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January 31, 2006

**EX PARTE**

Ms. Marlene H. Dortch  
Secretary  
Federal Communications Commission  
445 12th Street, S.W.  
Washington, D.C. 20554

**RE: In the Matter of E911 Requirements for IP-enabled Services (WC 05-196)**

Dear Ms. Dortch:

On December 15, 2005, Jon Metzler of Rosum Corporation, and James Green of Mercury Strategies, LLC, met with Commissioner Jonathan Adelstein, and Scott Bergmann, Legal Advisor for Wireline Issues to Commissioner Adelstein. The purpose of the meeting was to discuss Rosum's position location technology and its applicability to the geolocation of 9-1-1 calls made from Voice over Internet Protocol (VoIP) terminals. Recent demonstrations and results from "nomadic" location testing were also discussed.

Thank you for your attention. Should you have any questions, please do not hesitate to contact me. Materials left with Commissioner Adelstein and Mr Bergmann are appended to this filing.

Sincerely yours,

Jon Metzler

Cc: Commissioner Jonathan Adelstein  
Scott Bergmann  
James Green

## ROSUM CORPORATION

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## Corporate Fact Sheet

### **Experienced Team**

Chairman	- Dr. Jim Spilker Jr.
CEO	- Skip Speaks
CTO	- Dr Matt Rabinowitz
CFO	- Matthew Lewis
V.P. Engineering	- George Flammer
Chief Scientist	- Dr. Jim Omura

### **Board of Directors**

- Dr. Jim Spilker Jr., Co-architect of GPS, founder & CEO of Stanford Telecom
- Skip Speaks, former CEO, Kyocera Wireless, Triton Communications
- Paul Baran, co-founder: Stratacom, Metricom, and COM21; invented packet switched data
- James Gibbons, Board Member Cisco & former Dean of Engineering at Stanford University
- Lara Druyan, Allegis Capital
- Bill Tai, Charles River Ventures

### **Technical Board of Advisors**

- Dr. Matthew Rabinowitz, founder Rosum, co-founder of Panopticon
- Jim Omura, founder of Cylink, specialist in DTV
- Dr. Brad Parkinson, head of Joint Program Office that constructed GPS, Professor at Stanford University
- Jerry Whitaker, leading expert in Video and Television Engineering
- F. Craig Farrill, former CTO of Vodafone, co-founder of inOvate
- Perry LaForge, founder and director of CDMA Development Group, co-founder innovate
- Per Enge, Director, Stanford GPS Laboratory
- Marco Thompson, founder, San Diego Telecom Council

### **Key Application Segments**

- Asset Tracking & Recovery
- Government / Public Safety
- VoIP 9-1-1
- Location-based Services

### **Investors**

- Charles River Ventures
- Allegis Capital
- Motorola Ventures
- Steamboat Ventures
- KTB Ventures
- In-Q-Tel
- Other development partners

### **Business Summary**

Founded in 2000, Rosum is the first and only company to leverage the commercial broadcast TV infrastructure for positioning of mobile assets. The Rosum Positioning Technology (RPT) delivers seamless indoor and outdoor coverage and is particularly effective in urban and indoor areas, where traditional location systems have difficulty maintaining reliability, accuracy, and cost-effectiveness.

Rosum is engaged in the design and marketing of digital chips, servers and infrastructure products based on this technology. Rosum has established partnerships with leading companies in the public safety, asset tracking and telephony sectors. Rosum and leading GPS provider Trimble Navigation have developed a combined TV & GPS-based asset tracking product that delivers hybrid positioning based on the combined technologies. Rosum is currently supporting product trials for select partners.

### **Why Use TV Signals for Positioning?**

Traditional positioning systems are satellite-based and were designed for outdoor applications. However, they have limitations indoors, in obstructed areas or difficult urban environments, where satellite signals attenuate and/or fail. TV signals are plentiful, powerful, low and diverse in frequency, and easily penetrate walls, automobiles, and city buildings, making them optimal for urban-area and indoor positioning applications. In sum, Rosum transforms the commercial TV infrastructure into a high-power, multi-frequency terrestrial GPS.

### **Applications**

Mobile assets, from devices to people, are nomadic and unpredictable in their movement. The ability to track these assets to date has been limited in the technologies themselves, which either diminish in performance in urban areas, or require extensive pre-installed infrastructure. Rosum delivers robust, accurate indoor/outdoor coverage with a minimum of infrastructure, making it the best possible solution for wide-area location applications, such as asset tracking, emergency services, and mobile handsets.

In addition, TV spectrum represents a fully-operational complement to or substitute for the GPS should it be compromised. President Bush, in a December 2004 Presidential Decision Directive, mandated the search for terrestrial complements to the GPS.

### **Product Development Opportunities**

For further information on product trials or development opportunities, please contact [info@rosum.com](mailto:info@rosum.com) or [jmetzler@rosum.com](mailto:jmetzler@rosum.com).

### **Summary of Benefits**

- ***Robust and reliable indoors and in urban areas***
- ***Low cost device***
- ***Low infrastructure requirements***
- ***Accurate, available positioning***
- ***Consistently fast time to first fix***



