jessica Douma**, regulatory analyst, construction standards and guidance,

OSHA Directorate of Construction, U.S. Department of Labor

### Instructors

- **John Paul Jones**, vice president of training, Safety LMS
- **Sean Cooper**, quality assurance manager, Shenandoah Tower Service (assisting)

### Observers

- **Pat Cipov**, president, Cipov Enterprises, and chairwoman, NATE
- **Gordon Lyman**, president, Safety LMS
- **Erin Patterson**, regulatory analyst, construction standards and guidance, OSHA Directorate of Construction, U.S. Department of Labor
- **Don Bishop**, executive editor and associate publisher, AGL Media Group

### Sponsors

#### Shenandoah Tower Service – crane, crane basket and tower rigging

- **Dave Anthony**, president and CEO
- **Sean Cooper**, quality assurance manager, training assistant
- **Brandan Hardy**, crane/man basket monitor
- **Eric Severs**, crane operator
- **Zach Johnson**, safety and training director, and training assistant

#### GME Supply – fall protection equipment

- **Beau Aero**, president

#### Washington Gas – training location and hard hats

- **Orlando Spencer**, manager, WAN operations

#### Tessco Technologies – food and beverages

- **John Celentano**, strategic marketing manager

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With the crane operating in the background, John Paul Jones, vice president of training at Safety LMS (left), speaks with Jonathan Adelstein, president and CEO of PCIA, who paid a visit to the Washington Gas tower site on July 22. "It's great to see that a lot of people in the industry are learning how to climb, safety, and basic techniques so when it comes to training others and ensuring safety, they have firsthand experience of how it actually works," Adelstein said. *Photo by Rusty Oatman*

CLIMBER SAFETY EDUCATION

who had never been on a tower, climb what he described as a difficult structure. "I think they've done amazingly well," he said. "They showed fortitude. They stuck with it. They've been attentive. They had to practice some skill that they otherwise never would have had to engage in.

"The other thing is, this tower is a challenging structure. It makes it more realistic to have the training on a challenging structure than on something that would be more easily accessible, a tower that anyone could climb up and down as easily as you would a ladder," Anthony said.

**Wrap-up**

Coming back to where things started, Biby said that he had climbed towers

in the past that he wasn't supposed to climb, and he found satisfaction in learning how to do it right, thanks to the training offered in the Industry Leaders Authorized Climber Training Event. He was pleased to find that the use of proper training and equipment helped to overcome his fear of heights. Participating in rock climbing after receiving training and qualification helped him to understand that activities such as tower climbing need not be frightening experiences.

"The class showed me that proper training is available for those who make the effort to identify the training they need and take the classes," Biby said. "What we wanted to do with this event was to raise awareness of what proper training is and raise the bar for the

training someone should have before they climb a tower for the first time."

Schlekeyway said he used muscles he hadn't used in years. "I thought I was in good shape," he said. "I exercise, and in fact, I worked out the night before the climbing. And I played basketball in college."

"That was a long time ago," Pat Cipov teased.

Schlekeyway said that as a result of the wireless infrastructure industry being extremely busy, new companies spring up to meet the demand for tower construction and maintenance services. There is a shortage of technicians trained to climb towers. "On certain occasions, these men and women are placed on the tower prematurely, before they are adequately trained," he



John Celentano, strategic marketing manager with TESCO Technologies, a sponsor: "The concern has been elevated with more accidents on towers and the increased need for training and safe practices." Photo by Rusty Oatman

said. "It's both a quantity and a quality challenge from a safety perspective. Our vision with this Industry Leaders Authorized Climber Training Event

was to use platforms such as AGL Media Group, NATE, PCIA, Warriors 4 Wireless and OSHA to get the word out and let the industry see what high-quality training looks like, this is what the men and women go through to be able to work at elevated heights, and this is how long the course needs to last.

"This isn't one of those fly into a market for eight hours and hand someone a card, and then leave. This is the real deal, and we wanted to demonstrate leadership in participating in the course from beginning to end. We're putting our money where our mouth is," Schlekeway said.

### Sponsors

Together with others, TESCO Technologies sponsored the Industry Leaders Authorized Climber Training Event. John Celentano, the company's strategic marketing manager, paid a visit during the training on the tower. "We supply a lot of the type of equipment used in tower construction and maintenance, including climbing gear, although that wasn't our primary role

today," he said. "We provided some food and refreshments, and we're here to support NATE and OSHA's endeavors to promote climbing safety and safe practices on towers. The concern has been elevated with more accidents on towers and the increased need for training and safe practices."

Celentano said it was impressive to see how the training brought participants up to speed so quickly. "JP Jones and his team have a lot of experience," he said. "You can see that they're passionate about what they're doing, trying to convey the best knowledge to novice climbers. It's an interesting group that these people aren't in the business of climbing, but they received the training and are able to go 100 feet up on the tower and come back down and handle the equipment and maneuver around the tower a little bit."

Another sponsor, GME Supply, provided the fall-arrest safety harnesses and other associated equipment.

The other two sponsors, previously mentioned, were Shenandoah Tower Service and Washington Gas.

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# Silly Boys!

## Tower Work Is for Women (Too)

Interviews reveal women tower hands' opinions about working in the wireless infrastructure industry and what they think of their employers, supervisors and male coworkers.

By Dr. Bridgette Hester

**M**illions of women work in jobs that most might consider to be male-dominated, such as law enforcement, construction, plumbing, oil rigging and commercial fishing. The telecom industry is no exception. However, from the interactions I have had with the climbers and some company owners, it appears that there are more women joining the ranks of the telecommunications industry.

Historically and sociologically speaking, women are one of the most underutilized resources in the workplace. The following information focuses solely on the perceptions, ideas and opinions of the historically underutilized resource in this industry — the women of telecommunications.

I asked female climbers about their number of years in the field, their experience, whether they believe employers have valid concerns about hiring women, their advice to those employers and to women trying to get into the industry, and what they believe they bring to the table.

The female climbers interviewed have from two months to 15 years of experience, and most are seasoned tower hands, supervisors and safety

trainers. They know their jobs, they do their jobs exceptionally well, and they are held in high esteem not only by other female climbers, but also by male climbers with whom they worked. Moreover, these women are highly motivated to learn, they are willing to endure the same elements as any male climber, and they are not above paying their dues to make the wireless infrastructure industry their home.

When I asked male climbers about female climbers I interviewed, I never heard anything derogatory in reply. On the contrary, more often than not I was told that the women were valuable assets and that they would be sorely missed if they were not on a work site. One of the male climbers I spoke with put it another way: "Some of the women in the field can work a tower like a boss."

I asked the women about the most difficult aspect of being female in a

predominantly male industry, and two themes emerged from the answers: frustration and adoration. No woman said she believed that working in a predominantly male industry was difficult. The women said they don't mind proving themselves, but they found it could be frustrating to fight against the stereotypes and predetermined notions based solely on gender. Despite whatever frustrations might present themselves, every woman said she loved the industry, thoroughly enjoyed her work and loved working with her crews.

### Physicality and Effectiveness

What do the ladies have to say about any employer's general concerns about hiring women with respect to the job's physical requirements and how effective women might be? The women said that in their experience, employer fears of hiring women are

*More often than not I was told that the women were valuable assets and that they would be sorely missed if they were not on a work site. One of the male climbers I spoke with put it another way: "Some of the women in the field can work a tower like a boss."*

unfounded. Some said women's natural tendencies were to be more communicative, focused, organized and prompt, and to work more effectively with customers.

Two said the question made them feel conflicted. "I've argued why we shouldn't be treated differently based on our gender, yet I am asked why I may be better than some males," one of them said. "The question does have some validity, yet I find myself trying not to appear hypocritical."

The second responded by saying, "I think that I am better at some things than other coworkers, but I never feel that it's because I'm female, rather than because I'm me," she said. "I generally show more attention to detail and find ways to work smarter,

not harder, but any man could do that as well. I think the fight is more for gender equality in this industry, not for gender acceptance. We're just tower hands, period. We all have different strengths and weaknesses that every strong leader or foreman should take into consideration blind of gender when assigning tasks."

As for physical ability, they all said that just because they are women doesn't mean they can't handle the demands. Strength, endurance and the ability for the body to handle the strain of such a physical job are not monopolized by males. Anyone who has been in the industry can certainly say they have seen more than one male climber who couldn't handle the physicality of the job. Give a female

climber the opportunity, and if she can't effectively do her job for lack of physical capability to handle the load, or because she has poor rapport with customers, you will know it quickly.

### Men and the Workplace

Almost all of the female climbers said that concerns over relationships between male and female tower hands has been brought to the surface at least once in their past. One said, "I learned that one of my supervisors told my immediate supervisor not to hire me because I'm a female," she said. "He said he worried about me having sexual relations with my partner just because I'm a woman and he's a man. It doesn't work that way. He has since said he was glad the other supervisor

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ignored his advice.”

Similarly, another said she understood the concerns. “If I were a company owner, my only concern with hiring a woman in the field would be speed, quality and sexual lawsuits,” she said. “I would say it depends on the woman. If she does quality work and can avoid having sexual harassment charges filed against the company, I would absolutely hire a woman.”

Words spoken on the job by both female and male climbers can be a little colorful at times. All climbers, regardless of gender, will tell you that you had better have a thick skin, and you had better be able to dish it out as good as you take it; it’s the nature of the beast.

In the wireless infrastructure industry, as with other “alpha”

industries, female climbers would agree that tower climbers have to earn respect. In this industry’s environment, there is joking, kidding, and down-right crude exchanges. The women interviewed expressed similar sentiments about it, such as, “I knew what I was getting myself into. If I couldn’t handle it, I wouldn’t be in the industry.”

Moreover, one female climber said, “Employers worry about women not being able to handle the joking and they worry about sexual harassment suits. Dear God, if they really knew what has been tossed around in jest, they might fall over dead. I dish it out as good as I take it daily, and I’ve never complained. It’s quite fun. I would say most employer concerns about throwing women in the mix

are invalid. All around, we’re able to handle it just fine.”

Another responded, “The truth about boys: Get a bunch of guys together isolated from anywhere they care about, and when they don’t think I’m within earshot, I hear things that make me wonder if I’ve been way off all along. It’s been disheartening at times. I try to keep it all in perspective and hope that it’s just the industry and not society as a whole. And yet, in that same scenario, sometimes I hear things that are pretty adorable.”

**Temperament and Attitude**

Women offer an entire set of skills and attributes that is often overlooked and underappreciated — skills that make some employers skittish. Sen-

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*“Don’t expect this to be easy. It’s one of the most difficult and dangerous jobs in America and traditionally composed of males. Just as we don’t want to be generalized by the men, women shouldn’t generalize that all men are the same. You will encounter all kinds of men with a range of attitudes.”*

sitivity and showing emotions and empathy are often categorized as traits that show weakness or liability, but when applied directly and effectively by women in this industry, these so-called liabilities translate into being able to effectively read people and to manage crews and dangerous situations. They translate into an ability to understand customer concerns more effectively.

From the responses gathered, it was apparent that all of the women love their jobs; most love their employers and their crews. One said, “The guys in my company respect me and still joke with me. I love them. Yeah, there are some chauvinists, but mostly everyone is amazing.”

Others responded with similar choruses about their crews, employers and coworkers being supportive. You are unlikely to ever find one of these women behind a desk. For these women, the interactions with their employers and crews; the physicality, and challenges and camaraderie of the job; and the hunger to learn more far outweigh the nuisances of a sideways comment from a crew member who hasn’t caught up to the 21st century.

### Advice to Newcomers

Without fail, the women interviewed had encouraging things to say about more women entering the industry, and with that encouragement came

some sage advice. Mainly, don’t whine, don’t complain, get out there and do it smarter, not harder, and the industry isn’t for the faint of heart.

One veteran climber expressively encapsulated the overall theme with this advice:

“Don’t expect this to be easy. It’s one of the most difficult and dangerous jobs in America and traditionally composed of males. Just as we don’t want to be generalized by the men, women shouldn’t generalize that all men are the same. You will encounter all kinds of men with a range of attitudes. Don’t let the males who are intimidated or upset about your presence discourage you.

“You may encounter sexual harassment and sexual discrimination. Don’t expect special treatment because of your gender. Expect to lift the same amount of weight, climb the same heights and go to the bushes to relieve yourself. You will get injuries, break fingernails, miss your families, work tremendously hard, work in some nasty weather and hear some crude and disgusting conversations.

“Just remember that once you get past the potential issues and demonstrate that you can do the job, you are doing something most men can’t even do. You will form lifelong bonds and friendships unlike any other.

“But never give up — it can and has been done.”

### The Proverbial Glass Ceiling

One woman I interviewed, a 15-year veteran in the industry, concisely and eloquently summed up the general consensus of most respondents on whether they believed there was a glass ceiling in the industry. “Absolutely not,” she said. “Look at Pat Cipov, chairwoman of the National Association of Tower Erectors. The only glass ceilings in this industry or in any aspect of your life are the ones that you set for yourself.”

One climber said she believed there is a glass ceiling regarding her pay, but she also described her experiences in a much more positive light by saying, “I’ve come a long way. I’ve learned a lot. I’ve surprised a lot of people. I’ve impressed a lot of people. And that feels awesome to anyone. I’ve had many foremen fight for me, and many tell me they think I’m the best top hand in the company. Top hands don’t generally work with other top hands, so I don’t know much about the others, but I’m taking their word for it.”

The existence of the proverbial glass ceiling has long been established by sociologists, and although there may in fact be one in the wireless infrastructure industry, it appears the women I interviewed probably won’t notice it when they crash through it.

*Bridgette Hester, Ph.D., is a family and workplace strategist. She is the founder and president of the Hubble Foundation, which is dedicated to promoting the safety of tower workers, site crews and all workers at heights. Her email address is [bridgette@hubblefoundation.org](mailto:bridgette@hubblefoundation.org).*



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# Why Carrier Wi-Fi and Metrocells Are Better Together

By taking steps to deploy, collocate and integrate carrier Wi-Fi and cellular small cells, mobile network operators would move toward eventually implementing a single, seamless, wireless network model.

