# Preparing for The Big One

**Spacenet and ODN develop a breakthrough emergency communications solution for the Department of Transportation of Missouri USA**

**Spacenet**
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WTA
CASE STUDY

The Missouri Department of Transportation needed an emergency communications network capable of aiding first responders across the state and the region. It had to be robust, interoperable and cost efficient. It had to work when all else failed. Even in the wake of a devastating and deadly earthquake.

The New Madrid fault line, stretching 150 miles to the southwest from New Madrid, Missouri, is a prolific source of tremors and quakes across the Southern and Midwestern United States. It's also a major cause for worry among public safety officials in at least eight states. Scientists are convinced a magnitude 6 to 7 earthquake could hit the region at any time.

"We had to have an emergency communications system that could survive the big one, the 200-year earthquake that is way overdue. That's our biggest threat around here," explained John Diggs, a retired 30-year veteran of the US Marine Corps who is traffic communications coordinator for the Missouri DOT. "Our top objective at the outset of a catastrophe of any kind is to help direct police, fire and rescue crews safely in and out of the affected areas," added Diggs.

"We've got a lot of boots on the ground throughout the state. People who fix roads and whose top priority is keeping roads open or finding ways around obstructed routes in the event of a disaster," noted Rick Bennett, traffic liaison engineer for the Missouri DOT.

"We absolutely must have a network that keeps our land mobile radio system, our phones, and our laptop computers connected when main fiber and power lines are cut or disrupted," explained Bennett, whose team spent more than two years researching technologies and solutions to turn its 1960s vintage radio system into a communications lifeline that can survive the storm.

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They needed much more than radios and walkie-talkies. They needed phone service when primary phone service was out. They had to have Internet access when area ISPs were down. "It would take weeks, even months to repair communications outages caused by a big quake that cuts through a major fiber crossroads in the St. Louis area," Bennett said.

And perhaps the biggest challenge facing Missouri's DOT was its budget.

The innovative team could envision a state-of-the-art solution. They were convinced it could work on their aged infrastructure. But money was tight.

## Look to the Sky

John Diggs will never forget the day Spacenet's Neal Nystrom and Greg Heifner of Orbital Data Networks (ODN) vowed to fix the emergency network's problems. The technical troubles were jeopardizing one of Missouri's key links to statewide safety teams and the outside world.

"Spacenet and ODN had a real uphill battle to convince us satellite was the answer. We were very dissatisfied satellite users to say the least," said Diggs, recalling a previous service provider's failed attempts to deliver both emergency Radio over IP (RoIP) and Voice over IP (VoIP) phone service without extreme latency and poor performance. "In a nutshell, the incumbent wasn't willing to work with us and customize a solution to meet our needs," Diggs explained.

"The Missouri DOT needed more than satellite-delivered Internet access, traditionally what transportation and public safety teams use to navigate around phone and radio system outages," explained Neal Nystrom, Spacenet's lead engineer who credits Hurricane Katrina for waking up emergency officials across the country to the need for a comprehensive, battle-tested communications platform. His company designs, develops, and provides services for satellite, wireline and wireless broadband access solutions to business, government and industrial organizations.

"The Missouri Department of Transportation has a sophisticated operation that needed a smart, reliable and scalable hub-and-spoke VSAT solution capable of managing a wide range of statewide and regional communications systems in a catastrophic scenario," Nystrom added.

"What they had was an off-the-shelf, highly-shared satellite infrastructure that couldn't handle even their everyday communications requirements consistently. God forbid an emergency hit, that platform was nowhere to be found," explained Greg Heifner, president and founder of Orbital Data Networks, which specializes in emergency connectivity via satellite. ODN has teamed with Spacenet, a world leading provider of satellite networking solutions, on a growing number of communications backup systems throughout the U.S.

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"They were sick of satellite when we rolled up to meet with the team at Missouri DOT. They had a bad experience and were simply painting the technology with too broad a brush," Heifner said. "Emergency teams are very adept at looking to the sky for signs of storms and danger," noted Heifner. "The folks in Missouri were leery, but they would soon look to the sky for the best solution to their lingering challenge."

## Silencing the Naysayers

"There were a lot of naysayers. Even some of the radio equipment manufacturers said it was impossible to backup their digital networks via satellite," Nystrom said, remembering the day he and Heifner took on the troubled system.

Heifner was on a laptop at the Missouri DOT office in Jefferson City while Nystrom manned a console at a Spacenet teleport. The two tweaked and maneuvered the platform for hours, intent on proving a point and winning the Missouri DOT business.

"I spent some terrified moments thinking maybe they're right, maybe this won't work," Heifner said, recalling the intensity of the duo's effort to make the existing network operational. But the two had already become quite an accomplished pair of sleuths, fresh from developing a clever satellite fix for several government agencies in Louisiana.

Five or six hours into the long-distance checkup, the two engineers tackled the issues and had Missouri's transportation team well on its way to a robust replacement. "Spacenet and ODN have been a technical godsend. We've gone from being huge satellite skeptics to their biggest evangelists virtually overnight," said Diggs, who together with his colleagues quickly opted to move to Spacenet's Sky Edge network. "We knew we were on the right track," said Cris Kallenbach, senior traffic technician for the Missouri DOT.


