

# Katrina: Grid and Communications Power

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# Acknowledgements

## ■ People

- Dr. Philip Krein (co-PI)
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## ■ Organizations

- Dept. of Energy
- National Oceanic and Atmospheric Admin.
- Bell South
- Entergy Corp.
- Caterpillar Inc.

# Project Summary

- Perform on-site data collection of damage to power and communications (phone)
  - Pictures
  - Discussions with local people, prof. contacts
- Assess relative damage and impact
  - Electric power
  - Communications power – cell and landline telephone
- Suggest improvements and priorities

# Selected Quotations

- *“It doesn’t matter what kind of natural disaster it is, if you don’t have power, the network doesn’t work,” Mark Marchand, Verizon Communications Spokesperson.*
- *“One thing that people don’t understand is the relationship between the mobile phone network, local phone companies and the commercial power companies. We depend on local phone and power to run wireless networks,” John Taylor, Sprint Nextel Senior Manager of Public Affairs.*
- *“There will be many power and other issues to deal with... Our equipment needs power to work, and while many sites have backup generators or batteries, some of those sites may be flooded.,” Sal Todaro, Sprint Nextel Area Vice President of the Southeast.*

# Selected Quotations (cont'd)

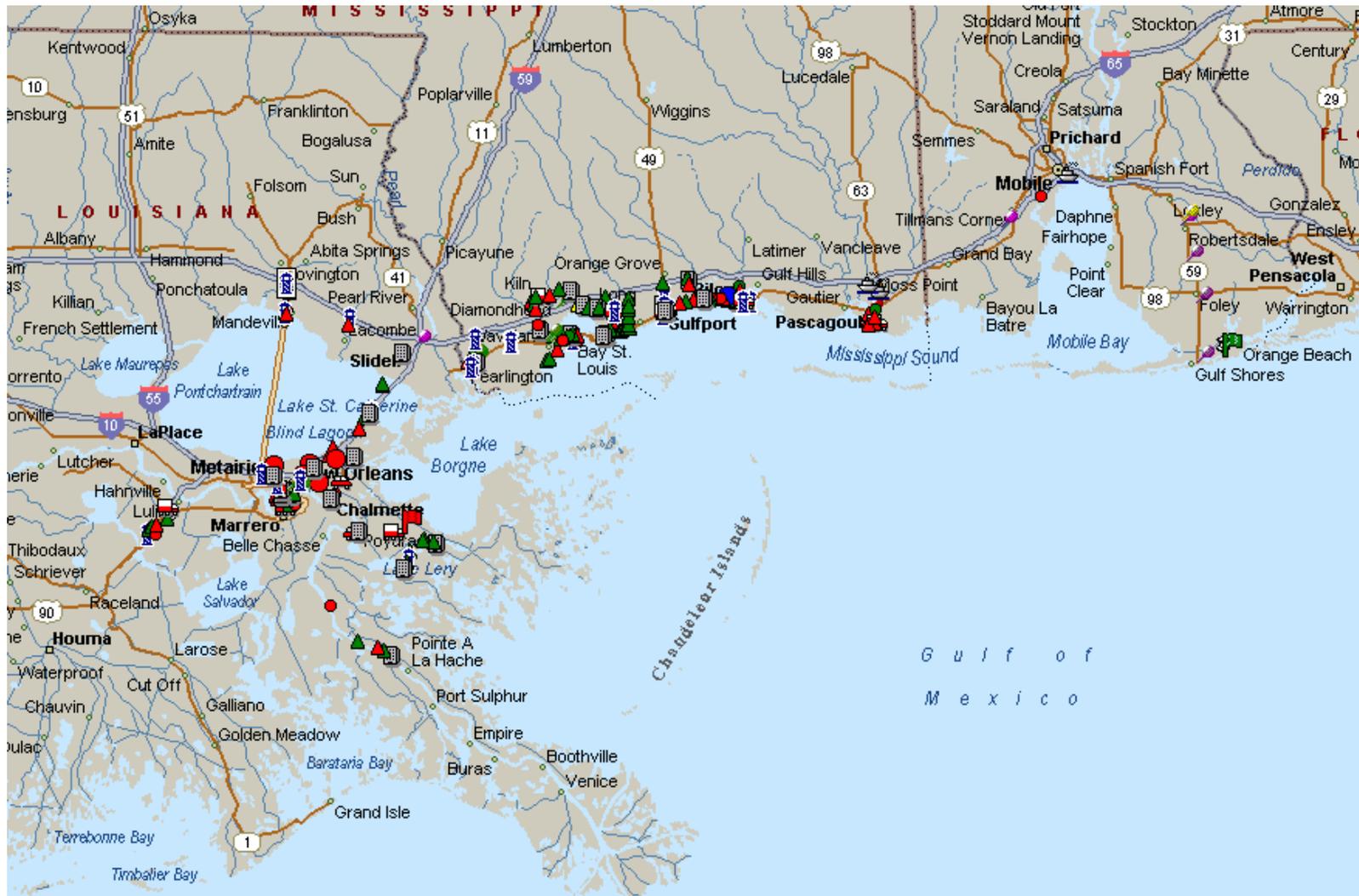
- *“We expect our challenge there [New Orleans’ COs] will be to restore the power equipment with batteries and generators,” Bill Smith, Bellsouth Chief Technical Officer.*
- *“This [Hurricane Katrina’s aftermath] may permanently alter the balance in New Orleans for the usage of cellular vs. traditional wire-line phone service,” Roger Kay, Endpoint Technologies Associates President.*
- *“We just have to wait and see how commercial power restoration and flooding go,” Clay Owens, Cingular Spokesman.*



