AWINS Interoperability Supports Katrina Relief

On August 23rd, 2005 ARINC delivered "Mobile Command and Control Unit 1" (MCCU-1) to Anne Arundel County Maryland. Built with the ARINC Wireless Interoperable Network Solutions (AWINS) architecture the vehicle was designed to be both a backup Emergency Operations Center (EOC) for the County and a statewide disaster and event response vehicle. It has the ability to deliver interoperability among any first responders statewide.

Less than a week after the ceremony, and before any training or testing had been completed, Hurricane Katrina rumbled in to the Gulf Coast. The hurricane destroyed much of the Louisiana, Mississippi, and Alabama coastline and flooded New Orleans, a city of about half a million people. Along with all of the homes, businesses, roads, and hospitals the hurricane also destroyed much of the emergency services infrastructure, including radio communications in some areas. Systems that were operational quickly became overwhelmed with the additional resources flowing into the area. The lack of timely communications was nationally recognized as one of most critical issues in the subsequent search and rescue efforts, and delivering aid in the hours immediately following Katrina. Without solid communications, leadership was unable to send aid to where it was needed most, and first responders were left to fend for themselves, unable to call for backup.

It was natural to think that MCCU-1 would be able to help improve communications and support a rescue effort. Maryland offered MCCU-1 to FEMA as part of the relief effort. When Maryland's offer of assistance was accepted, MCCU-1 was soon on the road to New Orleans as part of a large contingent of Maryland agencies under the direction of the Maryland Emergency Management Agency (MEMA).

Along with MCCU-1, Anne Arundel sent enough equipment and supplies to make themselves self-supporting for at least two weeks. Equipment included a large generator, extra fuel, tents, cots, meals ready to eat (MREs), a custom trailer to refuel and power the equipment (quickly built in time to support this mission), ambulances, pickup trucks, and vans to carry equipment and people. The team consisted of county fire officials and county maintenance technicians. Because MCCU-1 was so new, training had not been completed, so a small technical support team from ARINC rounded out the team.

MCCU-1 has capabilities that made it unique among resources dispatched to the area:

MCCU-1 is able to create it's own communications infrastructure

With a substantial radio communications capability (17 radios), and an additional VHF repeater added specifically for this mission, MCCU-1 could reach a wide variety of radios in the area. Forty foot masts increase the range of communications significantly, as do the ability to patch into any existing antennae.

Satellite communications mean that the truck is not dependant on local infrastructure to communicate with the outside world. Nor will it put a drain on any local resources that do exist.

MCCU-1 builds communications interoperability on demand

MCCU-1's primary feature is the ability to create interoperability between many different radio technologies and frequencies. The incident commander and their team can develop a communications plan that suits the requirements of the mission, regardless of what radios exist among team members. Foreign resources no longer need to have the right radio, or be issued radios unfamiliar to them. Dispatchers can create ad-hoc communications paths whenever the need arises, without the assistance of technicians.

MCCU-1 incorporates existing radio infrastructure when it exists

MCCU-1 is able to reach out and connect to existing infrastructure, either extending it's range, or it's capacity. It can be used to "fill in" gaps where infrastructure is broken, or where capacity is an issue.

MCCU-1 is completely portable and self-sufficient for days at a time

As an EOC on wheels, the MCCU is a completely portable command center, providing not just a space to work, but the functionality to do your job as if you were at your desk. The satellite connectivity enables users to reach back to in-house datacenters, or back up datacenters and achieve the same productivity with familiar systems, operating procedures, and applications.

Coupled with uninterruptible power supplies for electronics, and an internal generator, the MCCU can run for up to 3 days standalone. Towing an additional generator and fuel tank provides longer periods of independence.

Operation Lifeline

MCCU-1 had been outfitted for use throughout Maryland, and could communicate with first responder and emergency services organizations statewide at the push of a button. However, its first real test would be over eleven hundred miles away from its home base in an environment of extreme destruction and chaos. The deployment team would have to reprogram the sophisticated communications capabilities of MCCU-1 to meet the impromptu demands of what ever they were thrown into in Louisiana. The Anne Arundel group joined other Maryland teams, whose mission was to support the critical deployment of seven walk-in medical clinics, staffed with over 100 doctors and nurses. They were assigned a base of operations at Meadowcrest Hospital, evacuated just after the hurricane in Jefferson Parish just outside of New Orleans. With a very diverse multi-agency team, it was obvious that the interoperability capabilities of MCCU-1 would be in critical demand. The mission included 14 entities from Maryland:

- Anne Arundel
- Ocean City
- Harford County
- Howard County
- Montgomery County
- Prince George's County
- Calvert County
- Joppa-Magnolia
- Aberdeen
- Bel Air
- Maryland Defense Task Force
- MedStar Ambulance
- Cecil County
- Chesapeake City

Locally, resources from seven jurisdictions were part of the team over the course of the mission:

- Jefferson Parrish Police
- Jefferson Parish Fire
- The National Guard (multiple jurisdictions)
- Louisiana State Patrol
- Georgia State Patrol
- Park Police (helicopter)
- Private ambulances

There was little commonality among the radios from the 18 organizations. This meant that the interoperability solution that the team would have to build would be broad and complex. Without MCCU-1, there would be no way to coordinate the organizations' efforts, particularly those at remote medical clinics.

After the hospital parking lot was cleared of debris, MCCU-1 was set up. Dispatch operations commenced within 45 minutes. Communications bridges and dispatch services were set up as they were required. Over time, the network grew to include at least 9 different types of radio connections, some with multiple frequencies.
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- UHF
- VHF Hi Band
- VHF Lo Band
- 800MHz TAC2
- 800MHz TAC4
- 800MHz talkaround
- VHF Lo
- Aviation

- Marine Radio

Four permanent interoperable talk groups were configured for the various operational groups:

- Ambulances and transport
- Security
- Clinics
- Base camp logistics and hospital staff

The talk groups enabled people who had never worked together and had completely different radios, to act as a team. For example, the ambulances had a mix of 800MHz and VHF Lo Band radios, and normally would not be able to communicate. The talk group established by MCCU-1 enabled the ambulances to coordinate a backfill when a transport to the hospital was required. While the dispatcher could monitor the conversation, there was no direct interaction required, saving time, and the possibility of communication errors. It was also critical for the various security personnel to communicate. With looters and armed gangs in the area, everyone was at risk, including clinics that were more or less out on their own with minimal security. Without the MCCU-1 to tie their communications back to the base camp at Meadowcrest they would were at much greater risk.

While some bridges were used on an on-going basis, dispatchers in MCCU-1 created ad-hoc bridges as the need arose. When medical staff at a clinic needed supplies; the dispatcher created a bridge to temporarily enable the clinic to talk to the logistics group at the hospital. The bridge would then be disabled when all of the logistics were agreed upon.

WiFi-enabled phones allowed commanders and support teams to work in and around the base camp, but always stay in touch. Each one could participate in the radio-based talk groups at the push of a button.

MCCU-1 was designed for use as a command center and communications bridge at a disaster or event site, augmenting any existing communications infrastructure already in place. It was never expected to be the primary radio system covering more than 50 square miles in Jefferson Parrish, but the flexibility of the system was demonstrated over and over.

A good example of this was the ability to use an antenna on the roof of the hospital to get better range on radio reception. Recognizing that the infrastructure was disabled, the ARINC team brought a VHF repeater and extra antennas, and multiple portable radios with them. While not part of the original equipment in the MCCU, it gave the team added capacity, particularly for staff that didn't have radios for each person. This move paid off quickly because there was not much of an existing radio infrastructure to rely on when they first arrived on scene.

This capability has since been added as an optional component for all vehicles going forward.

MCCU-1 also connected into other local radio resources, such as Jefferson Parish 800MHz repeaters as they came back online. The ability to reach out and utilize other resources proved vital in the success of the mission.

Without a functional cellular, telephone, or data network infrastructure, communications with the outside world would have been impossible, but the multi-purpose satellite dish proved its worth. Because it's an IP-based communication path, it was able to accomplish multiple tasks same time. Streaming video over satellite was used for conferences with the Anne Arundel Emergency Operations Center and the Maryland Emergency Management Agency (MEMA), which oversaw the entire Maryland contingent. Even the Maryland Governor's office was kept up to date via IP phone.

E-mail and voice communications enabled the team to stay in contact with both the leadership back home and their families. After critical systems were up and running, the team used the WiFi network (also connected to the satellite) to create an "Internet café" outside MCCU-1. Here everyone on the mission could communicate with home by either e-mail or phone.

