



Central Valley Chapter - California Land Surveyors Association
www.californiacentralvalleysurveyors.org

Central Valley Chapter THE PRISM

Up
Coming
Meetings!

Date: September 26, 2018

Time: 11:30 a.m.

Location: Ripon Roadhouse
125 East Main Street, Ripon

Date: October 24, 2018

Time: 6:00 p.m.

Location: TBD

Date: December 5, 2018

Time: 6:00 p.m.

Location: TBD

Announcements

GEO WEEK 2019 ANNOUNCED

International LiDAR Mapping Forum (ILMF), ASPRS Annual Conference, and MAPPS Winter Conference will come together to form "[Geo Week 2019](#)" taking place January 25-31 in Denver.

2019 CLSA CONFERENCE ANNOUNCED

The 2019 annual conference will be held at the Silver Legacy Resort in Reno, Nevada in 2019, as a joint conference with NALS.

2019 STATE OFFICERS

During the July 2018 Board of Directors meeting, Officers for 2019 were approved by unanimous ballot as follows:

President—Annette Hovorka
 President-Elect—Keith Spencer
 Secretary—Rob McMillan
 Treasurer—Warren Smith
 Immediate Past President—Ron Nelms

BPELSG & SOCIAL MEDIA

The board is asking for your help in getting the word out regarding the launch of its Facebook and Twitter pages. The board is now posting information of interest to postsecondary institutions and students on a regular basis. This information includes regulatory changes, updates to our website, interesting articles, useful resources, and a host of other board-related data.

For those institutions that communicate with students through email or some other means, we invite you to share this information with them. The board is anxious to use these social media outlets as an ongoing way to reach our stakeholders. Thank you for your assistance in spreading the word

2018 Chapter Officers

President: Rich Fultz
 Vice President: Will Paul
 Secretary: Rich James
 Treasurer: Warren Smith
 Chapter Director: Warren Smith
 Chapter Director: Rich James
 Alt. Chapter Dir: Will Paul
 Alt. Chapter Dir: Rich Fultz

2018 Chapter Committees

By-Laws Committee:
 Keith Spencer (Chairman)
 Education Committee:
 Keith Spencer (Chairman)
 Membership Committee:
 Rich Brown (Chairman)
 Monument Pres Committee:
 Mike Quartaroli (Chairman)
 Newsletter:
 Rich Brown (Editor)
 Professional Practices Committee:
 Mike Quartaroli (Chairman)
 Website:
 Keith Spencer (Web Master)

2018 Chapter Programs

Public Outreach Committee:
 Zachary Wong (Coordinator)
 Workshops:
 Rich Brown (Coordinator)

Table of Contents

Page 2	Classes, Training & Education
Page 2	Editor's Message
Page 3	Monument Obituaries
Page 4	National News
Page 7	State News
Page 8	LightSquared Special
Page 9	Education News
Page 11	Classifieds
Page 11	Just For Laughs

Classes, Training, and Continuing Education

Mark Your Calendars

CAD Masters - AutoCAD Level I (3-Day Course)

Oct 8-10, 2018 Walnut Creek
 Oct 9-11, 2018, Sacramento
 Nov 5-7, 2018, Sacramento
 Nov 19-21, 2018 Walnut Creek
 Dec 3-5, 2018, Sacramento
 Dec 17-19, 2018 Walnut Creek

[Register here](#)

CAD Masters - AutoCAD Level II (2-Day Course)

Oct 15-16, 2018, Sacramento
 Oct 29-30, 2018 Walnut Creek
 Nov 19-20, 2018, Sacramento
 Dec 10-11, 2018 Walnut Creek

[Register here](#)

CAD Masters - AutoCAD Level III (1-Day Course)

Sept 20, 2018, Walnut Creek
 Dec 6, 2018, Sacramento

[Register here](#)

CAD Masters - Civil 3D Introduction (3-Day Course)

Sept 17-19, 2018, Sacramento
 Oct 15-17, 2018, Walnut Creek
 Oct 29-31, 2018, Sacramento
 Nov 13-15, 2018, Walnut Creek
 Dec 10-12, 2018, Sacramento
 Dec 10-12, 2018, Walnut Creek

[Register here](#)

CAD Masters - Civil 3D Advanced (2-Day Course)

Oct 1-2, 2018 Walnut Creek
 Nov 19-20, 2018 Sacramento
 Nov 26-27, 2018 Walnut Creek

[Register here](#)

CAD Masters - Civil 3D for Surveyors (2-Day Course)

Oct 3-4, 2018 Walnut Creek
 Dec 17-18, 2018 Sacramento

[Register here](#)

CLSA Webinars

Incorporating GIS into Workflows
 Sept 19, 2018, 11:00am-12:00pm

[Register here](#)

Lorman Education Webinar

Current Issues in Plat and Subdivision Law
 On Demand

[Register here](#)

Factors in Drafting Effective Easements
 July 31, 2018

[Register here](#)

If you have information about a training or class, please submit to: editor@californiacentralvalleysurveyors.org

Editor's Message



A couple of years ago our profession came under attack by a company wanting to operate on radio frequencies normally kept open as a buffer for GPS signals. With much opposition, LightSquared was eventually defeated and they filed for bankruptcy protection in 2012. Now fast forward to 2015, a number of investment firms came together to take over Harbinger Capital Partners, thus bringing LightSquared back to life, now to be known as Ligado. They have agreed to lower the power of their transmissions, this eliminating the interference with GPS signals.

I would like to think that the new investors of Ligado have learned that it is easier to play nice with others. I hope that they have good intentions in mind, and that they are not trying to seek one by the GPS users community. So, as this issue moves forward I ask that every professional that would be impacted by GPS signals getting disrupted, step up and get involved. Do your research and speak out to your politicians. Only then can we help with the solution and not complain about the outcome after the fact.

If you would like to comment on this topic or suggest another, please submit it to: editor@californiacentralvalleysurveyors.org

Monument Obituaries

By Mike Quartaroli, PLS



CLSA **CENTRAL VALLEY CHAPTER** Survey Monument Conservation Committee



USA WAS CALLED OUT WAS A LAND SURVEYOR CONSULTED?



