

Hurricane Katrina: Communications & Infrastructure Impacts

DR. ROBERT MILLER

Senior Research Professor, National Defense University

In some respects, Hurricane Katrina was the equivalent of a weapons of mass destruction (WMD) attack on the Gulf Coast. The hurricane caused catastrophic damage over an area roughly the size of Great Britain.¹

However, while it is tempting to view a storm such as Katrina as a once-in-a-lifetime event, doing so would be an exercise in wishful thinking. Although Katrina was a very large hurricane, it was not “The Storm of the Century,” or even “The Big One” which forecasters have warned about for many years. The best estimates are that at landfall, Katrina was at Category 3 strength (winds of 111-130 miles per hour [MPH]).² Sustained wind strength at landfall was about 125 MPH. By contrast, 1969’s Hurricane Camille was a Category 5 storm with winds greater than 155 MPH. Much of the extensive damage caused by Katrina was due to storm surge, especially along the Gulf Coast, and by levee breaches and resulting flooding in the New Orleans area, rather than by the wind and rain from the storm itself.

In other words, it should be clear that Katrina-sized incidents are neither unprecedented nor unlikely to recur. We will see more, and we may well see worse, either from storms, earthquakes, or other natural or man-made causes. The fact that a replay of Katrina-sized events are all but certain makes it all the more urgent that we draw appropriate lessons from the 2005 experience.

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1. The affected area was approximately 93,000 square miles. See *Hurricane Katrina, Lessons Learned* (GPO, February 2006): Forward.
 2. National Hurricane Center, *Tropical Cyclone Report: Hurricane Katrina, 23-30 August 2005* (20 December 2005): 3.

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Katrina as a Critical Infrastructure Collapse

Katrina offers lessons in another sense as well. One way to think about Katrina is to see it as a comprehensive critical infrastructure collapse—perhaps the most widespread critical infrastructure collapse that any advanced country has experienced since World War II. Virtually all of the critical infrastructure sectors in the region were put out of commission at the same time. Failures in one sector had cascading effects on others. These simultaneous failures far exceeded the experience base and available resources of public officials, and led to a partial or complete breakdown in command and control and in public order. Widespread critical infrastructure collapse is one of the marker elements that helps differentiate “catastrophes” from “disasters.”³

The concept of critical infrastructures is one of those classic inside-the-beltway obsessions that often seem to have little resonance in saner parts of the country. That’s unfortunate, because I suspect that as the 21st century goes along we will all find ourselves paying more attention to the implications of vulnerabilities in our critical infrastructures. There’s reason for this concern, given the ways in which today’s globalized, just-in-time, interconnected world magnifies the consequences of regional catastrophes. Globalization and interconnections mean that events which once could have been handled locally will have widespread ripple effects, and that these effects can be unexpectedly disruptive.

As one government commission put matters:

“...the U.S. has developed more than most other nations as a modern society heavily dependent on electronics, telecommunications,

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3. For planning purposes, the government distinguishes between “catastrophes” and what could be called more typical disasters. The Catastrophic Incident Supplement to the Dec. 2004 DHS *National Response Plan* defines a catastrophic incident as: *“any natural or manmade incident, including terrorism, that results in extraordinary levels of mass casualties, damage, or disruption severely affecting the population, infrastructure, environment, economy, national morale, and/or government functions. A catastrophic incident could result in sustained national impacts over a prolonged period of time; almost immediately exceeds resources normally available to State, local, tribal, and private-sector authorities in the impacted area; and significantly interrupts governmental operations and emergency services to such an extent that national security could be threatened. All catastrophic incidents are Incidents of National Significance. These factors drive the urgency for coordinated national planning to ensure accelerated Federal/national assistance.”*

energy, information networks, and a rich set of financial and transportation systems that leverage modern technology. This asymmetry is a source of substantial economic, industrial and societal advantages, but it creates vulnerabilities and critical interdependencies that are potentially disastrous to the United States.”⁴

These potential dangers are particularly acute in the “information infrastructure.” Our economy and indeed all of society now depend—to a far greater degree than, say, twenty years ago—on the continued operation of the Internet and other networks and systems. These are important in their own right. And increasingly they act as control systems for other infrastructure sectors.

