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Getting There is Half the Battle

By Skip Kirkwood, JD, EMT-P, & Jay Fitch, PhD

"Sheriff 212, Engine 3, Medic 13 and EMS-1, echo response—cardiac arrest at 1334 Southwest 134th Court. CPR in progress with instructions being given. Time out, 1936."

This radio transmission will get the attention of even the most experienced EMS responder. CPR, airway, intubation, drugs, defibrillation—but wait a minute, we've got to get there first!

Does every response unit have immediate access to current, easy-to-use map books? Do crews know the entire service area well enough to be able to drive directly to what sounds like an obscure address in a suburban area? Are there enough hands to read the map book, drive the unit (safely), handle the radio and contemplate initial actions upon arrival at the scene? If you are responding on Engine 3 (fully staffed) or Medic 13, perhaps. If you are in the defibrillator-equipped patrol car or the EMS supervisor's vehicle, probably not. But each responder has to get there quickly and safely. And even in multi-person units, how long does it take to locate the right map book in the collection of battered map books in the console? Fortunately, technology can be of great assistance to emergency responders. Each incremental improvement in public-safety technology offers the promise of quicker, safer, more reliable emergency response.

21st Century EMS?

In Stanley Kubrick's movie classic, *2001: A Space Odyssey*, "HAL" is the evil computer that takes control of the spacecraft and threatens the safety of its crew. Fortunately, we're still far from computers taking complete control of our response vehicles, but they certainly are capable of doing some of our mundane tasks more quickly, easily and accurately than we humans can in our high-speed, multitasking emergency response environment.

There are a number of 21st-century computer applications being introduced in the public-safety market. One of the most exciting is MARVLIS (Mobile Area Routing and Vehicle Location Information System). MARVLIS integrates global positioning system (GPS) information, computer-aided dispatch (CAD) systems, pushbutton status reporting and a powerful computerized navigation engine in a system that shaves a significant amount of time from almost any emergency response.

MARVLIS is a suite of computerized tools that integrate with any CAD system to improve the performance of dispatchers, supervisors and system managers. Performance improvement is accomplished by making real-time incident information and accurate computerized maps available in the vehicle, and by placing sophisticated but easy-to-use tools at the dispatcher's console and on the desktops of supervisors and managers who try to plan and manage complex and ever-changing systems.

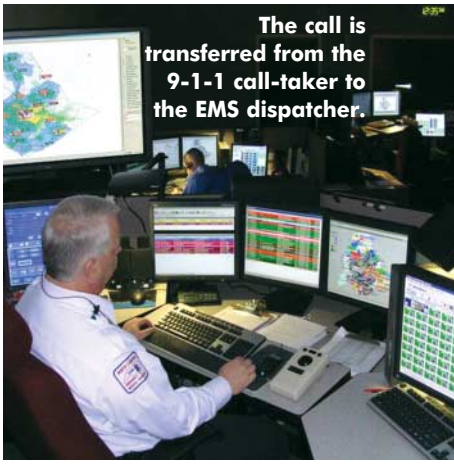

Each ambulance is then outfitted with the MARVLIS *client*.

MARVLIS was developed by Bradshaw Consulting Services (www.bcs-gis.com), of Aiken, SC. Bradshaw is an experienced public-safety vendor with numerous police, fire, EMS and military applications and installations under its belt.

How it Works

Using real-time data to enhance emergency response performance is not magic. It requires detailed planning (including lots of input from field personnel), reliable hardware and excellent software.

The basic MARVLIS involves several necessary components. The first is an *interface server*, which is a computer connected to the CAD system. It serves as the "brains" of MARVLIS. The server receives and records CAD information for each call, and transmits it to the appropriate ambulance vehicle. It then uses that information to generate routing recommendations and transmits those to the ambulance. It also receives status information from each ambulance, records it and passes it back to the CAD system.


The call is transferred from the 9-1-1 call-taker to the EMS dispatcher.

Each ambulance is then

Figure 1

outfitted with the MARVLIS *client*, which is a mobile computer connected to the server by a radio data connection. These are mounted in the unit and include a *GPS antenna* and a *radio modem*.

For those familiar with mobile data terminals of the past, this may sound somewhat familiar. This system, however, goes a step further and creates a conduit for communicating critical response data back and forth between the server and the client computers. The result: faster and improved response performance, and better service to the community.