ARE PROPERTY CORNERS IN JEOPARDY?
WHERE IS THE PROPERTY LINE?
ARE YOU DEEP RIPPING IN THE ROAD RIGHT-OF-WAY?
WHAT HAVE YOU DONE TODAY
TO PRESERVE SURVEY MONUMENTS?

Ask about the "Adopt A Monument" program. Make a lasting contribution to the Land Surveying Profession.

National News

West from Washington

By Jerry Penry, PS

The completion of the first transcontinental railroad on May 10, 1869, greatly changed the way Americans traveled and communicated between distant points. While the railroad transferred people and products, the telegraph alongside transferred information. Nineteen days after the completion of the railroad, Oliver N. Chaffee, a 34-year-old surveyor and astronomer from Detroit, Michigan, entered into a contract with the Iowa and Nebraska Surveyor General, Robert R. Livingston, to survey the 25th and 27th meridians west from Washington D. C. Both the railroad and the telegraph were instrumental in establishing these lines.

The Act of September 28, 1850, (9 Stat. 515), provided that the meridian through the observatory at Washington would be adopted and used as the American meridian for all astronomic purposes. The meridian at Greenwich, England, however, would continue to be used for nautical purposes. The difference between the two meridians was 5 hours, 8 minutes, 12.15 seconds, or 77°03'02.3" of longitude.

Chaffee wasted little time in assembling his crew to begin his work and endeavor to complete it by the end of the season. His main assistant was Professor S. W. Robinson whose expertise was making astronomical observations. Arriving at the eastern terminus of the Union Pacific Railroad at Omaha, Chaffee met with Edward Goodfellow who was in charge of newly created astronomical station that had been placed by the U. S. Coast Survey. The Omaha astronomical station was connected to the railroad by telegraph which Chaffee would need to determine the longitudes for his meridians on the western frontier.

Traveling by train to the last station in Nebraska, 463 miles west of Omaha, Chaffee arrived at Bushnell on July 8, 1869. The new town had little more than a water tank, windmill, and a boxcar for the railroad station. A monument was placed near the station where a series of astronomical readings were taken for two days while connected with the telegraph to coordinate with Omaha. Bushnell is about 8 miles east of the 27th Meridian and 16 miles north of the 41st Parallel, a line which Chaffee would also establish to connect the 25th and 27th meridians together.

Traveling 90 miles back east, Chaffee then stopped at Julesburg, Colorado, where he placed a second astronomical station near the railroad station to communicate with Omaha and determine its longitude west from Washington. This location could not have been a more ideal site for the astronomical station. It was only about one mile south of the 41st Parallel, and about 16 miles west of where Chaffee would establish the 25th Meridian. By the time Chaffee arrived at Julesburg, it had already seen its share of excitement. The town was an important Pony Express station in 1860-61 and had been burned by a large band of Lakota Sioux, Cheyenne, and Arapaho Indians on February 2, 1865. (The site of the original Julesburg townsite was approximately 5 miles west of where the town is located today.)

After completing the necessary readings at Julesburg, Chaffee established a meridian and measured 89.65 chains north to place a temporary point at its intersection with the 41st Parallel. By knowing the longitude of his meridian at Julesburg, the exact distance west from the 25th Meridian was determined to be 16 miles 10.47 chains. Chaffee then began measuring east on the 41st Parallel setting square wood posts at the full milepost locations until he reached milepost 9 which is just west of the South Platte River. For unknown reasons, possibly because of continuing hostilities of the Indians near the 25th Meridian, Chaffee returned to his meridian at Julesburg and then began surveying west to place the mile markers on the 41st Parallel until reaching milepost 95.

Knowing he was close to being due south of Bushnell, Chaffee left the 41st Parallel and traveled north to the town. The crew then measured south on the Bushnell Meridian a distance of 16 miles which crossed over the 41st Parallel. Chaffee returned to milepost 95 and continued west on the parallel until he intersected the meridian at 96 miles 22.62 chains. His latitude at this intersection was determined to be 41°00'06.2" which was evidently within the tolerance to not require correcting his line to be 628' further south. With the known longitude of the Bushnell Meridian, the remaining distance to the 27th Meridian was determined to be 8 miles 49.45 chains. Chaffee extended the 41st Parallel west and placed the intersection of the parallel with the 27th Meridian at a total distance of 104 miles 72.07 chains on August 17, 1869. This monument became the common point to Colorado-Nebraska-Wyoming.

The surveyors then began measuring north on the 27th Meridian across the barren terrain where few white men had previously traveled. The topography along and near this line presented many spectacular scenes that captivated the crew as they progressed. Chaffee frequently sketched the colorful bluffs in his field book by making grid lines so the images were spatially correct. Between the 68th and 69th miles, the North Platte River was crossed on August 27.

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Continued on page 6

SANDIS IS HIRING!

SANDIS is hiring numerous employees throughout the Central Valley to staff our work with California High Speed Rail.

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ABOUT SANDIS

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West from Washington, cont. from [page 4](#)

The four monuments needed for the end points of the 25th and 27th meridians were large square limestone monoliths. The sides were smoothed and lettered at an eastern quarry except for the final distances that Chaffee would be required to inscribe. The heavy monuments were shipped by rail to the nearest practical location where the surveyors then transported them by wagon to their points.

As the surveyors neared the northern end of the 27th Meridian, which was the intersection with the 43rd Parallel, a high bluff prevented any possibility of continuing with wagons. At the 128th mile, a final astronomical reading was made in order to determine the latitude and the final distance of 10 miles 22.67 chains needed to complete the line. The crew abandoned the wagons and continued with only the necessary equipment needed to measure. Without a wagon, the heavy terminal monument had to be painstakingly pulled with ropes across the prairie.