By Sofia Flores

**W**hat's the best way to get more from carrier Wi-Fi and metrocells? The answer is simple: Put them together. Mobile network operators (MNOs) are already using small-cell technologies to increase capacity and efficiency and decrease total cost of ownership (TCO). Co-deploying or integrating carrier Wi-Fi and metrocells can multiply their benefits and take a key step toward delivering the high performance and seamless connectivity that every customer craves.

## The Role of Small Cells

Today, MNOs are using carrier Wi-Fi and cellular small cells to build more efficient heterogeneous networks. MNOs want to use all of the access technologies at their disposal to boost coverage and capacity and deliver a superior quality of experience (QoE). They view small cells, both cellular and carrier Wi-Fi, as a means to improve performance and reduce TCO.

MNOs typically use cellular small cells to provide public access to their networks and support location-based services. They use carrier Wi-Fi cells to increase mobile traffic in conjunction

with their cellular networks. MNOs often try to make carrier Wi-Fi and cellular look similar to end users. But cellular and carrier Wi-Fi are different technologies. Cellular small cells are integrated into end-to-end, operator-owned networks that use licensed spectrum to cover a large geographical area. Carrier Wi-Fi networks can be integrated with end-to-end operator-owned networks or can be owned by partners. They often are deployed to support high-density coverage in a focused geographical area.

## The Small-cell Advantage

Alcatel-Lucent Bell Labs projections show that mobile data traffic will grow by a factor of 25 between 2011 and 2015. Conventional macro-based capacity-boosting strategies can't

address this rate of growth. Traditional cell-splitting in the macro network will lead to unsustainable business cases. The scarcity and high cost of spectrum will make adding carriers unsustainable, too. Deploying all future LTE Advanced technologies (carrier aggregation, eICIC, MIMO communications and CoMP) may increase spectral efficiency by a factor of 1.5, but this is far short of what's required in the next few years. (eICIC stands for enhanced inter-cell interference coordination; MIMO stands for multiple-input, multiple-output, and CoMP stands for coordinated multipoint, which is used with LTE Advanced to coordinate the transmission and reception for user equipment from several points to ensure optimum performance, even at cell edges.)

## Highlights

- Combining LTE, 3G and carrier Wi-Fi small cells amplifies network capacity and density benefits and gives subscribers the freedom of choice.
- The TCO per bit of a carrier Wi-Fi integrated small cell can be up to 75 percent lower than when deployed separately.
- Integration of carrier Wi-Fi and metrocells is the first step toward a single seamless wireless network.

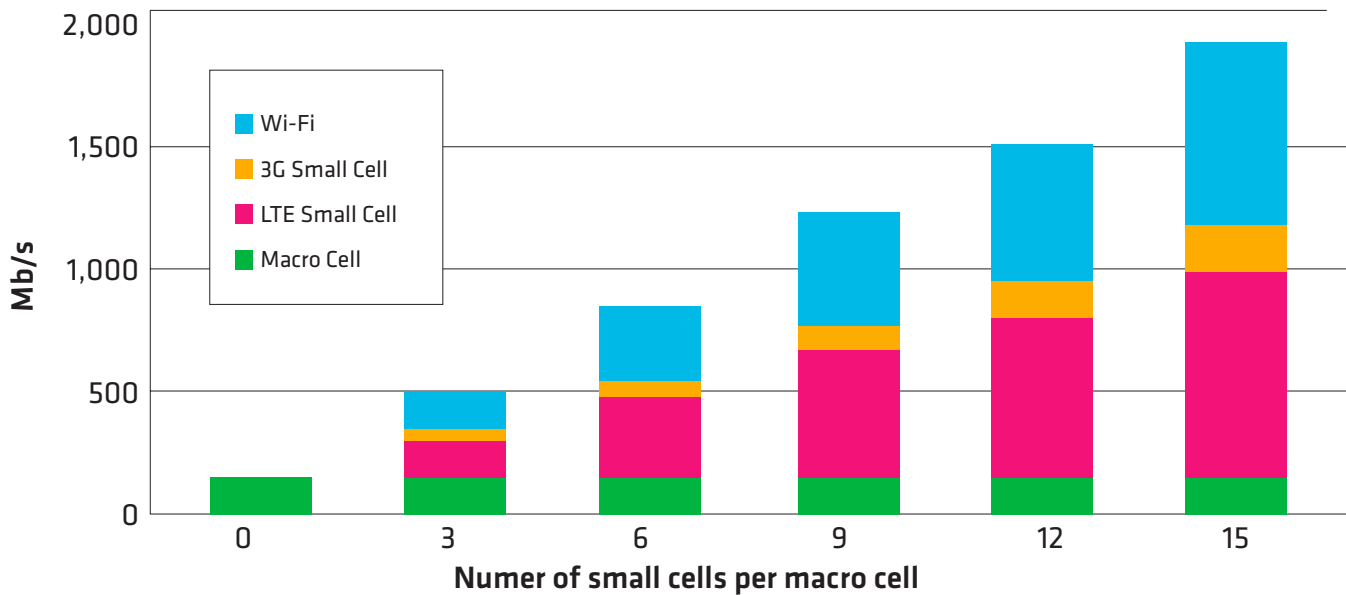


Figure 1. Deploying 3G, 4G LTE, and carrier Wi-Fi small cells within the same site significantly increases the capacity contribution of small cells.

The only cost-effective way to address rapid data traffic growth is to increase network density by adding carrier Wi-Fi and cellular small cells. Small cells boost capacity by making the network more spatially efficient. They decrease cost per bit by enabling MNOs to add high-bandwidth capacity and coverage exactly where it's needed in all environments. They improve QoE by bringing high capacity to traffic hotspots and coverage to indoor locations that aren't well served by traditional macro-only solutions.

### Common Deployment

Carrier Wi-Fi and cellular small cells deliver even greater capacity, efficiency and cost savings when they are deployed together. For example, by deploying three multiple-standard (a combination of carrier Wi-Fi LTE and 3G) small cells per macro site, an MNO can more than triple the capacity of its network. With six small cells per site, capacity increases by a factor of 5 or more. With 15 small cells per

site, capacity grows by a factor of 12 or more (see Figure 1).

When LTE, 3G and carrier Wi-Fi small cells are combined within the same site, they make a greater contribution to network capacity and density. This increased contribution can improve an operator's mobile business case. In addition, the ability to support multiple access technologies at one location can simplify deployment and reduce TCO.

### The Case for Integrated Cells

Mobile network operators can reduce TCO per bit even further by deploying 3G and LTE metrocells that have integrated carrier Wi-Fi support — in other words, with one box that supports cellular and carrier Wi-Fi access.

On their own, 3G and LTE metrocells can cut cost per bit in half compared with equivalent macrocell technology. When these cells are integrated with carrier Wi-Fi, the cost reductions are even more dramatic:

- If carrier Wi-Fi is integrated into a 3G small cell, cost per bit drops by an

additional 75 percent. The cost per bit of a carrier Wi-Fi integrated 3G small cell is less than one-quarter that of deploying the two technologies separately.

- If carrier Wi-Fi is integrated into an LTE small cell, cost per bit is slightly lower than for a carrier Wi-Fi cell on its own. The cost per bit of a carrier Wi-Fi integrated LTE small cell is less than one-quarter of deploying the technologies separately.

In short, MNOs increase their cost savings with each additional access technology they integrate into a single cell. For example, the TCO per bit of an LTE, 3G, and carrier Wi-Fi integrated small cell is just slightly higher than an LTE and carrier Wi-Fi-integrated small cell. These cost savings come from several sources. For instance, rental costs per bit go down when one site can support multiple access technologies. An MNO with an extensive deployment of carrier Wi-Fi access points can reduce site



rental costs per bit by replacing these single-technology access points with metrocells that integrate carrier Wi-Fi and cellular access technologies.

Integrated cells can also help reduce site preparation costs. An integrated small cell typically uses a single backhaul and power source for both supported technologies. As a result, it costs half as much to bring backhaul and power to the site. Integrated cells also help MNOs save on installation: One box typically costs less to install than two boxes.

Carrier Wi-Fi integrated small cells offer some intangible benefits, too. For example, one box on a lamppost is more aesthetically pleasing than two boxes. This is important to communities that are concerned about how their streets and buildings look. In some cases, it may be essential: In London, for example, only one box may be installed on each lamppost.

### Moving Toward a Single Network

Most mobile users aren't concerned about what access method they use. Some want to control whether they use carrier Wi-Fi or cellular access. All want simple, seamless connectivity and a superior QoS.

MNOs can give users what they want by building a single seamless network that spans cellular and carrier Wi-Fi technologies. To succeed, they need to treat carrier Wi-Fi access the same way they treat cellular access. This means delivering on seven key requirements:

- Automatic network discovery and selection: Through policy-empowered network access management, ensure that user equipment can automatically discover and select the operator's macrocells, small cells

*"The only cost-effective way to address rapid data traffic growth is to increase network density by adding carrier Wi-Fi and cellular small cells."*

or carrier Wi-Fi cells in a way that is transparent to the user.

- Automatic user authentication: Eliminate the need for manual logins and ensure that valid user equipment can automatically access the operator's carrier Wi-Fi and cellular networks.
- Secure Encrypted OTA transmission: Secure carrier Wi-Fi-based over-the-air (OTA) connections with the latest data encryption technologies — for example, carrier Wi-Fi Certified WPA2-Enterprise.
- Handovers for seamless mobility: Ensure that users enjoy uninterrupted service by supporting seamless handovers between carrier Wi-Fi access points and between carrier Wi-Fi and cellular.
- Automatic roaming: Simplify the user experience with technical and commercial frameworks that allow users to roam between cellular and carrier Wi-Fi networks.
- QoS with policy-based traffic management: Control traffic congestion

with policies that ensure that users get a high QoS on every network. Where required, move users between carrier Wi-Fi access points or between cellular and carrier Wi-Fi.

- Common charging: Simplify and unify customer billing by extending a common charging mechanism across all access technologies.

By taking steps to deploy, collocate and integrate carrier Wi-Fi and cellular small cells, MNOs can begin to fulfill these requirements and move toward a single, seamless, wireless network model. The most successful MNOs will be those that integrate all access methods at the packet core network.

*Sofia Flores is a senior product marketing manager at Alcatel-Lucent. Her email address is [sofia.flores@alcatel-lucent.com](mailto:sofia.flores@alcatel-lucent.com). Reprinted with permission from Alcatel-Lucent TechZine. Copyright 2013. To subscribe, please go to [www.alcatel-lucent.com/techzine](http://www.alcatel-lucent.com/techzine).*

## Seven Key Requirements for Carrier Wi-Fi Access

- Automatic network discovery and selection
- Automatic user authentication
- Secure encrypted OTA transmission
- Handovers for seamless mobility
- Automatic roaming
- QoS with policy-based traffic management
- Common charging





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## Mobilitie Gives Churchill Downs a Massive DAS Upgrade

With an upgraded DAS at Churchill Downs, AT&T carried a record amount of data during the Kentucky Derby. Fans expect to be able to use their wireless devices extensively before, during and after the Derby.

By Christos Karmis

Since 1875, the first Saturday in May has been set aside to host a special tradition in the horseracing community, let alone the sports world. That event is the Kentucky Derby, the first stop on a

horse's quest to achieve the Triple Crown. The backdrop for this famous race is Churchill Downs in Louisville. Racing fans travel from around the globe to see these thoroughbreds in what was affectionately coined as

"the fastest two minutes in sports."

Although the race hasn't changed much since 1875, the technology fans rely on to enhance their experience at the race certainly has. Fans coming to the events expect to be able to send

text messages, call friends and family, stream video and share pictures of their hats and outfits on Instagram. Having so many people in one location puts a tremendous strain on the wireless network.

Because the fan experience is so important, last year Churchill Downs selected our company, Mobilitie, to install a neutral-host distributed antenna system (DAS) to deliver the increased capacity the wireless carriers needed to accommodate the ever-increasing wireless demands seen on race day. The company completed a significant expansion of the DAS just in time for the 2014 140th running of the Kentucky Derby.

**Solution**

In order to meet the specific needs at Churchill Downs, we analyzed how the network was accessed during the Kentucky Derby in 2013. By understanding where the high-traffic areas were, we were able to fine-tune the system so that the network would be optimally balanced by placing capacity in exactly the right locations.

This year's DAS expansion more than doubled the number of sectors covering the six main floors and basement, along with the grandstands, temporary suites and infield. Part of the expansion included adding permanent sectors in the infield and adding coverage for the new Churchill Downs party deck expansion area.

In fact, one of the key differences of the DAS upgrade could be noticed before spectators even park their cars. In an effort to remove traffic from the macronetwork, we configured the system to transition easily from the macronetwork to the DAS net-



This is the head end for the Churchill Downs upgraded distributed antenna system, which is designed to support the yearly attendance at the Kentucky Derby and the anticipated continuing increase in mobile network traffic.

work using transition zones in the parking lot. As a result, both the macro and DAS networks can accommodate far more capacity than before.

**Results**

As a result of the massive expansion of the previous DAS, the coverage area has been expanded and the overall capacity of the network has been dramatically increased. The new infrastructure supported spectators' ability to stream and upload video,

upload photos to social networks, tweet/post, send emails and make calls. The DAS provided a seamless wireless experience supporting Long Term Evolution (LTE) and legacy technologies for the 60,000 spectators in the infield and more than 100,000 in the grandstands during the Kentucky Derby. All gambling areas located in the basement of the main structure accommodated wireless connectivity for the crowds and provided greater wireless connectivity



/ FEATURES /

## Key statistics about the 2014 DAS updates

- 253 antennas installed
- 152 omnidirectional
- 101 directional
- 1,200 amps needed to power the wireless infrastructure
- 40 tons of air conditioning needed to keep equipment cool (between 68 and 71 degrees Fahrenheit)
- More than 5 million square feet (about 115 acres) covered
- More than 1 million feet of fiber-optic cable
- 56,700 feet of coaxial cable
- 67 days to build original DAS

for those waiting in restroom lines.

AT&T and Verizon customers received wireless coverage for the 2014 event. After the races, AT&T reported that a record amount of data crossed its network. Between the Kentucky Oaks and Kentucky Derby races, AT&T saw a total of two terabytes of traffic and a total of 180 gigabytes of traffic during the peak hour of the Kentucky Derby, which was 5 p.m. to 6 p.m. on May 3. The totals for AT&T are the most from any sporting event at which the carrier has provided coverage.