Which Way Do They Go?

Back to the call being dispatched at the beginning of the article.

The call is transferred from the 9-1-1 call-taker to the EMS dispatcher. The dispatcher looks at the CAD screen and tries to identify by "eyeball" which unit is closest. Dispatch selects a unit at a nearby station, unaware that another unit, available but "on the road" (not at a station or post), is closer to the call. The unit at the station is dispatched instead of the closest available resource.

After getting to the unit, the crew identifies the correct map book, looks in the index and locates the address of the call. If it's on a main street, maybe no more help is needed. If it's not (maybe it's back in a subdivision somewhere), then the crew must backtrack, perhaps across several map pages, to their current location and then plan a route. The crew is probably unaware of the locations of road construction, heavy traffic or other impediments to quick response between their station or post and the location of the call.

Or how about this:

The call is transferred from the 9-1-1 call-taker to the EMS dispatcher. The dispatcher glances at the MARVLIS "candidate recommendations" box, where the unit that can reach the call fastest has been identified. MARVLIS has considered the location of every available unit, as well as traffic at this time of day, and has factored in any traffic obstructions that have been reported throughout the day. That water main break on C Street won't slow the unit going to this call. The dispatcher selects the unit that will have the fastest response time and dispatches the call.

After hearing the call, the crew glances at the MARVLIS computer in the cab of the ambulance. All of the CAD information is displayed on the screen. The "copilot" pushes the RESPONDING button (see *Figure 1*) to notify dispatch that they are rolling. In an instant, MARVLIS displays a recommended route of travel for the ambulance. Using the "follow me" mode, the computer adjusts the display so that the map is always aligned with the vehicle's direction of travel. The route takes into consideration the fact that traffic on eastbound Highway 26 is always at a standstill at this hour, and recommends an alternate route that will produce a faster response. The ambulance is also routed around that water main break.

The seconds or perhaps minutes needed to find the map book, open it to the correct page and figure out the best route to the call are eliminated.

Any experienced medic knows that the best route may involve different roads at different times of the day, due to rush-hour traffic patterns and varying traffic volumes. One of the available MARVLIS modules records the speeds of emergency vehicles as they travel along the roadways during various times of the day, and stores that information for later use. MARVLIS can profile and recommend routes based on actual travel experience, rather than on average speeds or posted speed limits, thereby selecting the most appropriate route for the time of day of a particular call. In other words, the software gets "smarter," constantly building on real-world experience in the community.

For the medics and first responders out there running calls, MARVLIS provides a variety of benefits. No more missing map pages, or pages so worn that street names can't be read. No more sitting in a traffic jam that could have been avoided if there had been a way to get the information before a call. And, no more waiting for the map to be read and the best route to be discerned before the vehicle is in gear and moving.

Quality Assurance, Driving and "He Said, She Said..."

One of every medic's nightmares involves getting called to the office to discuss a citizen's driving complaint. Supervisors hate these too, because there's normally no evidence. Supervisors want to support their people, and the public expects action of some sort. Unfortunately, in many cases, the result is that the medic is presumed wrong and gets a reprimand, which may not be deserved.

Not so in an agency that uses MARVLIS. In addition to providing routing data to ambulances, the MARVLIS server stores every GPS location and every status change in its database. Using familiar desktop PC controls, users can "play back" runs,

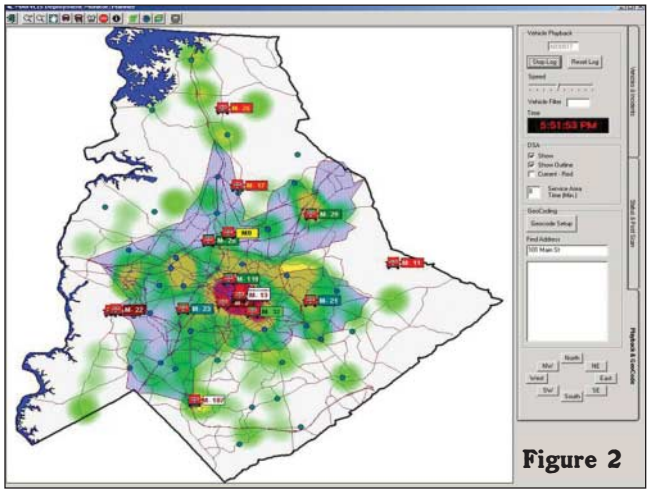


Figure 2


Figure 3

observing route, speed and vehicle status. This capability can be extremely useful to a supervisor who is called upon to answer inquiries about response performance, investigate driving concerns and provide feedback to field personnel. If necessary, the trip can be played back for a citizen, who can observe exactly what the ambulance was doing along its route.

