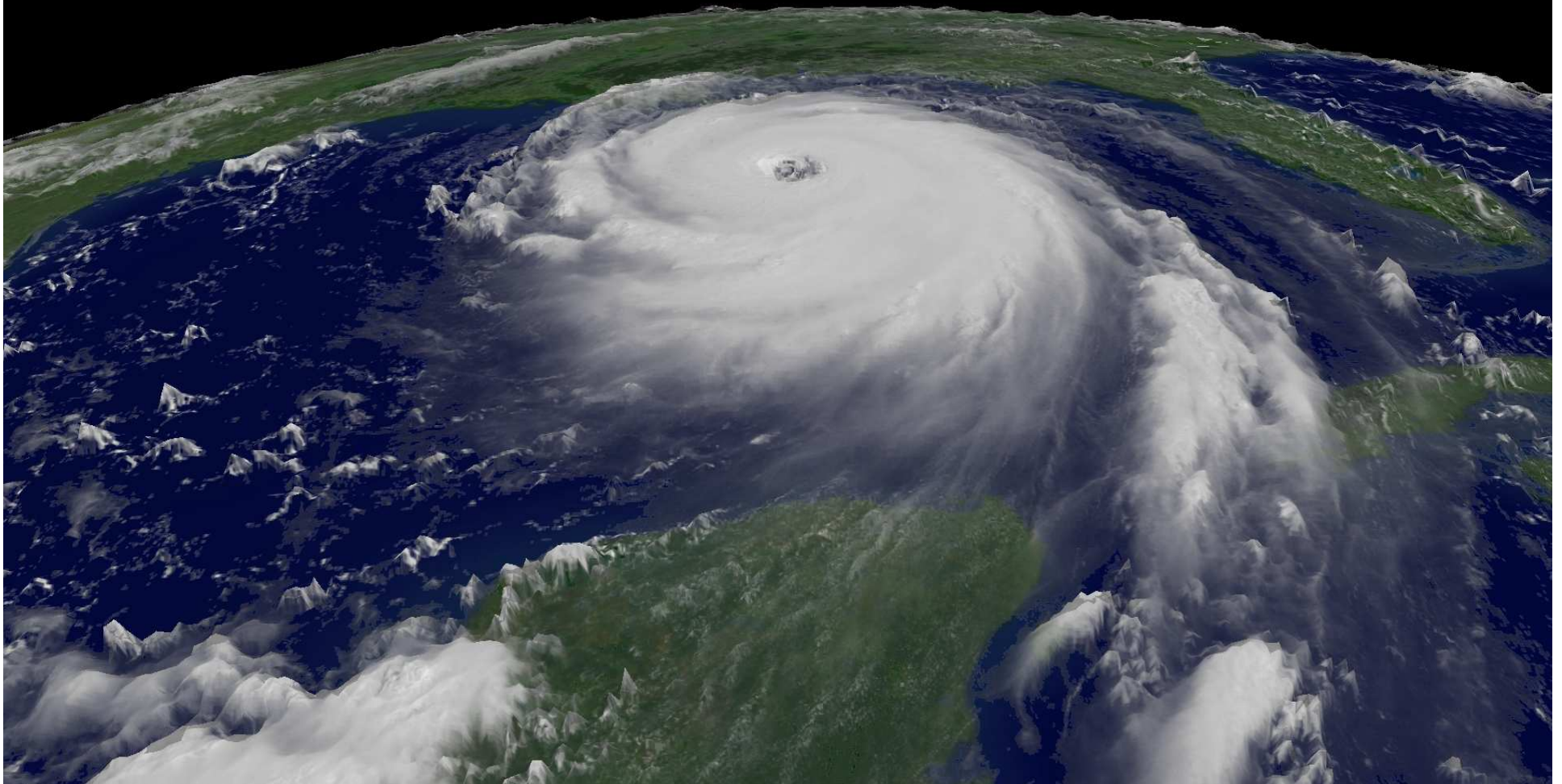# Emergency Cellular Communications during Hurricanes Katrina and Rita

# Briefing Goals

- The story of rapid, unplanned response from Corporate America to US Government requests for emergency cellular communications
- What worked and did not work
  - Technically
  - Organizationally
- What could be done better immediately with current technology
- Where the cellular roadmap is headed

# FEMA'S MISSION FOR QUALCOMM

Saturday, Sept 3rd, 2005 - 9am briefing:

Mission from DIR FEMA: get a Portable Full Sector Cellular Base Station, Satellite Backhaul system, 400 cell phones, 400 cell phone kits/batteries, 225 Globalstar Satellite handsets, wireless enabled laptops, generator, gas cans, cable, accessory kits, antennas, provisioning tools and a field engineering team on an airplane by 4:45am Sunday, West Coast Time.

Oh, and maybe a little spectrum, if that's not too much to ask?  AND don't forget, everything has to work out of the box in an unknown environment …

In less than 24 hours, the procurement, provisioning, kit packaging, charging and engineering for a complete deployable cellular system was completed

QUALCOMM

QUALCOMM Government Technologies
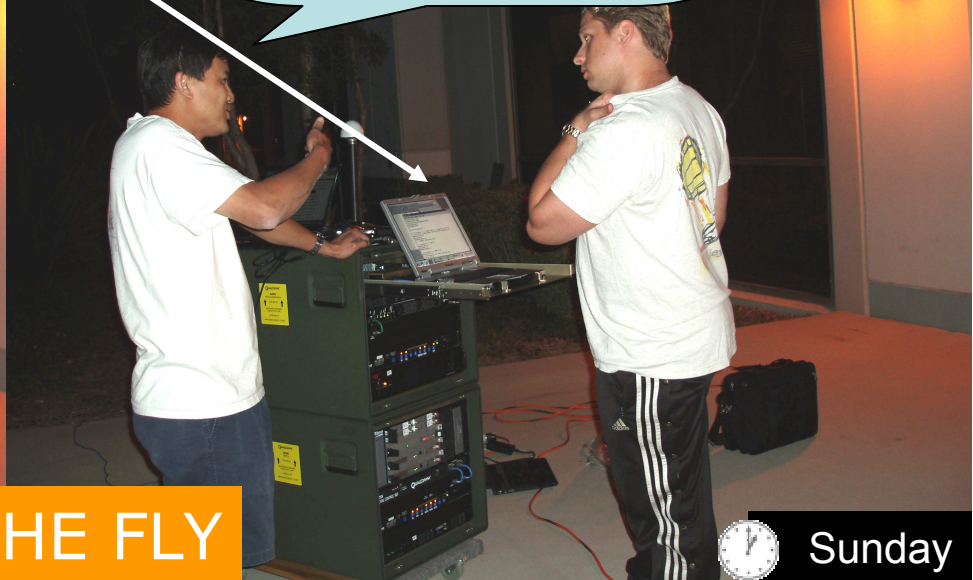
Saturday