# Why Use Broadcast TV for Positioning?

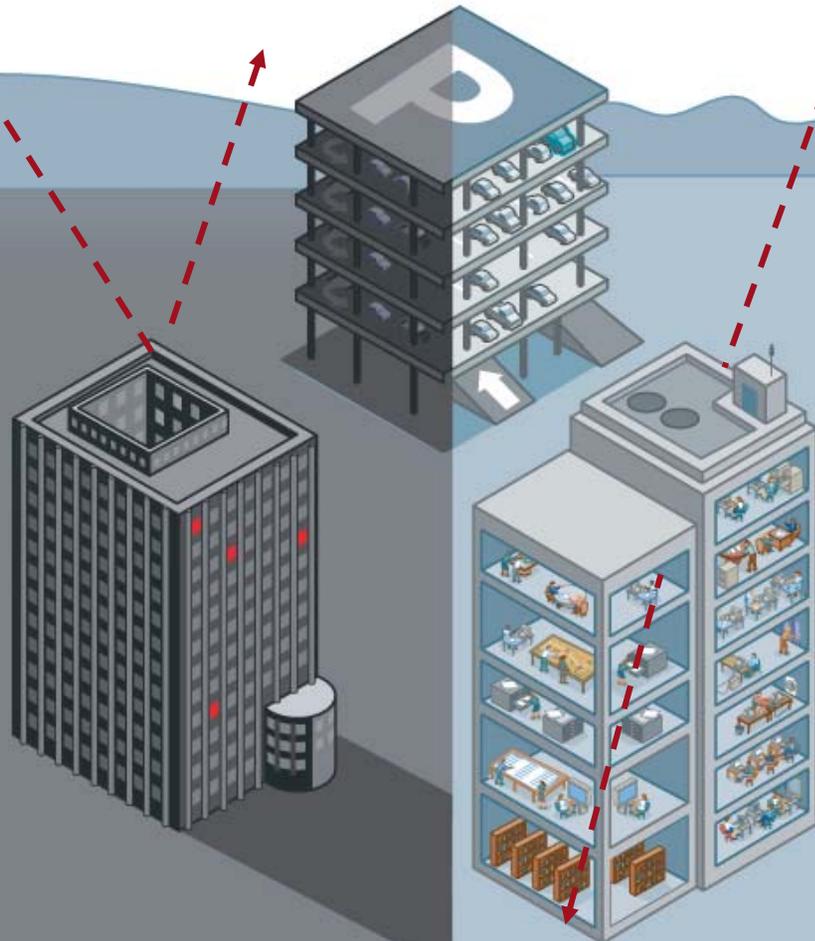


Advantages of TV over GPS:



**40 dB (10,000X)  
indoor power  
advantage**

- Low Power
- High Frequency
- Narrow Spectrum
- Vertical Signals



- High Power  
*1MW ERP typical (1000x GPS)*
- Low Frequency  
*50-750 MHz  
(stronger indoor signals)*
- Frequency Diversity  
*Clear 6MHz channels,  
multiple channels per tower*
- Horizontal Signals  
*Less attenuation from  
walls than roofs*

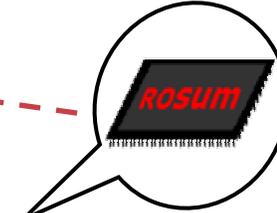


# How TV-based Positioning Works

1) 2800 transmitters with 4500 Analog and digital channels are already built and operational. Broadcasts contain synchronization pulses usable to measure timing.

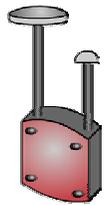


2) Rosum-enabled device receives TV signals, measures their timing, and computes pseudoranges



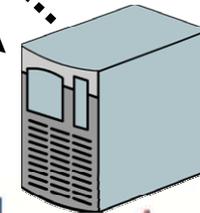
6) Results sent back to device or to tracking application

3) Device passes information to Location Server



Regional Monitor Unit covers 50-100km radius; sees same signals as mobile device

4) Aiding data for area stations



5) Location Server computes position



# VoIP 9-1-1 Timeline

<p>2004</p>	<p><b>February:</b> FCC defines “pure” (PC-to-PC) VoIP as “information service”, not telecommunications</p> <p><b>March:</b> DoJ, FBI, DEA file joint petition for implementing CALEA (Communications Assistance for Law Enforcement Act) in VoIP</p> <p><b>March:</b> Intrado announces V9-1-1 service; Vonage, AT&amp;T, Primus later adopt</p> <p><b>December:</b> Residential VoIP market breaks 1M* (Halpern); Vonage reaches 400,000</p>
<p>2005</p>	<p><b>March:</b> State of Texas sues Vonage; other states follow</p> <p><b>April:</b> CRTC mandates E911 call location for VoIP service providers; FCC begins investigation</p> <p><b>May:</b> FCC issues Order mandating E911 compliance in 120 days (later extended to 150 days); House &amp; Senate issue similar bills</p> <p><b>June:</b> FCC issues NPRM on VoIP E911, including solicitation on whether VoIP adapters should have automatic location capability by June 2006. VoIP residential market reaches 2.7M subscribers</p>

*\*Refers to interconnected residential VoIP telephony. Does not include PC-to-PC “pure” VoIP.*