At the Mecklenburg EMS Agency (MEDIC) in Charlotte, NC, this nightmare scenario actually occurred. A high-ranking city official reported that an ambulance went through an intersection against a red light without slowing, nearly hitting his car and continuing on its way. MEDIC supervisors were expected to investigate and take action. Bad news for that crew, right?

Not necessarily. Calling up MARVLIS, the investigating supervisor clicked to the date and time frame, and selected the ambulance that was involved. Playback of the data showed that the crew followed the organization's SOP to the letter. The ambulance's lights and sirens were operating as it approached the intersection. It slowed to an appropriate speed, moved into the opposing lane of traffic and crossed the intersection at a crawl—increasing speed only after clearing the intersection. Without a tool like MARVLIS, in many agencies the crew would have been presumed guilty, based on the credibility of the individual complaining. Instead, the facts prevailed and the crew was exonerated.

Deployment and Demand Planning

In most services that operate more than a few ambulances or other emergency response vehicles, someone is responsible for evaluating demands for service and planning station locations, post positions or district boundaries. Often, that individual has only pushpins or other difficult tools to work with.

The MARVLIS *Demand Monitor*, a tool for dispatch supervisors and system managers, provides graphic representations of call demand. By looking at demand on an hour-by-hour basis, deployment planners can develop an accurate and timely understanding of the need for service across the response area and make needed adjustments.

Deployment Planner is an off-line planning tool used to analyze call demand and coverage areas of stations or street-corner post locations. It can be used even in a service that does not have a CAD system, provided that call location information can be obtained and dumped into a geographic database. It automatically creates system status management plans based on historical demand patterns, and evaluates station or post coverage areas so that optimal facility or dynamic post locations can be identified and selected.

Deployment Monitor (see *Figure 2*) combines the features and outputs of Demand Monitor and Deployment Planner, and overlays the "striking distance" of each ambulance. Striking distance is the area that an ambulance can cover based on predetermined response performance standards (shown in blue in the photo). Expected demand pattern for the response area appears as well (shown in light green and yellow in the photo). This instant on-screen comparison enables an EMS dispatcher or supervisor to quickly identify areas where calls are likely to occur, but are not adequately covered by an ambulance that can respond within the established response time goal.

Gathering intelligence behind the scenes is the MARVLIS *Impedance Monitor* (see *Figure 3*). It records how long it takes ambulance vehicles to travel over each segment of the road network at any time of the day or night. This information is then automatically fed into the MARVLIS server, which uses sophisticated processing routines to identify "candidates" (closest response units in rank order) and plan routes based on the predicted travel speed of an emergency vehicle versus the route that a driver might select based on individual experience. These data, called impedance data, are also used to update Deployment Planner and Deployment Monitor, constantly improving the graphic representations of ambulance striking distance. This ensures a more accurate picture, rather than basing it on average or posted travel speeds.

The Result = Faster Response Times

MEDIC has been using MARVLIS since 2002. MEDIC implemented the system as part of a continued effort to lower response time and better utilize resources without increasing costs. So far, the result has been remarkable.

"The difference we've seen in system performance and employee satisfaction has been incredible," reports Joe Penner, executive director of MEDIC. He credits MARVLIS with reducing the service's average response time by 42 seconds per call. At first glance, that may not sound like much, but that represents a 10% across-the-board reduction. For a service running 83,000 calls per year, that means 51,000 response minutes saved. That's pretty impressive when you do the math. ■

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Jay Fitch, PhD, is the founder of the consulting firm Fitch & Associates (www.fitchassoc.com). For more than two decades, the firm has designed EMS systems and worked with a variety of public safety agencies to successfully improve effectiveness and efficiency. The company is pleased to count both MEDIC and Bradshaw Consulting Services among the clients it has served.

Photos appearing in this article are courtesy of MEDIC.

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