# A QUALCOMM Deployable Base Station

OA&M Computer

BTS

BSC Server

Power Panel

Power Amp

Mobile Switch & Media Gateway

PDSN (Packet Data)

Power Panel

Switch OA&M Server

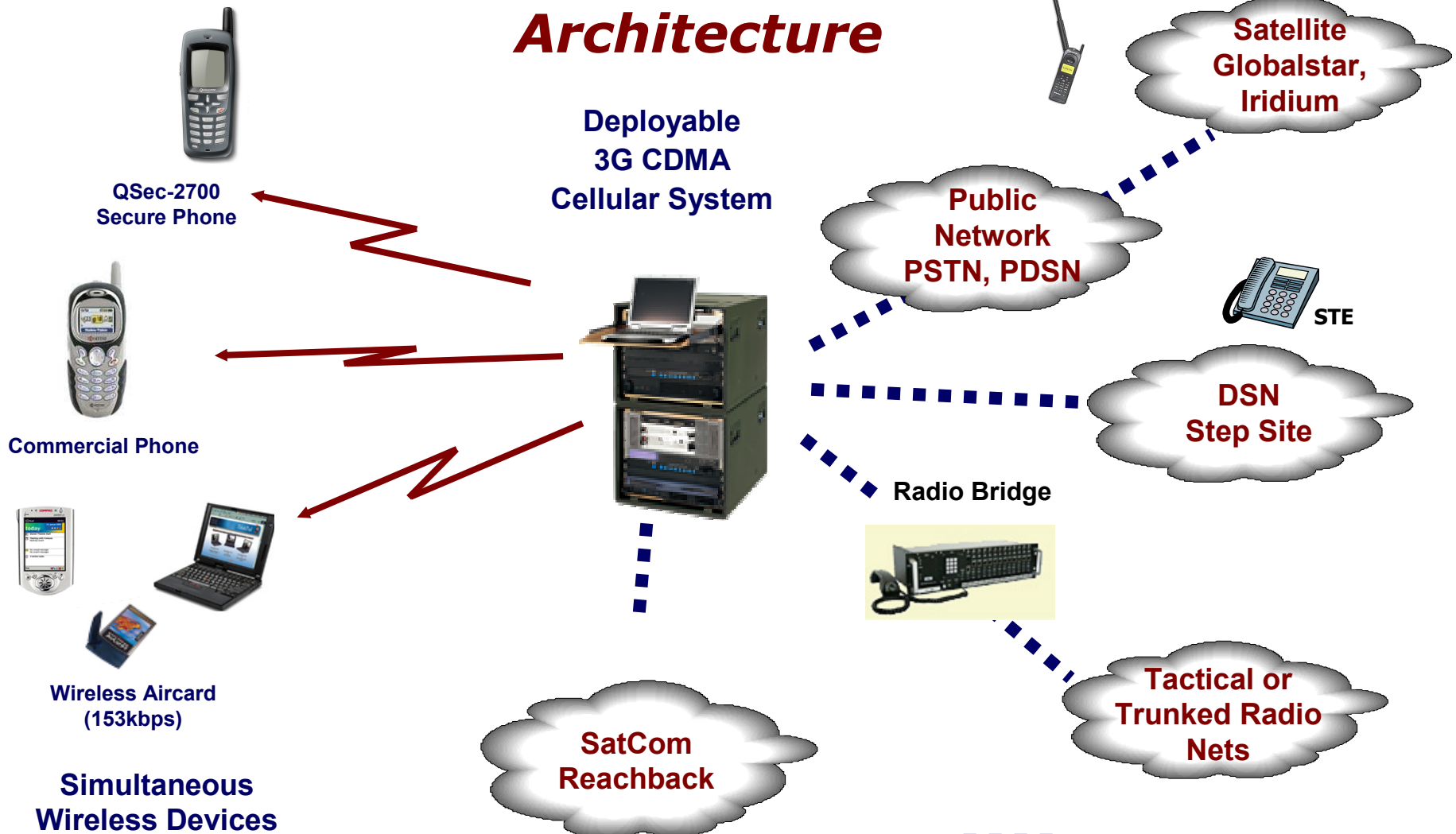Async Data IWF

**Size Reduction from 18U to ~10U In progress**

**Radio Access Node Case**

**Core Network Center Case**

**In CERDEC JC4ISR Demos; completed DoD JITC certification**

# Deployable Architecture

QSec-2700
Secure Phone

Commercial Phone

Wireless Aircard
(153kbps)

**Simultaneous
Wireless Devices**

Deployable
3G CDMA
Cellular System

**Satellite
Globalstar,
Iridium**

**Public
Network
PSTN, PDSN**

STE

**DSN
Step Site**

Radio Bridge

**Tactical or
Trunked Radio
Nets**

**SatCom
Reachback**

NOTE: Reachback links
are T1 and IP Terrestrial, Microwave or Satellite

Arrival – Baton Rouge
after a 4:45am departure – Sept 4, 2005

# Getting to St. Bernard Parish by helicopter



Parish EOC Site

# Definition of Deployable



ViaSat Terminal

**Lesson Learned**:
A "cell on wheels" is NOT a "deployable cellular system". The QDBS was specially made for small spaces as its target was the back of a Suburban.

