3D Location Indoor & Improved Location Outdoor

Problem

➢ *When a First Responder is trapped inside a building or needs help and cannot describe their exact location other First Responders may not be able to respond to assist.*

➢ *Geolocation & Situational awareness is paramount in emergencies & incident management*

➢ *Today, GPS is used to provide that for the Outdoors with some success, however until now no solution has existed for the Indoors.*

Required Elements for 'Mission Critical' Location Indoors

Mission Critical/Yield
- Ability to operate in the absence of power & withstand extreme weather conditions
- Ability to deliver location for every attempt

> 99% Yield

Horizontal Accuracy ('x-y' Axis)
- High accuracy (x-y)
- Identify building, Room/Zone, Store etc.

Vertical Accuracy ('Z' Axis)
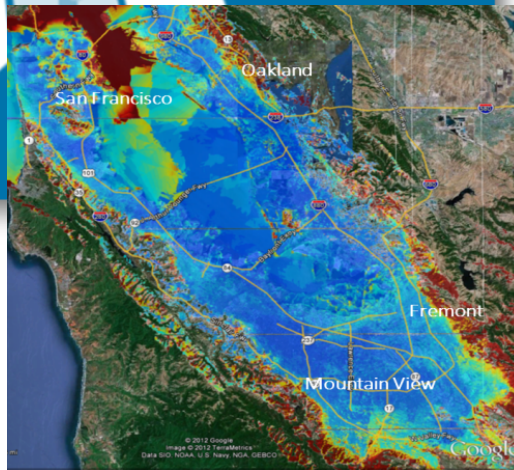- 1-3 Meter Vertical Accuracy
- Floor-level Positioning

Ubiquity and Consistency
- CONSISTENT experience in EVERY building within an entire metropolitan/suburban area
- Available in vast majority of end-user devices

'GPS' Performance Indoors
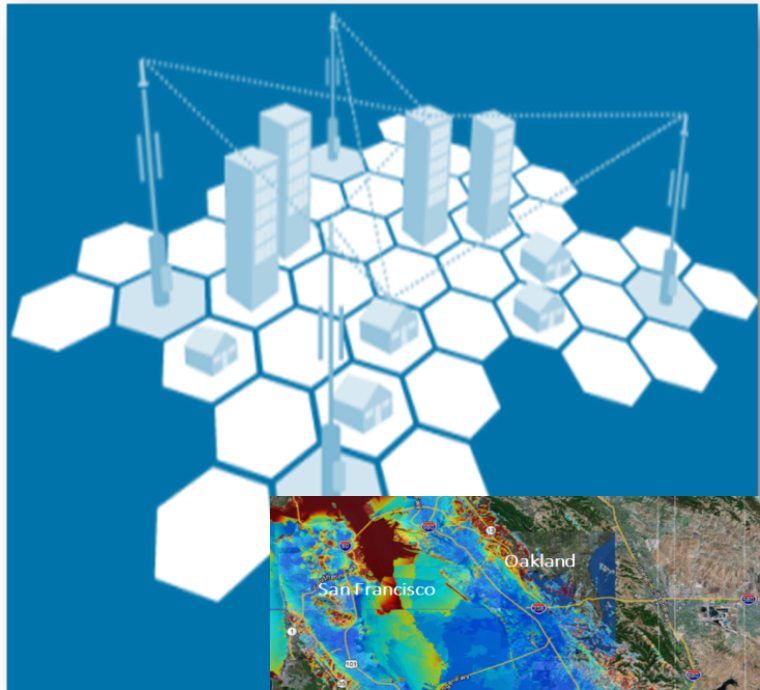
Current SF Bay Area Coverage

- An overlay network, dedicated to provide 3D (X,Y & Z axis) positioning with unique, proven floor-level vertical and horizontal accuracy

- Wide area coverage – can cover an entire market, much smaller than a Cellular Build
  - SF Bay Area is built to cover over 900 sq. miles with ~ 100 beacons

- Long-range, low-cost broadcast beacons placed on cell towers and rooftops – not building specific
  - Typical range 0.5-5 miles (depending on environment)