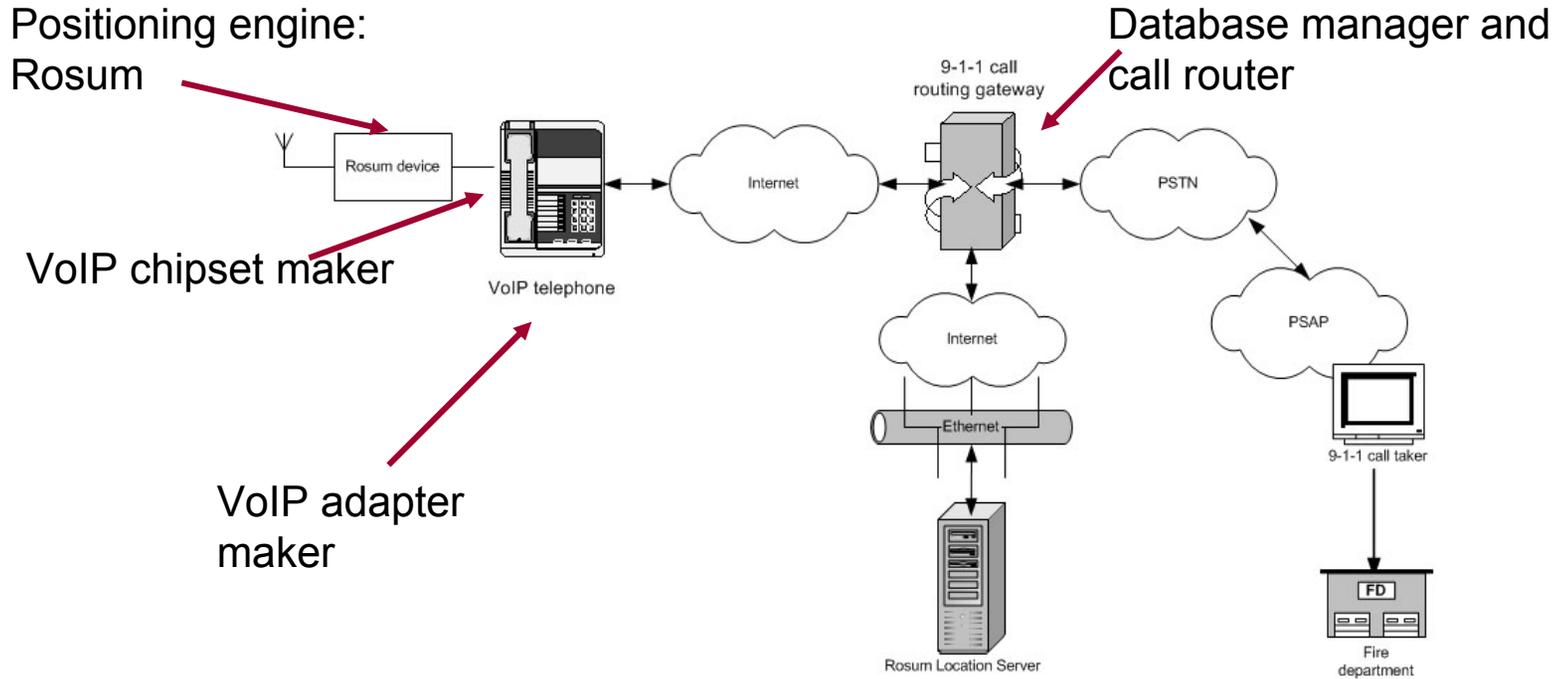
# Why Rosum

- **“Nomadic” VoIP use** (Home → Office → Hotel → Café) growing – location capability needs to move with device
  - Pre-installing and geolocating infrastructure in all buildings not feasible
  - Rosum solution moves with user without preinstalled infrastructure or manual user updates
- **VoIP is a purely indoor application** – occurs on the desk at home or on the road at hotel or office
  - Rosum has demonstrated Handset E911-level accuracy in all-indoor environments in multiple geographies
  - GPS unreliable indoors
- **VoIP use is concentrated in urban centers** where broadband penetration is high
  - TV towers are highly correlated with population centers





# VoIP E911 Solution Value Chain



*\*Shows Rosum as external dongle for sake of clarity.*





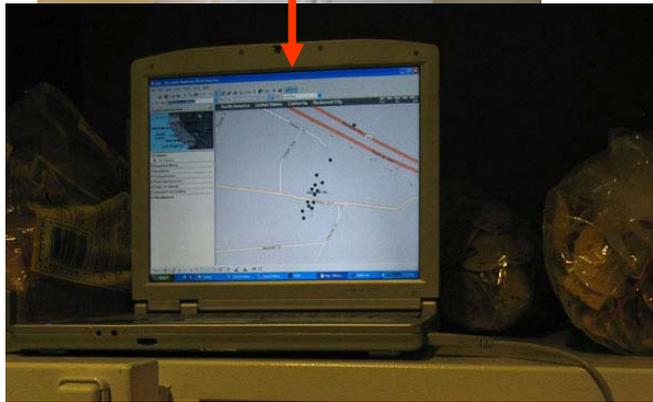
# Competitive Offerings

Technology	How It Works	Comment
GPS/A-GPS	Triangulation via received satellite signals	Poor performance indoors & in urban areas
IP address	Associate IP address with geographic coordinates	Very coarse (km-level accuracy; nearest colloc facility), subject to VPNs
WiFi access points	Assign location to APs by using GPS, then use to triangulate	Not robust - subject to moves/changes/outages, geolocation method coarse
IP	Add civic/geographic info to DHCP protocol	Most PSAPs not IP-enabled, near-term feasibility/authority unclear
Self-provisioning	User inputs her address manually	Solution currently used; subject to forgetfulness, input error; requires web browser