At the beginning of his survey, Chaffee noted that he was utilizing two sets of chainmen. One crew used a 66-foot Gunter's chain while the other used a 50-foot engineer's chain to prevent collusion in measuring. As Chaffee neared the northern end of the 27th Meridian, he indicated in his field book that he was also obtaining distances by stadia. The terminal monument was placed on September 6, 1869, at a distance of 138 miles 22.67 chains. This monument became the common point to Nebraska-South Dakota-Wyoming.

Chaffee returned to milepost 9 on to the 41st Parallel and surveyed east to the intersection of the 25th Meridian where he placed a monument on September 24, 1869. This point became the northeast corner of Colorado and the southeast corner of the Nebraska panhandle. From this location, a line was run south on the 25th Meridian setting temporary stakes at each mile. Chaffee had hoped to intersect his meridian with the 40th Parallel that had been established in 1859 as the baseline for the 6th Principal Meridian, but no monuments could be found. The meridian was extended another 2 miles south and the prairie was searched east and west for monuments on the parallel without success. Chaffee then made 101 stellar observations and placed his monument on October 1, 1869, where he determined the 40th Parallel should intersect his 25th Meridian. This monument became the common point to Colorado-Kansas-Nebraska.

[Click here for complete article](#)

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State News

How Drones Could Save California Billions in Wildfire Damage By Flight Evolved

Drones have been well documented as consumer photography and hobby products, and even made infamous by Jeff Bezos' Amazon drone delivery vision. However, the proactive use of drones has the ability to save money, increase efficiencies and save lives. One company – Flight Evolved – is utilizing drones to save California from wildfires ahead of the year's highly anticipated season.

After the most devastating wildfire season on record, California's largest utility providers are betting on drones, LiDAR remote sensing technology – same sensors auto manufacturers use for autonomous vehicles – and a small tea

What's Happening:

All it takes is vegetation to creep within feet of a powerline or a hellacious gust of wind to slap high voltage lines together, uproot a pole or to snap a wire to send sparks flurrying to create an inferno. Unfortunately, the overwhelming leading cause of wildfires are human related, and powerlines and electrical equipment are routinely at the [top of the list](#).

In 2017, many of the state's most overwhelming fires were the result of or further enhanced by damaged or at-risk high voltage powerlines. It does not help that the nation's most populated state had ideal wildfire conditions. With torrential winter rainfall that lead to rapid vegetation growth followed by bone-dry wind conditions, California was ripe for a massive burn. As a result, California state agencies spend nearly \$1.8 billion after witnessing historic levels of wildfire death, destruction and displacement. Even worse, total estimates including fire suppression, insurance, and recovery expenditures is estimated at about \$180 billion.

Utilities such as Pacific Gas and Electric and San Diego Gas & Electric need a readymade solution with actionable recommendations to prevent a devastating 2018 fire season and the team at Flight Evolved has the advanced and complete service for the task.

2018 Wildfire Mitigation Through UAVs and LiDAR:

How Flight Evolved Helps Utilities:

- LiDAR (Light detection and ranging)
 - LiDAR is a surveying method that measures distance to a target by illuminating the target with pulsed laser light and measuring the reflected pulses with a sensor. Those readings are modeled into a digital 3D representation of the target.
 - LiDAR is the same technology many auto manufacturers are currently using for autonomous driving.
 - Flight Evolved affixes LiDAR sensors to its fleet of drones or Unmanned Aerial Vehicles (UAVs) to scan large swaths of terrain for utility companies.
- End-to-End Solution with Actionable Data
 - Flight Evolved provides an end-to-end, turnkey solution that equips clients with actionable data.
 - The team of experts at Flight Evolved handle everything from data acquisition to analysis to provide utilities with solution recommendations for sound vegetation analysis and fire risk mitigation.
- It's a far superior solution to "data dumping" and expecting the utility companies to decipher the readings and create action. Flight Evolved provides tangible action steps whether replacing poles, trimming vegetation, or affixing advanced warning devices (SCADA) This all while giving insight to:
 - At-risk and damaged poles
 - Areas that require vegetation trimming to be in compliance with the state's minimum distances of up to 10 feet between flammable vegetation and high-voltage lines and also mandates firebreaks around power poles.
- Increasing Efficiencies
 - Flight Evolved is capable of covering vast swaths of the utility's territory for a fraction of the price with a far superior and rapid solution.
 - Utilizing UAVs with affixed LiDAR remote sensors is more cost and time effective than deploying manned crews to evaluate each and every one of the utility's thousands of high voltage power lines. Further, manned crews are not able to assess each and every pole and line, especially those located in remote, tough to access locations. UAVs are capable of flying over far ranging areas and into technical, remote locations.
 - Finds downed or damage lines and areas impacted by creeping vegetation all in the matter of days.

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LightSquared Special Report

Menace to GPS—LightSquared/Ligado

By Earl Soeder and Allen Nobles (Geospacial Users Group)

January 2018

Most of us remember the threat that LightSquared posed to GPS users a few years ago and thought it was in the past. It is NOT. LightSquared has now reorganized as “Ligado,” and the threat is still real. In the past few months, there have been many emails, articles, and conversations regarding the issue of GPS signals being affected by Ligado. What is most concerning is the fact that through meetings of the Geospacial Users Group and other surveyor-related meetings that users of GPS have no idea of the threat to GPS is still out there or even what Ligado consists of. At a large surveyor’s meeting just last week, we heard that there is no threat from this group now. So we want to provide more information to the Users Group and FSMS members about this concern.

To start, we need to explain who Ligado is. If you remember, LightSquared was established by Harbinger Capital (a private hedge fund) after it purchased the distressed company SkyTerra, which possessed a Federal Communications Commission (FCC) license for satellite transmissions. LightSquared was then going to move these frequencies to ground-based systems, with high power transmitters, which would basically overpower our GPS signals.

To understand many things, the best place to start is to follow the money. Money is a powerful motivator that can never be underestimated. The money trail brings to light some disturbing issues.

At the time of SkyTerra’s purchase, the Harbinger Capital hedge fund was under investigation by the Securities and Exchange Commission (SEC) for at least five different matters, including market manipulation, violation of short selling rules, and a questionable \$113 million-dollar loan. LightSquared’s goal was to provide internet service to the people with their ground-based systems and appeared to have the backing of other groups. The FCC seemed to work with LightSquared, so as a group we can’t take for granted that the group will not achieve at least part of its request.