Viewed in this light, Katrina is a possible harbinger of what we can expect if (or when) similar critical infrastructure collapses happen in our future. During Katrina, these infrastructure collapses occurred rapidly, almost simultaneously, and over a very wide area. The multi-state nature of the collapse inhibited effective response—as it is likely to do in any future incident.

Katrina’s Impact on the Communications Sector

Communications was one of the critical infrastructure sectors that were most severely affected by the hurricane and its aftermath. Paul McHale, the Assistant Secretary of Defense for Homeland Defense, stated that “the magnitude of the storm was such that the local communications system wasn’t simply degraded; it was, at least for a period of time, destroyed.”⁵ Over 180 central office locations were running on generators as commercial power sources failed. About

4. *Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse Attack*, (2004): 2.

5. Quoted in, *Hurricane Katrina, Lessons Learned*, p. 34. The statement can be found in Paul McHale, Assistant Secretary of Defense for Homeland Defense, testimony before a hearing on Hurricane Katrina: Preparedness and Response by the Department of Defense, the Coast Guard, and the National Guard of Louisiana, Mississippi, and Alabama, on October 27, 2005, House Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina, 109th Congress, 1st session: 74.

100 commercial radio stations were forced off the air.⁶ Up to 2,000 cell towers were also knocked out and responder Land Mobile Radio communications were significantly degraded.⁷ Emergency 911 service was severely damaged, and surviving stations were soon overwhelmed by spiking call volumes as desperate people tried to get help or check on those at risk. According to the Federal Communication Commission's "Independent Panel Reviewing the Impact of Hurricane Katrina on Communications Networks":

*The destruction to communications companies' facilities in the region, and therefore to the services upon which citizens rely, was extraordinary. Hurricane Katrina knocked out more than three million customer phone lines in Alabama, Louisiana, and Mississippi. The wire line communications network sustained enormous damage—dozens of central offices and countless miles of outside plant were damaged or destroyed as a result of the hurricane or the subsequent flooding. Local wireless networks also sustained considerable damage—more than a thousand cell sites were knocked out of service by the hurricane. At the hurricane's height, more than thirty-five Public Service Answering Points (PSAPs) were out of service, and some parishes in Louisiana remained without 911 or enhanced 911 (E911) service for weeks.*⁸

In addition to the immediate damage to communications, the storm had a variety of indirect, persistent effects. As the FCC panel noted, much of the backbone conduit for landline service was flooded out. So were many of the central switching centers. Wireless capabilities were degraded as cell towers were put out of commission. The sustained loss of electrical power meant that those facilities that survived the initial storm had to run on back-up generators or batteries. Some of these were flooded out and many of the others soon ran out of fuel. Widespread disruptions of transportation, roads and bridges—and, as we will see,

6. Testimony, Kenneth Moran, Director, Office of Homeland Security, Federal Communications Commission, before the House Committee on Homeland Security, Oct. 26, 2005.

7. Testimony, Dr. Peter Fonash, Deputy Manager, National Communications System, before the House Committee on Homeland Security, Oct. 26, 2005.

8. Report and Recommendations, Paragraph 2.

the collapse of command and control—hobbled repair crews and made local re-supply of such fuel difficult or impossible.

To be sure, not all communications facilities suffered equally. Some of the private networks maintained by utilities and others continued to function reasonably well. Satellite phones also worked once the immediate storm passed, although they were in very short supply and eventually many ran out of battery power. Satellite radio, such as XM and Sirius, continued to function. Other forms of radio, including amateur (ham) radio, also continued to operate as long as power was available.⁹ However, these systems brought only limited relief to the overall communications problem. Finally, the Federal Emergency Management Agency's (FEMA) Mobile Emergency Response Support (MERS) teams are designed to provide emergency communications, but apparently had little impact during the first few days after the hurricane landed.¹⁰ The White House *Katrina Report* described the results, "The complete devastation of the communications infrastructure left responders without a reliable network to use for coordinating emergency response operations."¹¹

The communications failure also severely damaged the control systems—known as Supervisory Control and Data Acquisition (SCADA) systems—that manage many other systems and infrastructures. These systems, many of which depend on the Internet, were often put out of business for prolonged periods.

Failures in maintaining working systems—what are called *operability* problems—were exacerbated by long-standing issues with *interoperability*. While it was not exactly news that many public entities have problems in communicating with each other, the impact of these

9. The NCS Shared Resources High Frequency Radio Program continued to work and provided important, though necessarily limited, services during the emergency. See Fonash testimony cited above.