The DAS upgrades will also support the roughly 30,000 people expected at each Churchill Downs event throughout the year. The installations

wouldn't have been possible without the cooperation of Churchill Downs, Mobilitie and the participating carriers that can be accessed through the expansion. Because the carriers are an important factor in how the network will be used, we made sure to do what was necessary so that all carriers could take advantage of the network at the venue. As a result, the fan experience at the Kentucky Derby has taken a giant leap forward since that first race in 1875.

*Christos Karmis is president of Mobilitie. For more information, visit [www.mobilitie.com](http://www.mobilitie.com). Photos courtesy of Churchill Downs/Kinetic Corporation.*

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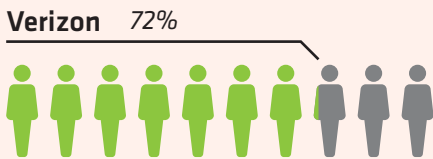
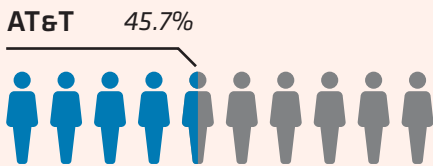
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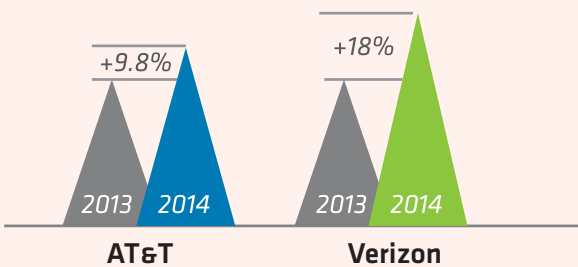
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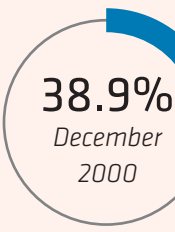
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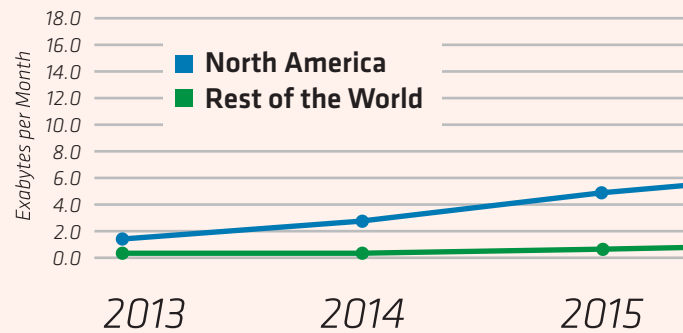
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### Wireless F



### Global Mobile Data Traffic by Region P



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Trends and Forecasts for the Wireless and Tower Industries

By Clayton Funk, Jason Nicolay and Ryan Carr

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The View From the Top

By Don Bishop

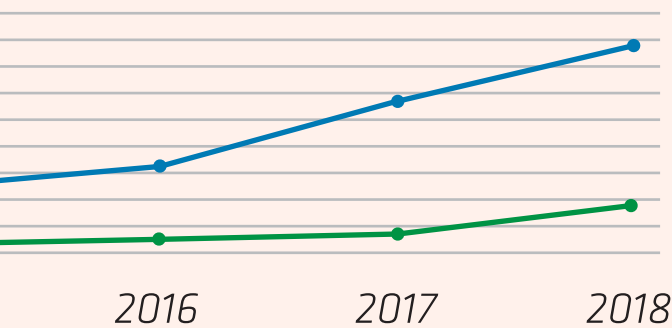
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Penetration



Projections



2014

# TOWER MARKET REPORT

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## Public Companies Maintain Financial Strength

By Don Bishop



# Trends and Forecasts for the Wireless and Tower Industries

Shared wireless infrastructure continues to be commonplace as carriers focus on enhancing the experience of their subscribers by providing reliable service throughout their networks.

By Clayton Funk, Jason Nicolay and Ryan Carr

**A**lthough the wireless industry and its related shared wireless infrastructure subsector witnessed significant changes over the last year, many previous themes remain. The shared wireless infrastructure industry continues to be well positioned for future growth as mobile video, music and data-intensive applications continue to increase and strain network capacity. Projected data usage on wireless networks, according to Cisco Systems, is forecasted to grow by more than 61 percent annually from 2013 to 2018 (see Figure 1). We'll examine what has changed over the last 12 months and discuss a few developments that could affect the shared wireless infrastructure and the wireless industries.

Several specific niches, collectively, make up the shared wireless infrastructure industry (see Table 1).

Most of today's shared wireless infrastructure niches originally started as single-use facilities. However, for some carriers, depending on their budgets, speed to market, consumer demand for wireless services and access

to capital are the catalysts for installing more shared facilities. The entire small cell ecosystem (femtocells, picocells, etc.) has gained popularity in the wireless infrastructure industry for a coverage and capacity solution as carrier networks continue to evolve and adapt to consumer needs and expectations.

## Attractive to Investors

Over the years, some elements remain unchanged — the shared wireless infrastructure industry attracts investors because of these factors:

- Investment-grade customers (i.e., AT&T and Verizon) and other tenants commit to long-term contracts that produce a steady, recurring revenue stream with minimal customer churn.
- Infrastructure owners can financially and operationally leverage their assets.
- The businesses are capital-intensive, requiring investors to continually commit capital that will ideally earn an attractive return on investment.
- The industry has barriers to entry requiring towers to receive regulatory approvals (zoning) and tower developers to have access to carriers.

- Ownership remains fragmented. Carriers and tower owners publicly decry difficulties with zoning approval for antenna sites and changes to existing sites. They both chafe at the limited access to prime locations to serve as coverage sites, capacity sites or both. However, for investors in shared wireless infrastructure, 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 spectrum, often acquired through Federal Communications Commission auctions, and they are required to meet established FCC license build out deadlines. Those expensive and lengthy processes limit the carriers' competition. Simply building out a network, even on a limited scale, can rapidly boost costs into the millions and billions of dollars. Access to and the availability of capital are yet additional factors that limit who owns spectrum utilized for commercial services.

Tower owners have an ability to financially leverage their assets

Towers	Rooftops	Small Cells	Backhaul
Vertical real estate for wireless carriers, mobile private network operators, government agencies and broadcasters	Existing commercial, retail and multi-unit residential buildings for antenna placement in strategic locations	Distributed antenna system (DAS) networks and other types of microcells, in the past a technology of last resort, are now viewed by most carriers as another method in the toolbox for achieving desired coverage and capacity, especially in dense urban environments.	Wireless backhaul (microwave) and wired backhaul (fiber-to-the-tower)

Table 1. Several specific niches, collectively, make up the shared wireless infrastructure industry .

because of the recurring, contractual revenue the towers generate. The long-term agreements with investment-grade, national wireless operators provide stability. The barrier to entry represented by zoning approval and access to capital helps to keep the churn rate among tenants low.

The abundance of capital to invest is favorable for entrepreneurs. Access to both debt and equity capital for tower owners tends to be easier and more abundant when compared with

many other industries.

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 funding who can foresee an exit to a larger consolidator at a future date.

Although the wireless industry's fundamentals continue to be sound, those who follow the space are watching to see if Sprint and T-Mobile USA attempt to merge. At this writing, there continues to be a significant amount of rumor and speculation with nothing formally announced. Those in both the wireless and tower industries know there could be a significant shift in the entire wireless ecosystem if the Big Four — AT&T, Sprint, T-Mobile USA and Verizon

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Wireless — become the Big Three.

**Macroeconomic conditions**

Over the last year, the U.S. economy has continued to steadily improve, with expectations for more economic growth in the second half of 2014.

The economic situation in Europe has also improved, with the European Union officially exiting a recession in the second quarter of 2013. In June 2014, consumer confidence remained strong and now is at its highest level since before the credit

crunch or recession. As a result, retail spending is anticipated to keep on pace and grow at approximately 4 percent during 2014, and unemployment has decreased to 6.1 percent as a result of federal spending and increased corporate hiring. Another positive factor in the U.S. economy is that interest rates have remained low. Regardless of recent increases in 30-year mortgage rates and 10-year Treasury notes, Kiplinger believes interest rates will climb to 4.5 percent and 3.5 percent, respectively.

As of this writing, there continued to be conflict between Ukraine and Russia in addition to increased conflict between Israel and Palestine. It remains undetermined if either of these events could derail or significantly affect the U.S. economy, but these and other global factors cannot be ignored.

Outside of any influences beyond the borders of the United States, what does a steadily improving economy mean for tower owners? Strong consumer confidence has historically translated into wireless subscribers continuing to demand a faster and more consistent consumer experience, motivating wireless operators to continue spending capital to upgrade and enhance their networks. Access to inexpensive debt should allow tower companies to continue to secure new credit facilities and debt issuances, allowing tower owners to pursue growth through organic development and acquisitions.

**Wireless Trends**

Even with an improving economy, there are still key areas to watch as one attempts to forecast where the shared wireless infrastructure industry is

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headed. First, continue to watch the performance and projections of the wireless carriers. Key metrics include average revenue per user or account (particularly the growth of revenue from data plans), subscriber growth and capital expenditures. Second, 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 under long-term contracts underpins the trends for shared wireless infrastructure companies. A significant spike in the cost of that credit, a rapid shuttering of the credit markets or both would be likely to significantly derail the amount of money carriers will invest in their networks and, in turn, shared wireless infrastructure.

Wireless carriers continue to see headwinds in growing their voice communications businesses. 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. Inexpensive pay-as-you-go wireless services that do not require contracts have been increasingly in favor, at the expense of the postpaid sector dominated by Verizon Wireless and AT&T. Given the continued explosion in the usage of smartphones as well as the increased number of consumers turning to tablets and e-readers, carriers that can offer consistently reliable, fast networks for data usage have been able to grow their respective market shares. Given that AT&T and Verizon Wireless are the two largest wireless companies, their operational and financial perfor-

mance is a good barometer for the overall wireless industry.

First quarter 2014 results had AT&T adding nearly 1.1 million net connections for a total of 116 million connections, while Verizon Wireless, with 549,000 net adds, had 103.3 million

retail customers. AT&T reported postpaid net adds were 625,000 to reach 73.3 million, representing the company's best first quarter net adds in five years. Verizon Wireless reported 539,000 retail postpaid net additions during the first quarter,

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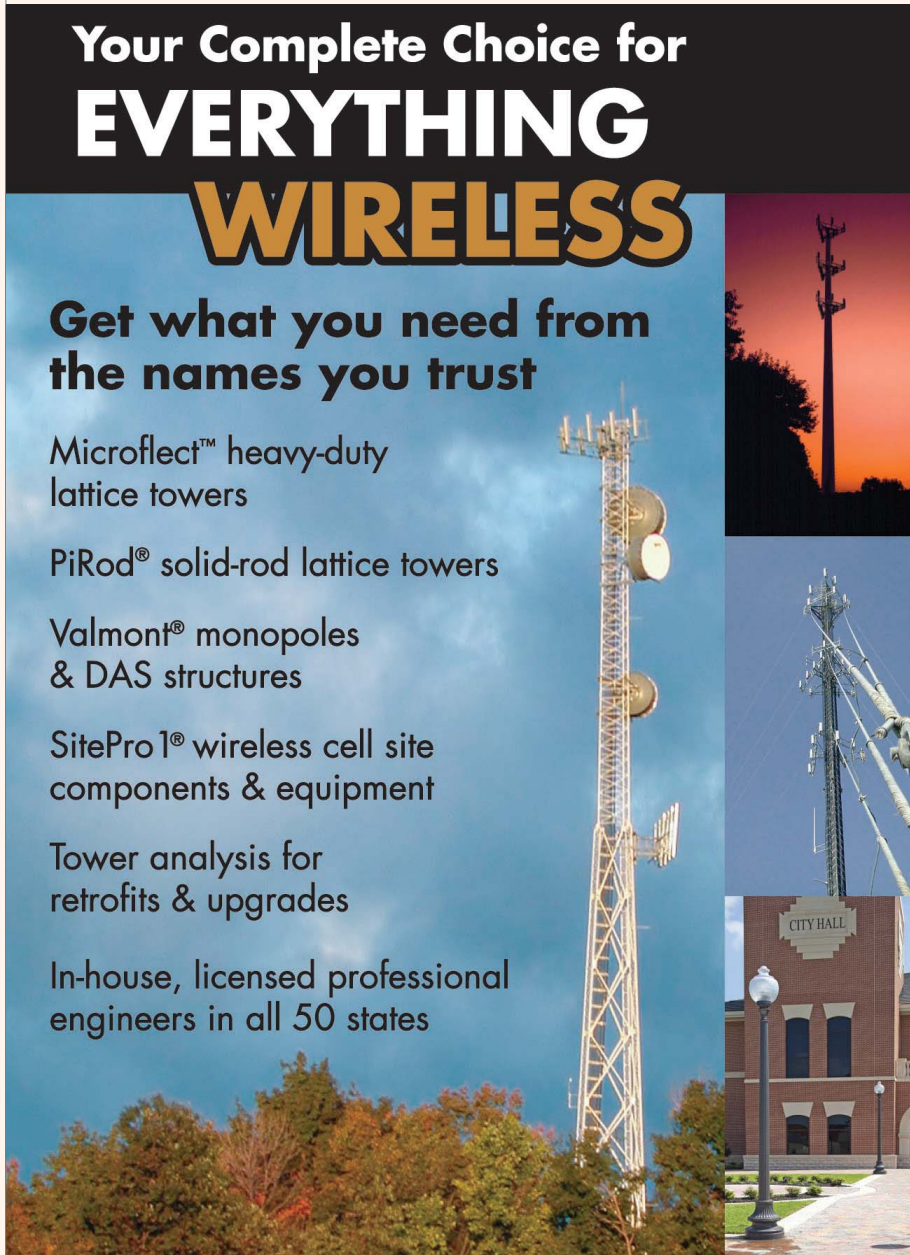
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TOWER MARKET REPORT



growing its postpaid subscriber base to 97.3 million. Connected devices such as tablets, e-readers and other devices continue to boost both AT&T and Verizon Wireless' net additions and served to attract new subscribers desiring access to the latest and most popular consumer wireless devices and services.

