Firefighters fight back

Handheld GIS/GPS improves wildland fire-fighting crew efficiency and safety

By Michael Hoose, Fire Captain, Santa Barbara City Fire Department

Wildland fires are nothing new to the West, but recent years have seen some of the largest fires in memory. This past year, extreme fire behavior in California forced hundreds of thousands to flee their homes ahead of wind-driven wildfires, fueled by record dry weather that has made brush especially susceptible to fires. The most recent fires consumed over 500,000 acres, damaged or destroyed more than 3,000 structures, and were directly responsible for several fatalities. Overall, the 2007 fire season destroyed some 9,375,000 acres.

What's causing the surge? Growth thick from previous wet years, and a policy shift away from prescribed controlled burns to more aggressive fire suppression, may be creating an excess of brush, grasses, and trees as fuel. In addition in many areas, drought-stressed fuel beds have been infected with various insects further drying stands of timber. Decreasing prescribed burns due to perceived risks such as proximity to homes likely cause an increase in fire size and spread where available fuel has accumulated.

As more and more people move into "urban–interface" areas, where homes are close to trees, brush, or both, the

Michael Hoose with the MobileMapper CE at the Tinta Creek blow-up, August 22, 2007. [Photo credit: Rich Ames, Fire Engineer, Santa Barbara City Fire Department]

threat to life and structures has increased. Roads and utility infrastructure in these areas often leave much to be desired. Still, the public expects, often unrealistically, fire-fighting personnel to protect these areas. In response, pre-incident planning has been expanded in scope, and new GIS techniques have been adopted to improve fire crew safety and provide a wide spectrum of pre-incident planning options.

Zaca Two fire. [Photo credit: Michael Hoose]

Mobile GIS/GPS

Using the newest handheld GIS/GPS units, trained fire personnel can conduct effective pre-incident planning in even the most inaccessible potential fire areas. They can capture data to create maps for distribution to local officials or, in the event of an incident, to incoming Strike Team Leaders, including initial attack engines or structure protection resources, or Incident Management Teams tasked with managing complex fires.

In addition, handheld GIS/GPS devices are being used on the fire lines. They help firefighters locate access and egress points and water sources, understand difficult topography, and solve other fire-related problems.

Previously, firefighters would spread paper topographic maps out on the hood of the nearest engine. Crew Bosses, Division Supervisors, Field Observers, and others would pencil in changes to the location of the fire line, structures lost or damaged, proposed dozer lines, and hand lines—all based on memory or observation.

Data entered with different color pens, and proliferating arrows and notations, would create confusion. Later, someone would have to manually digitize the data to map sets back at the command post—a time-consuming process for Incident Commanders responsible for making quick and accurate decisions that, necessarily, are sometimes based on data from maps in front of them.

While the success rate was good, the introduction of mobile GIS/GPS devices, such as the Magellan MobileMapper CE, enables a vastly more efficient, accurate, and time-saving method.

With GIS/GPS, multiple data sets are placed as layers on maps and then validated in the field. Line firefighters thus capitalize on the portability of data-rich maps to make the best decisions possible.

Each change is time stamped, and accurate symbology can easily be displayed or changed without erasures and damage to paper maps. Because the data are in a GIS-ready format, maps are quickly produced to provide Incident Commanders with the latest intelligence from the field in a standard, familiar format.

Real-time data can be sent via digital radio or cellular phone. Additionally, with commercially available programs, such as ESRI's ArcPad (used with the Fire Mobile Mapper applet), structure triage pre-plans and pre-incident planning strategies (locations of safety zones, helispots, drop point locations, or staging areas) are readily available.

As these applications become more user-friendly and easier to learn, mobile GIS/GPS is providing firefighters on the front lines and at the Incident Command Post with highly accurate data in a GIS-ready platform.

With the ability to add existing data (such as an uncontrolled fire line or fire perimeter), dozer line locations, as well as sensitive areas such as archeological sites to topographical or aerial maps displayed on a MobileMapper CE, fire personnel can pinpoint locations in relation to the data and confirm or improve the maps already produced.

Radio communications can immediately provide nearby crews with updates. Situational awareness and firefighter safety is improved.

The Zaca Two Fire

July 2007 saw one of California's largest fires ever—the Zaca Two fire in Santa Barbara County. The fire consumed 240,207 acres of brush and conifers over 61 days. It was first reported on July 4th and only declared completely contained by Labor Day, though fire personnel remained on the fire line for many more weeks to rehabilitate impacted areas.

[Photo credit: Michael House]

Fueled by winds, low humidity, a significant fuel bed and steep topography, the fire burned areas that had little known fire history. Ground forces supported by fixed-wing and rotary aircraft dropped water and retardant in attempts to create lines to hold the fire. Highly trained "Hot Shot" crews set back-fires to protect endangered areas. All of these actions were reflected in maps produced at the Incident Command Post by the Situation Unit's GISS (Geographic Information System Specialist).

Currently, most fire personnel carry recreational handheld consumer GPS devices. And while these units are very helpful and cost efficient (such that they can be purchased by firefighters themselves), the data are not "GIS accurate" and must be imported into a GIS format by an aftermarket utility.

At the Zaca Two fire, while on a 14-day assignment as a Field Observer, I was outfitted with a Magellan MobileMapper CE, a sub-meter-accurate GPS handheld receiver built to withstand the extremes that come with the wildland fire territory—difficult terrain, heat, fine dust from smoke and ash, and bumpy rides in the cab of a fire engine.

The MobileMapper CE touch-screen display is large and can use the same map data found in the daily IAP (Incident Action Plan) map packet. This is especially advantageous when the fire is large and the user would have to thumb through 20-25 different pages to get the information.

While assigned on the Zaca Two fire, I received data from the GIS unit and placed it on my MobileMapper CE SD card. The GPS was activated and I compared fire line and dozer line data with Incident Action Plan maps. In some instances, dozer lines were found to be incorrectly placed, and changes were made. In the case of land ownership, correct placement is crucial for rehabilitation needs, as well as for cost apportionment for any action taken.

On another assignment, our "Task-Force" was to prepare a structure protection plan for an organic apple orchard and surrounding residential buildings. Structures not found on the map but considered to be of cultural and historic significance were assigned resources to assure their protection, and incomplete road systems and structure locations were updated. The final output were hard copy maps which were given to the Division Supervisor for review and then distributed to incoming engine companies assigned to the "apple farm structure protection group."

The ease of using the MobileMapper CE with ArcPad made it possible to create a map set in four hours. While there is a learning curve for any GIS-based software application, using the Magellan MobileMapper CE during pre-incident planning goes a long way in reducing that curve.

When fires occur, whether small or large, simple or complex, mobile GIS/GPS technology dramatically improves wildfire firefighters' margin of safety and our efficiency.

This new technology helps firefighters view unfamiliar terrain in a familiar format, especially when working in terrain they've never seen in daylight, and in darkness. And as mobile GIS becomes the standard, the technology will likely find a very useful place in the firefighters' armory for fighting and preventing serious fires with readily available, fairly accurate field data.