10. *A Failure of Initiative* reports that the senior Federal official in Mississippi testified that despite deployment of a MERS unit, Mississippi's "communications capabilities were far short of what was needed to be effective." p. 165.

11. White House, *Katrina Lessons Learned Report*, p. 37. The report provides a vivid description of the consequences of the communications collapse.

interoperability failures was magnified when “normal” communications links blinked out.¹²

Operational Consequences for Government: “The Fog of Katrina”

The consequences of this massive communications failure were both swift and severe, especially in southern Louisiana. Modern governments—and for that matter modern societies—depend heavily on telecommunications. This is especially true in emergencies. The communications capabilities that most public agencies depend on for everyday operation were eroded, and in some places eliminated, for days and in some cases for weeks. In effect, when communications went out something like the “fog of war” descended upon the Gulf Coast. To quote just two examples, the New Orleans Police Department’s communications system was inoperative for three days after the hurricane, and only a few backup channels were available to first responders in the area.¹³ Mississippi’s National Guard responders were unable to establish effective communications links with the governor or the state’s emergency management agency for 48 hours after the hurricane hit.¹⁴

Law enforcement units who rushed in from other jurisdictions often had two-way radios that used different frequencies than local police, DoD military responders found it difficult or impossible to communicate with FEMA or other civilian authorities, some of the key data was locked away on classified systems, and situational awareness—knowing what was going on, who was where, who needed what, and who was going where and when—was significantly degraded. The federal government’s systems for setting call priorities

12. The two terms deal with different things. From a responder/ government point of view, “operability” exists when users have a basic level of communications. “Interoperability” means that responders and officials from different jurisdictions and agencies can communicate with each other and exchange data in real-time. You can’t have the latter without the former. See the Statement of Dr. David Boyd, Director, Office for Interoperability and Compatibility, Science & Technology Directorate, Department of Homeland Security, before the U.S. House Committee on Homeland Security, April 25, 2006.
13. House of Representatives, Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina, *Final Report: A Failure of Initiative*, H. Rpt. 109-396, Feb. 15, 2006: 164.
14. *Ibid.*, 168.

seemed to work effectively, but the lack of basic operability limited their effectiveness.¹⁵

One persistent problem was the lack of basic coordinating information: “No knowledge management plan existed for incident response. There was no central list of information needs, or listing of potential information sources, to help prioritize reconstitution efforts. Joint task force phone numbers were not preassigned, and several numbers changed while the response was underway. In many cases, key messages were printed and handcarried around command centers to make sure incident managers had the right information.”¹⁶ In military terms, government lost its “C 4 ISR” (or Command, Control, Communications, Computers, Intelligence [in the sense of situational awareness], Surveillance, and Reconnaissance) capability.¹⁷ Without working communications, government at all levels was in effect deaf, dumb, and blind, blundering about and trying to make sense of an endlessly confusing and rapidly changing situation. This rapidly led to chaos.

All of these factors degraded the ability of public officials to keep up with events and try to direct recovery efforts. Also—and very importantly—the lack of authoritative and believable information from public officials created a climate rife with rumor, misinformation and speculation, significantly reduced the government’s ability to

15. The National Communications System, or NCS, is the primary Federal government agency responsible for emergency communications. NCS operates several emergency services, such as the Government Emergency Telecommunications Service (GETS), which gives critical users priority for landline calls, and the parallel Wireless Priority Service (WPS). For emergency situations NCS operates a high-frequency radio system (called SHARES), as well as the Telecommunications Service Priority (TSP) program for restoration purposes.

16. Lt. Col. Greg Gecowets, “Coordination, Command, Control and Communications,” Joint Center for Operational Analysis Quarterly Bulletin, Vol. VIII, Issue 2, June 2006, p. 20. Colonel Gecowets points out that responding DoD elements had trouble creating an unclassified situational awareness picture, since most of their resources are (for understandable reasons) classified. Accessing classified systems from the field and sharing information among emergency centers was often difficult, and in any case, classified systems are usually unavailable to civilians.