Carriers will continue to focus on growing revenue from sources other than voice-only customers as they work to maintain and grow their average revenue per user or account. The good news is that 45.7 percent of AT&T wireless subscribers are postpaid smartphone subscribers as of March 31, 2014, an increase of 9.8 percent year over year. In its most recent quarterly report, AT&T said that approximately 31 percent or \$5.1 billion of its wireless revenue is derived from data services, an increase of nearly 21 percent from the prior year. Verizon reported that more than 72 percent of its retail post-paid subscribers used a smartphone device, an increase of 18 percent over the prior year, which has assisted with Verizon's total first quarter service revenue increasing by 7.5 percent year-over-year to \$18.0 billion. 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 73 percent of Verizon's total data traffic goes over its LTE network.

Earlier this year, AT&T announced that it planned to build 1,500 to 3,000 macrocell sites per year for the next few years as part of a wide-ranging effort to enhance its network and improve coverage and capacity. At the time of this writing, however,



there were numerous reports about cuts in spending and layoffs due to significant cost overruns with AT&T deploying their "cell site of the future," which was supposed to integrate the 700-MHz, 850-MHz, 1.9-GHz and 2.3-GHz spectrum bands on one installation. Numerous news reports surfaced that the cost overruns of AT&T's network upgrades were more than three times its budget. This is of high interest to anyone in the tower industry because AT&T and Verizon Wireless have been the most active carriers over the last 12 months. A prolonged slowdown or stoppage by AT&T may erode investor confidence in the industry despite all the positive long-term wireless trends.

A positive theme and key area of growth for wireless carriers is increasingly coming from machine-to-machine (M2M) data usage and companies also using carrier networks under the moniker of the Internet of Things. M2M communications are made possible by a device such as a sensor that is attached to a machine to capture

an event that is relayed over a network delivering data to another machine that is programmed to receive and react to the data. The sensors are typically embedded and can capture events such as temperature, location, consumption, heart rate, stress levels, light, movement, altitude and speed. These sensors receive and transmit the event data wirelessly to a central server where this data is translated into information that can be analyzed and acted upon (e.g., the temperature is too hot and as a result a transmission will be sent to turn the temperature down). In the United States alone, M2M connections are forecast to rise from 33.6 million to 64.2 million between 2012 and 2018, according to AT&T.

As mentioned earlier, those in both the wireless and tower industries will watch what could happen between Sprint and T-Mobile. Merger and acquisition activity among wireless carriers over the last 12 months has been extremely active and robust. From that period, there are five deals

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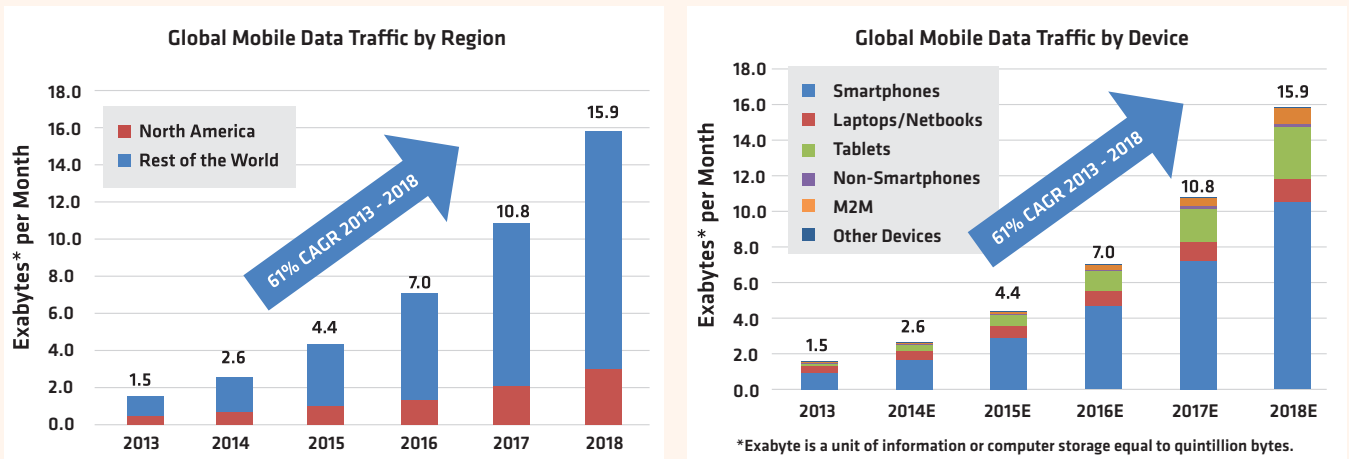


Figure 1. Customers' insatiable demand for wireless access to mobile Internet, data and other information will drive an increase in mobile data traffic by 10x over the next five years. Source: Cisco Visual Networking Index Forecast, February 2014

to highlight that are driving consolidation and resulting in an infusion of capital into the carriers.

- Verizon/Cincinnati Bell Wireless:** Verizon agreed to acquire the wireless assets of Cincinnati Bell in a \$210 million transaction. Verizon acquired a wireless network covering approximately 5.8 million people. This deal is currently pending FCC approval.
- AT&T/Leap Wireless:** AT&T agreed to acquire Leap Wireless d/b/a Cricket Wireless for approximately \$4 billion. The transaction moves AT&T into the prepaid wireless space in a meaningful way by acquiring nearly 5 million prepaid subscribers and greatly increases their spectrum positions in many major markets. This deal closed in March 2014.
- Verizon/Vodafone:** Verizon agreed to acquire the 45 percent stake of Verizon Wireless held by Vodafone for \$130 billion. The transaction resulted in complete ownership of Verizon Wireless by Verizon Communications. This deal closed in February 2014.
- Softbank/Sprint:** Softbank agreed to acquire 72 percent of Sprint for

a \$21.6 billion valuation, which provided an \$8 billion capital infusion into the third-largest wireless carrier. Despite Dish Network's attempt to acquire Sprint, Softbank prevailed by sweetening its offer to shareholders. This deal closed in July 2013.

- Sprint/Clearwire:** After multiple offers and counteroffers, Sprint received shareholder approval to acquire the remaining interest in Clearwire it didn't already own in a deal valued at \$3.8 billion. Despite multiple efforts by Dish Network to secure the opportunity to acquire a significant stake in Clearwire, Dish was outbid by Sprint. This deal closed in July 2013.

Similar to last year, the Big Four have been busy securing additional spectrum. Most recently, T-Mobile announced a \$3.3 billion purchase from Verizon of 700-MHz A Block spectrum in New York, San Francisco, Los Angeles, Miami and 19 other markets covering a total population of 149.5 million. In January 2014, AT&T announced the acquisition of 49 AWS licenses from Aloha Partners covering 49.3 million people.

With the constant rumors surrounding a potential Sprint and T-Mobile merger in addition to the flurry of wireless and spectrum transactions over the last year, it is not unrealistic to assume there will be further consolidation among large regional and local wireless carriers. Consolidation has historically provided carriers with additional access to much needed spectrum and supported the need for additional capacity in urban markets especially. There is little reason to think these would not be the same catalysts underlying any future tie-ups between carriers.

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

### LTE for 4G networks

All of the Big Four wireless operators have selected LTE technology for their 4G networks. Over the last couple years, the carriers have been busy deploying LTE equipment to upgrade and expand current networks. Verizon Wireless is leading the pack and has

substantially completed its rollout. Verizon Wireless covers more than 306 million people with its 4G LTE, next is AT&T with 290 million people. Sprint, with more than 470 markets, now covers 250 million people and anticipates completing its network roll out by year-end. T-Mobile USA covers more than 230 million people. However, as mentioned earlier, AT&T has put on hold any further deployment, and Sprint and T-Mobile USA are active adding only a small handful of new sites in select markets. If this trend continues, Verizon Wireless will further distance itself from the other members of the Big Four.

With 4G LTE network deployments well underway or nearing completion, what's next for the carriers? All Big Four wireless operators have indicated their intent to further upgrade their networks to LTE-Advanced in coming years. LTE-Advanced is focused on higher capacity with increased peak data rates, higher spectral efficiency, an increased number of simultaneously active subscribers and improved performance at cell edges. These achievements will be realized through carrier aggregation, enhanced use of multiple-antenna techniques and support for relay nodes. Further network improvements that deliver a more consistent customer experience could result in tower owners receiving additional modification requests from their existing tenants and possibly new collocation interest as the networks continue to become denser.

The phrase "network densification" has been thrown around as what carriers will focus on in order to deliver to subscribers an ideal customer experience with small cells being the solution.

### Wireless & Tower: 2000 vs. Today

	THEN December 2000	TODAY December 2013
<b>Wireless</b>		
Subs (in millions)	109	336
Penetration	38.9%	104.3%
MOUs/Month/Sub	309	650
MBs/Month/Sub	NA	802
ARPU	\$52	\$47
EBITDA Margin	26.7%	24.9%
<b>Towers</b>		
Cell Sites	104,288	304,360
Tenants per Tower	1.5	2.0
EV/EBITDA	28.6x	20.3x
Leverage	10.4x	5.9x

Source: Media Venture Partners, CITA, company filings and industry news.

Figure 2. In comparing today's wireless and tower industries with the way they were in 2000, it is important to keep in mind that there are large, fundamental differences between the characteristics of the industries today and the characteristics of the industries more than a decade ago.

Urban environments have already seen carriers deploy capital into small cell deployments, but typically for the carriers' own use. Being able to tout they are the only carrier with coverage or capacity in a specific area harkens back to the days when the A and B Block cellular providers would not collocate on one another's towers. It remains to be seen, outside of DAS installations in airports, stadiums, arenas and universities, if the small cell niche evolves into a shared wireless infrastructure coverage and capacity solution similar to what the tower industry has become for carriers.

#### The Tower Deal Environment

Consistent with the last few annual market reports that Media Venture Partners has completed for *AGL Magazine*, the merger and acquisition market for shared wireless infra-

structure, especially towers, has shown incredibly robust valuations. Nearly every tower company is expressing strong interest in acquiring good-quality assets ranging from towers to DAS networks to portfolios of underlying ground leases. Other than CiG Wireless announcing two deals that totaled more than 85 towers, early 2013 provided tower buyers with limited acquisition opportunities of any size and scale. However, there were some significant transactions completed later in the year. American Tower's deal to acquire Global Tower Partners (GTP) was significant in that GTP was the largest privately held tower company by a significant margin. Also significant was Crown Castle's announcement to acquire AT&T's approximately 9,600 towers, one of the largest, if not the largest, carrier-owned tower portfolios. Outside of



/ TOWER MARKET REPORT /

**Major Tower Transactions From June 2013 to June 2014**

Closed Date	Seller	Buyer	Towers	Price (\$ in millions)	TCF Multiple	Price per Tower
December 2013	Global Tower Partners	American Tower	5,400	\$4,800	~18.5x	\$505,208
December 2013	AT&T	Crown Castle	9,700	\$4,850	~22.5x	\$888,889
April 2014	Richland Towers	American Tower	60	\$385.9	NA	\$6,431,667

Figure 3. The tower merger and acquisition market during the last six months was extremely busy, with the three largest deals in the past 12 months having been completed during this period.

last year's larger transactions, there continues to be limited supply on the market for buyers seeking to acquire inventory in the United States. Early 2014 has seen American Tower acquiring Richland Towers, but few other larger announced deals were to be found in the United States. There is a strong desire by both public and private tower companies to deploy capital into tower assets, and this is driving demand for nearly all types of tower portfolios. With the current supply-demand imbalance, the deal environment remains extremely competitive with more buyers trying to acquire towers than there are sellers.

Every deal is different, and various types of towers will be valued uniquely depending on a variety of factors. Although circumstances will vary for each transaction and not every tower or tower deal is the same, in general most deals for telecom towers are being completed at historically high multiples of tower cash flow. Broadcast, government and microwave towers tend to trade at multiples below where telecom towers are bought and sold, but nevertheless are achieving historic highs.

Over the last 12 months, only a few headline domestic tower transactions with more than 100 sites

were reported, but dozens of smaller acquisitions have also been closed. Figure 3 highlights three larger domestic tower transactions that were publicly announced and closed between June 2013 and June 2014.

**Trading Multiples**

Public tower companies are trading at near historic highs and are currently trading over 20x forward EBITDA (earnings before interest, taxes, depreciation and amortization). Despite these impressive multiples, private tower transactions continue to receive strong multiples at or above where the public tower companies have

TOWER MARKET REPORT

**Historic Enterprise Value to EBITDA Multiples (12 Months Forward)**

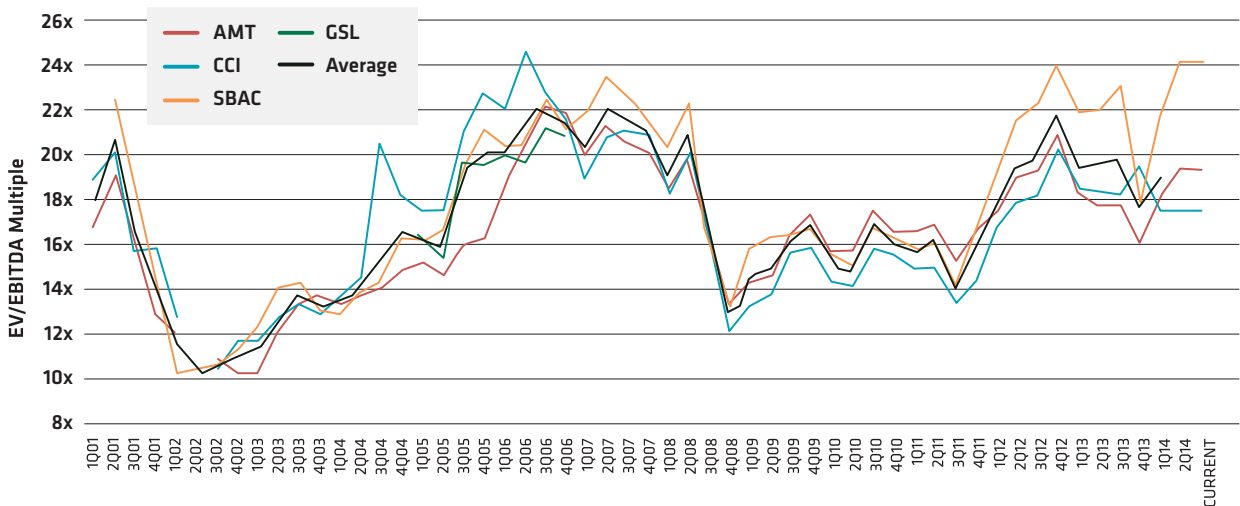


Figure 4. The historical enterprise value to EBITDA (12 months forward) shows how the multiples for the public tower companies have fluctuated during the past decade. Companies represented are American Tower (NYSE: AMT), Crown Castle International (NYSE: CCI), SBA Communications (NASDAQ: SBAC) and defunct Global Signal (NYSE: GSL).

