

U.S. Gulf Coast Telecommunications Power Infrastructure Evolution since Hurricane Katrina



Overview

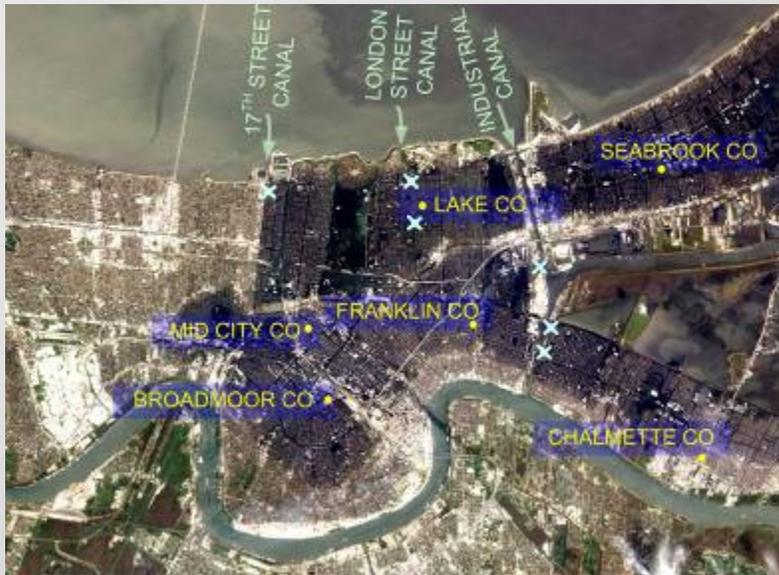
- » Introduction and motivation
- » Historical background
- » Planning perspective
- » Power infrastructure evolution
- » Conclusions

Introduction and Motivation

- » Objective: To describe how telecommunications power infrastructure in the U.S. Gulf Coast evolved from the time the area was affected by Hurricane Katrina.
- » This work continues the analysis presented in INTELEC 2006. Both papers are based on photographic records from site surveys, one performed a few weeks after Katrina made landfall and the other in a few instances from June 2008 to January 2009.
- » Power infrastructure evolution tells an history that may serve to answer the following questions:
 - How was telecom infrastructure affected by Katrina?
 - How did these effects influenced post-disaster network planning decisions?
 - Is the network now more or less resilient than one Katrina made landfall?

Historical background

» Hurricane Katrina made landfall in Buras, LA, on August 29, 2005.