Each containerized box of the 2 parts of a QDBS is 150 pounds, including chassis weight. ViaSat backhaul dish was also less than 150 pounds.

Allowed for helicopter deployment and physical movement up 7 flights of stairs.

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Satellite Backhaul on the Roof of the EOC

# Provisioning of Phones on the Dedicated QDBS system



**Lesson Learned**: Pre-provision and pre-place stashes of phones and work with Government authorities to provision EXISTING cell phones to fall back to an emergency deployable cellular system.

Provisioning of cellular devices in the field is difficult. Development and deployment of specialized over the air provisioning needs to be done.

# First Mobile to Land Call – FEMA Gene

**Lesson Learned**:
A deployable cellular system MUST come with its own Mobile Switching Center (MSC). The switches in the Louisiana area were damaged or overloaded.

FEMA used QUALCOMM's PSTN PBX switch to make calls in and out of the St. Bernard Parish bubble on an emergency basis.

The Cellular Base Station at the EOC

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# FEMA takes control of the 1st QDBS
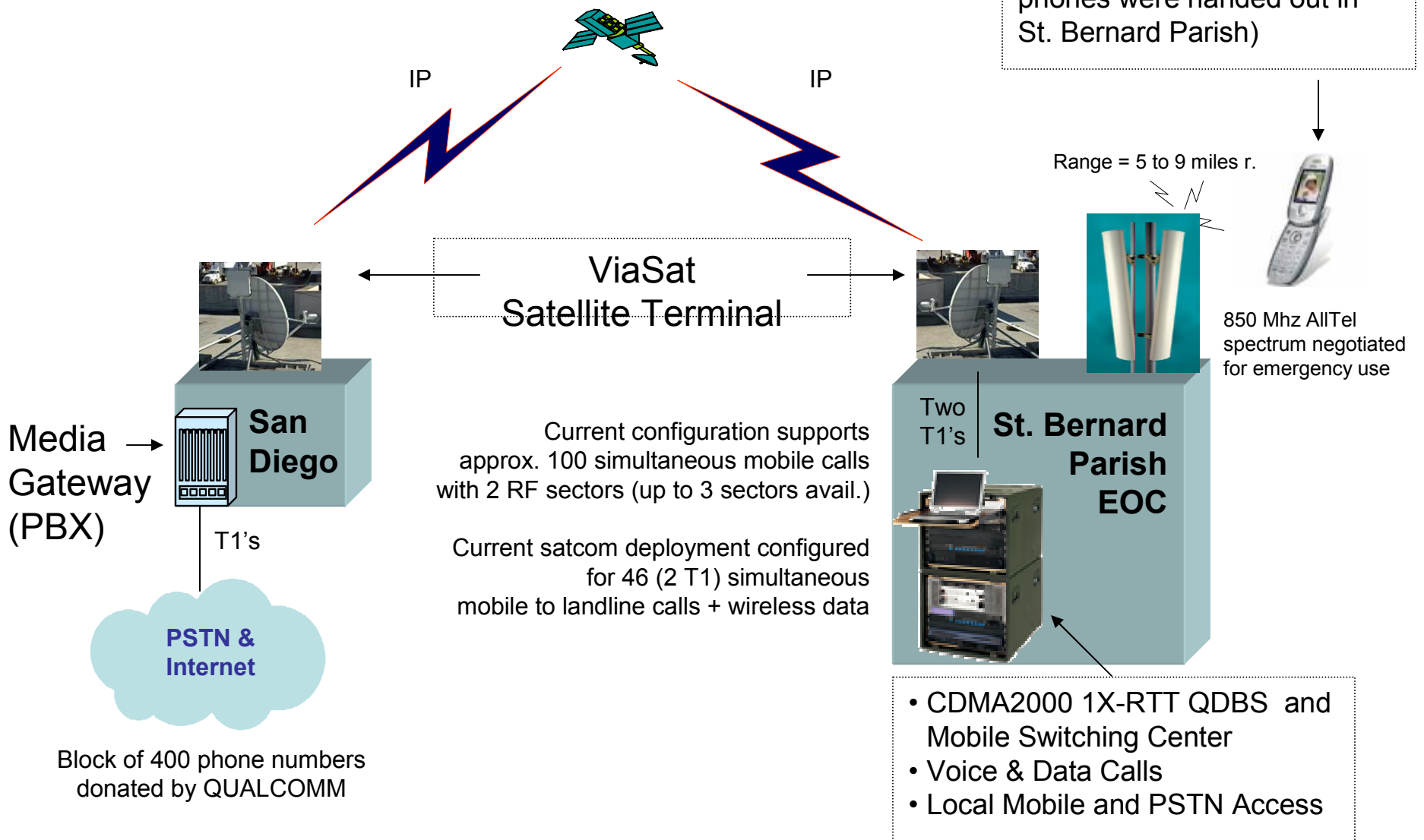


**Lesson Learned**:
Equipment must be easy to deploy and use in a crisis situation. FEMA MERS Field Engineer Gene Gehrke was able to learn how to setup and deploy a full QDBS cell system with satellite backhaul and data connectivity in less than a day. FEMA was able to take the system later and move it to another location in less than 2 hours, not counting travel time.

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# Configuration of FEMA's QDBS

400 Kyocera CDMA phones provisioned on QDBS (100 phones were handed out in St. Bernard Parish)

IP

IP

Range = 5 to 9 miles r.

ViaSat
Satellite Terminal

850 Mhz AllTel spectrum negotiated for emergency use

Media Gateway (PBX)

**San Diego**

Two T1's

**St. Bernard Parish EOC**

Current configuration supports approx. 100 simultaneous mobile calls with 2 RF sectors (up to 3 sectors avail.)