### Trading Multiples for Public Tower Companies Continue to be Strong (\$ in millions, except share price)

Company	Stock Price June 30, 2014	%of 52-Week High	Equity Value	Enterprise Value	Enterprise Value /			
					2014E Revenue	2015E Revenue	2014E EBITDA	2015E EBITDA
<b>Public Tower Companies</b>								
American Tower	\$89.98	97.2%	\$35,777	\$49,808	12.3x	11.2x	19.1x	17.2x
Crown Castle	\$74.26	95.3%	\$24,808	\$36,197	10.3x	9.8x	17.4x	16.4x
SBA Communications	\$102.30	99.7%	\$16,310	\$22,857	15.4x	14.1x	23.8x	21.2x
<b>Tower Average</b>		<b>97.4%</b>			<b>12.7x</b>	<b>11.7x</b>	<b>20.1x</b>	<b>18.3x</b>
CiG Wireless	\$0.51	11.3%	\$20	\$46	2.1x	1.1x	NA	NA

Sources: Consensus estimates and company reports.

Figure 5. Tower stock prices have grown by more than 85 percent since the beginning of 2012. As of June 30, 2014, shares of publicly traded tower companies were, on average, trading at 98 percent of their 52-week highs and 20.1x 2014E EBITDA.

been trading recently (see Figure 4). For tower companies, despite their high valuations, low-20s EBITDA multiples have continued to be attractive.

#### Tower Index Stock Price

Since last year's Tower Market Report, public tower company valuations have continued to experience an increase in their per-share price. Despite increased

market volatility in early 2014, public tower stocks are trading at 98 percent of their 52-week highs as of June 30, 2014. On average, public tower stocks have seen their valuation grow by 21 percent since last year's report and by more than 85 percent since Jan. 1, 2012. As of June 30, 2014, public tower companies traded at an average of 20.1x 2014 estimated EBITDA

(see Figures 5 and 6).

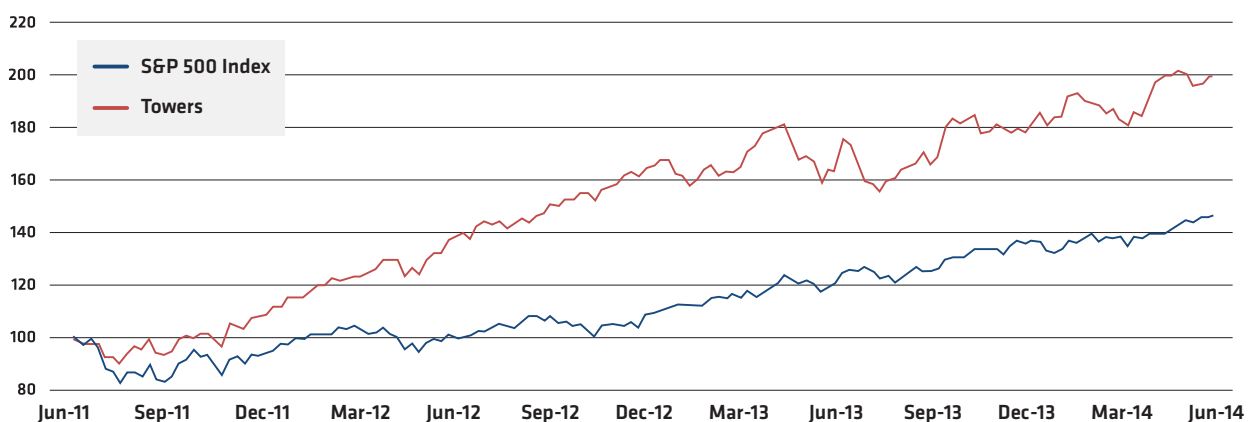
American Tower, Crown Castle International and SBA Communications have "buy" or "outperform" ratings.

#### Wireless Capex

Capital expenditures (capex) by wireless carriers continue to drive growth for shared wireless infrastructure companies. Both public and private

### Trading Multiples for Public Tower Companies Continue to be Strong

Public Tower Companies Composite Value Compared to S&P 500



Source: Yahoo! Finance and Media Venture Partners, LLC

Figure 6. The value of shares in public tower companies has significantly rebounded since the most recent recession, which hit bottom during the fourth quarter of 2008. As of June 30, 2014, the value of public tower stocks has completely rebounded and significantly exceeded pricing from mid-2008 prior to the credit crunch.











Carriers' Network Upgrade			
	2G/3G	4G	Future Deployment
	<ul style="list-style-type: none"> <li>Cellular</li> <li>PCS</li> </ul>	<ul style="list-style-type: none"> <li>700 MHz B &amp; C Blocks</li> <li>AWS</li> <li>WCS</li> </ul>	<ul style="list-style-type: none"> <li>700 MHz D &amp; E Blocks</li> <li>700 MHz A Block - Chicago (Leap)</li> </ul>
	<ul style="list-style-type: none"> <li>PCS</li> </ul>	<ul style="list-style-type: none"> <li>BRS/EBS</li> <li>PCS G-Block</li> </ul>	<ul style="list-style-type: none"> <li>800MHz</li> </ul>
	<ul style="list-style-type: none"> <li>PCS</li> </ul>	<ul style="list-style-type: none"> <li>AWS</li> <li>PCS</li> </ul>	<ul style="list-style-type: none"> <li>700 MHz A Block</li> </ul>
	<ul style="list-style-type: none"> <li>Cellular</li> <li>PCS</li> </ul>	<ul style="list-style-type: none"> <li>700 MHz Upper C Block</li> <li>AWS</li> </ul>	
	<ul style="list-style-type: none"> <li>PCS</li> </ul>	<ul style="list-style-type: none"> <li>PCS</li> </ul>	<ul style="list-style-type: none"> <li>700 MHz A, B &amp; C Blocks</li> </ul>
	<ul style="list-style-type: none"> <li>Cellular</li> <li>PCS</li> </ul>	<ul style="list-style-type: none"> <li>700 MHz A, B &amp; C Blocks</li> <li>AWS</li> </ul>	<ul style="list-style-type: none"> <li>700 MHz A Block</li> </ul>
			<ul style="list-style-type: none"> <li>TBD</li> </ul>
			<ul style="list-style-type: none"> <li>700 MHz E Block</li> <li>AWS-4</li> <li>PCS H-Block</li> </ul>

Figure 7. The Big Four and other large wireless carriers are rapidly deploying their 4G LTE networks.

quarter results that the company plans to spend nearly \$21 billion on capital expenditures during 2014. As of March 31, 2014, AT&T had already spent nearly \$3 billion or 53 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 these capex dollars to continue the build out of its LTE network. Despite the strong start to the year, AT&T has recently slowed its capex spending as a result of the DirecTV acquisition and also reportedly due to cost overruns of AT&T's network upgrades being more than three times its budget.

- Sprint continues to be focused on its Network Vision project, which consolidates network technologies while also reducing the overall number of sites the company uses. The company's LTE network, which launched in 2012, currently covers more than 250 million people. Sprint's coverage and LTE build out will be further enhanced with Sprint's access to Clearwire's LTE network through the purchase of the remaining shares of Clearwire. During the first quarter, Sprint spent nearly \$930 million in wireless capex, which was 85 percent of the company's overall capex for the period.
- T-Mobile USA announced substantial progress in its integration and expansion of MetroPCS and significant growth in the 30 expansion markets launched throughout 2013. During the first quarter of 2014, T-Mobile spent \$947 million in capital expenses and estimated that

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 in excess of \$50 billion during 2014, which will largely support the carriers' continued 4G network build out and anticipated upgrades to LTE-Advanced. As a result, tower companies, both public and private, continue to receive an increase in the number of amendments and modifications to their sites, especially in urban and suburban markets where carriers are focused on building their 4G networks and securing additional capacity. Tower companies are also beginning to develop new coverage and capacity

sites again as carriers' initial deployment of LTE nears completion in the core population centers.

- Verizon Wireless launched its first 4G LTE markets in December 2010, and by December 2013 Verizon Wireless' 4G LTE build out covered more than 298 million pops in more than 500 markets or 99 percent of its existing 3G network footprint. In its first quarter 2014 results, the wireless carrier announced it had spent more than \$2.6 billion on wireless capital expenditures or 62 percent of the company's first quarter capex total. Verizon's wireless capex dollars largely went to increase the capacity of its 4G LTE network.
- AT&T also announced in its first

total capex for 2014 would be between \$4.3 and \$4.6 billion. T-Mobile now covers approximately 230 million people with 4G LTE including 95 of the Top 100 metropolitan areas in the United States. The company expects to cover 250 million pops with LTE by the end of 2014.

- U.S. Cellular, during its first quarter earnings announcement, stated it anticipates spending \$640 million during 2014 on capex. The company spent \$89.6 million during the first quarter. U.S. Cellular covers approximately 58 percent of its subscribers with 4G LTE and expects to expand LTE to 93 percent of its subscribers by the end of 2014.
- C Spire, an independent regional wireless operator in the South, began its LTE upgrade in the summer of 2012 and currently covers more than 2 million people in 96 markets. C Spire intends to expand LTE coverage to several other markets in Florida, Mississippi and Tennessee throughout the remainder of 2014.

Although several more spectrum owners have sold a significant amount or all of their wireless assets — Cincinnati Bell Wireless, Revol Wireless, MobiPCS, Golden State Cellular, Aloha Partners, CableOne and Stelera Wireless — there is constant speculation as to whether a new wireless entrant will emerge. Dish Network, the most likely new entrant, continues to be busy inserting itself into any discussion on this topic because of its large spectrum holdings. Dish successfully lobbied the FCC to allow the company to utilize its 40 megahertz of former satellite spectrum for terrestrial use (AWS-4). Dish, with its various spectrum holdings, continues to exhibit

an interest in becoming a major player in the wireless industry, but has not yet acquired or developed such a platform.

Overall, rapid growth of data use is forcing carriers to upgrade network capacity and start planning for the

next generation of networks and its deployment timeline. Towers are the direct beneficiaries of any build out. See Figure 7 for a summary of each carrier and major spectrum owner's spectrum holdings and its announced plans for each band.



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**Spectrum Auctions**

The upcoming FCC spectrum auctions will be closely watched by anyone in or around the wireless ecosystem. FCC Auction 97 (AWS-3) is scheduled to take place in November 2014 and potential bidders may include companies such as AT&T, Verizon, Sprint, T-Mobile and DISH. A larger auction on the horizon, however, is the auction for the 600-MHZ band of spectrum, otherwise known as the "Incentive Auction" or "TV Spectrum Auction." Analysts forecast that the 600 MHz auction could raise as much as \$40 billion; however, the proceeds will be split among the U.S. government, the nationwide public safety network being planned called FirstNet

and any broadcasters that submitted their spectrum into the auction in return for a percentage of the proceeds.

Significant to tower owners and anyone in the shared wireless infrastructure space is that, historically, any new spectrum acquired by wireless carriers has resulted in increased deployment of network infrastructure. This, of course, translates into lease amendments and modifications, new collocations and new site development for tower owners.

**Credit Environment**

With the U.S. economy improving, albeit at a slow and steady pace, public tower companies are continuing to receive robust access to the credit

markets. Since June 2013, public tower companies have secured \$2.8 billion in senior debt capital and \$3.8 billion in completed term loans.

- American Tower secured \$1.25 billion in senior unsecured debt and \$1.5 billion through a term loan over the last 12 months in domestic issuances. American Tower announced in August 2013 its intent to raise approximately \$1.25 billion in new senior unsecured corporate bonds. The company issued the debt through two tranches — \$750 million at 3.4 percent due in 2019 and \$500 million due in 2024 at 5.0 percent. In addition, the company issued a \$1.5 billion term loan with a floating rate of London Interbank

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Offered Rate (LIBOR) plus 1.13 to 2.25 percent. American Tower utilized the proceeds to repay its revolving credit facility and for general corporate purposes.

- Crown Castle secured \$800 million

through a term loan and \$850 million in senior notes over the last 12 months. In August 2013, Crown Castle received an additional \$800 million to a previously established term loan with a rate of LIBOR plus 2.25

to 2.50 percent due in 2019. Most recently, in April 2014, the company issued senior unsecured corporate bonds of \$850 million with an interest rate of 4.875 percent and a maturity date in 2022. In May 2014, the company used the proceeds to redeem debt that was due in 2019.

- SBA Communications over the last 12 months has secured a \$1.5 billion senior secured term loan and \$750 million in senior unsecured debt. In February 2014, SBA Communications entered into a senior secured term loan whereby the company would borrow \$1.5 billion at 4.875 percent in two tranches, both maturing in March 2021. Both tranches were offered in the second quarter of 2014. Proceeds from the first tranche were expected to be used to pay down existing debt and pay down the company's revolver; proceeds from the second tranche were to fund the pending Oi acquisition in Brazil, along with general corporate purposes. Effective July 1, 2014, the company closed on \$750 million of senior unsecured debt, due in 2022, at 4.875 percent, to be used to redeem notes due in 2019 and for general corporate purposes.

An improving economy and an attractive asset class — shared wireless infrastructure — have meant public tower companies are continuing to receive favorable interest rates and excellent credit ratings. Despite constant speculation about a potential increase in interest rates, public tower companies are continuing to take advantage of their access to the capital markets to issue new notes and repay older ones nearing maturity to

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extend maturity dates.