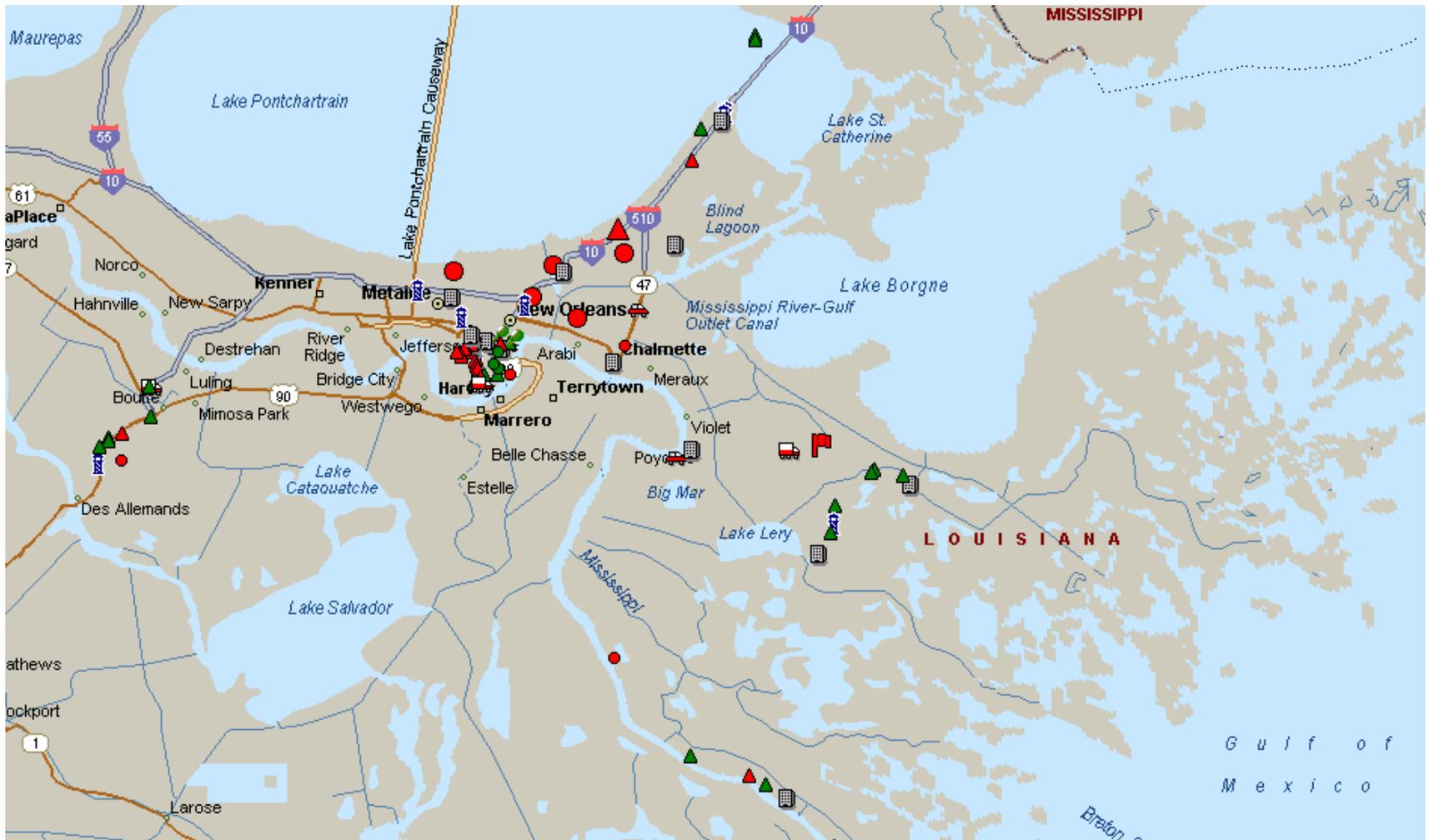
# Power Infrastructure

- Grid power
  - Transmission lines
  - Distribution
- Landline telephone
  - Central offices and SLCs
- Cellular telephones
  - Towers

# On-Site Visits (10/16-10/23/05)



# New Orleans Area



# Main Power Grid

- Transmission vulnerable but easily repaired
  - A few main lines with relatively fast response
  - Lines supply many people
- Distribution lines
  - Complex network
  - Individual lines less important
