UWB Localization
&
Urban Applications

Workshop on
Short-Range Ultra-Wideband Radio Systems:

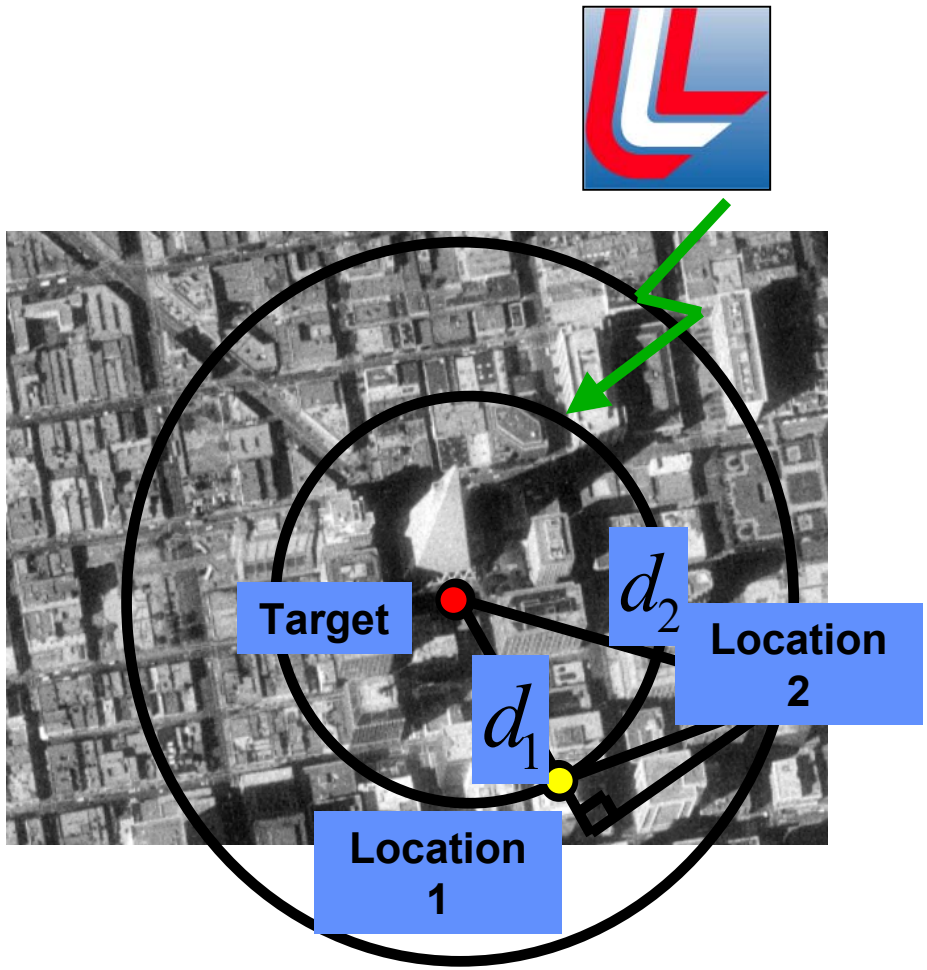
Santa Monica, CA

11 April 2006

Geo-Location in Harsh Urban Environments

Urban Geo-Location

- **Problem Definition**
  - Accurately locate (within 1-2 feet) a wireless network node in a harsh environment where GPS is not available.
- **Paradigm**
  - Measure "Range" from Several (*"3 or 4"*) Locations
  - Compute Position
- **Applications**
  - First Responders
    - Firefighters
    - Police
  - Corporate or Government Assets, Security Keys, Materials, and CREM Tracking
  - Military Applications