**The Future**

Consumers continue to view wireless as an everyday necessity instead of a luxury or option. The tower market has and will continue to be a direct beneficiary of the wireless industry's strong staying power, and as a result, the tower market has proven to be fairly insulated from macroeconomic issues. The tower deal environment, although slightly sluggish the first few months of this year in terms of the volume of deals, could see some sizeable transactions come to market the last half of 2014. Similar to the past couple of years, tower owners considering selling some or all of their assets in 2014 have the benefit of

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tablets and other handheld devices are being designed for multiple networks. Demographics show younger adults choose wireless over wireline with approximately 39 percent of households now being wireless-only. Wireless is an everyday part of life for the future of our country and does not seem to be going away, nor is it threatened to be replaced by any new modes of communication. We are quickly headed toward a day when many people will only access the Internet via mobile devices. M2M and the many different segments under the M2M label are projected to grow strongly over the next five to 10 years by compound annual growth rates of 10 to 50 percent. The global M2M industry size is forecast to

being in a sellers' market because of the limited inventory on the market and the depth of the interested buyers. The wireless industry, overall, continues to have the underlying characteristics of being a long-term winner as wireless voice, data and mobile Internet and video use do not show any signs

of decline.

Trends continue to show a move toward everything wireless. There continues to be a robust market for companies developing products specifically for wireless users, including mobile apps and dynamic, mobile Web content. Popular smartphones,

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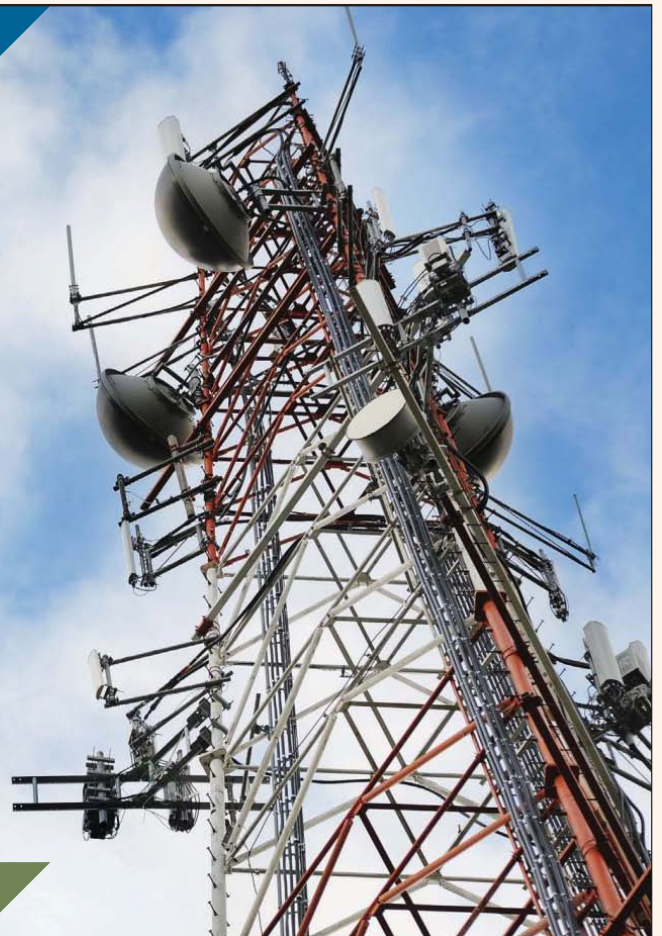
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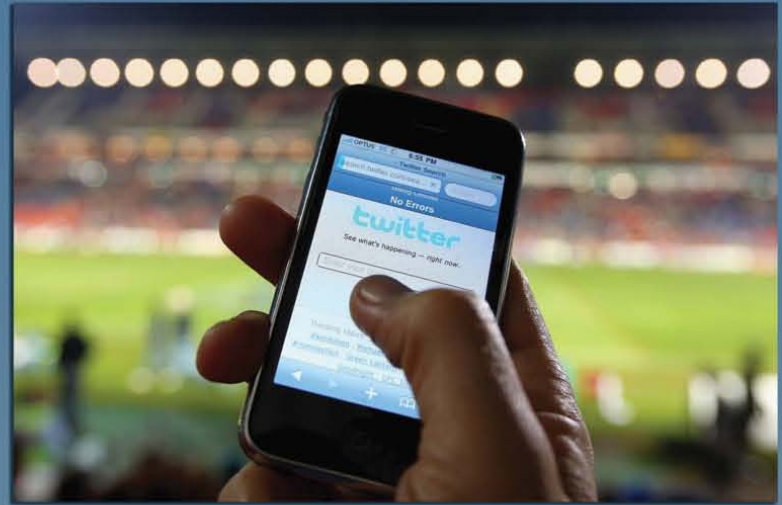


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grow to around \$200 billion in revenue by 2020, according to Strategy Analytics.

Although subscriber penetration is currently at over 104 percent, minutes of use remain high and data as a percentage of revenue has been growing. Spending on wireless data continues to surge as consumers connect smartphones, tablets and even cars to networks. U.S. mobile data revenue climbed 20 percent to \$24.8 billion in the fourth quarter of 2013, according to industry consultant Chetan Sharma.

Upcoming FCC auctions, as mentioned earlier, could see new entrants emerge into the wireless world and become potential new tower tenants.

It will be interesting to watch over the next several months to a year to see whether the increased use of small cells by the various wireless carriers continues to be primarily end-user driven and utilized by single customers or, in a fashion similar to the way the tower industry evolved, whether the carriers end up relinquishing control of these

facilities and small cells become more of a neutral-host business like towers. The tower industry as a business niche emerged in the mid-1990s as carriers realized they could save both time and money on the front end by having third parties invest their own time and money to develop sites while the carriers focused on network design, marketing and subscriber growth.

If it makes financial sense for both carriers and third-party owners, shared infrastructure will continue to become the rule, rather than the exception, as carriers respond to consumer demands. The macrocell site build out will continue to flourish while being complemented more and more by alternative sites, such as femtocells, picocells and distributed antenna systems. Backhaul demand, whether via fiber-to-the-tower or microwave, will continue to increase significantly as wireless subscribers use mobile devices for more and more data-intensive applications, such as mobile video streaming and data services, rather than just voice. Overall, the shared wireless infrastructure business continues to be a robust and viable business niche, complementary to and providing mission-critical solutions for the wireless industry.

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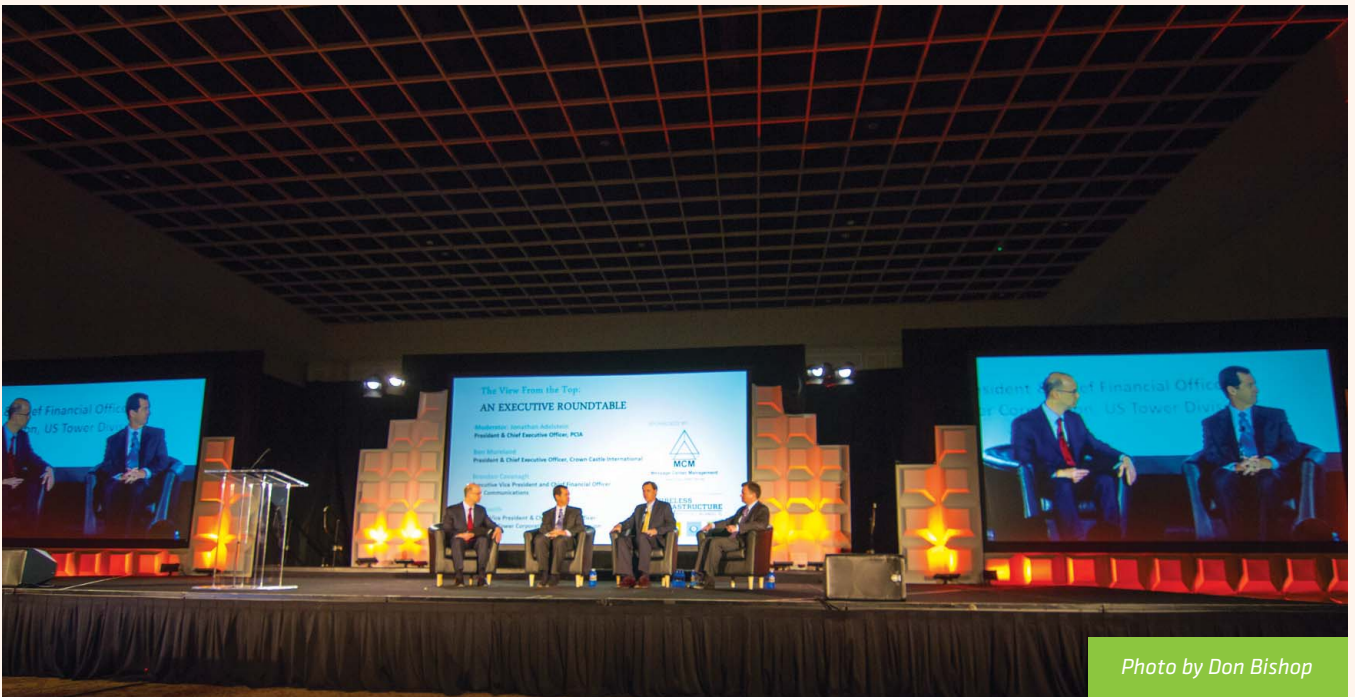
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## The View From the Top

Executives of three large telecommunications tower companies assess the state of the industry and make predictions for antenna site development and company operations for the coming year.

By Don Bishop

Speaking in Orlando, Florida, on May 20, executives of three large tower companies answered questions at a session named “The View From the Top.” The occasion was the Wireless Infrastructure Show, and the executives were W. Benjamin “Ben” Moreland, president and CEO of Crown Castle International; Rodney Smith, senior vice president and CFO of American Tower’s U.S. Tower Division; and Brendan Cavanagh, executive vice president and CFO of SBA Communications. Jonathan

Adelstein, PCIA’s president and CEO, was the host. The following are highlights from the session, edited for length and style.

**Adelstein:** Ben, how’s your integration of AT&T Towers going? And Rod, maybe you could talk about your integration of Global Tower Partners.

**Moreland:** We’re up to our ears in the integration right now. We’re in the middle of integrating 9,700 sites we acquired from AT&T at the end of last

year. We’re about halfway through. It’s usually a six- to nine-month process before acquired sites are fully integrated and able to take applications at the same speed and pace that we’re used to in Crown Castle. The support we’re getting from AT&T has been very helpful.

**Smith:** American Tower closed on our acquisition of Global Tower Partners in the fourth quarter of 2013, and the integration is substantially complete. We’re ahead in terms of capturing our sales, general

and administrative expense synergies that we originally had in our investment case.

We also posted strong growth on those assets in the first quarter of 2014. The core organic growth for the GTP assets that we acquired was 9.9 percent, outpacing the core organic growth of the legacy of American Tower sites, which was 9.2 percent. Both numbers represent strong growth, well ahead of the 68 percent core organic growth range that we target long-term.

Strong growth from the GTP assets results from the high-quality locations of the assets. When we acquired them, the assets had, on average, two tenants versus the two and a half tenants on our legacy sites. That facilitates quick and easy collocation with minimal capital expense, and it helps with the collocation process.

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**Adelstein:** Where are we in the 4G build out?

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**Cavanagh:** 4G deployments have a long way to go. Although SBA has seen record growth over the last couple of years from all of our big four carrier customers in the United States, based on the backlogs that we have today, which continue to remain at record levels, the growth trajectory for continued deployment is significant for the next few years.

A lot of the amendments that we've been signing have been for 4G upgrades. A lot of coverage build also is being done because carriers still have many areas with coverage objectives to meet. We expect see continuing growth for several years at levels similar to the past couple of years.

*Rod Smith: "In the past several years, American Tower invested over \$7 billion in U.S. infrastructure. We have assets on four other continents in 12 countries. But 64 percent of our acquisition capital has been spent in the United States over the last several years."*

**Moreland:** Our investment focuses on the U.S. market. In the past two years, Crown Castle invested \$9 billion in adding infrastructure in the United States. We acquired the carrier towers from T-Mobile USA and then AT&T as well as a sizeable business in the small cell arena with NextG Networks.

We're going to have a record application volume this year. It's playing out the way we expected with amendments and a continuing build out of the original 4G deployments, depending on which carrier and which market. We're seeing significant collocation activity return to the market, primarily with the industry leaders first, because their networks are the most loaded with 4G. They are adding capacity and coverage where they didn't previously have it and where they now need it based on the use of the 4G networks. That's going to continue right through Sprint and T-Mobile over time.

One of the premises for our industry that is compelling to the carriers and to Wall Street is that using wireless infrastructure is an efficient way to build and deploy networks. Sharing infrastructure is an efficient use of capital. We've proven that through up and down business cycles when the industry continued to grow and meet Wall Street expectations, notwithstanding difficult times in the financial

markets that occurred four or five years ago.

**Smith:** In the past several years, American Tower invested over \$7 billion in U.S. infrastructure. We have assets on four other continents in 12 countries. But 64 percent of our acquisition capital has been spent in the United States over the last several years.

Verizon has completed its initial roll out of LTE. The network is a mile wide and an inch deep. They're going to have to densify the network. They cover 300 million pops, which is good for the United States.

AT&T is also rapidly moving through the initial LTE upgrade, and they're approaching 300 million pops.

We see Sprint and T-Mobile actively working on upgrading their networks to LTE. They're a little behind Verizon and AT&T, but toward the end of the year, they may have 225 million to 250 million covered pops.

It's been a long time since we've seen all four wireless carriers as active as they are today. We believe that will continue, so it's a great time in the U.S. wireless space.

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**Adelstein:** What do you see favoring wireless infrastructure development, and what big obstacles remain?

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**Cavanagh:** Many states have adopted



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Jonathan Adelstein, president and chief executive officer, PCIA. Photo by Don Bishop



Brendan Cavanagh, executive vice president and chief financial officer, SBA Communications. Photo by Don Bishop

collocation-by-right laws. We're now starting to see that happen at the federal level. The FCC seems to appreciate what infrastructure does and seems to be doing things to try and speed the process for deployment. Some things fly in the face of that, such as rules adopted regarding public notice for migratory birds.