  - Labor intensive repairs
  - Substations susceptible to floods
- Poles and lines surprisingly resilient

# Backup to Main Grid

- Mostly distributed generators (gensets)
  - Normally diesel-powered turbines driving electric generators
- Require regular refueling
- Mobile and fixed versions

# Pass Christian, MS



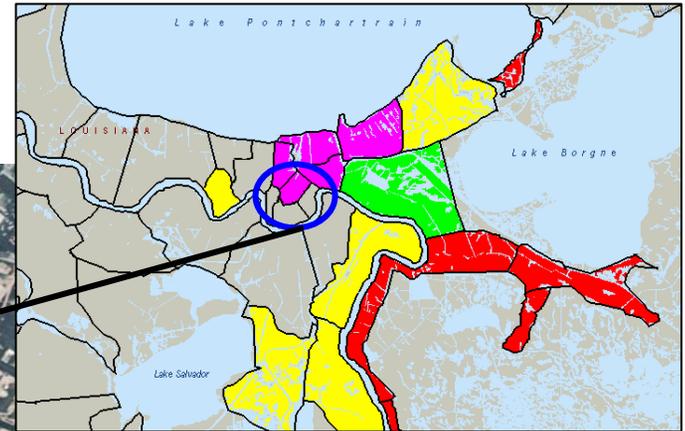
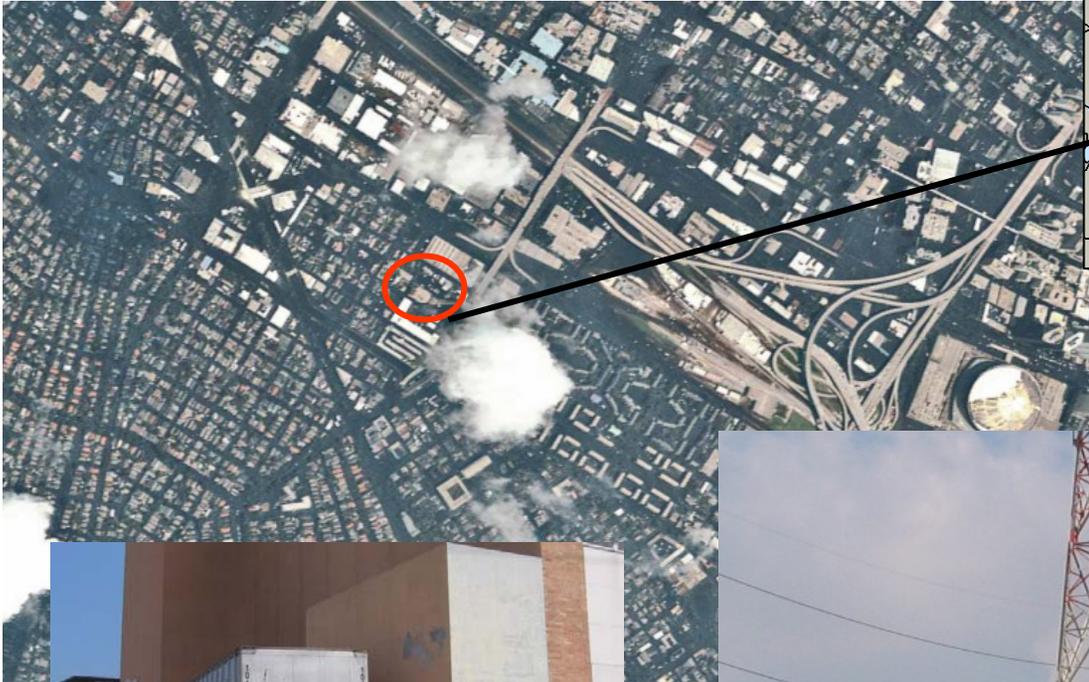
*Storm surge destroyed most fixed gensets located close to the shore*