- Deployed and managed to deliver 'Mission Critical' (ability to withstand power outage & storms) location with multi-layer reliability
  - Beacon redundancy – Master & Slave Transmit
  - Battery backup to ensure continuity during power outages

- Complementary to GPS

- Designed to be built into phones standard – no accessories required

- Initial beacon network operational for six years in Top 47 markets

Network Equipment

NextNav Beacon

- Designed for deployment in unconditioned space
- Small form factor 37.78" Hx 30.70" W x 19.68" D
- No special power requirements or backhaul
- Management link via LTE or POTS

Beacon Interior

- Battery backup ensures continued operation without power
- Duel redundant power supply & components
- Internal rubidium clock backs up GPS

Omni Antenna
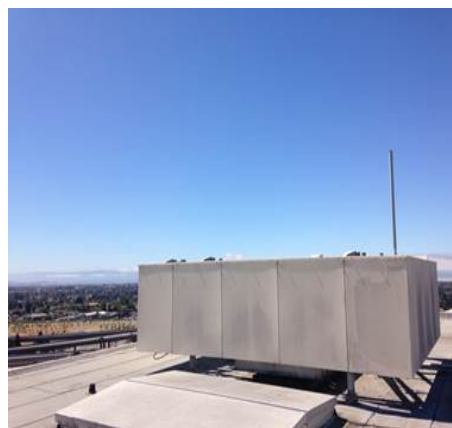
- Low-impact omni antenna
- Eases zoning, and creates placement flexibility
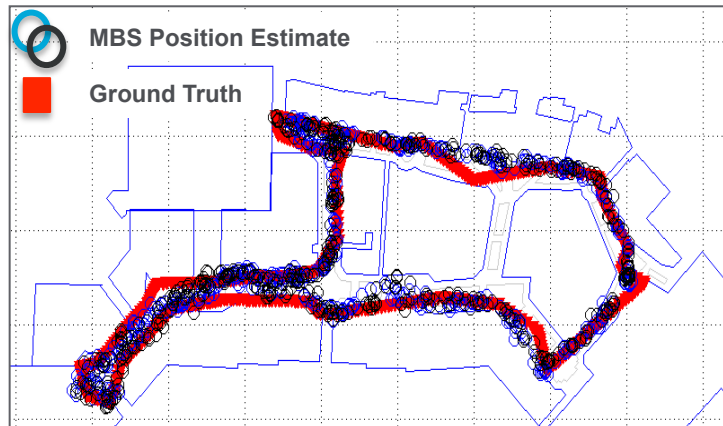- Omni antennas are ideal for location

Weather Station

- Weather stations deployed across NextNav network
- Enables high-accuracy pressure altitude

Indoor Location & Navigation

Accurate Horizontal (X-Y) Tracking

- Delivers < 9 ft (3m) Vertical position (floor level) and <30 ft (<10m) Horizontal position.

- MBS signal provides location and navigation in any part within it's coverage instantaneously
  - No building specific information required
  - Maps are optional