Background: NASA

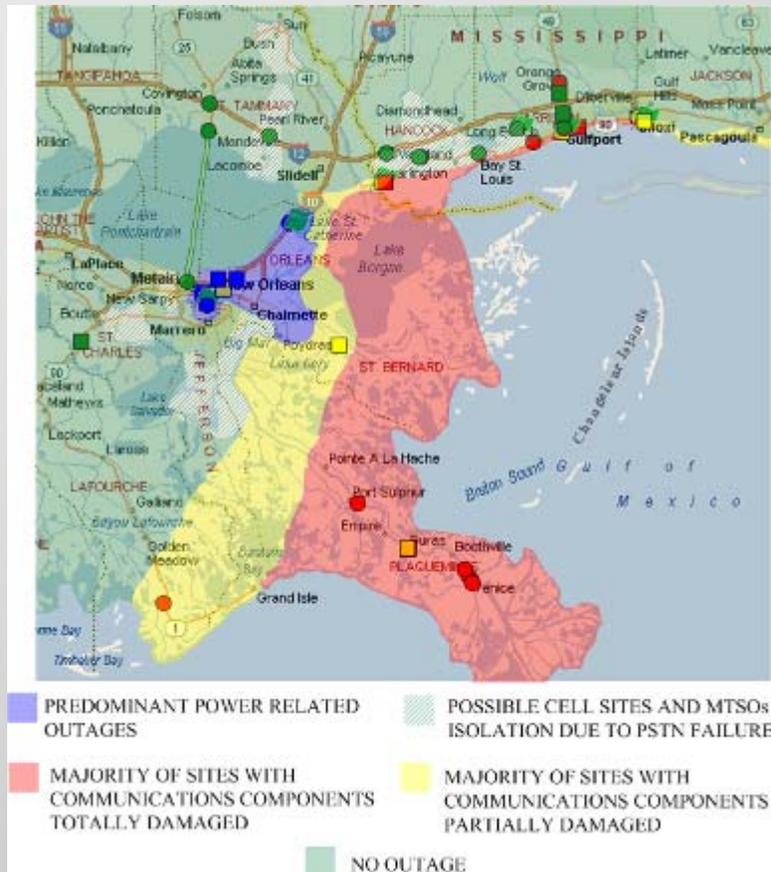


Historical background

- » PSTN: Most outages caused by lack of power (3/4 in central offices). Use of DLCs to replace damaged cables and destroyed COs.
- » Mobile: Little damage to MTSOs and cell sites. Power issues were also the origin of most outages. PSTN failure was also an important problem. Inhomogeneous and often inadequate construction practices.
- » Effects more severe on centralized network elements than on distributed network elements.
- » Almost exclusive use of diesel gensets to provide long back-up power.
- » Logistical issues: deployment of multiple gensets in cell-sites. Deployment of gensets to DLCs.
- » Natural gas outage not as widespread as electrical outage.
- » Little use of alternative energy sources (PV, wind, hydrogen).

Historical background

» Significant power issues in cell sites and DLCs (distributed load centers) but low percentage of damaged DLCs or cell sites.



» Most cell sites and DLCs failed due to power issues

Historical background

- » Additional relevant suggestions from INTELEC 2006's paper:
 - » Use natural gas to power back up power generating units.
 - » Migrate from energy standby systems towards power distributed generation systems.
 - » Implement homogeneous cell site construction practices locating all infrastructure above the flood plane.
 - » Use portable COs instead of DLCs.
 - » Coordinate deployment of portable gensets to one per site
 - » Use wherever possible pole mounted systems over ground mounted systems.



FCC's order from Katrina lessons

§ 12.2 Backup Power.

Local exchange carriers (LECs), including incumbent LECS (ILECs) and competitive LECs (CLECs), and commercial mobile radio service (CMRS) providers must have an emergency backup power source for all assets that are normally powered from local AC commercial power,