# Waveland, MS



# *NEW ORLEANS BROADMOOR*

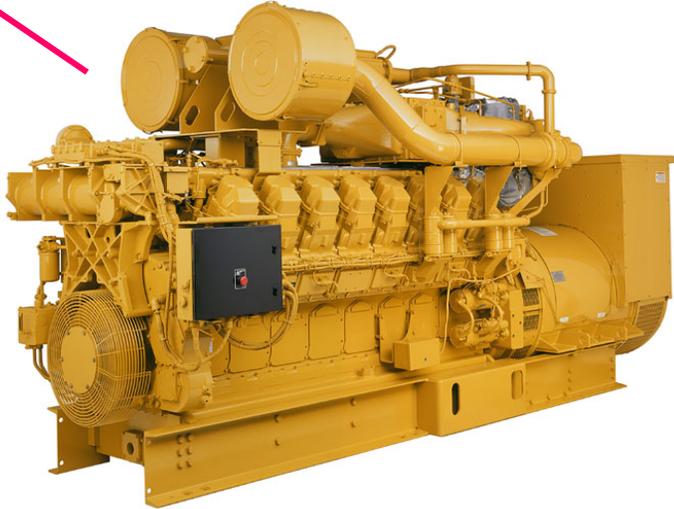


*Genset*

*Water level*



*Portable  
Generator sets*



# Refueling and Deployment

*New genset  
not connected*



*Genset being  
refueled (once  
a day)*



# Solar-Powered Electricity and Water Purification (rarely used)



# Biloxi, MS Substation

*Missing connections*



*Open door*