Current satcom deployment configured for 46 (2 T1) simultaneous mobile to landline calls + wireless data

T1's

**PSTN & Internet**

Block of 400 phone numbers donated by QUALCOMM

- CDMA2000 1X-RTT QDBS and Mobile Switching Center
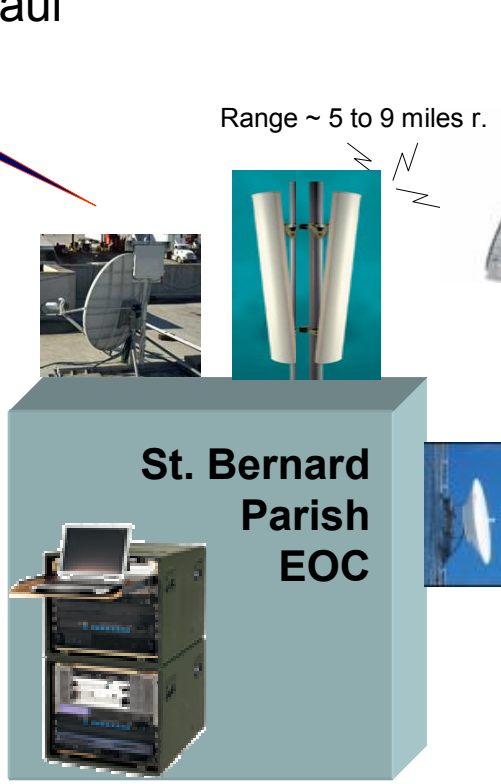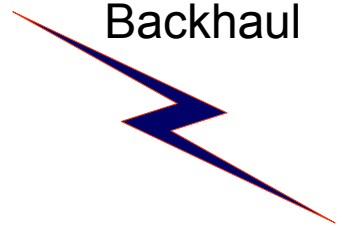- Voice & Data Calls
- Local Mobile and PSTN Access

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# PROPOSED EXTENSION OF FEMA MERCURY SYSTEM (PHASE 2)

**PROPOSAL**:
Take the 3rd RAN from Phase 1 and add an additional RAN and link together with FEMA supplied Microwave Link the original EOC site
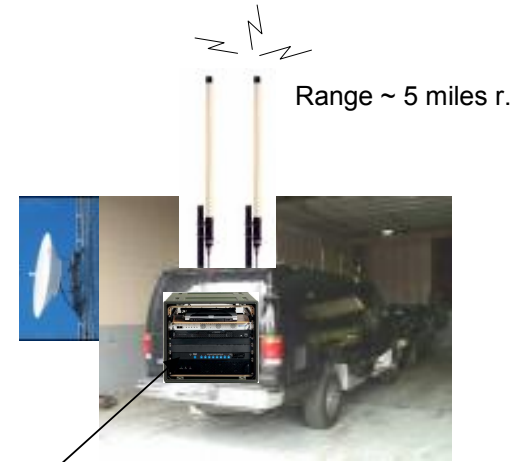
ViaSat Backhaul

850 Mhz Alltel spectrum negotiated for emergency use

Range ~ 5 to 9 miles r.

Range ~ 5 miles r.

St. Bernard Parish EOC

Microwave link

Deployable CDMA 2000 1X-RTT BSC, BTS, IPA and 2 Omni-directional antennas

Extended range deployment would support approximately 40-50 additional simultaneous mobile phone calls – adds another 5 mile radius "bubble" attached to the MSC at St. Bernard

New Orleans NAS
Belle Chasse, LA
19 Sep 2005

GUI

Dipole
w/ Diversity

Satellite
Modem

UPS

RAN

MSC

09/19/2005

FEMA & Northern Command Initial sites

FEMA QDBS operational Sept 8th (Notional 2-RF Tx coverage pattern)

FEMA

Northern Command operational Sept 19th (Notional 1-RF Tx 5 mile coverage circle)

Cellular = Interoperability out of the box

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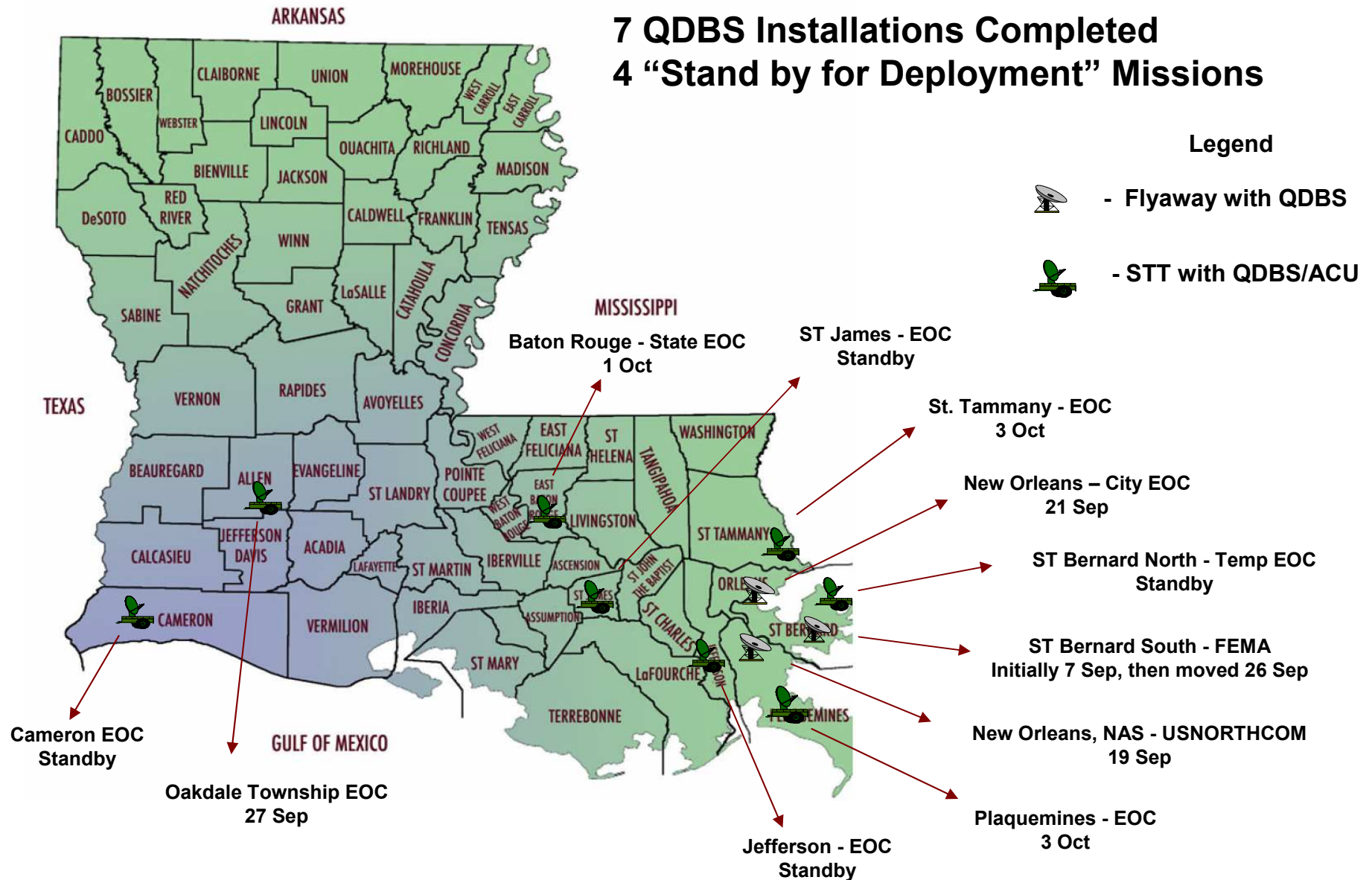
Radio Access Node