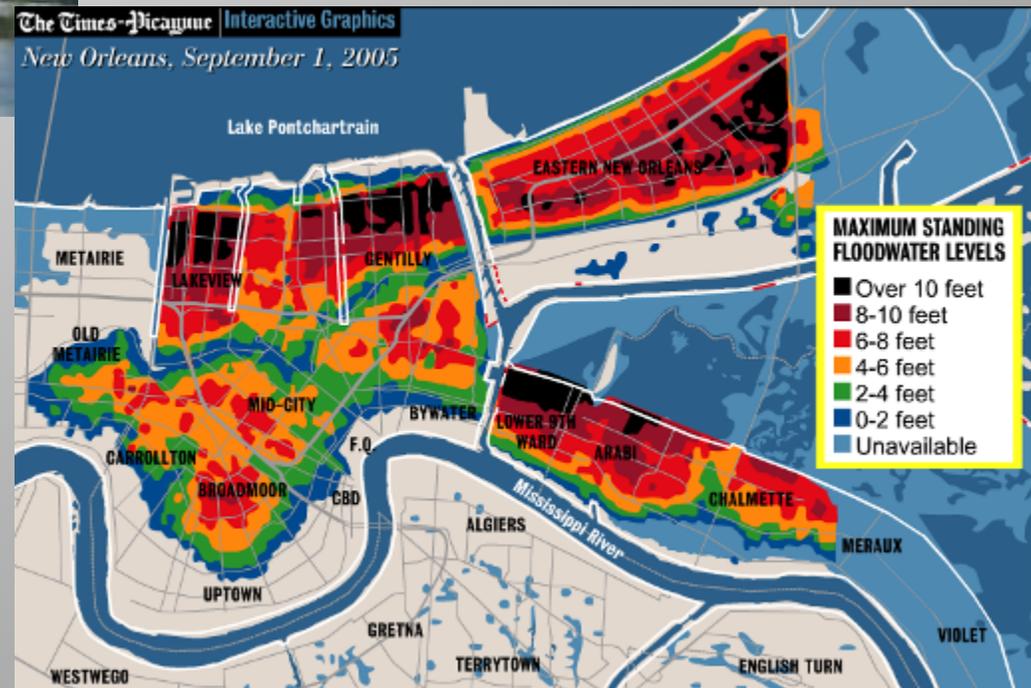
Federal Communications Commission

FCC 07-107

including those inside central offices, cell sites, remote switches and digital loop carrier system remote terminals. LECs and CMRS providers should maintain emergency back-up power for a minimum of 24 hours for assets inside central offices and eight hours for cell sites, remote switches and digital loop carrier system remote terminals that are normally powered from local AC commercial power. LECs that meet the definition of a Class B company as set forth in Section 32.11(b)(2) of the Commission's rules and non-nationwide CMRS providers with no more than 500,000 subscribers are exempt from this rule.

Planning perspective

- » Planning difficulties impacting network reconstruction decisions:
 - » Geographical vulnerabilities



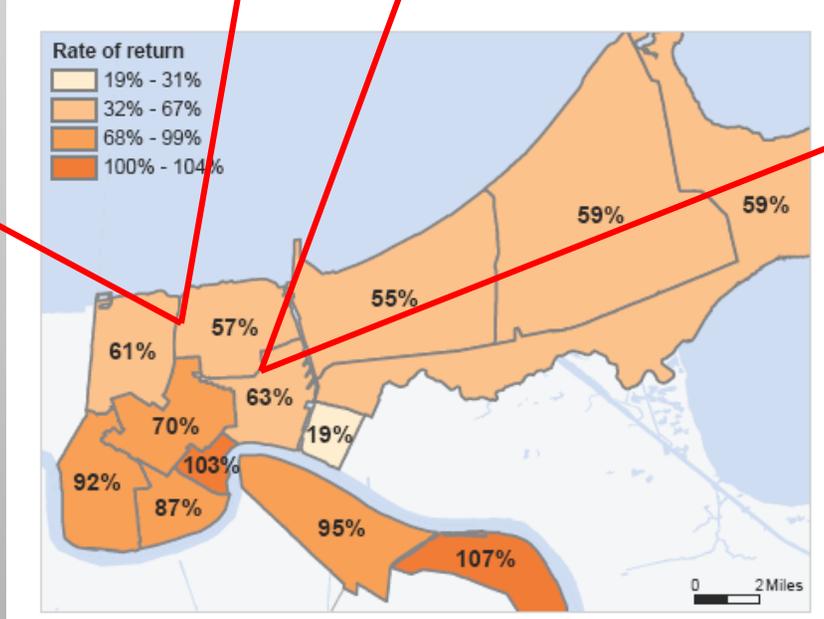
Planning perspective

» Planning difficulties impacting network reconstruction decisions:

» City repopulation



Share of June 2005 residences active in September 2008, by planning district



The Brookings Institution Metropolitan Policy Program & Greater New Orleans Community Data Center

Power infrastructure evolution

» Planning difficulty: to reconcile the immediate repair needs with the long term network planning goals based on an uncertain demand.

» Advantages of DLCs:

- They can follow changing demand better than multi-pair copper cables.
- They can be deployed quickly reusing existing or rebuilt distribution infrastructure (usually aerial).
- They don't require a building.

» Disadvantages of DLCs:

- Need to be deployed relatively close to the demand.
- They are designed with lower target availability than centralized network elements.
- Many DLCs hosted by a CO which may become a single point of failure.
- They require local power. Without local generating capacity battery back up times (at least 8 hrs. as requested by FCC) is often insufficient to sustain continuous operation until a portable genset is deployed. Portable gensets increase logistical needs because they require regular refueling. Portable gensets are usually unreliable.