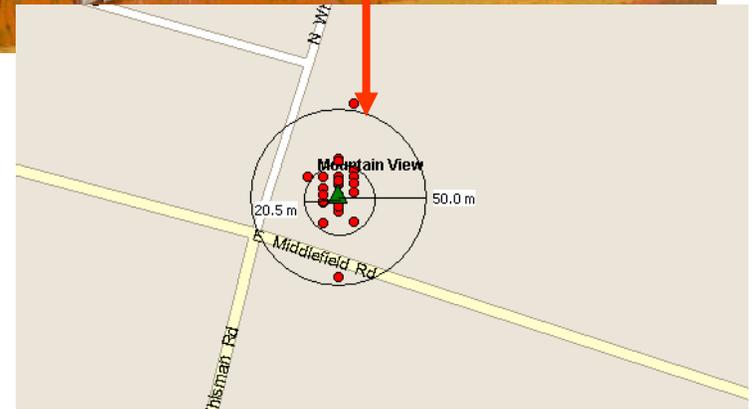




# Rosum preserves availability in the most challenging RF environments



*Rosum kitchen, February 2005.*



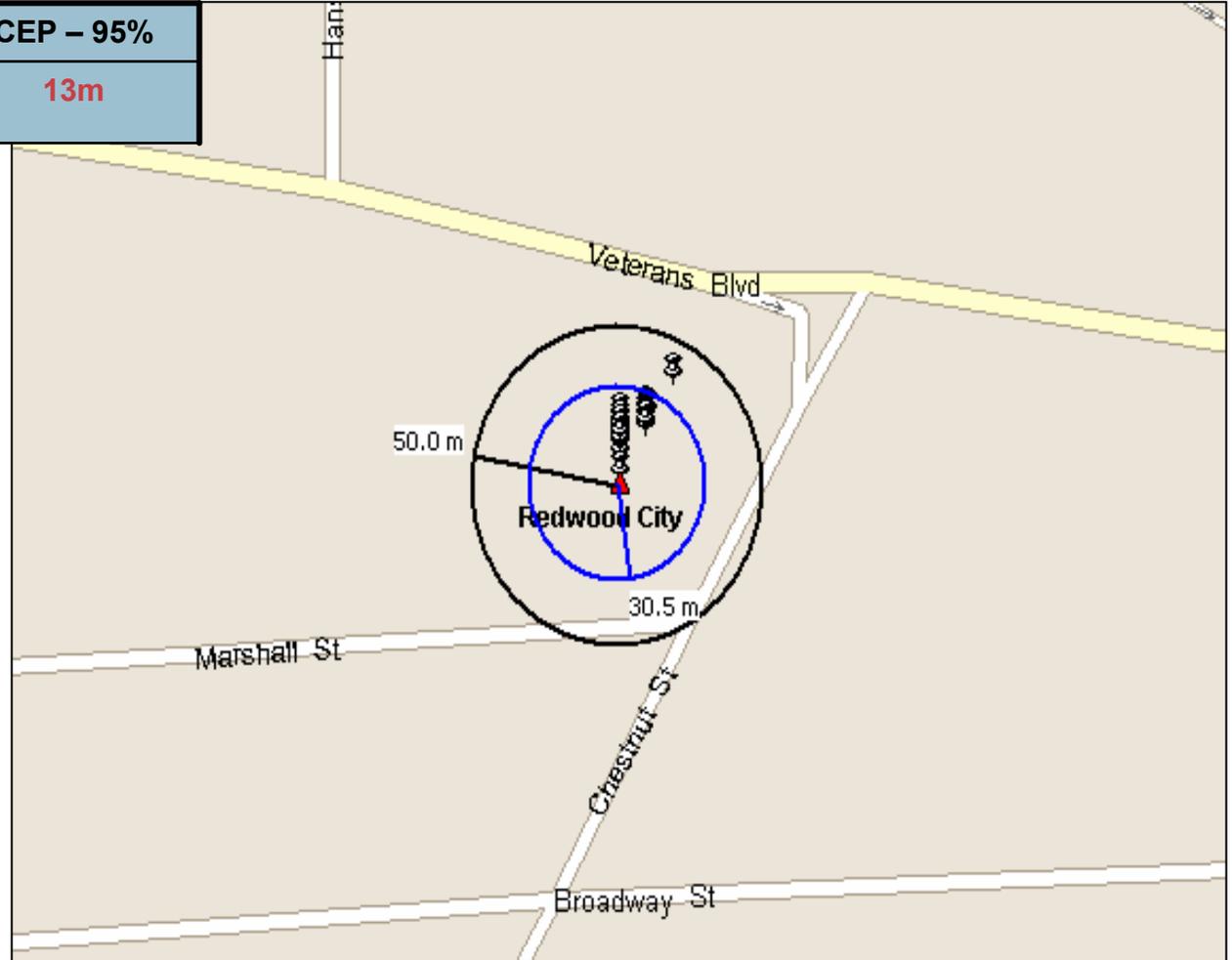
*Rosum conference room, October 2005.*





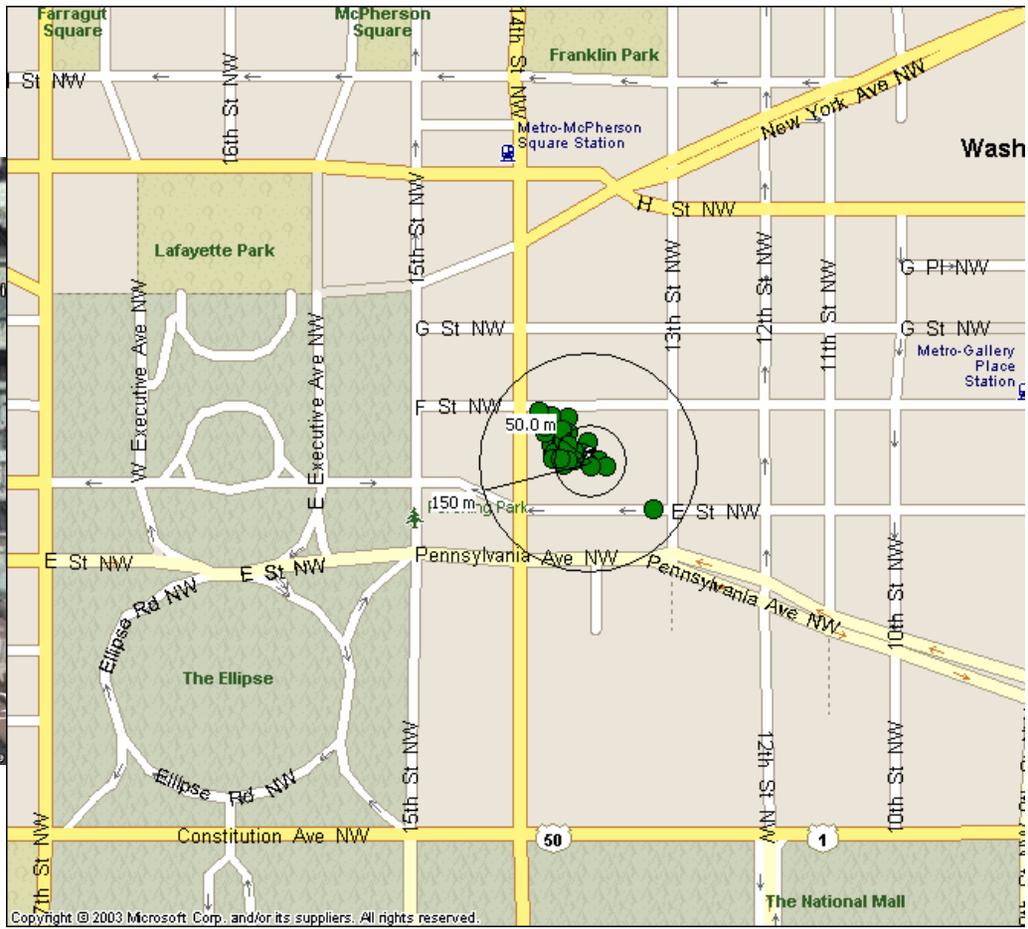
# And provides GPS-level accuracy out of doors