Core Switch

UPS

GUI

Plaquemines Parish EOC

2 0ct 2005

Cellular interoperability with Land Mobile Radio

Macro Cell Dipole w/ Diversity Antenna

ACU-1000 LMR Interface

STT

# QDBS Katrina & Rita Missions



**7 QDBS Installations Completed**
**4 "Stand by for Deployment" Missions**

**Legend**

- Flyaway with QDBS

- STT with QDBS/ACU

Baton Rouge - State EOC
1 Oct

ST James - EOC
Standby

St. Tammany - EOC
3 Oct

New Orleans – City EOC
21 Sep

ST Bernard North - Temp EOC
Standby

ST Bernard South - FEMA
Initially 7 Sep, then moved 26 Sep

New Orleans, NAS - USNORTHCOM
19 Sep

Plaquemines - EOC
3 Oct

Jefferson - EOC
Standby

Oakdale Township EOC
27 Sep

Cameron EOC
Standby

# JTF-Katrina Parish Network



**QUALCOMM**

**QUALCOMM** Government Technologies

Net Centric Management

Internet

**TDMA Network**

Note 1: STTs replaced with Flyaway Transit Case Ku-band SatCom Terminals

Terminal CH01

PSTN (AT&T)

PBX

Router(s)

Linkway x6