17. To use another military term, the many units and agencies in the area lost the ability to create and maintain a common operational picture. Trying to make sense of the situation absorbed a great deal of senior leaders’ time and energy.

maintain public order, and added to the sense of dislocation and loss of public confidence. As one analyst put it: “Numerous media reports described incidents of crime and murders at the refuges of last resort, snipers shooting at rescuers, and other significant degradation in civil order. Although re-examination of these events has shown that many of these reports were in error or exaggerated, they had an impact on the allocation of resources and actions of responders because government officials lacked a realistic understanding of the situation in New Orleans, as well as the capability to convey an accurate picture of what was going on to the public.”¹⁸

This feeling of dislocation came as a shock and a surprise to both the government and the public. A House of Representatives report summarized the consequences and deserves extended quotation:

Poor situational awareness and its resulting effect on command and control contributed to the negative effects of inaccurate media reports because public officials lacked access to the facts to address media reports. Throughout the early days of the response, media reports from New Orleans featured rampant looting, gunfire, crime, and lawlessness, including murders and alleged sexual assaults at the Superdome and Convention Center. Few of these reports were substantiated, and those that were—such as the gunfire—were later understood to be actually coming from individuals trapped and trying to attract the attention of rescuers in helicopters. Officials on the ground in New Orleans interviewed by Select Committee staff stated the media greatly exaggerated reports of crime and lawlessness and that the reports from the Convention Center and Superdome were generally unsubstantiated...

The near total failure of regional communications degraded situational awareness and exacerbated problems with agency coordination, command and control, logistics, and search and rescue operations. Reliable communications are critical to the preparation for and response to a catastrophic event because of the effect they have on establishing command and control and maintaining situational awareness. Without functioning

18. James Henry, *Incomplete Evacuation*, Joint Center for Operational Analysis Quarterly Bulletin, Vol. VIII, Issue 2, June 2006: 7.

*communications systems, first responders and government officials cannot establish meaningful command and control, nor can they develop the situational awareness necessary to know how and where to direct their response and recovery efforts. Similarly, without the ability to call for help, citizens cannot seek emergency assistance, alert responders or others to their whereabouts and needs, or receive updates or instructions from officials.*¹⁹

This problem was not limited to Southern Louisiana. The communications blackout along the Gulf Coast was almost as bad, at least for a while. As historian Douglas Brinkley put it in talking about Hancock County, Mississippi:

*The cell phone towers had all been knocked out, and the landlines were down, so communication was as primitive as a rag waved frantically by a person in trouble.*²⁰

In many cases, the inability to communicate led to a sense of paralysis. Here's Brinkley again:

*In a city surrounded by water, the police had only a handful of operable boats. Their radio system, cellular communications, and landlines went down simultaneously. They were without satellite phones. Because of flooding they couldn't even send couriers from one part of the city to another. [Quoting New Orleans Deputy Police Chief Warren Riley] "As a commander, as a captain, you prepare for weapons of mass destruction, for a terrorist situation, for hostage situations, SWAT situations, things like that. We prepared for terrorists trying to take over the Superdome. We prepared for terrorists to come down on Bourbon Street during Mardi Gras. But this storm was the ultimate enemy. It cut off the food, the water, the transportation, the lights. It segregated your units and stranded them where they couldn't do their assignments... This storm was absolutely beyond plausibility. How do you prepare for this?"*²¹

19. House Select Bi-partisan Committee to Investigate the Preparation for and Response to Hurricane Katrina, Final Report, *A Failure of Initiative*, House Report 109-396, Feb. 15, 2006: 165 & 169.

20. *Ibid.*, 163.

21. *Ibid.*, 202 & 208.

After a few days of this, the repair of some communications facilities and the deployment of backup systems helped dispel this confusion and allowed government at all levels to begin to get a grip on the many problems facing the region. But it was a long—a very long—week before this “fog of Katrina” began to dissipate.

Some Implications

It would be an exercise in wishful thinking to pretend that Katrina was a unique event and nothing like it will happen again. Although we pray that it doesn't, prayers are no substitutes for prudent policy.

The communications sector is a case in point. Although all parties agree on the fundamental need for a more robust and inter-operable network, and Federal, state and local governments have made efforts to improve both basic operability and interoperability, the process can perhaps best be characterized as “stately.” What is missing, it seems, is the kind of sense of urgency that is needed to overcome the many forces of inertia within our federal system of government.