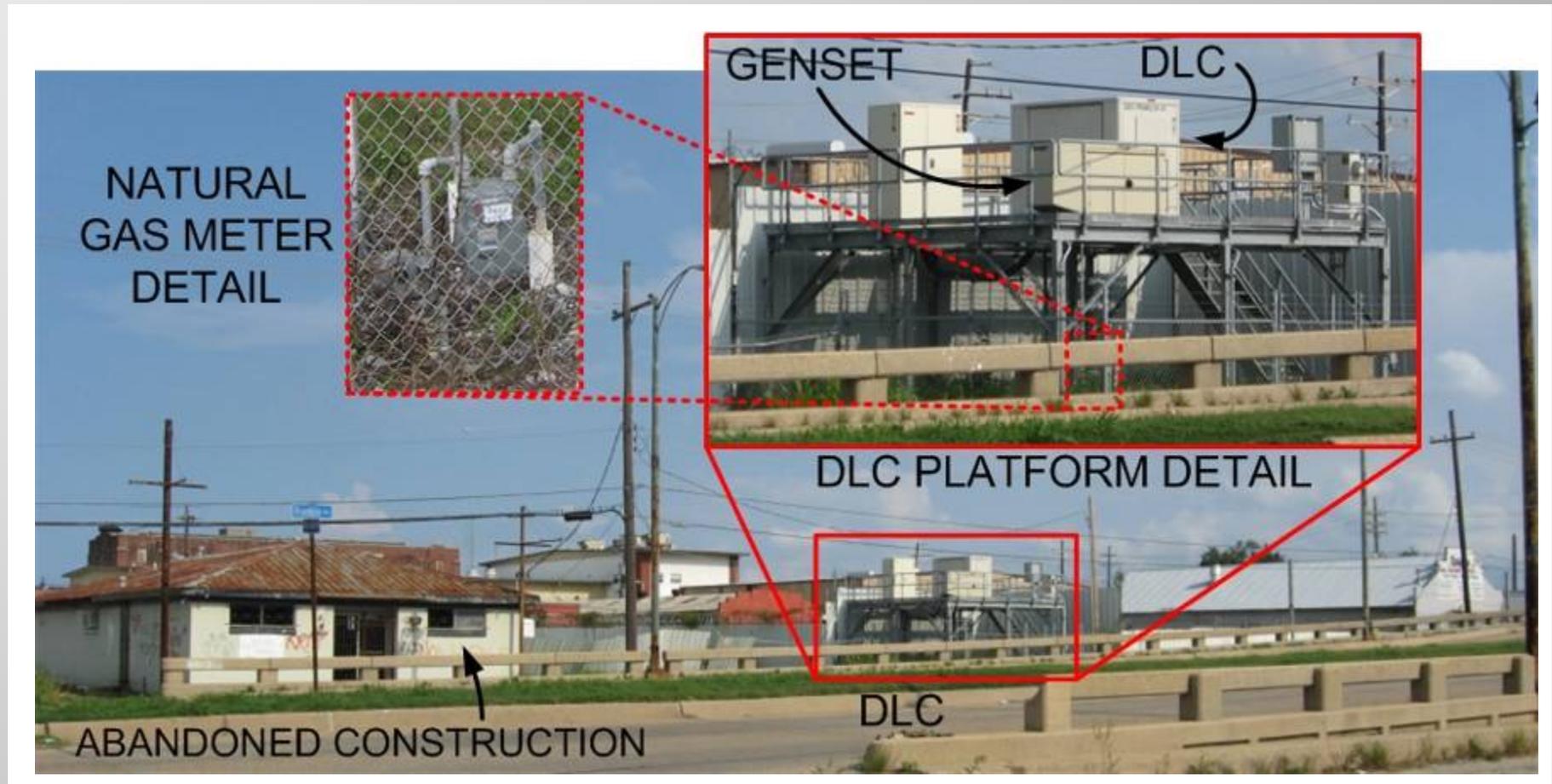
Power infrastructure evolution

» DLCs in outside plant applications



Power infrastructure evolution

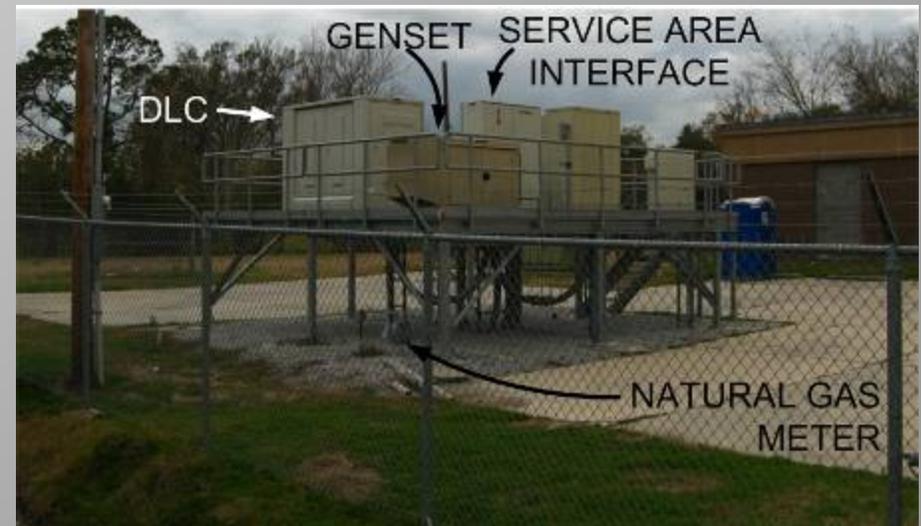
» DLCs in outside plant applications



Power infrastructure evolution