*Debris*



## *Mississippi River Delta, LA*



*Maximum water (storm surge + waves) level*

*Control building location*



*Receding water*

# Distribution Lines



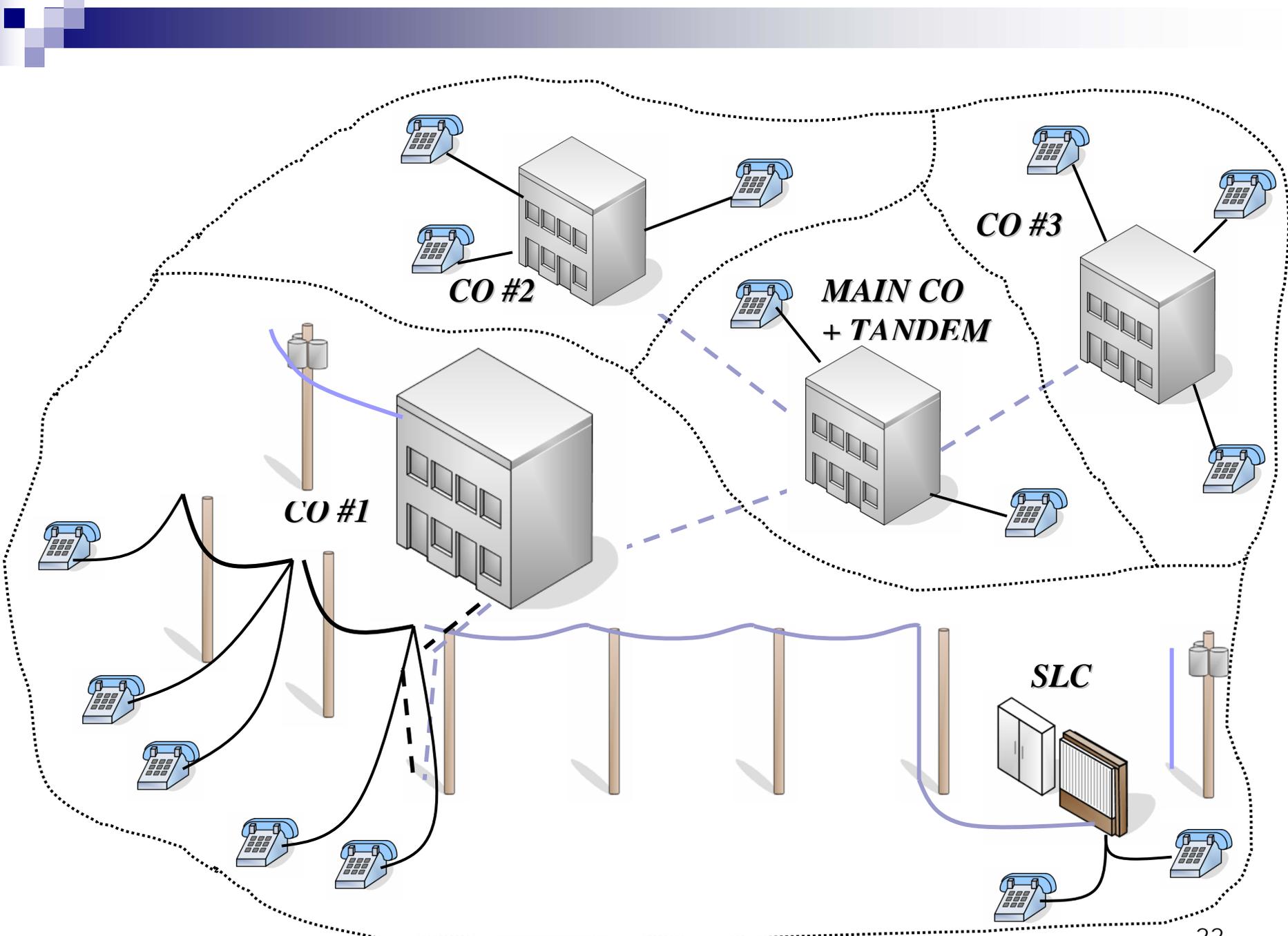
# Distribution Lines



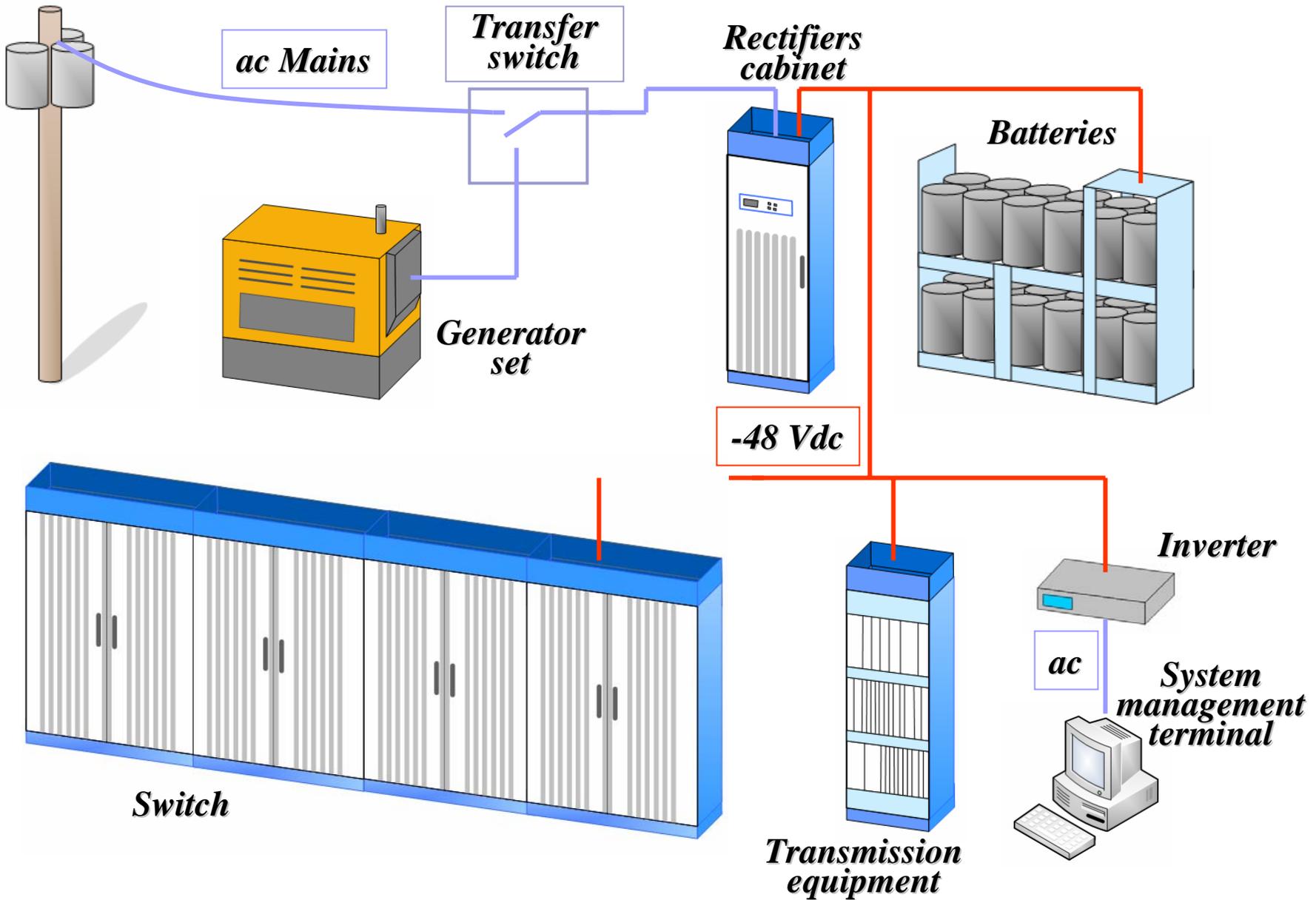
*•Electrical power transmission and distribution lines show some damage but it is less significant than centralized system parts such as central offices and substations*

# Fixed Telephony

- Coastal Central Offices (COs) damaged
- Rely on batteries and gensets
  - Batteries good for about one day
  - Generators last until fuel runs out (perhaps days)
- Flooding damages equipment
  - Time-consuming to replace
- Backup equipment limited and unreliable
  - Mostly for emergency lines



