Cellular Networks

Benefits and Shortfalls For Emergency Communications

Presented by:
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1. Common Assumptions
2. Wireless network overview
3. Network impacts in disasters
   a. Single Points of Failure
   b. Risk Mitigation Methods/Restoration
4. User Mitigation measures
5. Alternate Communications
Common Assumptions

“Cell phones will always work when the power is out because it has a battery.”

“Cellular phones are just like telephones.”

“Cellular phones operate with Satellites.”

“My cell phone will work because it doesn’t depend on Land Lines.”

“All cellular communication companies use the same technology, so it is really a matter of price”

“Push to Talk (e.g. Nextel Walkie Talkie) works directly phone to phone.”
The technologies and capabilities differ:
- Primary technologies: CDMA vs. TDMA

TDMA stands for "Time Division Multiple Access".

CDMA stands for "Code Division Multiple Access".

Each technology essentially achieves the same goal, but by using different methods. Each strives to better utilize the radio spectrum by allowing multiple users to share the same physical channel.

CDMA Providers:
- Sprint Nextel (Sprint PCS Phones)
- Verizon
- Alltel
- BellSouth

TDMA Providers
- Global System for Mobile Communications (GSM)
- T-Mobile (GSM)
- Nextel – iDEN technology
- Cingular (GSM)
Cellular Network

Single Points of Failure

- PSTN
- 3rd Party Owned
- Land LEC
- OC-N
- Cell Company Owned
- Base Station
- MSC
- MSC
- Land LEC
- OC-N
- 3rd Party Owned
- Cell Company Owned
■ Examples of Cell Sites

■ Key Components:
  – Tower/Structure
    • Brings RF signal to altitude
    • Coaxial Cable
  – Shelter
    • Protects vital equipment
    • HVAC
  – Antennas
    • Propagates RF Signal outward
      – Omni (whip)
      – Sector
      – Amplifier Antenna
Cell Sites- Risk Exposure: Power

- **Single Point of Failure 1: POWER**
  - **Fact 1:** Your Cell Phone Communicates directly to a Cell Site.
  - **Fact 2:** Cellular base stations depend on Commercial Power to operate.
  - When Power is lost- Cell Service is Lost.

- **Risk Control Mechanisms:**
  1. Battery backup can range from 1-6 hrs
  2. Portable Generators
  3. Fixed Generators
  4. Refueling plan
Cell Sites - Risk Exposure: Telco

Fact 1: Cell sites typically depend on T1 circuits from the Site to the Switch; these are "Land Lines".
Fact 2: When the circuit goes down, cell service is lost.

These circuits are operated and maintained by Local Exchange Carriers (Local Telephone Company). A national wireless carrier can use as many as 1500 LECS nationally.

- Risk Control Mechanisms:
  1. LEC escalations
  2. Microwave backhaul
  3. Satellite backhaul
  4. Adjacent cell site coverage
Risk Exposure: Damage

- **Fact 1:** Average wind rating of cell towers is between 100-125 mph.
- **Fact 2:** Most damage is caused by falling/flying debris.
- **Fact 3:** Ice Storms and Wind storms can cause severe damage.
- When site is damaged- Cell Service is Lost/impaired.

Risk Control Mechanisms:

1. Well trained and well exercised restoration strike teams.
2. Cell Site on Wheels (COW).
3. Disaster Recovery agreements with site repair general contractors.
Cell Sites - Risk Exposure: Capacity

- **Fact 1**: Cell sites are designed to handle specific capacity.
  - Capacity issues happen often during disasters.
- **Fact 2**: Once capacity is exceeded, blocking occurs.

**Risk Control Mechanisms:**

- Well trained and exercised strike teams to add capacity.
- Cell Site on Wheels (COW) deployment.
- Cell on Light Truck deployment (COLT).
- Wireless Priority Service.
- Consider leveraging your carriers Push to talk technology.
- Priority Connect (Nextel only).
Nextel Walkie Talkie

Benefits:
- Instant Communications- “Coast to Coast in Under a Second”.
- Solves many interoperability problems with first responders.
- Bypasses the PSTN.
- Higher voice compression= less blocking.
- Priority Connect available.
- Off-network walkie talkie available on most handsets (short range)

Shortfalls:
- Depends on cell sites and all risks previously discussed (power, damage).
- Depends on Local Telephone land lines from the cell site to the switch.
- Depends switches and all risks involved with switches.