As the mission wore on, maintaining high moral became important. MCCU-1 helped in this regard too. The team downloaded sports scores, news stories, and other useful information, such as hurricane tracks that were posted on a large bulletin board for the team to use.

The team could also keep up with events in other parts of the disaster area, track the weather and order supplies when they ran low. From its initial set up, MCCU-1 ran flawlessly for 6 straight days before its first power cycle. As part of a training exercise for the operations staff, the system was restarted, and ran for an additional 9 days. The entire mission was run on an extra generator towed by MCCU-1 from Maryland.

MCCU-1 was a critical component of a medical mission that treated in excess of 5800 patients, including more than 55 who had to be transported to operational hospitals. The team also rescued 35 people, including 20 children. MCCU-1 received significant praise from all members of the team, many of whom recognized that without the powerful communications capability, their job would certainly have been more dangerous and challenging.

Not having to concern themselves with communications problems made their mission that much more successful. When word of MCCU-1's capabilities spread through the area, other teams specifically sought out the Anne Arundel vehicle to get a tour and learn more about its powerful communications ability. Eleven

hundred miles from home, and in extremely adverse conditions, MCCU-1 “aced” its first exam.

Post deployment - Lessons learned

The ARINC team has learned much about what worked and what was missing after the first mission on MCCU-1. ARINC has since expanded the options that we can equip (Mobile Command Vehicle) MCV’s with. The following options are now available with each MCV:

Cellular connectivity

In addition to the satellite and POTS line patch panel, customers can incorporate a bank of cellular connections. The rack mount phone bank is fully integrated into the dialing plan of the on board VoIP phone system and can be used for both inbound and outbound phone calls from any phone in the truck. They act as normal phone lines to the end user, with the IP PBX choosing the most efficient connection. External antennae provide extended range, and the rack mount kit provides power.

Connections made with the Cellular services are interoperable with any radio in the vehicle, so that mobile phone users can participate in radio communications.

One significant benefit is that these connections can be utilized while the vehicle is underway, the satellite and land-line connections cannot. Almost all vehicles have some number of workstations that are usable while underway, and this makes them more productive in preparing for disaster response.

Mesh Networking

Mesh networking provides a mechanism to extend IP connectivity to a larger perimeter around a vehicle, or a means of backhaul to a fixed network in place of the satellite.

Extending a network perimeter allows remote video over IP cameras, WiFi phones, laptops, and other WiFi devices to work at longer distances from the command post. In the case of the work in Jefferson Parish, it would have enabled MCCU-1 to cover the entire hospital with WiFi access.

Many urban areas are also “lighting up” large areas with Mesh networks. The Mesh connection in the vehicle would allow those Mesh networks to be used as another means of connectivity (backhaul) from the truck and provide IP access to internal applications, additional interoperability, the PSTN, and the Internet.

Mesh networks may also be used to “internetwork” several mobile command vehicles for large events or responses.

Microwave

Microwave transceivers can be implemented in areas where line-of site is possible with microwave networks, and again provide backhaul options. Microwave is another way to connect multiple trucks when they are in line of site as well.

Radio repeaters

Although many areas have hardened radio systems, there are still times when radio connectivity is unavailable due to infrastructure failure. Having a radio repeater (or repeaters) available would allow an MCV to extend radio communications from a functional area into a destroyed area. It could also create an island of radio communications more powerful than the traditional mobile radios implemented in most trucks when not adjacent to functional area.

In Louisiana, trucks with a mobile repeater and extendable mast would be held back from the coastline during a hurricane, and then deployed to areas where radio infrastructure had failed after the storm passes. As these areas are also where most outside help would be coming to, the interoperability capabilities would also play an important role in communications during recovery.

For a more seamless interoperability capability, the truck might be equipped with a repeater for both the native radio system, as well as the most predominant radios of the out of area help, giving them the ability to work in a larger area, while maintaining radio communications.

Private Cellular

Private Cellular networks establish local coverage for cell phones when service providers lose local coverage, or when dedicated service is desired. The private network can provide local mobile phone coverage, and connect those phones to outside resources through the satellite connection or any of the other backhaul mechanisms the vehicle has. Those cell phones become part of the AWINS architecture and can be interoperable with any radio or other device connected to AWINS.

802.11 Bridges

Directional Antennas and 802.11 can be used as another means of creating bridges between trucks for distances up to 15 miles (approx). There are several technology options that give varying degrees of performance and distance.