T1s

Call Manager

For VoIP phones

Linkway

MRT

VoIP T1s

**ViaSat Hub, Carlsbad**

Cell Phones

Laptops with AirCards

CDMA Base Station

Linkway

NIPR ROUTER

ACU1000

LMR Networks

Spare

Linkway

NIPR ROUTER

CDMA Base Station

ACU1000

LMR Networks

*See Note 1

**STT/QDBS/ACU Standard Package**
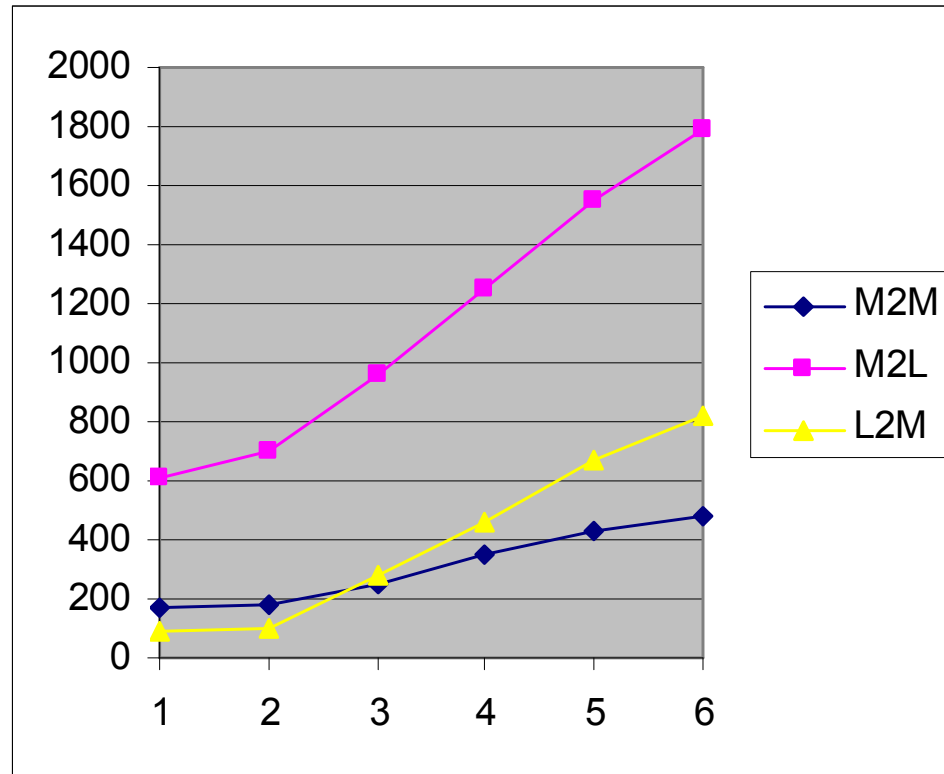
Terminal
STT01
STT02
STT03
STT04
STT05
STT06

**STT Packages to Parishes**

# Call Statistics for FEMA System
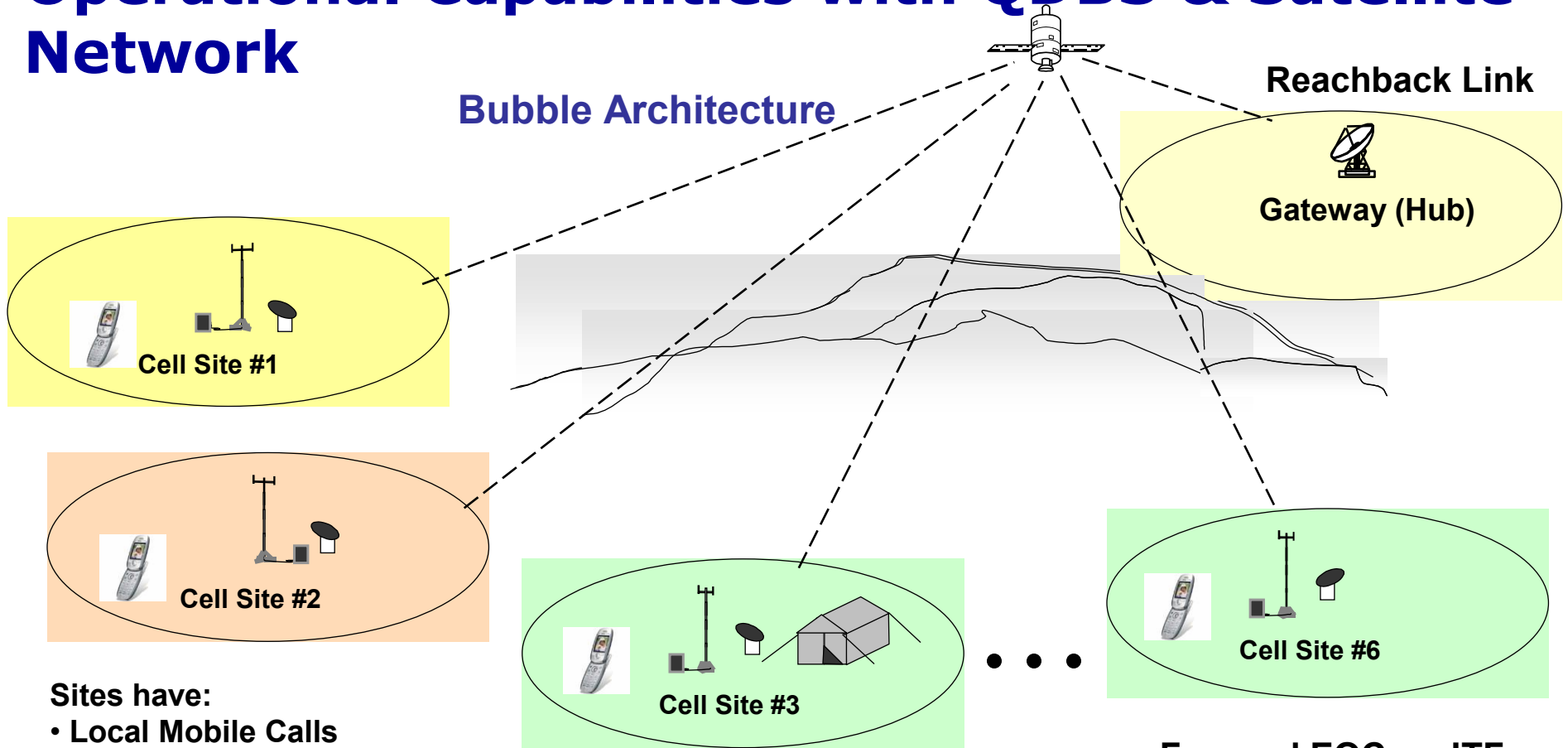
Number and types of mobile calls



Legend
L2M: Land to Mobile
M2L: Mobile to Land
M2M: Mobile to Mobile

Day 1 through 6 calls for 100 phones (out of the 400)

**Lesson Learned**: even as the commercial networks came back on line, their coverage was still spotty, overloaded and on any  given day it was hard to call in, call out or both.

# Operational Capabilities with QDBS & Satellite Network

Bubble Architecture

Reachback Link

Gateway (Hub)