MEDIAN	CEP - 67%	CEP - 95%
5m	5m	13m



# Dense Urban: JW Marriott Hotel, Washington DC

MEDIAN	CEP - 67%	CEP - 95%
41m	52m	88m

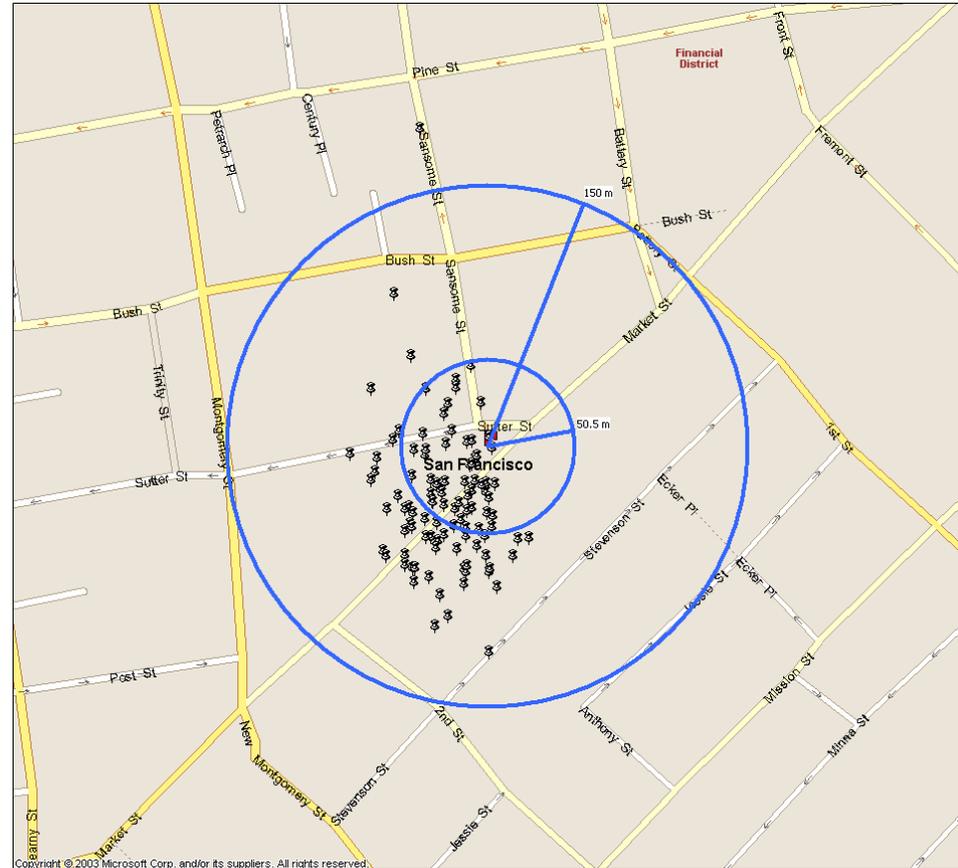


# Extreme Urban: Montgomery BART, San Francisco

MEDIAN	CEP - 67%	CEP - 95%
48m	58m	95m



*Ticket level, one floor underground.*





# Patent Portfolio to Date

- Positioning with Ambient Signals
  - ATSC Digital, NTSC Analog TV (e.g, Americas, Korea)
  - ISDB-T Digital TV (e.g. Japan)
  - DVB Digital TV (e.g. Europe)
  - Non-TV Ambient Signals (e.g. OFDM signals)
  - Other Synch Codes for Analog NTSC, PAL, SECAM
- Integration with GPS
- Integration with Cellular Infrastructure
- Local Augmentation Systems
- Signal Processing for Positioning (e.g. Multipath techniques)





# Recognition and Awards

May 2005 – Rosum named to **Red Herring 100 Top Private Companies in North America.**

October 2005 – **MIT Technology Review** named Rosum Co-founder & CTO Matthew Rabinowitz to the **TR35**, one of the top 35 innovators under age 35.

December 2005 – **World Economic Forum** will choose Rosum TV-GPS for **Technology Pioneer Award** as an innovative, transformational technology with long-term market and societal impact. 30-50 Firms chosen globally each year.

January 2006 – Rosum to be named **Frost & Sullivan 2006 Communications Market Enabling Technology of the Year.**





# Rosum leadership straddles the TV, GPS, and cellular worlds

## Management Team

### **Dr. Jim Spilker, Chairman, Founder**

Founder and former CEO of Stanford Telecom.  
GPS Architect.

### **Skip Speaks, CEO**

Former CEO of Triton Communications, Kyocera  
Wireless

### **Dr. Matthew Rabinowitz, CTO, Founder**

Founder of Panop.com

### **George Flammer, VP Engineering**

CTO of G3M Co., Director of Communication  
Technologies at Metricom

### **Matthew Lewis, CFO**

CFO of Mobilink Telecom  
(sold to Broadcom)

### **Dr. Jim Omura, Chief Scientist**

Founder of Cylink

### **Todd Young**

Director of Product Development

### **Jon Metzler**

Business Development Director

## Board of Directors

### **Dr. Jim Spilker, Chairman**

Co-architect of GPS, founder and CEO of Stanford Telecom

### **Skip Speaks, CEO**

Former CEO of Triton Communications, Kyocera Wireless

### **Paul Baran**

Invented the concept of packet data, co-founder of: Com21, Telebit,  
Stratacom and Metricom

### **Dr. Jim Gibbons**

Former Dean of Engineering at Stanford University, Cisco Board Member

### **Bill Tai, Board Member**

Partner, Charles River Ventures

### **Lara Druyan**

General Partner, Allegis Capital

## Board of Technical Advisors

### **Dr. Jim Omura, Chief Scientist**

Former UCLA professor, founder of Cylink

### **Dr. Brad Parkinson**

Head of Joint Program Office that constructed GPS, Stanford Professor

### **Jerry Whitaker**

Leading Expert in Video and Television Engineering

### **F. Craig Farrill**

Former CTO of Vodafone, co-founder Kodiak Networks

### **Perry LaForge**

Founder and Director of CDMA Development Group, co-founder inOvate

### **Per Enge**

Director of Stanford GPS Research Laboratory

### **Marco Thompson**

Founder Doctor Design, CTO Wind River Services,  
Founder & past President, San Diego Telecom Council





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## Rosum Corporation Selected As World Economic Forum 2006 Technology Pioneer

**Mountain View, CA – December 5, 2005 --** Rosum Corporation, a leading location-technology company, today announced its selection as a 2006 Technology Pioneer by the World Economic Forum. Technology Pioneers are companies that have been identified as developing and implementing innovative technologies with transformational societal and economic impact. Rosum is one of 36 companies across the globe selected for this prestigious honor.

“The creative innovations produced by our Technology Pioneers hold the promise of significantly affecting the way business and society operate”, said Peter Torrelee, Managing Director of the World Economic Forum. “As a global knowledge hub, we see the Technology Pioneer community as key contributors to this dialogue and to the mission of the World Economic Forum.”