- No Pre-Planning required – Wide area system

Reliable Floor-Level Altitude (Z) Tracking
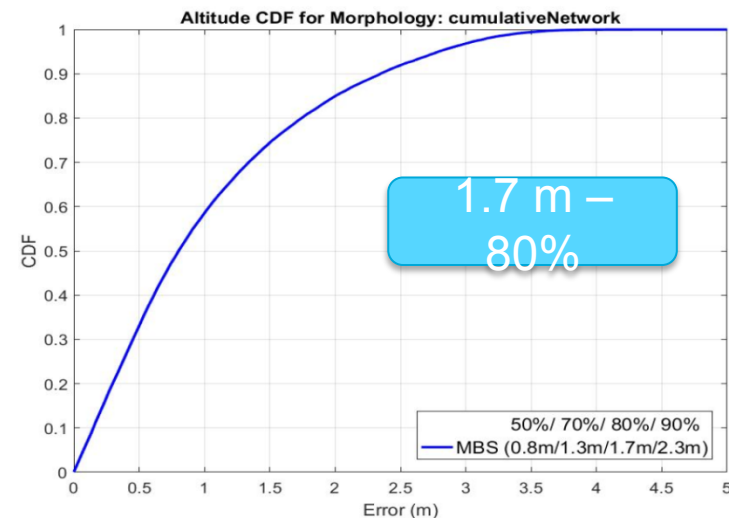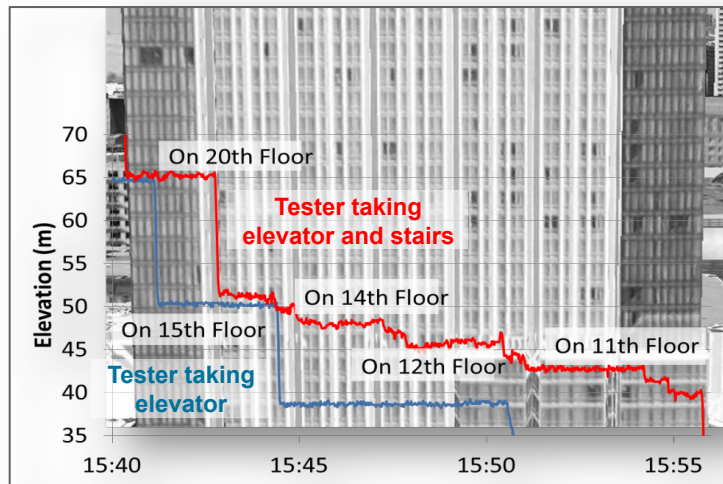
(Results based on latest CTIA/ATIS Testbed for Indoor Location Technologies)

3D Context & Visualization Service: Companion Service

- **3D Context Visualization Service**: Supports real time 3D tracking of 9-1-1 callers and first responders
  - Accurate 3D representations of all structures
  - Floor plans ingested into hosted platform where available

- In addition to visual display, supports user context information and other building details where available (e.g., address, floor, suite/room)
  - Could be integrated with Body Camera systems & other sensors

- Information can be displayed via web interface, dedicated tablet/phone application
  - Fully-featured UI: breadcrumbing, pan/tilt/zoom, prioritized identification of individuals or groups, buildings etc.

- APIs available for integration into existing tools and applications where preferred
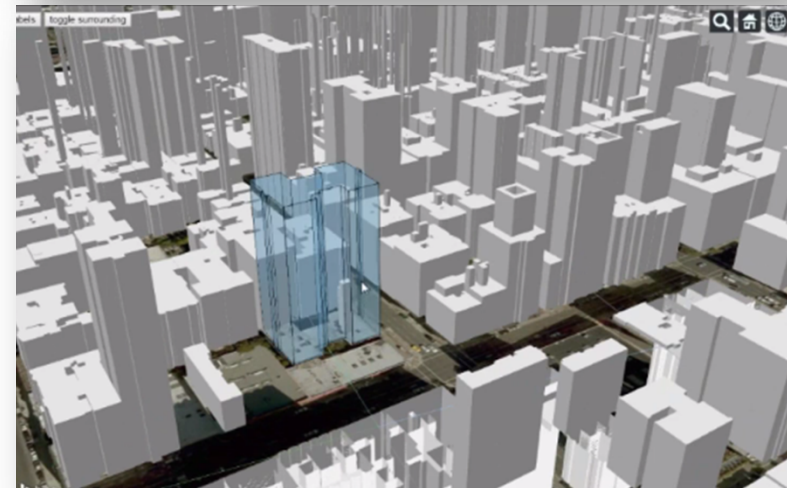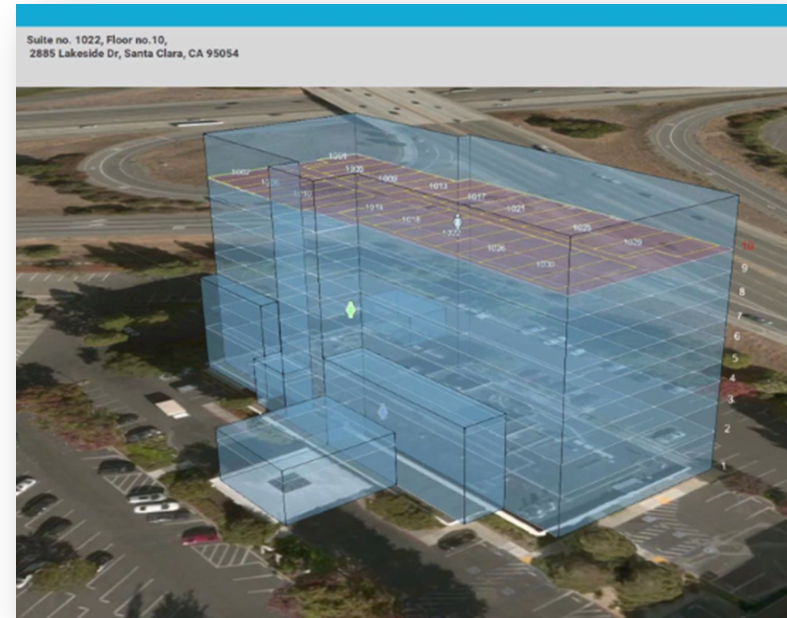
User Experience – Video