Cell Site #1

Cell Site #2

Cell Site #3

• • • •

Cell Site #6

Forward EOC or JTF

Sites have:
• Local Mobile Calls
• Landline Access via Satellite
• Wireless Data up 153kbps with Aircards in Laptops
• ACU-1000 Radio Interface for LMR Interoperability
• 100 Phones per site (can be upgraded)
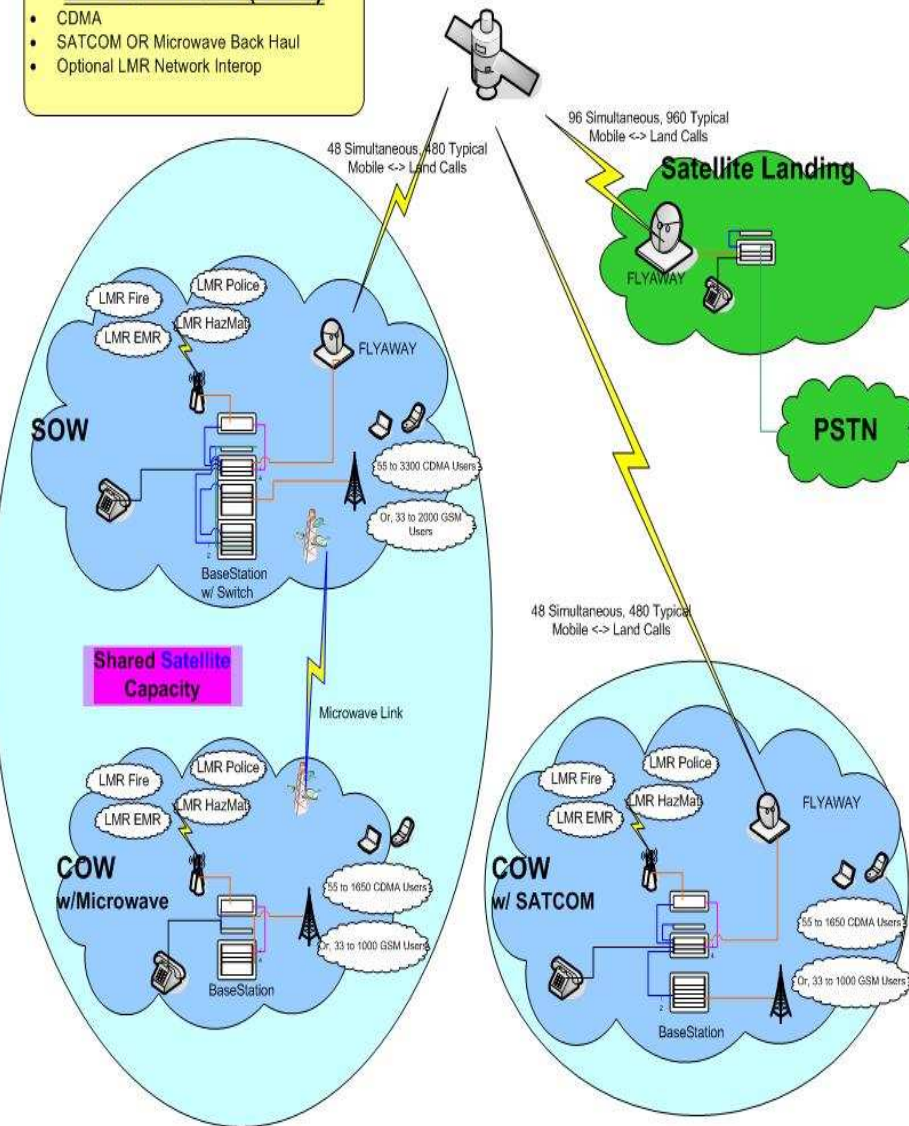• Mobility coverage between cell sites
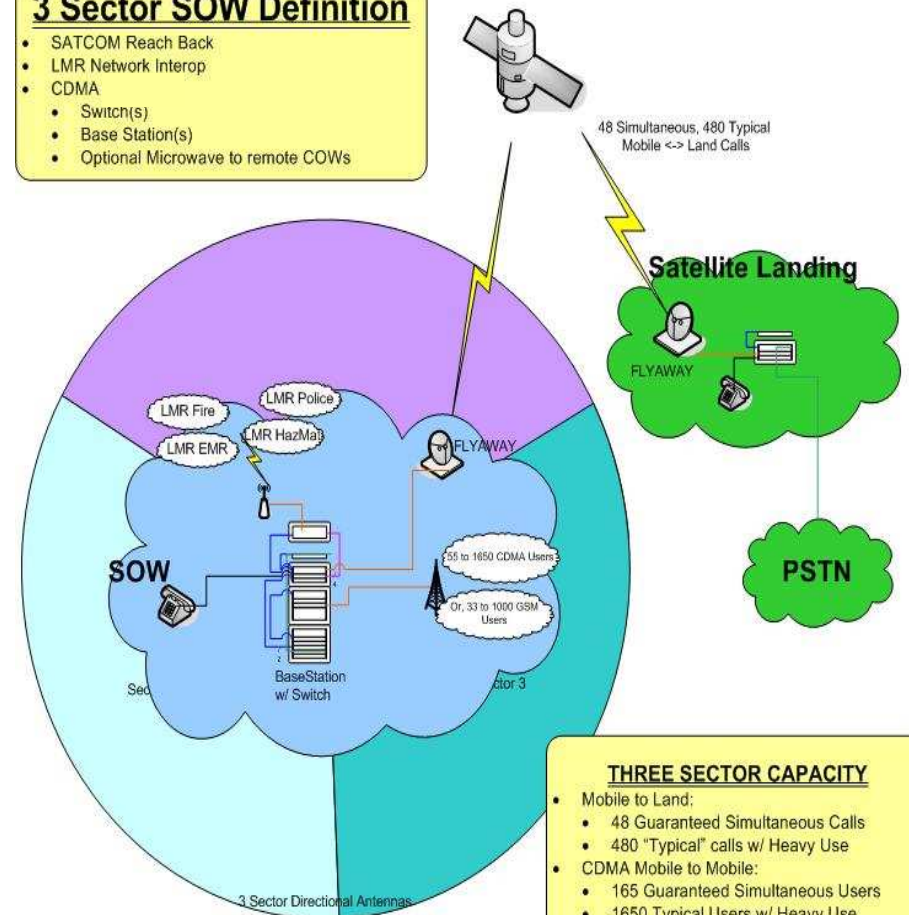
# How Cellular Fits in NORTHCOM's Architecture

- *Secure voice (Type 1/ SBU)*
- *Secure data (Type 1/SBU VPN)*
- *3G Broadband Access*
- *Push-to-talk*
- *Location Services*
- *Multimedia*

**Assured Access**
**Voice & Data**

**Comm or Mil**
**SATCOM**
**Reach Back**

**Shared Information**
**and**
**Common Understanding**

**Class**
**COP / COIs**

**DoD**

**Defense**
**Agencies**

**DISN**

**Deployable C4**
**Modules**

**STEP or**
**Teleport**

**Unclass**
**COP / COIs**

**Commercial**
**3G Broadband**
**Networks**
**(WPS)**

**USNORTHCOM HQ**

**Information Management**
**Center (TCCC)**

**Wireless IP**
**Video / Sensors**

**PSTN**

**Armed Service**
**Components**

**First Responders**

**Land**
**Mobile**
**Radio**

**DHS**

**DHS**
**Agencies**

**QDBS can augment and guarantee**
**cellular access during times of crisis**
**along with Wireless Priority Access on**
**the commercial systems**