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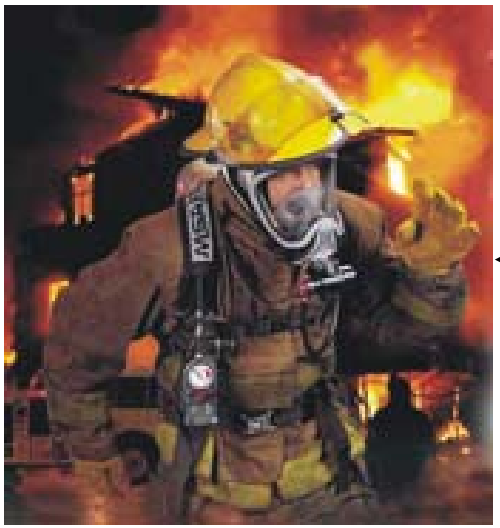
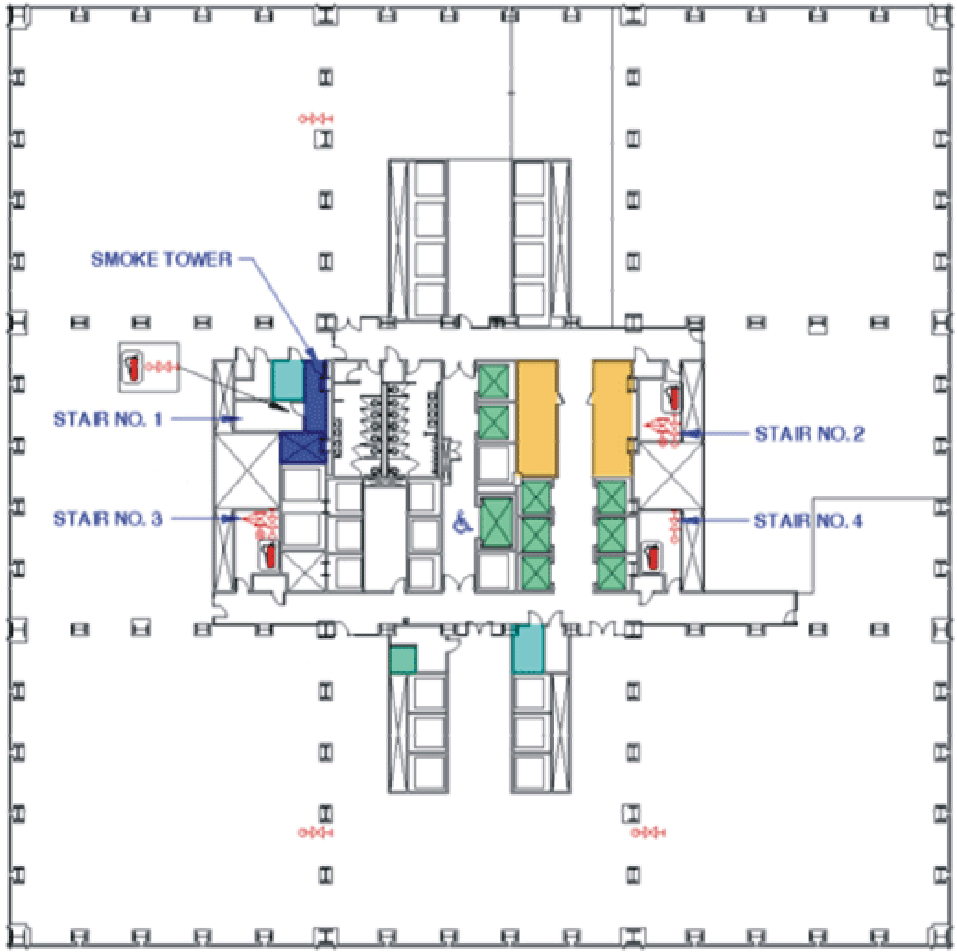
Digital Routing in Buildings