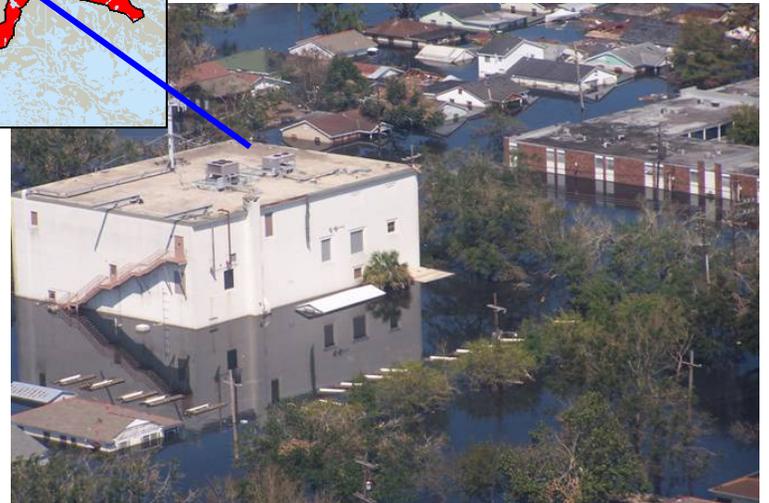
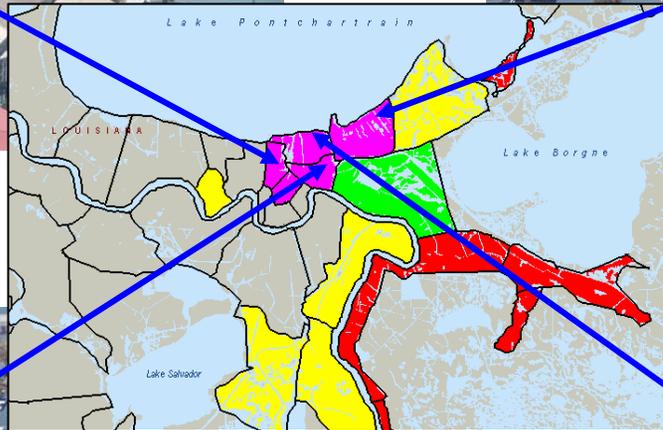
# CENTRAL OFFICE POWER SYSTEM



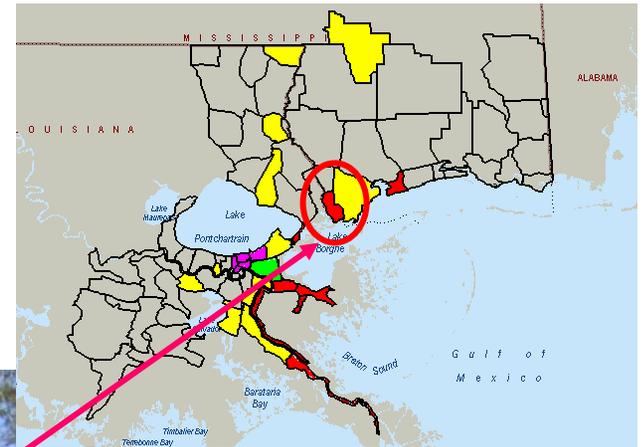
# Example CO Damage



# NEW ORLEANS LEVEE BREACHES IMPACT



# Pearlington, MS



*SLC cabinet*

# Wireless Telephony

- Cell towers disabled due to flooded ground cabinets
- Many gensets deployed – logistical effort
- Natural absence of communication wires a big advantage
- Rely on batteries for short-term outages
- Cells on wheels (COWs) deployed where electronics are damaged
- Cell network mostly OK four days afterward
- Pole-mount electronics supplied with uninterruptible power supplies (UPS) – battery powered

# Cell Sites with Portable Gensets



# Cell on Wheels



## Cable TV UPSs



*Intact UPSs on pole*



*Damaged UPS on ground*



# Perspectives

- Difficult access, refueling needs, logistics, and availability are problems for gensets
- Many backup plans don't anticipate such a disaster
- Cell networks more responsive
  - Of course we need power to charge cell phones!
- Poles and pole-mount devices held up better than imagined
- Fixed telephony extremely important but susceptible for a few miles in

# Perspectives (cont'd)

- Team met many people outside metro areas where no help had come at all – power out for weeks
- Power-of-last-resort largely missing
  - Rapidly deployable and naturally distributed (e.g. like solar-battery combinations)
    - More expensive per kW-hr than gensets – is Katrina enough to make this a priority?
  - Human-powered devices
    - Ad-hoc cell networks, flashlights, phones, etc.

# References

## ■ Quotations

- [[http://netscape.com.com/2102-1037\\_3-5907075.html?tag=st.util.print](http://netscape.com.com/2102-1037_3-5907075.html?tag=st.util.print)]
- [[http://netscape.com.com/2102-1037\\_3-5907075.html?tag=st.util.print](http://netscape.com.com/2102-1037_3-5907075.html?tag=st.util.print)]
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