Sprint Nextel’s iDEN service solves interoperable communications problems for over 50,000 federal law enforcement and homeland security users, as well as 1 million first responders at the state and local level.
Elements of a COW Deployment

1. **COW asset** available. This contains the electronics and Air Conditioning units.

2. **Telco:** Connection into the landline network. This can be microwaved in from another location, or be available at the COW deployment location. An exceptional more costly alternative is Satellite backhaul to a Nextel switch.

3. **Power:** Most COW needs can be supported by a 25 KW Generator. Increased capacity or power levels can drive higher power needs.

4. Viable **location** for the COW.
   Note: The availability of Telco or power can accelerate deployment.
SatCOLTS

- The SatCOLT™ is a Satellite based Cell-On-Light-Truck that enables rapidly deployment in remote and/or disaster environments. It is a full cell site that is connected back into the larger Sprint Nextel Network.

- SatCOLTs provide coverage to Nextel or Walkie Talkie on PowerSource Phones.
Risk Exposure: Wireless Switching Office

- **Risk Exposure: Power and Smoking Hole**
  - **Fact 1:** All Switches depend on commercial power to operate.
  - **Fact 2:** If destroyed, call processing could be impaired/lost for an entire region.

- **Risk Control Mechanisms:**
  - Generator Power
  - Wireless Switch On Wheels
    - No Wireless Switch on Wheels exists in the US to my knowledge.
  - Extremely hardened facilities with redundant systems in key components.

(REF: www.corp.att.com/ndr/exercises.html)
Risk Exposure: Wireline Switch Damage and PSTN Congestion

- **Fact 1:** Depending on the destination, the cell traffic may have to transit the PSTN.
- **Fact 2:** The PSTN has limited capacity available and often during it will become congested during disasters.
- **Fact 3:** One Switch in the PSTN can control the majority of telephone switching traffic for a region.

Risk Control Mechanisms:
- Wireless Priority Service (Enables you to get to the PSTN).
- Government Emergency Telecommunications Service (GETS).
- Switch on Wheels.

(REF: www.corp.att.com/ndr/exercises.html)
Congestion, at many points, can block a call!

Local Exchange Networks → PSTN → Local Exchange Networks

Government Emergency Telecommunications Service addresses wireline congestion
GETS minimizes the possibility of the loss of wireline telecommunications services for personnel during events such as

...earthquakes

...hurricanes

...and other major disasters

(Ref: NCS.GOV)
Calling cards are in widespread use and easily understood by the NS/EP User, simplifying GETS usage.

GETS priority is invoked “call-by-call”

GETS is a "ubiquitous" service in the Public Switched Telephone Network…if you can get a DIAL TONE, you can make a GETS call.

Plus!..GETS has
✓ Priority in the signaling network
✓ Exemption from control restrictions

Dial 1-710-NCS-GETS (627-4387)
At the tone, enter your PIN.
When prompted, dial your destination number (area code + number).
If you cannot complete a call, use a different long distance carrier:
AT&T: 1-888-288-4387
or- 1010 + 288
MCI: 1-800-900-4387
or- 1010 + 222
Sprint: 1-800-257-8373
or- 1010 + 333
+1-710-627-4387

From a Wireless Priority Service enabled device:
Dial *727 before any call, including a GETS call.

Assistance: For help or to report trouble, dial 1-800-818-GETS (4387) or 1-703-818-3924.

Test Calls: Make periodic GETS calls to 1-703-818-3924.

US GOVERNMENT PROPERTY. If found, return to:
NCS (N2), 701 South Court House Road, Arlington, VA 22024-2198
WARNING: For Official Use Only by Authorized Personnel.

1234 5678 9012

Name: Michael Chertoff
Organization: Department of Homeland Security

Government Emergency Telecommunications Service

Department of Homeland Security

Michael Chertoff

Department of Homeland Security

Michael Chertoff
GETS Proven for Long Distance and Local Calls

- **Sep 11, 01**: 10,000 GETS calls into/out of/within New York City and Washington with 95% completion rate.

- **NE Blackout Aug 03**: 1,231 GETS calls into/out of/within affected areas with 90% + success rate.

- **Hurricane Ivan Sep 04**: Helped Eglin AFB order mission critical parts, recall personnel, and coordinate with the White House.

- **Hurricane Katrina Sep 05**: 32,000 GETS calls into/out of/within Gulf coast with 94% completion rate.