» DLCs in replacing central offices (St. Bernard)

- Resilience reconstruction requires elevating the building



January 2009

Power infrastructure evolution

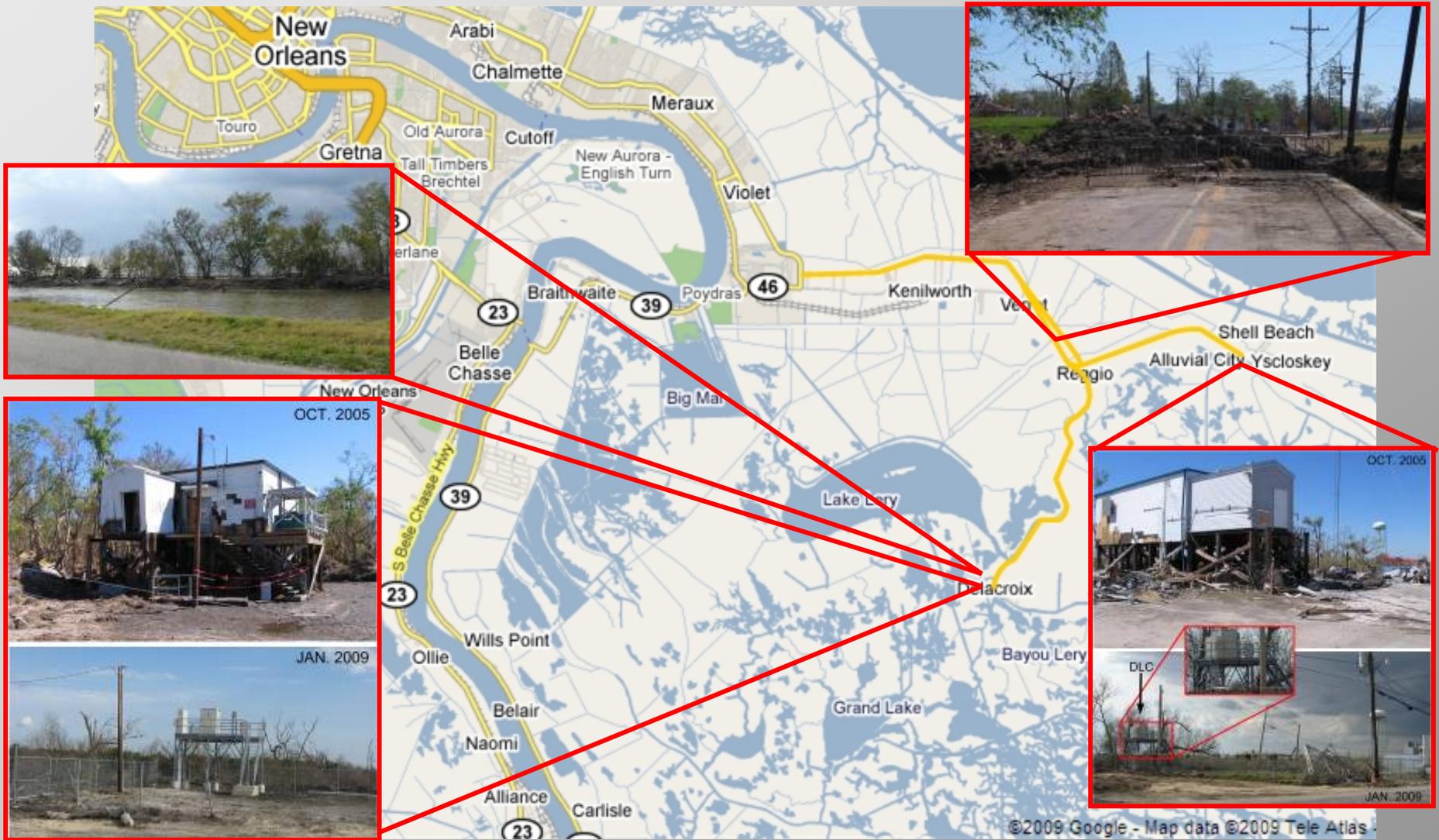
» DLCs in replacing central offices (Pass Christian)