There is a larger concern at work here as well. As a starting point, we should realize that there is a significant policy difference between a catastrophe such as Katrina and a more “typical” disaster. As noted, the former was a full-scale and widespread critical infrastructure collapse that rapidly outstripped the coping capability of local, state and national government. As a result, many of the things that most of us have come to expect in an advanced, 21st century civilization disappeared for a few days, and the result was that government was paralyzed and society in some cases slipped back into a state of nature. Of course we cannot know what or where the next catastrophic event will be, but we can be reasonably sure that many of the same problems—including the communications problem, with all the difficulties it brought in its train—will recur in the next catastrophe—whatever its causes—and in fact the next one may very well be worse than Katrina. After all, with Katrina we had plenty of warning and we knew there wasn't likely to be a second onslaught (although Hurricane Rita came close). As a result, response groups and the government had time to respond, suffered few if any direct losses, and could operate with little fear of

further incidents. We can easily imagine scenarios where none of these favorable circumstances will apply.

Mitigation and Restoration Efforts: The “Second Responder” Issue

In the immediate aftermath of a disaster, attention is properly focused on rescue operations and first-responder needs. But as Katrina shows, there is also a compelling need to attend to what could be called “second responders”—those who begin the often arduous process of restoring basic services. These second responders are the ones who help restore electric power and the communications nets, clear the roads and patch the holes in critical infrastructures. They can be thought of as the necessary reinforcing wave in any recovery operation.

Although we cannot realistically hope to prevent another event such as Katrina, we can certainly take a number of steps to mitigate its effects and improve “second responder” operations. This is particularly important in dealing with such essential infrastructures as communications.

Some of the policy options that may improve the speed and effectiveness of both first- and second-responder actions in the communications sector include:

- Taking further steps to make it easier for military assets in areas such as wireless communications to backstop local response and law enforcement resources. Military communications networks, often encrypted and with a heavy emphasis on security, have not been designed to carry out homeland defense missions that require interoperability with emergency responders and civilian agencies. Although this lack of interoperability may have made operational sense in the 20th century, it is worth re-examining in light of current realities.²²

22. Active duty DoD assets (often referred to as “Title 10” forces) are generally seen as “responders of last resort,” which will be called in only when other local, state and federal resources are inadequate. For a general discussion of the problems caused by interoperability difficulties between the military and civilian agencies, see Government Accountability Office, *“Hurricane Katrina: Better Plans and Exercises Needed to Guide the Military’s Response to Catastrophic Natural Disasters,”* (GAO-06-643, May 2006).

- Embarking on a broader re-examination of the military's proper role in responding to catastrophic incidents. Under the National Response Plan, the general rule is that the military backs up but does not supplant other responders.²³ However, it is increasingly obvious that only the active duty military has the resources, mobility and deployability needed to respond to catastrophic events that affect large areas and cross state lines.
- Building more redundancy into the current telecommunications networks at critical nodes.
- Requiring public communications carriers to maintain adequate and tested back-up facilities.
- Devoting resources to improving our ability to collect and disseminate accurate, prompt public information in order to reduce the kinds of false rumors that were so widely disseminated by the media in the immediate aftermath of the hurricane.
- Taking steps to reduce the time and effort needed to restore critical services and infrastructures when things do go wrong, including intensified efforts to create more rapid-deployment resources within DHS and creating more rapid-deployment federal/state/local joint operations centers.²⁴
- In general, working more closely with non-governmental entities and the private sector to enable a coordinated, less spasmodic response effort.
- Trying to untangle the Gordian knots—almost all of them political and not technical—that have limited interoperability.

Summary

Katrina provided a foretaste of what we can expect if and when the country faces another truly catastrophic incident. Given our increased

23. There are partial exceptions, notably in the case of catastrophic events that call for immediate response on a major scale; however, activation of the so-called Immediate Response Clause requires requests from cognizant civil authorities (as of this writing the requirement for an initiating civilian request is now under review, in good part because of the Katrina experience, and may be modified).

24. FEMA's Mobile Emergency Response Support (MERS) units saw their staffing and resources steadily reduced in the years before Katrina.

dependency on critical infrastructures and the speed with which these can collapse, it makes sense to learn Katrina's lessons while we still have time. One of these lessons is the importance of getting communications capabilities up and running as quickly as possible. Doing so requires a mix of technical and policy changes that, together, will serve to mitigate damage and accelerate restoration.