(Ref: NCS.GOV)
Organizations that support one or more of the following five National Security/Emergency Preparedness (NS/EP) mission areas, qualify for sponsorship to become a GETS/WPS user:

- National Security Leadership
- Public Health, Safety, and Maintenance of Law and Order
- Disaster Recovery

(Ref: NCS.GOV)
Congestion, at many points, can block a call!

Problem: Congestion on the Wireless Network

Government Emergency Telecommunications Service addresses wireline congestion

Wireless Priority Service addresses wireless congestion at call origination and call termination

(Ref: NCS.GOV)
“Add-on” feature to your existing cell service

Dial *272 and the destination number: Call queues for next available radio channel

For cell and landline congestion: Dial *272 and GETS access number, enter PIN, and dial destination number

Note: WPS available on Nextel National Network at this time. Sprint Phones will have it available in Mid 2007.

(Ref: NCS.GOV)
When you need to make an official call, and you encounter congestion, retry your call but prefix your dialed number with *272
e.g. *272 704 555-1234
Everything else is automatic – your call will queue for up to 30 seconds, “grabbing” the next channel.
If landline networks are also congested, utilize *272 plus the GETS access number to get priority in both wireless and landline networks.
Priority Connect

Priority Connect is a feature that provides priority access to the Nextel network and its resources for subscribers of this service during times of congestion.

The calls from those who subscribe to the Priority Connect service are queued higher than other subscribers increasing the likelihood that calls will be completed.

Priority Connect is available for:
- Priority Connect and Emergency Group Connect are only available to public safety and critical infrastructure and can be requested through sales channels.

NOTE: Only available on Nextel Phones with the use of Direct Connect (Walkie Talkie).
GETS

- No charge for the GETS calling card
- Pay only for usage at 10 cents or less per minute (operator assisted/international calls higher cost)
- Test calls to 703-818-3924 not billed

WPS

- WPS is ordered on a per-phone basis from your existing service provider.
- $4.50/month, $10 one-time set-up, and 75 cents per minute usage cost when WPS is invoked
Who Should Have GETS/WPS?

- Key Decision Makers in State & Local Government
  - Leadership (headquarters, regional, field)
  - Key staff positions
  - Critical Skills Specialists

- Emergency Functions:
  - Operation Centers
  - Command Post and Command Vehicles

- Critical Infrastructure:
  - Leadership/Decision Makers
  - Business Continuity and Emergency Managers

Presidential Directive 63 May 1998- Subject: Critical Infrastructure Protection:

“Critical infrastructures are those physical and cyber-based systems essential to the minimum operations of the economy and government. They include, but are not limited to, telecommunications, energy, banking and finance, transportation, water systems and emergency services, both governmental and private”
Satellite Phones:
- Satellite phones provide additional backup when cellular or landline service is not available
  - Not just for rural environments
- Carriers include Globalstar, Iridium, Inmarsat, etc.
- Can be utilized as handheld mobile sets, in vehicles with mobile or fixed installations, and in structures with fixed antenna units.

Nextel PowerSource:
- Phones utilize 2 networks in one phone: Nextel Walkie-Talkie and CDMA voice/data.
- Provides additional redundancy against many uncontrollable SPOF.
- Has roaming for Voice/Data.
- Roaming agreements:
  - Many carriers have roaming agreements with other carriers.
  - If one network is down, the phone can roam to another network.
  - Limited to agreements in place and phone type.
Contact:

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Desk: 704-921-7374
Email: richard.zinno@sprint.com
How to order WPS/GETS?

- **Step 1 – Get a POC:**
  - Find out if your organization has a GETS/WPS “Point of Contact” – work with your POC to add services
  - If no POC, assign a program lead with the authority and time to implement

- **Step 2:** Identify individuals and functions to have GETS/WPS

- **Step 3:** POC registers on-line

- **Step 4:** Order GETS/WPS thru on-line system

- **Step 5:** WPS feature updated or GETS mailed to POC in 3-5 days

- **Step 6:** Update Emergency Plans and Drills to include GETS/WPS
MAILING ADDRESS:
OMNCS
P. O. Box 4502
Arlington, VA  22204-4502

TELEPHONE:
Information/Sign-Up
(M-F:  0700-1800 EST)
  ▪ 1-866 NCS-CALL
Trouble Reporting
(24x7)
  ▪ 1-800-818-GETS

WEBSITE:
http://gets.ncs.gov
http://wps.ncs.gov

E-MAIL:
gets@ncs.gov
wps@ncs.gov