**Moreland:** Generally, there's been recognition of the value that our shared infrastructure brings to the consumer and to the economy. Section 6409(a) in the Middle Class Tax Relief Act has been a big benefit that speeds the collocation process.

Three-quarters of 911 calls remain on wireless networks. Things like that resonate with the public, particularly

when they can look in their pockets, find their smartphones and realize how much everyone relies on them.

**Smith:** Regulations for collocating on existing towers and for building new towers are far from perfect. But we see a shift for the first time in which the U.S. government recognizes the value of bringing broadband services to people across the country.

One of the things that exacerbates the issue is the dramatically increased volume and demand for new collocations and new towers. The big wireless carriers and tower companies have the resources to upgrade infrastructure to deal with that. Government agencies don't. They're being flooded with additional applications, and that can

slow the process.

An outdated regulation that's been in place for more than a decade requires someone to climb a tower every quarter and inspect lighting kits. We have sophisticated network management systems with cameras that monitor everything without the need to climb the tower. The FCC grants waivers in some cases, but it would be nice to see the regulation upgraded to match what actually happens with monitoring today.

**Adelstein:** Do you see some revenue opportunities with Dish Network and FirstNet?

**Moreland:** What's been clear since the industry began is that there are always parties on the outside that own spectrum or that have a product that they ultimately want to launch on a wireless network. Today, we have the four big wireless carriers. But there are always new entrants that seek access to the consumer on a wireless device. With the innovation happening at the device level, I think there's really no end in sight for that.

There are two spectrum blocks out there, one with FirstNet and the other with Dish Network, that hold undetermined future opportunities. Eventually, their spectrum will be deployed in some shape or form that will result in further sharing of our infrastructure, making the network available to consumers or first responders, depending upon how it goes.

**Cavanagh:** Ultimately, that spectrum will be deployed, which will be a good thing for our industry because we almost definitely would require

*Ben Moreland: "Our investment focuses on the U.S. market. In the past two years, Crown Castle invested \$9 billion in adding infrastructure in the United States."*

additional infrastructure in order to deploy it. The question of how that happens and whose hands it's in when it happens remains uncertain to some degree. As a result, the relative effect on our industry remains uncertain.

The significant opportunity remains with the four big U.S. carriers. We're seeing growth opportunities today that we didn't even see years ago. We'll continue to see significant growth from the existing pool of carriers, and it's nice to know that there are other guys out there with additional swaths of spectrum that will ultimately be deployed, whether it's in partnership with an existing carrier or independently. That will help to sustain the growth rate for years to come.

**Smith:** When carriers upgraded networks to 3G, they didn't have handsets to use all the 3G capabilities. That made for a pause in between the 3G and 4G roll outs. Today, the handsets are there for LTE. There is no pause, now that they've increased the network capacity for LTE. We see no pause for carriers needing to densify the networks.

Penetration for LTE devices was 26 percent at the end of 2013 and is expected to reach the mid-30 percent range or more by the end of this year. With more people with more smartphones, that will test the LTE networks and put a strain on them. It's not necessarily the number of carriers that are out there, it's the demand on those networks and the number of customers that those networks have to support.

For Dish, we're agnostic whether they partner with the carrier or they try to build out on their own because



W. Benjamin "Ben" Moreland, president and chief executive officer, Crown Castle International. *Photo by Don Bishop*

the underlying demand is there to use that spectrum either way.

We believe there will be a public service network at some point, but not this year. Maybe it will begin next year, and it will be the latter half of this decade before it makes a difference to revenue. The public safety network will come out with the government partnering with existing carriers, or FirstNet could build its own network. Either way, we're here to support that initiative.

**Adelstein:** How do you see spectrum auctions affecting wireless infrastructure?

**Moreland:** Additional spectrum allows carriers to add network capacity efficiently and provide the consumer with more video, which is taking up a significant amount of available bandwidth. Spectrum sold at auction and ultimately deployed drives addi-



Rod Smith, senior vice president and CFO, American Tower's U.S. Tower Division. *Photo by Don Bishop*

tional value and utilization of our infrastructure. It typically comes with additional equipment on the sites, which gives rise to amendments and additional rent charges, and it gives rise to in-fill locations depending upon the frequency and its propagation characteristics, and the carriers need to match coverage with capacity in particular markets. We look at the auctions as bringing more of the same. We applaud the administration's efforts to make more creative approaches to spectrum availability come to fruition.

**Cavanagh:** The shift in spectrum from entities such as broadcasters to wireless is positive for us. The fact that spectrum was a limited resource in the early days helped to drive the tower business because there are only two ways to deploy wireless services: through spectrum or more antennas and more equipment. Spectrum limitation was obviously a boon for the





Photo by Vasili Antoniou

wireless infrastructure industry.

As additional bands of spectrum have become available to wireless carriers, each new wave of spectrum deployment has required additional equipment and infrastructure to deploy it, to expand the networks and advance new technologies. Additional spectrum that will be auctioned will continue to drive wireless infrastructure industry growth.

**Smith:** American Tower is uniquely positioned as the largest independent broadcast tower owner in the United States. And we bought 60 more big broadcast center towers in the first quarter. Taking spectrum from the broadcast industry and moving it into the wireless industry is a net positive. The spectrum was either not being used or was underused, so we don't see any incremental churn on the broadcast side. Whenever you

place unused or underused spectrum in the hands of the wireless carriers, they increase their capital spending to deploy it, and that drives amendments to our tower sites.

**Adelstein:** What trends do you see for small cells and distributed antenna system (DAS) networks?

**Moreland:** We're in the small cell and DAS business in a large way. Crown Castle has 12,000 nodes fed by 6,000 miles of urban fiber. The significant growth reminds us of the early days in the tower business when we used to build them by the thousands instead of the hundreds.

We see DAS as a neutral-host model with shareable fiber. Whether the electronics are on the same pole or the next pole over in an outdoor setting or whether the DAS is in an

arena, the DAS operator wants all the carriers active in that market or in that venue on the DAS. It depends upon where each individual carrier is in its deployment phase.

DAS is a complementary architecture that doesn't replace macrosites. Nevertheless, in many cases it's the only way to obtain additional capacity in an indoor venue or in a high-density urban or residential area with a macro tower site that is 10 to 20 years old and woefully insufficient to meet the capacity needs of the consumers in those areas.

Today, DAS is about 6 percent of our company and growing rapidly.

**Cavanagh:** Small cells are for real and are complementary to macrosites. They have a targeted or precise coverage objective. We will continue to see small cells deployed underneath the existing and growing macro layer

of the network. SBA has an investment in ExteNet Systems, which has started to see significant growth in DAS network deployment.

We're starting to see some wireless carriers look to deploy small cells on existing macro towers at much lower levels. It's an opportunity to use rental positions on assets that we already own that once were thought to be unusable because they're at much lower heights. To be able to monetize a resource that we once didn't believe we could is positive for the industry.

**Smith:** Small cells and DAS are complementary to the macro towers, which is our core business, although American Tower participates in DAS networks. I separate DAS networks from small cells. They are different product lines.

American Tower is the leader in in-building DAS, such as Las Vegas casinos, big racetracks and the sporting venues. The main four carriers, especially AT&T and Verizon, aggressively go after in-building DAS locations. We're supporting them and further cementing our leadership position in indoor DAS.

Our outdoor DAS networks average 1.5 tenants, and many have been in place for multiple years. Our in-building networks average 2.5 tenants, and they lease up quicker in desirable venues. Other carriers want in more quickly with indoor networks than with outdoor networks.

Small cells will play a part in future wireless carrier networks, especially in core urban areas with dense populations. Those areas don't compete with macrosites, so we don't see small cells as a competitive threat to macrosites.



Photo by Vasilii Antoniou

The primary revenue for the tower companies is on the towers, which is where 98 percent of our revenue comes from. That's where all of our future growth will come from. We'll participate in DAS networks, but DAS won't become a material part of our business anytime soon.

**Adelstein:** How do you evaluate making investments outside of the United States?

**Moreland:** We look at the opportunity cost of capital. The incremental dollar we generate in cash flow we put to work on a risk-adjusted-return basis. The shared wireless infrastructure model works well all over the world. Crown Castle has an international business in Australia.

Nevertheless, we see the U.S. market as the No. 1 growth market on a risk-adjusted return basis. That's where we made significant investments during

the past couple of years. To the extent we see opportunities that make sense in overseas markets, we would invest. But it's primarily a valuation consideration for us.

**Cavangh:** The United States is the best tower market, and SBA has a substantial majority of its assets in the United States. There has been a lot of consolidation in the United States and, as a result, it has become difficult to move the needle with U.S. portfolio growth, in large part because we're much bigger. To make a material effect takes that much more and the opportunities are less as a result of having rolled up many of the larger tower companies that existed underneath these three companies here in the United States.

We continue to focus on growth in the United States. The organic growth here is tremendous. But as a way to expand the playing field and increase our realm of opportunities,





Photo by Vasili Antoniou

we expanded into other countries. For SBA, the focus has been on locations not far from home. We're based in South Florida, and we have a large Latin American population upon which to draw that helps us with the countries in which we decided to invest. Primarily, we invested in Central America and most recently, in Brazil. We have many local people who can help us manage through that.

We're investing where wireless networks are at least five and maybe 10 years behind where they are in the United States to see the cycle of growth of new technologies, 3G and 4G, roll out.

**Smith:** American Tower is the most aggressive tower investor internationally of the three public tower companies. Notwithstanding that, the United States is the primary market

for us. Other places complement our investments in the United States and provide long-term shareholder value.

We run a 10-year unlevered financial model. We look for targeted, risk-adjusted returns. The returns we expect differ by country. In more developed markets such as the United States and Germany, we're comfortable with a high single-digit or 10 percent return. In India and throughout Latin America, a mid-teens return works for us. In Ghana and Uganda, we want higher risk-adjusted returns in the high teens, maybe even 20 percent.

International markets go through different phases of network development. The advanced markets are at one stage. The evolving markets are at another, where they're going from finishing 3G deployments and starting 4G deployments. The emerging markets

in India and some other regions are building voice networks for the first time. In many places, they will build voice wireless networks before landline networks are built. Uganda, Ghana and some parts of India are like that.

Having the right targeted investments internationally will allow us to elongate our growth curve. As the United States begins to slow, we'll have 12 additional markets at different stages that will help us continue to grow our business. In the first quarter of 2014, our domestic business grew with 9 percent core organic growth. The international markets, collectively, grew about 14 percent.

*The next Wireless Infrastructure Show is April 27-30, 2015, in Hollywood, Florida. For more information, visit [www.wirelessinfrastructureshow.com](http://www.wirelessinfrastructureshow.com).*

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# The Market Outlook for Small Cells

As regulators tussle over the definition of a small cell, deployment of small cell technology speeds up. Predictably, local governments want to regulate them, and developers want freedom from regulation.

By Don Bishop

Count the cubic feet. That's how you can tell whether a wireless installation is a small cell. PCIA, a membership organization representing wireless telecommunications infrastructure companies and wireless network operators, told the FCC what the difference is. A small cell has equipment enclosed in a volume no larger than 17 cubic feet and uses an antenna with a volume no larger than 3 cubic feet.

## Regulations? Relax

The FCC wants to know because it is looking into whether to relax regulations for small cells and preempt small cell state and local regulation, too. How to do that without potentially undermining the regulation of microcells might be tricky. As early as September but perhaps toward the end of the year, the FCC may reveal how it's going to do that when it hands down one or more notices stemming from its inquiry in a proceeding it started in September 2013 in a notice of proposed rulemaking (NPRM).

**William J. Sill**, a partner in the Wilkinson Barker Knauer law firm, said that in responding to the NPRM,

the wireless industry lined up on one side of the small cell regulation issue and state historic preservation officers (SHPOs) and local jurisdictions lined up on the other side. SHPOs administer the national historic preservation program at the state level, review nominations to the National Register of Historic Places and consult with federal agencies during Section 106 reviews, which pertain to the National Historic Preservation Act.

## Opposition Examples

Sill gave as an example of opposition to relaxed regulation a comment filed in the NPRM proceeding by the Massachusetts Archeological Society. The society said that the review procedures related to the National Environmental Policy Act and to the NHPA for installation of distributed antenna system (DAS) networks and small cell wireless infrastructure should not be streamlined, lessened or excluded. As another example, he said that the city of Eugene, Oregon, told the FCC that it would be ill advised to adopt proposed expansions of regulatory exclusions for DAS and small cells.

The NPRM deals with other matters,

such as definitions for terms used in the antenna collocation by right legislation known as Section 6409(a) in the Middle Class Tax Relief and Job Creation Act of 2012 and rules for temporary towers. "The FCC probably will provide guidance on Section 6409(a) and final rules for temporary towers in an initial order coming out of the NPRM and will deal with small cells in a later order," Sill said. "The FCC probably will subject small cells to some form of light regulation."

## Network Operators

**Seth Jones**, senior manager of network engineering at Sprint, said his company views PCIA's volumetric definition of small cells as appropriate. "We deploy femtocells in residences that support one to five users," he said. "We deploy picocells that support 65 to 100 users. Beyond that, there are microcells that tend to be base transceiver station (BTS) systems where all of the white space, redundant systems and battery backup are ripped out, leaving a miniaturized BTS that you can deploy more lightly and effectively. So the volumetric drive makes a lot of sense."

Meanwhile, **Laszlo Herczku**, an RF planning engineer for the Verizon Wireless Northeast region, said Verizon Wireless uses PCIA's dimensions as a standard in formulating solutions for the small cell realm on a day-to-day basis.

### Small Cells as Tools

Jones said small cells are tools for system designers. "For an arena, I may choose to do a heavy-lift, multi-BTS deployment with a DAS," he said. "But that would be overkill for some other deployments. Small cells fill a gap that existed for quite some time in the industry where your choice was either a half-million-dollar-plus site and a monopole with a caisson to get to the in-building world, or you had to go into a building with a BTS with a fairly significant DAS.

"As DAS matured and became more digital instead of just using coax for delivery, and as macrocells reached a point where you realistically couldn't build more macrocell coverage to support in-building wireless service, a tools gap occurred. That's where small cells are filling in, with more small- to medium-sized businesses. With massive stadiums, you're more likely to use neutral-host, multicarrier DAS systems because all of the network operators want to be there. Small cells are just a different size tool."