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On January 26, 2011, the FCC granted LightSquared a conditional license to install high power transmitters that would broadcast signals much more powerful than, and directly adjacent to, the primary GPS signal. The FCC is charged with managing the frequency allocation of licensees to ensure maximum compatibility, yet they have seemed nonchalant to the obvious impact the LightSquared signals would have to users of GPS. LightSquared transmitters: 1529 – 1559 MHz @ high power, GPS L1 receivers: 1575.42 MHz @ very low power. The FCC has substantially deviated from its standard operating procedures by granting a conditional waiver to LightSquared, in its proposing to provide Fourth Generation (4G) cellular services across the United States. The radio spectrum that has been authorized is directly adjacent to the primary GPS frequency, and the signals to be broadcast will be much more powerful than the GPS signals. Why was the FCC willing to jeopardize such an important service such as GPS and why has LightSquared been put on the fast-track by the FCC to license approval is a question nobody during that administration is willing to answer.

The FCC manages the spectrum of radio frequencies including allocation, licensing and enforcement in the United States and its territories. It was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. The FCC has developed a complex schema for allocating the available frequencies and has tried to ensure that adjacent

Continued on page 15

Education News

Continuing Ed Outside Your Comfort Zone

By Bill Beardslee, PLS, PE, PP

Since its inception in the geomatics arena in the 1990s, the requirement for continuing education (also called continuing competency) has had the aura of a penalty rather than an opportunity. Obtaining legislative approval in many states for the continuing education requirement was difficult. Getting courses approved for credit in many states has been, and continues to be, a challenge.

But why? Are we so bold as to think we know all we ever need to know?

Over the years, I have heard most or all of the arguments against the concept:

- I'll learn what I need to know on my own.
- Why do I need business courses? I paid all my bills last month.
- Why do I need communication courses? I avoid talking to people, and I have voicemail.
- It's just the "good old boys" wanting to get my money for the society.
- And on and on.

Unfortunately, many of the professionals who attend seminars or take online courses would be very willing to just send a check to get their credits without taking any courses. How sad and myopic. (I will save a discussion on the online courses for another day.)

Continuing education is not a penalty. It is not an unwanted tax. It is an opportunity to explore areas you know little about or are weak in.

It is also continuing education, not repeating education. Many folks take the same or similar technical courses over and over to avoid leaving their tiny comfort zone. Personally, I would like to see the states prohibit taking the same courses in successive renewal periods or limit the number of times a person can repeat a course.

Especially Communication

Continuing education opportunities are a wonderful chance to obtain direction outside your comfort zone. Unfortunately, some states frown on non-technical courses for credit: a significant mistake.

For example, across all industries, a major area of recruitment concern for most positions is oral communication skills. That is even more critical in the technical fields where little or no formal non-technical skills are addressed. Yet, most technical people would rather have a root canal than take a communications or business course.

As for you owners and managers, do you ask your staff on return from a seminar (that the firm most likely paid for) to "share with us what you learned and how we can apply it to better our methods?"

In a 1999 survey of all state boards, 80% of the citizen complaints against land surveyors were on business practices. My daily experience would lead me to believe that fatal flaw has not changed. Yet, at any conference, the classes on deed retrace-ment will have 120 attendees, while the business or communications class next door will have 20.

While my experience is primarily with surveyors, I believe the approach to continuing education is similar in other geomatics specialties, whether it is a requirement or not. And company size doesn't matter. Whether you're in a one-person operation or a large firm, non-geomatics skills are a necessity.

A fine young surveyor in one of my seminars once asked, "What use is all this management stuff to me? I'm a one-man operation."

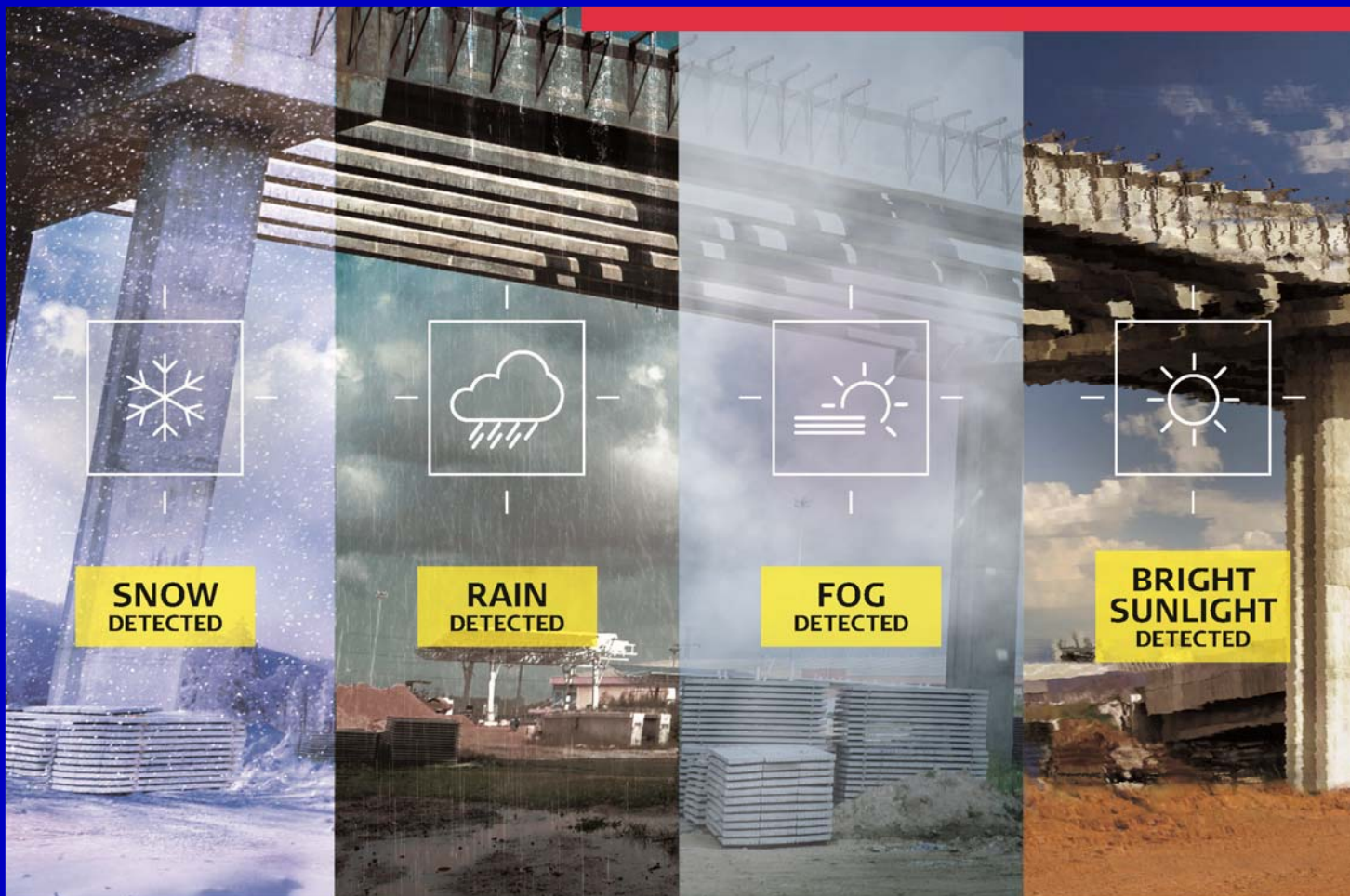
My answer was, "Most of it will have no use at all, unless someday you would like to be more than a one-person operation."