The Missouri DOT's emergency network includes at least 25 locations: ten district offices and more than a dozen remote radio towers, served by a mix of fixed and mobile VSAT terminals. Several key sites offer full-time, big-bandwidth access, while the vast majority of the sat dishes deliver emergency service on demand.

"We have set up satellite antennas at remote communications towers throughout the state, which provides a robust architecture for on-demand connectivity in the event of an outage or emergency," explained Heifner. Operators at the Spacenet teleport in Marietta, Georgia, where the satellite capacity originates, manage and monitor the system around the clock.

"In Spacenet and ODN, we found satellite solutions providers with teleport and engineering expertise, effective training programs and a willingness to change their networks to meet our needs and solve our problems cost effectively," Kallenbach said, noting the team also developed a unique telephone solution called Satellite Transport Audio Circuits (STAC). The STAC phone design eliminates the high drop call rate of conventional satellite phones, uses less bandwidth and reduces the impact of latency.

"That's head and shoulders above anybody else we ever dealt with on the network," added Diggs. "Normally you have to burn a hole in the sky and your pocketbook to overcome latency and packet loss. Spacenet and ODN found a way to get it done within our financial comfort zone."

There was still a lot of work to be done to ensure the emergency communications system was always on and on budget.

## Trigger Happy

Spacenet and ODN recognized the traffic on the Missouri DOT's emergency VSAT network broke down into two categories. Mission critical voice traffic delivered over radios and voice-over-IP phones. And Web usage.

Spacenet's Nystrom leveraged the Sky Edge system to send Internet access over the shared network and what are called random access channels, much like the DOT's original satellite network . The lower-bandwidth, jittery and choppy HTML-type traffic works fine in a day-to-day emergency communications application. And it keeps the per site monthly costs extremely affordable.

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The Missouri DOT's problems arose when critical radio and telephone transmissions required a higher quality of packet delivery than the old VSAT system could provide. In essence, the previous emergency network went down the moment an emergency broke out.

"The magic of Sky Edge is in its clever ability to discern immediately between the web and voice traffic," explained Nystrom. "We know what the radio bridging equipment looks like on the Missouri DOT network when voice transmissions begin, and we put direct access (DA) channels in place to instantly trigger a smooth streaming process," Nystrom detailed. "The only time bandwidth usage goes up is during emergency situations, which lets the customer ensure voice quality and easily manage costs."

"Our old system pulled from a big pool of users. At peak times, it simply didn't have the horsepower to deliver the consistent and constant quality of service we depend on," explained Diggs. "We can utilize small bits of bandwidth to access the Internet in stand-down mode, but the DA channels within our new network are triggered when we need to ramp up to emergency mode. The result is crystal-clear radio and phone connections," said Diggs, noting the Missouri DOT/Spacenet/ODN satellite solution bypasses the Achilles heel haunting most radio and cell tower configurations – the vulnerable fiber that is susceptible to breaks, floods and outages.

## Under Fire

The Missouri DOT team didn't have the luxury of targeted testing. Just three months later, the Missouri DOT system got its biggest test under fire: a 100-year flood in the town of Clarksville, where the mighty Mississippi was roaming wildly out of its banks. The event marked the inaugural deployment of the MEROC (Mobile Emergency Response Opera-

tions Center) and the MERV (Mobile Emergency Response Vehicle) along with a team of Missouri DOT personnel. The equipment offered enough power and communications connectivity to handle all the Internet, radio and phone traffic required by rescue and safety crews responding from multiple jurisdictions across the state.

"That's the moment we knew we had exactly what we needed in an emergency network. Regardless of their organization or the brand of their phone, radio or laptop, these officers and rescuers were able to gather intelligence and reach out for help when primary telephone lines were down or under water," recalled Diggs, who remembers how a cheap webcam tied into the network allowed officials to keep an eye on the rising river.

"That was our first attempt at transporting video," Kallenbach noted. "It was a little jerky and it was grainy, but it worked and it sure beats smoke signals," Diggs explained with a chuckle. The Missouri DOT network enabled the state emergency management agency to monitor radio traffic and communicate from the scene.

"The Clarksville flood brought together city, state and federal officials who were quickly and easily patched into our DOT network using their own communications gear," said Bennett. "This solution that we've developed with Spacenet and ODN clearly demonstrates that interoperability doesn't have to be difficult or expensive," Bennett added.

## Over the Top

The Missouri DOT has spent nearly a decade getting thoroughly prepared for the big one. The last two years of network development with Spacenet and ODN, "has finally put us over the top in our ability to deliver emergency communications in a worst case scenario," explained Bennett, whose team and network won the Innovation and Technology Award at the 2009 International Satellite and Communications Exchange (ISCe) Conference.

"I'm convinced that our people and our ability to communicate when networks are down saved lives during the Clarksville flood. And I'm certain our emergency system will save more lives in the future," Bennett added.

Making a life-saving difference is what drove Greg Heifner to start his company, ODN. And now that Neal Nystrom has seen firsthand the impact Spacenet's Sky Edge network can have on emergency response, public safety solutions are where he prefers to hone his system engineering skills.

"I can't think of a better application for satellite communications," said Spacenet's Nystrom. "When lives are on the line, the Missouri DOT is keeping police and rescue teams in touch quickly and reliably. It's an incredible accomplishment and we're honored to be a part of this life-saving network." ■