“We are honored to be recognized as a Technology Pioneer by the World Economic Forum,” said Skip Speaks, CEO of Rosum Corporation. “This selection validates the potential impact of our pioneering technology. Rosum’s technology will help our customers serve the public good, first in the public safety realm, such as by facilitating the work of first responders and tracking high-value or high-risk assets in urban and indoor environs where cost-effective and reliable tracking has not been feasible to date. On a larger scale, the Global Positioning System’s vulnerabilities to both natural and man-made interference are well-established. Our technology augments the GPS in areas where its performance is challenged.”

Each year, members, constituents and collaborators of the World Economic Forum nominate Technology Pioneers. Selection criteria include:

- **Innovation.** The technology must be innovative, not more than two years old, and the company should invest significantly in R&D.
- **Potential Impact.** The technology must have the potential to have a substantial long-term impact on business and society in the future.



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- **Growth and Sustainability.** The company should have all the signs of a long-term market leader and should have well-formulated plans for future development and growth.
  - **Proof of Concept.** The company must have a product on the market or have proven practical applications of the technology. Companies in “stealth” mode and companies with untested ideas or models will not qualify.
  - **Leadership.** The company must have visionary leadership that plays a critical role in driving the company towards reaching its goals.

### **About World Economic Forum**

The World Economic Forum ([www.weforum.org](http://www.weforum.org)), based in Geneva, Switzerland, is an independent organization committed to improving the state of the world. Funded by the contributions of 1,000 of the world's foremost corporations, the Forum acts in the spirit of entrepreneurship in the global public interest to further economic growth and social progress. The Forum serves its members and society by creating partnerships between and among business, political, intellectual and other leaders of society to define, discuss and advance key issues on the global agenda. Incorporated in 1971 as a foundation, the World Economic Forum is impartial and not-for-profit, and is tied to no political, partisan or national interests. In 1995 the Forum was awarded NGO consultative status with the Economic and Social Council of the United Nations.

### **About Rosum**

Rosum is the first and only company to use unmodified broadcast TV signals for position location of mobile assets. The Rosum solution is uniquely suited to tracking of mobile devices in urban areas and indoors, where GPS and assisted GPS solutions often fail. Rosum's leadership is composed of industry leaders from the GPS, cellular and television worlds, and the company is venture-backed by leading investors including Charles River Ventures, Allegis Capital, and Motorola Inc. Partners include Trimble Navigation, the leading GPS company, and In-Q-Tel, the CIA's venture investment arm. Rosum's founding team includes the original architects of the GPS constellation. More information is available at [www.rosum.com](http://www.rosum.com).

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## **Rosum Corporation Receives Frost & Sullivan 2006 IP Communication Market Enabling Technology of the Year Award**

*TV-GPS pioneer recognized for developing robust VoIP E911 solution*

**Mountain View, CA – October 25, 2005** – Rosum Corporation, the leader in reliable position location technology, today announced that it has received the prestigious Frost & Sullivan 2006 IP Communication Market Enabling Technology of the Year Award. The award recognizes Rosum’s innovative TV-GPS positioning technology as a robust solution to an important public safety issue – Voice over Internet Protocol (VoIP) E911 – and particularly in resolving the location of nomadic VoIP E911 callers.

Rosum’s TV-GPS positioning system utilizes unmodified broadcast TV signals for position location. There are 2,800 TV transmitters and 4,500 TV transmitters in the United States alone, and they are well-correlated with population centers where broadband use – and therefore VoIP telephony use – is highest. Rosum designs and manufactures the chipset, software, and infrastructure components of its TV-GPS system. Rosum also has developed a local-area TV-GPS technology that is portable and deployable for supporting first responder police, fire and rescue personnel. Over 50 pending or approved patents protect Rosum’s technologies.

“Rosum’s technology has numerous applications, but VoIP E911 services seem to be one of the most immediate opportunities for its implementation,” said Frost & Sullivan analyst Elka Popova. “We believe that Rosum can provide a reliable alternative to existing E911 solutions and get the industry closer to resolving the issue of public safety, which is of major concern to regulatory bodies, service providers, vendors and end users alike.”

According to Frost & Sullivan, Rosum excelled compared to competitive offerings based on the following criteria:

- Value of the new technology in developing solutions that deliver greater benefits to end users
- Potential of the technology to become an industry standard
- Impact of the technology on market participants and their business strategies
- Recognition by industry participants as to the leadership of the company in this technology
- Capabilities of the company to deliver this technology to the market as an innovator
- Dissemination of information of benefits, and potential to the end users for quick acceptance by the market

“We are delighted to be chosen by Frost & Sullivan for this prestigious award,” said Skip Speaks, president and CEO of Rosum. “The award recognizes the value our solution delivers in public safety fields with mission-critical requirements, and in particular, in resolving VoIP E911.”

#### **About Frost & Sullivan**

Founded in 1961, Frost & Sullivan is recognized as a global leader in growth consulting. Frost & Sullivan Awards are presented to companies that demonstrate excellence in their industry, commending the diligence, commitment, and innovative business strategies required to advance in the global marketplace. Frost & Sullivan rigorously analyzes specific criteria to determine award recipients in a vast variety of market industries and landscapes.

#### **About Rosum:**

Rosum is the first and only company to use unmodified broadcast TV signals for position location of mobile assets. The Rosum solution is uniquely suited to tracking of mobile devices in urban areas and indoors, where GPS and assisted GPS solutions often fail. In exclusively indoor and urban-area testing, the Rosum solution meets the FCC’s Wireless E911 accuracy requirements for handset-based positioning systems. Rosum’s leadership is composed of industry leaders from the GPS, cellular and television worlds, and the company is venture-backed by leading investors including Charles River Ventures, Allegis Capital, and Motorola Inc. Partners include Trimble Navigation, the leading GPS company, and In-Q-Tel, the CIA’s venture investment arm. Rosum’s founding team includes the original architects of the GPS constellation. More information is available at [www.rosum.com](http://www.rosum.com).