To end this rant, I would like to caution all in the geomatics world about technological isolation. For thousands of years, isolation has been a form of torture to alter the mental state of a captive by creating depression. Today, many in the technology world are voluntarily isolating themselves from human contact. Yet, humans thrive on, and need, personal contact.

So, with the next opportunity, attend that seminar outside your comfort zone. Talk to all your attending peers about what they are working on or suggest a course to the sponsoring group.

If all that fails, call me—we'll talk.

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Classifieds

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Just for Laughs

Reaching the end of a job interview, the Human Resources Manager asked the young surveyor fresh out of university, "And what starting salary were you looking for?"

The engineer said, "In the neighborhood of \$100,000 a year, depending on the benefit's package."

The HR Manager said, "Well, what would you say to a package of \$200,000 a year, 5 weeks vacation, 14 paid holidays, full medical and dental, company matching retirement fund to 50% of salary, and a company car leased every 2 years – say, a red Mercedes?"

The surveyor sat up straight and said, "Wow!!! Are you joking?"

And the HR Manager said, "Of course, ...but you started it."

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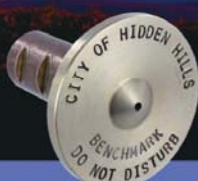
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Menace to GPS, *cont. from page 8*

signals do not interfere with each other (on next page):

Federal Communications Commission Radio Frequency Allocation Table

<http://reboot.fcc.gov/spectrumdashboard/searchSpectrum.seam>

RNSS Band: 1559 – 1610 MHz

GPS L1 Frequency: 1575.42 MHz

The primary GPS frequency (L1) is broad- cast from the satellites and received by ground- based receivers on the frequency 1575.42 MHz which falls within one of the FCC's Radio Navigation Satellite Service (RNSS) bands. The Mobile Satellite Services (MSS) and Aviation band adjacent to the GPS L1 signal have been proven to be compatible with each other over the last thirty years by tens of millions of users worldwide. New broadcasting license applicants to the FCC are normally required to go through an extensive period of re- view, as well as demonstrating interoperability, be- fore being allowed to deploy their systems. However, on January 26, 2011, the FCC waived its own rules and granted LightSquared a provisional license to install high powered, earth- based transmitters within the 1525 to 1559 MHz range which would drastically interfere with mil- lions of GPS users throughout the United States.

In the Commission's "Waiver Analysis," the FCC stated that the exception was justified by better serving [broadband] public interests. Ironically, the cellular industry which is to be served by the LightSquared product, relies on the very same GPS signals that may be disturbed.

The conditions of the waiver as it relates to the topic of GPS interference include the need for LightSquared to help organize and participate in a working group of industry professionals to analyze the issue and provide recommendations for nearterm and operational measures that can be taken to reduce the risk of interference. A final report was submitted by LightSquared to the FCC on June 15, 2011 including the working group's analyses and specific recommendations going forward to mitigate potential interference to GPS devices.

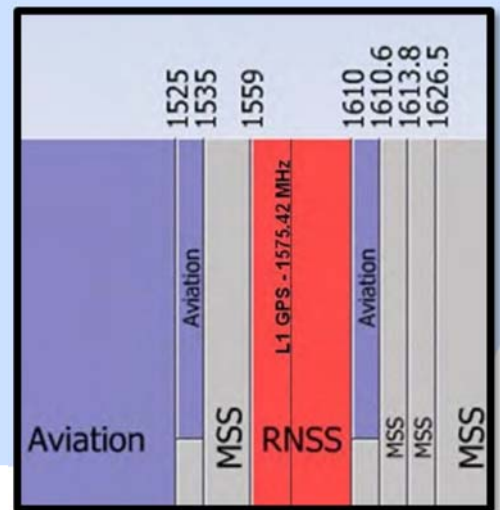
Testing conducted by the GPS manufacturer Garmin concluded that their current consumer grade receivers experience significant jamming within a radius of several miles from a simulated LightSquared transmitter and had a complete loss of lock at a simulated distance of 0.66 miles from the transmitter. A GNS-430W Aviation certified GPS receiver began to be jammed at 13.8 miles from the simulated LightSquared transmitter and experienced complete loss of lock at 5.6 miles.