Firefighter & Police

- Rescue
- Status

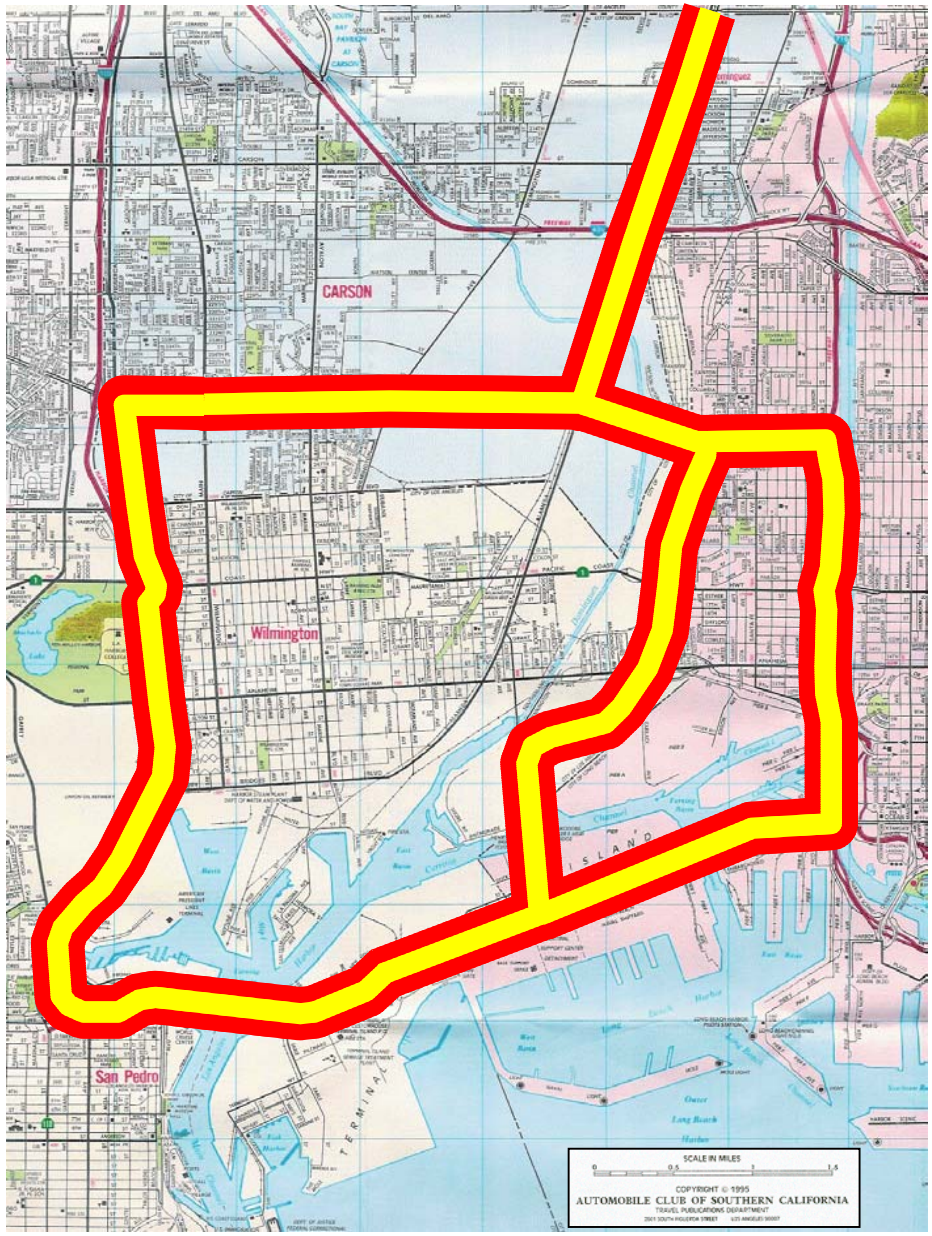




Large Area Urban Geo-Location

Alameda Corridor

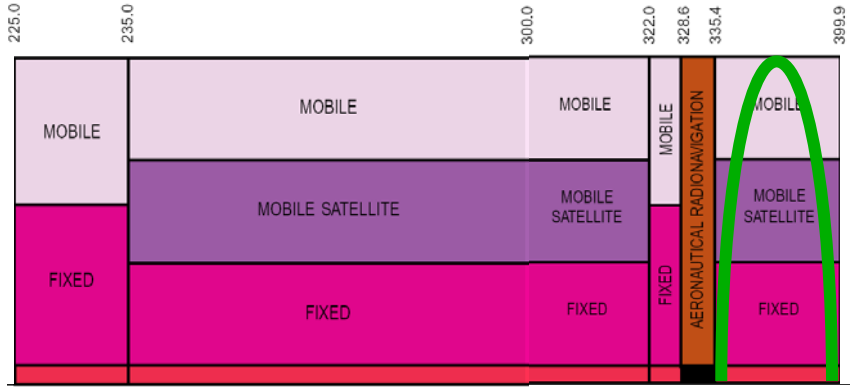
- **Impound Container Tracking**
- **Requirements**
  - Near Real-Time – 10 sec
  - Identify Stopped/Diverted – 10 ft
  - Low Cost – No Usage Fees
- **Range**
  - 5 by10 Miles Area
- **Options**
  - GPS – Easy to Defeat & Spoof
  - E911 / AGPS / EOTD
    - » Poor Accuracy – 150-350 ft
    - » High Cost – Frequent Updates
  - Real-Time Location System (RTLS)
    - » Installed in Port of Los Angeles
    - » Extensive & Inflexible Infrastructure
    - » Short Range – 1 Km – 2.45 GHz