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# VoIP E9-1-1

*Potential Solutions and Some Lessons from the Wireless E9-1-1 Experience*

**Jon Metzler, Business Development Director, Rosum Corporation**

**F**irst, a quick hypothesis: VoIP telephony, while generally a home application now, will eventually trace the path of wireless – you will truly be able to dial a person, not a place. That evolution is already underway, as evidenced by the launch of 802.11x-compatible VoIP terminals for the home. For now, these are essentially cordless substitutes, but they can also be taken from the home for “nomadic” use. For customers, this is a wonderful, liberating thing. For PSAPs and emergency call takers, this is yet another challenge to be addressed, and one that comes fresh on the heels on upgrades to meet the needs of Wireless E9-1-1.

The FCC issued its order for VoIP E9-1-1 compliance on May 19th. That same day, both the House and Senate introduced VoIP E9-1-1 bills. The FCC order gave carriers 120 days to comply. With that in mind, in this article, I’d like to cover potential solutions to the VoIP E9-1-1 issue. In addition, I will try to draw some lessons from the Wireless E9-1-1 experience and show how heeding those lessons could facilitate implementation of E9-1-1 capability in VoIP.

## VoIP E9-1-1: What Now?

Now that the FCC, House, and Senate have spoken, the real question is, what now? How will E9-1-1 service be delivered?

There are near- and long-term answers to that question. For example, on the long-term front, the I3 specification from the National Emergency Number Association (NENA) outlines a fully IP-enabled PSAP, which could handle a VoIP 9-1-1 call with no analog conversion. For customers, this would be a



CHRISTY WHITEHEAD

**A dispatcher for Little Rock, Arkansas, takes a call. Locating 9-1-1 callers originating from anything other than a landline telephone has been problematic for years - a number of solutions for wireless and now VoIP calls have been proposed.**

wonderful thing. PSAPs could take 9-1-1 calls with pictures, or video, or even from the instant messaging software clients. This would be very useful for people with limited English, or for people who aren’t in a position to speak.

However, if Wireless E9-1-1 provides any lesson, however, it is that converting all PSAPs to IP will take a long, long time. Moreover, where will that cost recovery mechanism that would help absorb PSAP investments come from? This is one of the great lessons of Wireless E9-1-1 and one that must be applied to VoIP E9-1-1. Put simply, someone has to take the 9-1-1 call, and someone has to pay for the infrastructure that can support that. Diverting 9-1-1 funds for other

purposes will only shortchange those on the frontlines.

For now, the FCC is assuming that customers will provide their own location through a web browser. This method has many limitations, from typos to simple forgetfulness to lags in location updates. With that in mind, I’d like to look down the road at potential solutions that do not require manual updates by the customer. I’ve divided them into the same categories as Wireless E9-1-1: Network-based Solutions, and Handset-based Solutions. (As with cellular, the boundary between the two is somewhat porous.) First, let’s take a look at the network and what’s possible in VoIP.

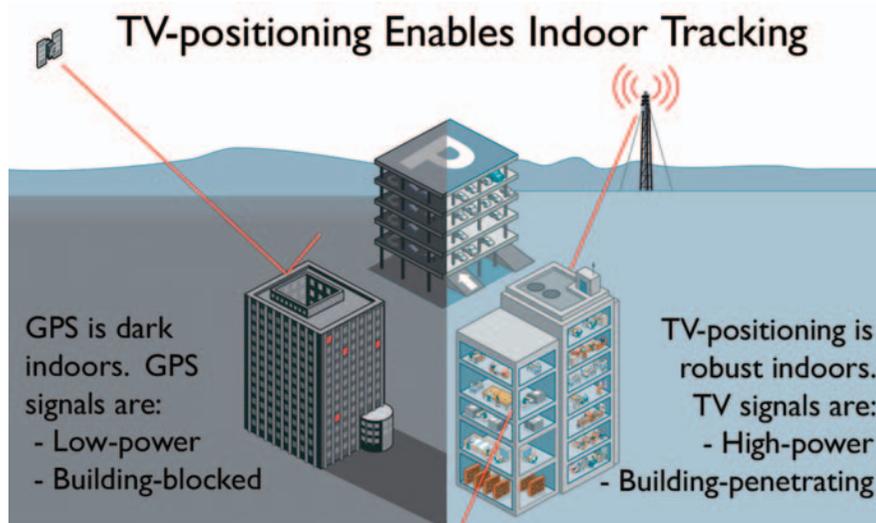
## Potential “Network-based” Solutions in VoIP

*Using the IP Address.* Using the device’s IP address to geolocate the device is one possible option. However, using the customer’s IP address has two major shortcomings from a reliability standpoint. A customer could be tunneling into a remote office through their company’s Virtual Private Network (VPN). Their IP address might look like they’re in the home office in Seattle when they’re really in Dubuque. Secondly, IP addresses are subject to spoofing [A technique used to gain unauthorized access to computers, whereby the intruder sends messages to a computer with an IP address indicating that the message is coming from a trusted host. – [www.webopedia.com](http://www.webopedia.com)]. (For residential VoIP customers, this is admittedly rare.) Further, there is no central repository for IP addresses, meaning no one database (say, provided by the FCC) that associates IP addresses with known locations.

What’s more, IP address-based location does not provide necessary accuracy. To use an analogy, it may give you the right exit from the highway, but won’t give you the street address. Four services I tried gave me the coordinates of ISP collocation facilities about five miles away from my home and office. At least that’s the right metropolitan area, and it might even get you inside the right PSAP boundary. But in the end, it’s not accurate enough to tell personnel where they should go.

*IP Address Improvements.* Organizations such as the Internet Engineering Task Force (IETF) have proposed changes to Internet address protocol (DHCP – Dynamic Host Configuration Protocol) so as to include geographic (latitude, longitude, and altitude) information and civil address information. This is obviously quite compelling. What is uncertain is whether these will be implemented, and how. Will the proposed changes be standardized in the future? When will that be? All of this is uncertain. If it’s a matter of getting new standards approved, then this could take years.

*Port Mapping in the Enterprise.* Another possible method is mapping Ethernet ports. This is mainly an enterprise-focused solution. If done successfully, this could route rescue personnel to the right room, not just the front door.