The GPS industry is being represented on the FCC-mandated "GPS Interference Working Group" by the United States GPS Industry Council (USGIC). After conducting tests with actual LightSquared generated signals at Holloman Air Force Base, the State of New Mexico's E911 pro- gram director stated that the tests "substantiate concerns that the LightSquared network will cause interference to GPS signals and jeopardize 911 and public safety nationwide." Eyewitnesses reported that during the testing process, some equipment was limited to 7 visible satellites at any location. Upon moving 50 yards from their position at the test site towards the tower, visibility was diminished to 3 or 4 satellites, and at 60 yards, they were unable to establish any satellite connections.

At the time of the testing, LightSquared had already signed deals with SI Wireless, Cellular South, Leap Wireless, and Best Buy. GPS and the effects they would have did not even seem to be on the docket for LightSquared. When asked by Cecelia Kang of the Washington Post about launch dates and the concerns surrounding GPS, LightSquared CEO, Sanjiv Ahuja, answered "We are on track. And we expect to reach over 100 million pops next year and 92 percent of the population by 2015."

Verizon, T-Mobile, and AT&T had to spend millions of dollars each and spend much more time obtaining their licenses for cellular transmissions. LightSquared was grandfathered into their license through the purchase of SkyTerra and approval from the FCC. The usual FCC process is to conduct extensive testing prior to approvals. For LightSquared, the process was approved first, then tested, as stated previously.

The test determined the effects were real, they were conclusive, and they shut down GPS as we know it. Through a large



Continued on page 16

Menace to GPS, *cont. from page 15*

push by the GPS industry (including manufacturers and agriculture) and governing agencies, LightSquared was told to go back to the drawing board, and present an alternative solution. Since LightSquared's motive was the 10 million dollars profit, they did not present a true technical alternative solution. FCC did not confirm LightSquared's modified request, and in 2012, the company went into bankruptcy, to which many assumed it was gone. However, several people kept engaged in this issue knew the money was too great, and it could resurface again. Reorganizing and emerging as Ligado in December 2015, it continued to pursue repurposing of its spectrum by sponsoring tests by Roberson and Associates, and tests at the National Institute of Standards and Technology (NIST)/National Advanced Spectrum and Communications Test Network (NASCTN) to establish test procedures.

Both groups of tests were carefully reviewed by the National Space-Based Positioning, Navigation and Timing Advisory Board (PNTAB) who found serious flaws. In general, Ligado rejected the 1-dB criterion and did not accept the need to protect all classes of users, particularly high-precision receivers. In addition, it did not consider the new GPS L1 signals (L1C and L1M), nor did it check the impacts on the international GNSS. The PNTAB assembled a 14-point summary of deficiencies and requested updates and corrections for the flaws.

NASCTN'S response did not really address the points, or either claimed that there were no funds to correct the problems. The PNTAB then developed a **Six-Point Criteria** for acceptable interference testing, summarized as:

- Accept and strictly apply the 1-dB criterion.
- Verify interference for all classes of receivers.
- Test and verify for all operating modes.
- Focus analysis on worst cases.
- Include the new GNSS signals.
- Include GNSS expertise and openly publish results.

Both Ligado test sets clearly failed on all six points.

While the Ligado-sponsored tests were neither independent nor adequate, the United States Department of Transportation (DOT), led by Karen VanDyke, sponsored a very complete set of independent tests; these are the most credible estimates of harmful interference. The test results have been made public. The PNTAB's six points were published after DOT testing had begun, but DOT expanded and modified their effort to satisfy the criteria. The DOT conclusions, based on modeling real-world antennas and propagation patterns, are shown in **Table 1**.

Standoff Distance	General Location/ Navigation	High-Performance Receivers	Timing Receivers	Cell Phones
10 Meters	0.8 milliwatts (P2 is 197,900 times too large)	64 microwatts (P2 is 24,687,500 times too large)	8.7 milliwatts (P2 is 181,609 times too large)	12.3 Watts (P2 is 128 times too large)
100 Meters	79.4 milliwatts (P2 is 19,899 times too large)	6.5 milliwatts (P2 is 243,077 times too large)	0.9 Watts (P2 is 1756 times too large)	1.2 kilowatts (P2 is 1.25 times too large)

TABLE 1. DOT ABC test results. Maximum tolerable effective radiated power (EIRP) for classes of the most susceptible GPS receivers for modified Ligado proposal (P2) of 1.58 kilowatts. In red are the factors that Ligado P2 exceeds the maximum tolerable radiated power. At 100 meters, all classes of receivers tested had results that would exceed the 1-dB threshold, even for the reduced power level (P2, 1580 Watts) which has been the most recent filing. The shaded square is particularly troublesome. It shows that, for the most susceptible high-precision receivers, the Ligado proposed power exceeds the 1-dB threshold by over 200,000. This result is particularly damning for the proposed repurposing, because it is this class that produced the highest payoff in the recent Department of Commerce Study — over \$30

Continued on page 17

Menace to GPS, cont. from [page 16](#)

billion per year.

This ongoing discussion on the effects have resulted in continued meetings through other groups such as the Radio Technical Commission for Maritime Services (RTCM). RTCM held a joint meeting in May 12, 2017 in Clearwater, Florida representing special committee SC104, along with special committee SC131 representing Ligado, to discuss the issue of interference of GPS signals and to see if SC131 had any alternative solutions. The meeting was organized by Kate Duffy, RTCM President and chaired by Ross Norsworthy.

RTCM is voluntarily obligated to the International Maritime Organization (IMO) to provide a Committee Draft (CD) to the International Electrotechnical Commission (IEC) by the end of July 2017. SC131 has a preliminary draft CD that includes a draft adjacent band interference mask for the RNSS band 1559 MHz to 1610 MHz. SC131 constituents have the opinion that it is premature for SC131 to finalize the proposed adjacent band interference mask.

The heart of the controversy is the outstanding Notice of Proposed Rule Making (NPRM) by the FCC to license the use of an adjacent band to the RNSS band 1559 to 1610 MHz for use as a cellular telephony service; it is being opposed by a significant portion of SC131's constituency. DOT has been conducting tests to determine the consequences of the NPRM on the installed GPS infrastructure in the U.S. Some test results have been published, but the issues have not been resolved. Consequently, SC131 currently has a conflict of interest between its tasking and its constituency.