### RF Levels

Jones said that although small cells bring access points closer to consumers than towers do, the RF they emit is widely distributed and at a much lower level. "The approach is to have a massively distributed RF footprint,"

## Speakers from the AGL Conference in National Harbor, Maryland

- **William J. Sill**, partner, Wilkinson Barker Knauer
- **Seth Jones**, senior manager of network engineering, Sprint
- **Laszlo Herczku**, RF planning engineer, Verizon Wireless Northeast region
- **David Bronston**, special counsel, Phillips Lytle
- **Sonny Pieper**, area manager of national small cell business development, AT&T Antenna Systems Group

he said. "The idea no longer is to mount an antenna or two or five antennas in a major arena, but instead to mount hundreds of antennas. The small cells have built-in RF transceivers, as would a DAS node. We want fewer and fewer users on each end node. It's common to have 50 or 100 or more antennas even in very small arenas in order to keep the power levels down and to distribute the traffic more efficiently."

Herczku said Verizon Wireless analyzes its deployments whether macrocell or small cell for compliance with FCC guidelines for RF exposure. "When we test or integrate an in-building wireless system, we take measurements and ensure compliance so we won't have potential problems with RF exposure," he said. "We even have third-party reports written up if it becomes an issue."

### Access Points

David Bronston, a special counsel in the New York office of the Phillips Lytle law firm, said New York is making street furniture available for small

cell deployments. The city issued a request for proposals to use thousands of pay phone kiosks for what the city calls public communications structures. Bronston said advertising would generate the revenue and that Mayor Bill de Blasio wants free Wi-Fi on all of the installations. "There will also be, I believe, a port available for more of a microcell," he said.

New York owns 200,000 light poles, not including Verizon and ConEd utility poles, Bronston said. The city franchises light poles to DAS providers such as ExteNet, Crown Castle, Mobilitie, Lightower and Xchange Telecom. "Time Warner put hotspots around the parks," he said. "Google put a Wi-Fi system in Chelsea. Transit Wireless installed a four-carrier, neutral-host DAS with Wi-Fi in about 50 underground New York Subway stations. They have to complete 277 underground stations by 2017."

### Air Interface Technologies

Not all sources offer the latest available air interface technology, LTE, in their



*Sonny Pieper: "In the hotel industry, for example, guests are demanding it. People don't return for events or don't bring conferences back if they don't have a good experience. That goes right to the bottom line. So, wireless communications has become like a utility."*

small cell products.

**Sonny Pieper**, area manager of national small cell business development at AT&T Antenna Systems Group, said AT&T's current product is 3G-only. "We're working with our original equipment manufacturer partners — Cisco, Alcatel-Lucent and Ericsson — to come up with an LTE version," he said "We call it a multi-standard metrocell that will support additional users and that would allow an LTE and a Wi-Fi component. That will be the Swiss Army knife of metrocells, if you will. But it's not a reality today, so AT&T now has only a 3G offering, which creates challenges for us. You may have OK LTE coverage in a building and you're going to install small cells inside to improve the signal from one or two bars to four or five bars, but how you combat the LTE RF is another issue."

The multistandard metrocell with LTE will require LTE-type bandwidth to support it. The dedicated Internet access that supports a small cell is more robust than what AT&T can use with 3G. Pieper said AT&T has made some enterprise deployments where it shares the customer's Internet access and its local-area network, plugging into the customer's Internet access and sharing the bandwidth.

"But we want to establish our own

bandwidth and Internet access, and it needs to be a fairly robust pipe to support 3G, 4G, LTE and Wi-Fi," Pieper said. "This is different than a repeater technology. It doesn't require any ambient RF signal outside the venue. In theory, you can put this at the North Pole as long as you can get a broadband connection there. It may not involve working with the local exchange carrier, whether that would be our Verizon friends in the Northeast or Southern Bell in the South. It could be a cable company. It could be a Comcast cable modem. It could be some third-party provider. We want to have options."

Herczku said Verizon's small cells are designed strictly for LTE 4G.

Jones said Sprint offers air interface technologies from 3G and 4G to LTE, and it has some existing CDMA deployment.

### Deployment

Jones said the early promise of small cells was that they would be what he called lick it and stick it technologies. "You show up to a building, plug it in and leave, and everything was done," he said. "But what we have found is that the process for deploying them is not radically dissimilar from deploying any other type of cellular infrastructure. They are smaller. Small cells can

be carried by one person. But the integration process, the engineering process, the access to power, the access to backhaul and the zoning regulatory environment don't change just because the box itself is smaller."

The network engineering manager said that the industry may see small cells as elegant technical solutions. "But you still have to get them on the ground. You still have to get them on the pole. You still have to get them in the buildings," he said. "So really cracking that site acquisition and that deployment code is something I think we're all very competitively working to figure out."

Bronston said that although the contracts associated with small cell deployment tend to be smaller than those for macro towers, they still cover the system owner's right to be there and whether the landlord can move system elements around. Moving cabling and antennas is one thing, he said, but the landlord taking the system's equipment space would be much more expensive for the system owner. Access is a big issue for the service providers, and so are the security protocols for the landlord.

"The landlord will want the right to review any alterations," Bronston said. "They want to have a say on where the equipment goes, although they may defer more to the system owner about RF for antenna siting. What are the rights and obligations on termination? Can they take over some of the equipment if they want to and give it to a third party? Do they want you to take it out? These matters are subject to negotiation."

Bronston said indemnification is a big issue for arenas, universities,

hospitals and campuses. Sometimes they want a timeline on the build out, although that can be difficult for a carrier to give. "Insurance clauses are important," he said. "The landlord will say, 'You're taking this property as-is,' so the carriers have to perform their due diligence. Most landlords will not perform any prework for the project."

Pieper said AT&T's small cell agreement is thinner than agreements used for land leases, rooftop leases or DAS because the business risk is lower.

"People are demanding a robust wireless experience where they live, work and play, and it's not optional," Pieper said. "In the hotel industry, for example, guests are demanding it. People don't return for events or don't bring conferences back if they don't have a good experience. That goes right to the bottom line. So, wireless communications has become like a utility."

Pieper said that at AT&T, "we view this as a zero-ramp proposition. And that is a very eye-opening statement to some people. There's an education shift. A lot of folks have inserted themselves in between the carriers and the customers. That has to change if we're going to deploy fast and cover as many venues and buildings as we can."

*William J. Sill, Seth Jones, Laszko Herczku, David Bronston and Sonny Pieper spoke at the AGL Conference in National Harbor, Maryland, on June 18. This article is based on information from their conference appearances. The next AGL conference is in Dallas on Oct. 9. For information about AGL conferences, visit [www.aglmediagroup.com/aglevents](http://www.aglmediagroup.com/aglevents).*

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# Public Tower Companies Maintain Financial Strength

Seemingly similar at first glance yet different in some fundamental ways, three public U.S. tower companies benefit from low interest rates as they pursue investments for expansion within the industry.

By Don Bishop

For tower companies, their own access to capital and the spending by carriers on wireless networks pave the road to building successful businesses that grow.

Tower companies have ready access to capital at attractive rates, according to **Brendan Cavanagh**, chief financial officer of SBA Communications. He said tower companies have been fortunate to have good access to low-cost capital for many years, and capital availability perpetuates portfolio investments to further the growth of the tower business. SBA is the most highly leveraged of the three public tower companies. SBA has focused on a target leverage range of 7 to 7.5 turns of net debt to EBITDA, which it has been able to maintain because of the predictability and stability of the wireless infrastructure business and the natural de-leveraging that occurs in the industry.

## Attractive Rates

"We've been able to continue to incur additional debt, raise it at very attrac-

tive rates and turn around and invest it in high-quality assets both in the United States and internationally," Cavanagh said. "Our intention is to continue to do that so long as we continue to see high-quality assets available throughout the world."

**Rodney Smith**, chief financial officer for American Tower's U.S. business, said the ready access to capital hasn't changed the company's capital structure or balance sheet. "We're an investment-grade credit risk, and that's important to us," he said. "We have a target leverage rate between 3x and 5x EBITDA. We stretched ourselves up to 5.8x for the Global Tower Partners acquisition that closed in the fourth quarter of 2013. We're in the process of deleveraging to below 5x." Having an investment-grade credit rating gives American Tower the flexibility to act quickly with transactions, the CFO said.

American Tower seeks to reduce expense rates and interest rates and to extend the maturities of its debt instruments, Smith said. "Our debt

has an average tenure of 5 years at an average of 4 percent, which is a low cost of debt," he said. "We're about 80 percent fixed rate and 20 percent floating rate. I think all the tower companies are experiencing low interest rates."

## Rapid Growth

Smith commented that although the United States has seen slow gross domestic product growth during the past five years, the wireless and tower industries have been growing rapidly. He explained that the leasing demand for tower space is tied to network development, which reflects a secular demand that extends for multiple years. "Our business is specifically non-cyclical, so we've seen strong leasing demand even in spite of slow GDP growth," he said.

With respect to American Tower's foreign investments, Smith said the company has properties on five continents and 13 countries. "We run investment opportunities through a 10-year unlevered discounted cash



Brendan Cavanagh, CFO, SBA Communications: "Even though carrier activity has been high during the past few years, backlog levels remain unparalleled compared with the past."



Rodney Smith, CFO, American Tower's U.S. business, said FirstNet's wireless network construction project may provide business opportunities for tower companies in the last half of this decade.



Jay Brown, CFO, Crown Castle International: "All three of the public tower companies ... are really conservatively levered relative to where the real estate investment trusts are."

flow model, and we will look for places where we can get the right targeted risk-adjusted rate of return," Smith said. "That's different for all the markets in which we operate."

He said that American Tower is comfortable with a risk-adjusted return in the high single digits in the United States and Germany, the mid-teens in Latin America, and the high teens or 20 percent in Ghana, Uganda and some regions in India. "As long as we can find assets to invest in where we can get our risk-adjusted rate of return, then we're willing to make those investments," Smith said.

Crown Castle International's CFO, **Jay Brown**, said that not only have the three public tower companies

historically had good access to capital priced at low rates, but the way all three have managed their balance sheets would suggest that they are viewed more as a real estate business. "There may even be benefits both in terms of rate and ratings because the ratings agencies evaluate tower businesses more akin to what typical real estate businesses are," he said.

"If you compare the three companies to a typical real estate investment trust (REIT) — a typical REIT with a single-A credit rating would have in the ballpark of 35 to 40 percent of its enterprise value in the form of debt," Brown said. "All three of the public tower companies, although there are some differences in how

much leverage we have, are really conservatively levered relative to where the REITS are."

### Carrier Spending

Smith said all four of the major carriers are spending capital and upgrading their networks. "Verizon Wireless is the furthest along with upgrading its existing network to full LTE," he said "It's nearly finished, and Verizon now covers about 300 million pops in the United States with its LTE network."

Following close behind is AT&T, which Smith said was likely to finish its LTE deployment during the summer, giving the carrier an LTE network covering nearly 300 million pops.

"We see a drop-off for Sprint and



T-Mobile USA,” he said. “They’re further behind but still active. We think that toward the latter part of this year, they’ll have their LTE networks substantially complete, with Sprint at perhaps 250 million pops and T-Mobile at perhaps 225 million pops.

### LTE Networks

“For the first time in a long time, all four of the major carriers are active and, at the moment, they’re active in getting their LTE networks up and running,” Smith said. “What that’s meant for us during the past several years is a lot of amendments. Now that Verizon has finished its initial LTE upgrade, we’re seeing them transition into more collocations. We expect the other carriers will follow.”

Cavanagh said that for the tower companies, a positive aspect of the carrier’s network deployment is that although they built out 4G networks, they are a mile wide and an inch deep, meaning that a lot of fill-in cell site construction is needed to improve capacity to go with the coverage. “We’re continuing to see sites that were upgraded once for LTE being touched again for LTE because some of sites were upgraded years ago and it’s become clear that the amount of equipment installed for the initial upgrade is insufficient for today’s traffic.” Because carriers have to revisit some of the sites, Cavanagh said it is difficult to say exactly how far along the carriers are with 4G deployment.

“Even though carrier activity has been high during the past few years, backlog levels remain unparalleled compared with the past,” SBA’s CFO said. “The carrier activity trajectory

will continue for some time to come, not only for upgrades to existing sites but also for in-fill. Sites that you might think would not be touched by AT&T or Verizon because they have nearby sites are seeing leasing activity because of capacity offloading. They’re finding it necessary to lease space on sites where they weren’t thought to need it previously.”

### Constant Investment

Brown said that five years ago, carriers spoke of 12- to 18-month deployment cycles that came to conclusions. He said carriers have transitioned toward making a long-term, constant investment in their networks. “It’s consistent with the way they think about capital allocation, where ongoing capex spent on their networks is a part of their capital allocation, and they don’t expect to be done spending in a short period,” Brown said. “The runway for growth in our industry is long and significant as the carriers continue to improve and invest in their networks over a long period.”

### FirstNet

Many tower owners express interest in plans the First Responder Network Authority (FirstNet) has for building a nationwide public safety wireless communications network because the construction project has potential

for leasing space on existing towers and for building new towers.

From American Tower’s view, Smith said he doesn’t believe FirstNet will generate any leasing or construction for the rest of this year and that any activity in 2015 will be limited. He said maybe FirstNet’s construction project would provide business opportunities for tower companies in the last half of this decade.

“We’re not quite sure if the government’s going to build a freestanding network on its own or if it’s going to partner with wireless carriers, but either way, we think that there will be incremental revenue drivers that will affect our tower base,” Smith said.

From SBA Communications’ perspective, Cavanagh said, “It’s ultimately positive to have the FirstNet network out there as a potential additional source of organic growth in the future.”

*This article is based on comments made by Brendan Cavanagh, Rodney Smith and Jay Brown at the Wireless Investors Conference led by Clayton Funk, managing director, Media Venture Partners. The conference was part of the Wireless Infrastructure Show conducted in May. Photography by Don Bishop.*

*Rodney Smith: “We’re not quite sure if the government’s going to build a freestanding network on its own or if it’s going to partner with wireless carriers, but either way, we think that there will be incremental revenue drivers that will affect our tower base.”*

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