**Rosum’s VoIP E9-1-1 solution takes advantage of existing TV broadcast signals to triangulate device location, locating 9-1-1 callers using IP-based telephones in a manner similar to GPS.**

The issue here is maintaining a current database that reliably maps devices to geolocated ports, and maps the ports themselves. Even today, port mapping can be a manual exercise. Further, reflecting what enterprise IT managers call Moves, Adds and Changes in real-time is not a trivial task. Mapping calls to the last router in the hierarchy will still leave potential errors of hundreds of meters. Using “smart jacks” that can be pinged to give their own location is one option, but one that requires updating a huge installed body of Ethernet ports. Last but not least, port mapping is mainly an enterprise solution that doesn’t apply to homes.

*WiFi Access Points.* WiFi (802.11 networks) access point-based location is another option. If there are enough access points, triangulation of device location is possible. This is being done in some enterprise environments. However, WiFi access points are highly subject to moves and changes. And in non-business environments such as homes or cafes, there usually aren’t three access points, and access points usually aren’t geolocated in the first place. Further, access points outside of the enterprise, such as in a home or hotel, are provided as a good-faith exercise, and may move or even go out of service. Lastly, WiFi access points are often located by near-volunteer “warfinders,” who essentially drive around looking for access points, then log their coordinates with a handheld GPS device. This is a wonderful

service, but not robust enough for safety-of-life applications.

That all said, the immense number of WiFi access points out there is of some value. Perhaps of themselves, they are not a solution robust enough to provide E9-1-1 coverage. But in conjunction with other solutions, they may provide some value, particularly as VoIP handsets compatible with WiFi networks become more common.

## Handset-based Solutions

Now I will take a look at potential handset-based solutions for location of VoIP 9-1-1 calls. Again, I have focused exclusively on those that don’t require customer interaction.

*Device MAC Address.* The MAC address on a VoIP adapter is basically like a serial number that is unique to the device. This is how the cable companies deal with the 9-1-1 issue – set-top boxes have MAC addresses that are assigned to a physical address.

Set-top boxes don’t move much, so this is a workable solution. However, for pure-play VoIP services to the home such as Vonage or CallVantage or Primus that don’t have a fixed line into the home, be it cable or copper wire, using the MAC address is subject to the device portability issue discussed above. Keeping the location associated with a nomadic VoIP adapter – in real-time – would be an immense task.

*Embedding Location Technology on the Device.* Many cellular carriers met



LAUREN BAMBERGER

**Dispatcher Heather Montgomery tones out a fire call to volunteers in Little Compton, Rhode Island. New methods of receiving 9-1-1 calls, including Voice over Internet, are providing new challenges to dispatchers, especially in a solo-dispatcher facility like Little Compton.**

the FCC’s specifications for Wireless E9-1-1 issue by adding GPS to their cellphones. This is an effective solution outdoors, but has shortcomings indoors and in urban areas. Even cellular-assisted GPS (A-GPS) falls short in urban environments, and the cell tower fallback that it provides is very coarse in accuracy terms.

### The Broadcast TV Alternative

TV-GPS, a new system pioneered by Rosum Corporation that uses unmodified broadcast television signals to triangulate device location, much as you would with GPS. The broadcast TV infrastructure essentially becomes a location infrastructure on the ground – rather than using 28 satellites in the sky, TV-GPS uses 4500 TV channels from 2800 transmitters right here on the ground. TV signals were designed to be receivable indoors in the first place – they are high in power, and low in frequency, which enables them to punch through walls in a way that GPS signals cannot.

Whereas WiFi access point-based positioning requires maintaining and updating a massive database of access points, the TV broadcast infrastructure has already been built. Their locations are provided by the FCC. As such, TV-GPS represents one potential solution to the issue of locating VoIP 9-1-1 calls, both indoors and out.

### Moving Forward

In an E911 Institute panel in May, a Vonage representative mentioned that

the company would move further in a mobile direction – handsets will look and behave more like cellphones. This is what the CRTC and FCC classified as “nomadic” VoIP. It’s not “mobile,” per se, in that customers probably won’t be able to use handsets while driving. They could, however, make a call from one WiFi café, and then a different call from another. In a nomadic scenario like this, where the customer hops from location to location, on-device automatic location determination capability that doesn’t require customer interaction is the likely ideal solution.

### Finding a PSAP Cost Recovery Mechanism

VoIP is a cost-sensitive, cost-competitive service. Lower pricing is one reason for its extraordinary growth. As we move ahead to address the challenges of VoIP E9-1-1, what is crucial is to develop a solution that avoids an unnecessary cost burden on customer, carrier, and PSAP, and one that is in keeping with expectations of reliability that come with the three numbers “9-1-1.”

VoIP service has relatively minimal upfront costs, which has enabled startup carriers to move into the market. Should integrating with the native 9-1-1 infrastructure prove costly, this may price them out of the market, or at least force consolidation. With regard to PSAPs, they have already borne one cost burden in achieving Phase II Wireless E9-1-1 compliancy. A cost recovery mechanism to offset the added costs that come with handling VoIP 9-1-1 calls must be estab-

lished.

The Joint Program Office proposed by the members of the Congressional E9-1-1 Caucus represents a potential oversight and funding body. While \$250 million in funding has been authorized by the House (HR 5419), at present, the office has not been funded. What funding is available will come from the National Highway Traffic Safety Administration.

Another option is using Homeland Security funds, which, to date, have generally not gone towards 9-1-1. DHS funding seems the most intuitive – PSAPs are the first line of response in any disaster event, small or large. It is unclear whether this need will be reflected in future federal budgets. For now, DHS funds are generally at the discretion of the local program manager.

While these potential funding organs are being established, existing mechanisms, such as state 9-1-1 funds raised by Wireline and Wireless 9-1-1 tariffs, must be used for their original purpose. Making sure they are not siphoned off by budget-hungry state governments will be imperative.

The interconnectors such as Intrado will play a key role in helping mitigate this cost burden. All-analog PSAPs should be able to receive calls translated into the MSAG and appropriately respond without infrastructure upgrades.

Asking the customer to manually update her location was a best-effort first step at a time when access to the native 9-1-1 infrastructure wasn’t available. However, user errors, update lags or simple forgetfulness mean that we shouldn’t stop there. Solutions that require standards-building or expensive infrastructure upgrades will leave customers underserved and PSAPs financially strapped. An on-device, automatic location solution delivered by the interconnectors to both digital and analog PSAPs will allow the current 9-1-1 infrastructure to be leveraged, and more importantly, will save lives. **E911**

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