- Resilience reconstruction requires moving the central office away from the coast.



Power infrastructure evolution

» DLCs in replacing central offices (Delacroix and Yscloskey)



Power infrastructure evolution

» DLCs in replacing central offices (more on Delacroix)



» Access issues

» Demand issues

Power infrastructure evolution

» Inconsistent construction practices in wireless communication systems



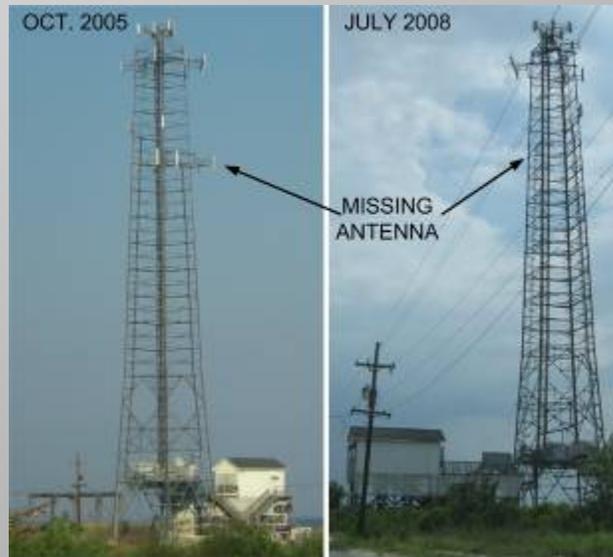
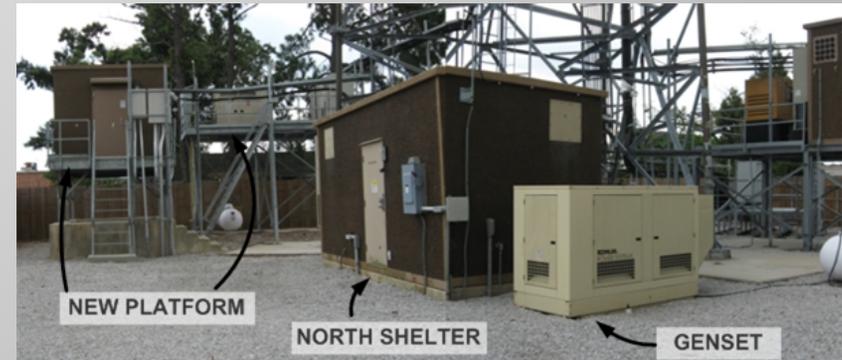
OCT. 2005

JULY 2008



Power infrastructure evolution

- » Somewhat more permanent gensets
- » Increased use of propane
- » Demand following



Power infrastructure evolution

» Pole mounted infrastructure



Conclusions

- » Significant planning difficulty: to reconcile the immediate repair needs with the long term network planning goals based on an uncertain demand.
- » The PSTN shows an extensive use of DLCs, most on platforms, some with permanent natural gas gensets.
- » There are still significant vulnerabilities in communication networks that are not addressed by FCC's "Katrina order"
- » Inconsistent cell site construction practices persist.
- » There is an increased use of propane to fuel permanent gensets

THANK YOU VERY MUCH

QUESTIONS?