Therefore, SC131 is considering an alternative approach that would fully utilize all of the available resources. This multi-band/multi-system approach would provide superior resilience to interference (both in-band and adjacent band) and spoofing. (L1 has been the primary consideration. Norsworthy believes L2 and L5 and other satellite systems should be used.)

The meeting ended with SC131 getting up and leaving the meeting, citing the issue is not its concern. As we stated, this issue will not go away since there is a lot of money involved by investors.

In December 2017, Phil Falcone's Harbinger Capital is seeking \$2 billion in damages for "massive fraud" alleging that Apollo Global Management and others sold it on a plan to launch a terrestrial broadband network while concealing test results showing the network would cause crippling GPS interference and was unlikely to be approved. Assertions in the lawsuit about those tests, the impact of the interference to GPS, and an indirect admission about the difficulty of meeting the standards normally used to assess GPS interference may have implications for Ligado Networks, the current holder of the frequencies.

On January 16th, 2018, GPS World published an article about how the war rages on regarding the signals and the threat to any device using precision GPS, including public safety vehicles, aviation, precise machine control and agriculture, and the newest category, UAVs. The results to UAVs are dramatic since they are unmanned and need to have precise positioning.

As the Geospatial Users Group continues to hold meetings around the state, we will continue to update members, and attendees of our meetings, of any decisions or outcomes of this threat.

Respectfully Submitted,
Geospatial Users Group
Earl Soeder, Allen Nobles & Richard Allen

Sources:

Testimony of Jim Kirkland, Vice President and General Counsel of Trimble Navigation Limited: Hearing of the Commerce, Justice, Science Subcommittee of the House Appropriations Committee (March 12, 2011)

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LightSquared Special Report

Build a Wirteless Network for Drones

By Brian Fung (The Washington Post)

In its bid to blow up the nation's cellular industry a half-decade ago, a company named LightSquared proposed something no wireless carrier had done before: It vowed to build America's first retail cellphone network using airwaves traditionally reserved for orbiting satellites.

The idea was exciting — and unproven. While mainstream carriers such as Verizon and AT&T waged war over more traditional low-frequency airwaves, Reston-based LightSquared wanted to beam mobile Internet from cell towers to customer smartphones over high-frequency waves, bypassing the competition and entering as a new, hungry rival in a market dominated by big corporations. It was seizing on the potential of what was, at the time, less desirable airwaves.

But the project quickly fell behind. With a \$3 billion investment at stake, LightSquared filed for bankruptcy protection in 2012 after failing to keep up with its debts and becoming embroiled in a high-stakes confrontation with John Deere, Garmin and even the military. The once-radical effort stalled.

After a multiyear restructuring during which LightSquared's owner and top investor — the embattled hedge-fund manager Philip Falcone — stepped aside, the company has reemerged. It has a new name — Ligado — and even grander ambitions.

[How Philip Falcone lost his inside-the-Beltway battle to create a wireless rival to AT&T and Verizon]

If it succeeds, Ligado will be well-positioned to control a massive chunk of the industrial market for connected devices, a market that Morgan Stanley thinks will be worth \$110 billion a year by 2020. Success, however, depends on billions of dollars of investment in construction, not to mention getting the blessing of regulators who blocked the company's path once before.

Ligado is promising not only to build the world's first wireless network using ground-based airwaves that had long been considered unsuitable for cellular use, but it's also planning to join that capability with a satellite hovering above North America. The novel pairing, its executives say, will largely support industrial customers, not individual consumers. But, they emphasize, that doesn't mean the average American won't see benefits from the hybrid network.

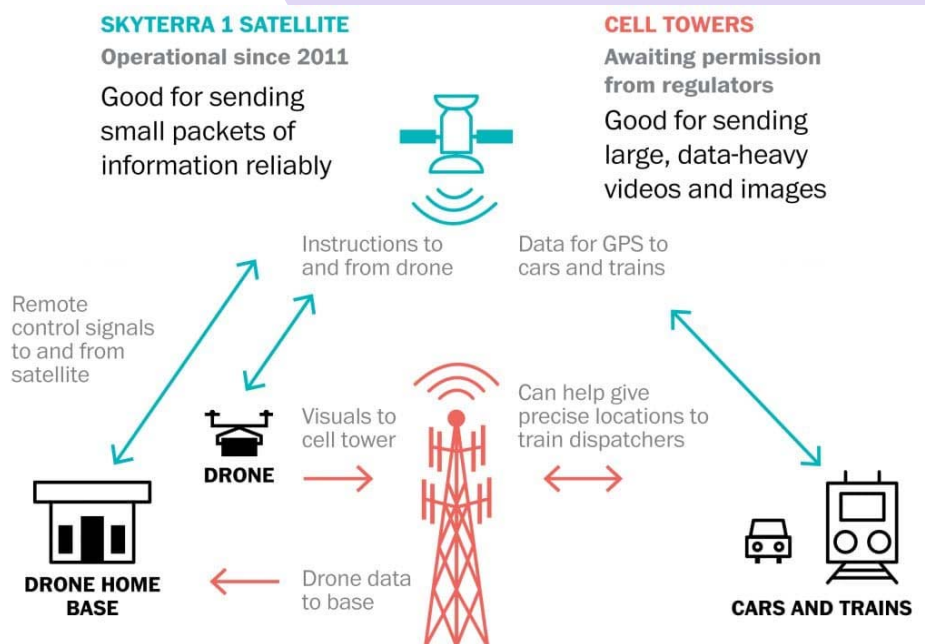
"It's new owners, a new board, a new management team," Ligado chief executive Doug Smith said. "We're excited with the solution we came up with. This is not another cellphone network. It is absolutely a type of service that doesn't exist today."

For example, the new system could allow self-driving cars to receive instant GPS location readings that are accurate to within five inches, according to Smith. Achieving that level of accuracy will probably become vital to the automotive industry as vehicle automation goes mainstream — whether for parallel parking or for staying in the correct lane at 60 miles per hour.