Large Area Urban Geo-Location

UWB Real Time Location System

- **Large Area Coverage**
  - 5-10 Mile Range
    - » Few Towers
  - Military UHF Band – 225-400 MHz



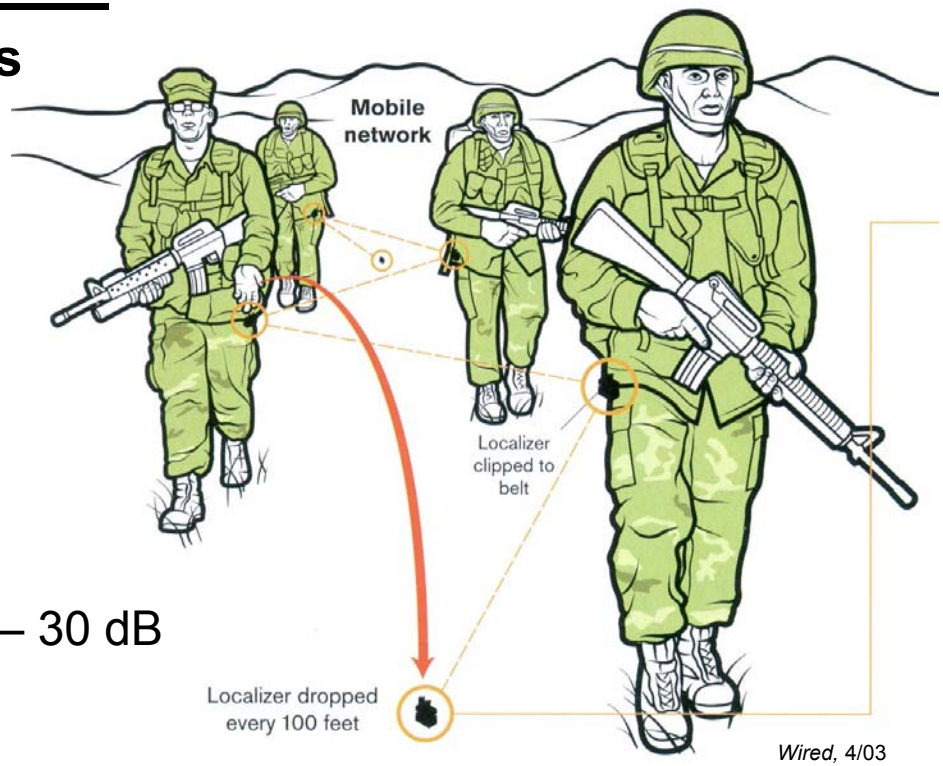
- **Modified RTLS**
  - 2.45 GHz → to UHF 225-400 MHz
    - » Longer Range
  - 30 MChips/sec = 60 MHz BW
    = 20% Fractional BW = **UWB**
  - 1 Watt Peak = 10dB Above Noise Floor
    - » 3 Km – Aeronautical

- **ANSI INCITS T-20 371.1**
  - Short Bursts ~ 1 msec
  - 511 Chips/Bit ~ 27 dB Processing Gain
  - 10-15 ft Accuracy = GPS

Conclusions

Military UHF – UWB Localization

- **DARPA – Urban Warfighter Status**
  - 1 Km Range
  - 60 dB Link Margin
    - » Multipath Nulls – 30 dB
    - » Attenuation – 30 dB
- **UHF UWB DSSS**
  - UHF – Optimum Urban Propagation
  - UWB DSSS Solves Nulls – 30 dB
  - Processing Gain Solves Attenuation – 30 dB
- **Implementation**
  - Single Chip CMOS
    - » A/D – 150 Msps / 2 bits – 5.5 ft Resolution
    - » Simple Transmitter – Class D
- **Licensed Operation – Government**
  - Short Burst Transmissions - msec



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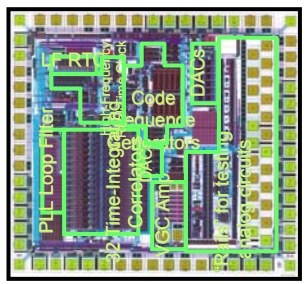

Aether 5 Receiver / Transmitter Chips

Point of Contact

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