Click to play or go directly to **https://vimeo.com/222454215**

E911 Requirement & Industry Benchmark

- **MBS - Reliable 3D location**
  - **Independent of Venue**
  - **Independent of Broadband penetration**
  - **Works when power is out**

MBS Fixes: Correct floor, building

Current Tech: No floor info., outside building

101 California Street, CA

- In 2015 FCC introduced new rules for location accuracy (indoor & outdoor) when dialing 911
  - Six year phase in for X-Y
  - 50m (164 ft) 'X-Y' – 80% of Calls
  - 3m (10 ft) 'Z' – 80% of calls (Desired)

- Based on Blind Government and Carrier Tests (AT&T & Verizon) NextNav's MBS technology is the only solution that meets/exceeds all FCC's metrics in all environments
  - Proven floor level accuracy; < 6 ft (2m) vertical 80% of time
  - 99% Yield

MBS Service

```
"type": "Feature",
"geometry": {
   "type": "Point",
   "coordinates":
[-74.006393,
40.714172]
},...
```

MBS 3D location system, with beacon coverage designed to meet first responder objectives. Access to Spectrum

3D Context & Visualization service to enable real-time 3D tracking

- *Hosted back-end service for tracking 9-1-1 callers and First Responders*
- *Tablet / phone and web-based applications for tracking First Responders at an Incident*
- *Ability to upload city and building maps*
- *3D building model rendering*

APIs for integration into first responder applications and workflows

Devices with MBS Built-In

GPS Independent Timing

- *Presence of high precision Rb clock self-synchronizes MBS technology independent of GPS*
- *Provides LTE network hardening & GPS resiliency for FirstNet*

Deployables for remote areas

Conclusion

- Satisfies Public Safety's needs for '*Enhanced Mission Critical Location with Z axis capability*'
    - Only Mission critical location that delivers high precision X-Y-Z; GPS (Does not work Indoors), OTDOA (not accurate)
    - Best performing 3D location technology as demonstrated in CTIA/ATIS (2016) & FCC/CSRIC (2013) tests
    - Ability to withstand power outages & not dependent on Broadband penetration

- Technology designed for mass market applications
    - Mass market Chipsets with MBS capability coming into market from Tier 1 GPS chipset providers (e.g: Broadcom, Intel etc)
    - No impact to Overall Device cost (sub Dollar)
    - MBS enabled on server end by Ericsson and TCS
    - Technology standardized in 3GPP (Rel 13) and OMA (2.0.3)

- Using Context & Visualization Service will provide improved 'Situational Awareness' for First Responders

- Can provide a reliable backup to GPS in Urban Areas in a Commercial form factor

- Broadcast Network across multiple applications ensures lowest cost solution