Ligado's satellite-terrestrial network could also give railroad companies a boost. The high-precision location features may allow train dispatchers to pinpoint the precise endpoints of a train, which could help avoid collisions or improve the efficiency of rail operations.

"Knowing exactly where that end-of-train is at any moment makes it much safer," said Sid Bakker, president of TPSC, a railroad telecommunications provider. "If we can communicate that to the back office, or to other trains or maintenance vehicles, we just increase driver safety."

Emergency helicopter services could benefit from satellite-terrestrial communications, too — enabling rescue workers to keep their choppers humming at peak



Continued on page 19

Source: Ligado

DENISE LU / THE WASHINGTON POST

Build a Wireless Network, *cont. from* [page 18](#)

performance by automatically sending diagnostic data back to base. That data about the equipment could help maintenance crews anticipate a mechanical or electronic problem in the aircraft before it begins.

In an industry in which everything is fine-tuned to the last detail and backed up by contingency plans, the inability to get live, real-time maintenance data from aircraft is the missing piece, said Mike Stanberry, chief executive of Shreveport, La.-based Metro Aviation, which supplies helicopters and maintenance services to hospitals across the country.

"We were killing people in the industry because we were deficient in these areas," Stanberry said. "This live data information was the last bucket, and probably the most important."

Ligado's network will be built in stages. Although the company's main satellite, SkyTerra 1, has been operational since 2011, Ligado is awaiting permission from federal regulators to begin building ground-based cell towers. The first beneficiaries will be such companies as TPSC and Metro Aviation, along with ports, utility companies and other industrial businesses. Because most of these firms operate in geographically specific areas, don't expect Ligado to build a national cellular footprint anytime soon. It'll start by setting up ground-based towers in just the places that need them most, said its executive vice president, Valerie Green.

The network is expected to split its duties according to the type of traffic it's handling. For relatively small packets of information that require high speed and low drag — such as diagnostic data — the satellite connection will be key. But the ground-based network will handle more bandwidth-heavy applications, such as the video produced by an aerial drone while inspecting a railroad track.

The unconventional network is Ligado's crown jewel as it seeks a dominant position in a new sector of the economy. As more Americans turn to the Internet of Things — a constellation of Web-enabled smart devices and appliances — to perform everyday tasks, the broadband provider that can support the constant flow of communications stands to make a great deal of money.

Other telecom companies have invested heavily in the Internet of Things, too. For instance, Verizon's IoT division is nearly a billion dollar business annually, according to its executives. But Ligado's focus on industrial infrastructure is both demographically and geographically unique, Smith said.

"I think the requirements would be different," he said. "If you go back to the rail example, there's lots of miles of track that just don't have any coverage on it today. So one of the first reasons [a traditional cellular carrier can't operate there] is because it's not there."

As the first company to attempt a hybrid network using satellite airwaves, Ligado's experiment is being closely watched by network operators and regulators around the world. But the company's new strategy emerged after a long and difficult road.

LightSquared's plans to build a nationwide 4G data network were foiled in 2012 when the Federal Communications Commission rescinded the company's airwave license, citing concerns by Deere, Garmin and other critics that transmissions over LightSquared's satellite airwaves would interfere with GPS navigation devices.

At the time, Falcone, a former professional hockey player known on Wall Street for his competitive streak, had pledged a long-haul battle over the future of his company.

"One of the things I learned in hockey is that the game's not over until the buzzer sounds at the end of the third period," he told The Washington Post in 2012. "And until that buzzer sounds, you keep on playing as hard as you can."

In 2012, the buzzer rang out. Already under financial pressure from creditors, LightSquared filed for bankruptcy protection, and a path to emerge only came clear in March 2015 when a number of investment firms, including Centerbridge Partners and Fortress Investment Group, proposed to take over from Falcone's Harbinger Capital Partners. Under that deal, Falcone would retain a nonvoting stake in LightSquared. But he would lose the ability to litigate or negotiate with the GPS companies he blasted with a lawsuit in 2013 for allegedly standing in his way.

"Falcone was clearly a bomb-thrower — typical New York guy," said one person familiar with the negotiations who spoke on the condition of anonymity because the talks were private. "He was just shotguns blazing, all hours of the day. And really, he probably could have done the same deal that Doug Smith did, if he had been willing to negotiate and compromise."

The new management swiftly moved to defuse tension with the GPS industry. Knowing that LightSquared's satellite airwaves were still intensely valuable, they named a former chairman of the FCC, Reed Hundt, to the board, as well as former Verizon chief executive Ivan Seidenberg. Together with Smith, the group devised a new approach — one that had the company making significant concessions.

Among the changes was a decision to drastically reduce LightSquared's transmission power levels so that any data traveling over its airwaves would not jam the GPS signals. The firm agreed to clean up its signals so that less noise would spill over into the GPS industry's back yard. And LightSquared committed to never using one of its satellite channels for ground-based pur-

Continued on page 20

Build a Wireless Network, *cont. from page 19*

poses, ensuring a buffer between the GPS airwaves and the LightSquared airwaves.

"The new leadership is committed to a constructive approach to interference concerns," said Jared Hendricks, a senior managing director at Centerbridge.

Days after formally exiting bankruptcy in December 2015, LightSquared announced it had reached a compromise with GPS industry officials. A couple of months later, the firm relaunched as Ligado - and has been hoping ever since for a green light from the FCC to begin building its cell towers.

By most measures, Ligado appears ready for takeoff once more. Deere did not respond to requests for comment and Garmin declined to do so. But other GPS industry officials say they are largely supportive of the changes the company has put in place, though some outstanding issues must still be negotiated.

"Discussions with Ligado have been constructive with the new leadership," said Jim Kirkland, senior vice president and general counsel at Trimble, a GPS device maker that had clashed with LightSquared. "We're happy we're able to resolve some of the spectrum issues, and we're committed to working with Ligado on the remaining issues."

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GPS Throughout History