**USCG**

# Recommendations for 2006 - 2007

- Integrate and pre-place QDBS units with FEMA, State and local emergency response and Homeland Security/Defense
  - Work with NCS, State and Local Governments and cellular carriers on spectrum arrangements for "emergency" use of unused channels – need only one
  - Work with satellite providers on back haul arrangements
  - Example: State of California looking at 6 QDBS "mobile" units in each of 6 different regions for a total of 36 systems
  - Determine how many units should be mobile (ie. Put in command and control vehicles
    - Existing or new vehicles present different challenges
- Develop and execute a plan to enable every day cellular handsets to be programmed to "fall back" to QDBS
  - Provisioning over the air with a software application resident on the phone to enable "re-provisioning" and manual switchover during a crisis
  - Manual switching is the preferred method to avoid "ghosting" onto the commercial networks that tend to fade in and out during reconstruction
  - Major challenge to cover as wide a spectrum of COTS cell phones as possible on the greatest number of carriers.
- Add a directory services application to handsets to allow users to quickly look up critical staff phone numbers across agencies and departments
  - Greatest issue after the emergency deployable systems were up was communicating the individual phone numbers to people
  - Lookup by title and function is just as important as name
  - Requires organizations to develop and maintain a database of individuals and phone numbers that are fed to a higher tier database at local, state, regional and nationwide levels

# Recommendations for 2006 – 2007 (cont)

- Add GPSOne position location capability on the system and handsets
  - Server elements on QDBS and on commercial systems for seamless 24/7 use from everyday operations to emergency operations
  - Client software on handsets is the most difficult depending on the wide range of handsets that are being used.
  - Easy integration into most Emergency Operations Centers
- Add Clear and Secure Cellular Push to Talk to system and handsets
  - Server elements on QDBS and on commercial systems for seamless 24/7 use from everyday operations to emergency operations
  - Client software on handsets is easy to develop and download
  - Voice quality is good but latency can still be an issue, though in these circumstances it may be appropriate as a strategic command and control capability vs. tactical
- Determine how commercial command and control software could be used to configure handsets over the air
  - Over the air service provisioning
  - Update of critical software and services
- Determine and deploy back-haul options depending on scenario
- Email and SMS services (e.g. RIMM server connections to backhaul)

# Cellular Future Roadmap

- Broadcast Multi-media for public and first responder use
  - MediaFLO
  - EV-DO Platinum
  - ICE-FLO study being conducted by the National Security Agency
- Peer to peer for Land Mobile Radio "like" push to talk services on cellular
  - Currently "push-to-talk" uses the infrastructure
  - With deployable infrastructure, could insure push-to-talk works on cellular during crises
  - Future of peer-to-peer in doubt due to no commercial reason for its development and deployment
- Widespread deployment of position location services
  - As commercial use of GPS position location is deployed, use of GPSOne and Broadcast Messaging can be used to tailor special messages, maps, etc. to the general population as well as to first responders
  - Requires that the tower location databases be accurately maintained and deployed.

# Questions and Answers

# Thank You

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# BACKUP SLIDES

# Hurricane Katrina
## QUALCOMM Deployable Base Station (QDBS) in a unplanned short term scenario

- On Sept 2, FEMA made an emergency request to QUALCOMM to deliver a QDBS for New Orleans area coverage in response to Hurricane Katrina

- Over Labor Day QUALCOMM mobilized resources and personnel to configure and test emergency QDBS system

- Sun. Sept. 4 QUALCOMM utilized the Corporate jet to deliver a QDBS, ViaSat Ku-band satellite backhaul terminal, 400 commercial cellular phones, generators, technical installation team, etc.

- QUALCOMM worked with ALLTEL Cellular to provide a dedicated channel for communications during the crisis at 850 MHz. Verizon Wireless and Sprint were also prepared to help with spectrum

- QUALCOMM and FEMA personnel setup the cellular system at the St. Bernard Parish Emergency Operations Center and turned it over to FEMA.  Once site location was determined, **Setup was within one day**.

  - Note: St. Bernard Parish Location had limited power, no elevators, no air conditioning and was an Exxon-Mobile refinery plant building

  - Portability of the downsized base station & satcom system was key to success

  - FEMA personnel were trained and took acceptance of the system within 24 hours after satellite reach-back was established

# Hurricane Katrina & Rita
## QDBS in a unplanned short term scenario, cont'd

- After Initial Operations, FEMA was able to take down the system the week of September 13th move it to a new location

  – It was operational again in less than 2 hours

- Northern Command also set up an operational QDBS system in New Orleans (Belle Chasse) through a pre-existing contract vehicle with a prime communications contractor, Rivada Pacific

  – Pursuant to a concept of operations and execution that had been put together over the course of the last year

- Northern Command on behalf of Louisiana State Officials ordered six additional systems for Katrina and Rita response

  – First two systems setup and operational (Oakdale and Baton Rouge)

  – The above systems included LMR interoperability utilizing the ACU1000

  – Next four systems were delivered shortly thereafter for stand by use

# CDMA QDBS: Capabilities

- Provides <u>dedicated</u> cellular calls to be made for both voice and data (up to 153 kbps per user) in a 5-9 mile radius
- Integrated into a Federal or State emergency communications plan a QDBS system can be moved into an area by the controlling agency and provide communications within hours

  - Setup time can actually be as little as 20 minutes, excluding complex site preparations, antenna and satellite setup time
  - Integrated into a vehicle provides ease in transportation to sites that require simple antenna coverage
  - If PSTN trunking is not available alternate satellite backhaul options are available to guarantee incoming and outgoing calls when the land line phone system is down
  - Network planning would allow interoperability of multiple QDBS' across agency operational or geographic boundaries
  - Emergency spectrum channels allocated by commercial cellular carriers (proven ability)
  - Provides internet browsing and IP connectivity