

INITIAL ATTACK GIS WHITE PAPER

Jim Kniss, Ventura County Fire Department, GIS Analyst
Lyle Kogler, Los Angeles County Fire Department, Forester

PAPER ABSTRACT

Southern California is a unique wildland fire environment. The term "Initial Attack" describes the resources that respond to the first phases of a wildland fire incident. Rapidly spreading wildfires often do most of their total damage in the first few hours. The Incident Commander (IC) makes critical decisions about the allocation of resources and incident strategy and tactics based on his awareness or understanding of the situation. GIS can provide the IC with additional situational awareness by collecting and displaying timely and relevant spatial information. The Initial Attack GIS concept was originally coined by Ventura County Fire Department. Recently, both Los Angeles County and Kern County Fire Departments have felt the need to implement Initial Attack GIS. The 2002 and 2003 fire seasons gave Southern California Fire Departments plenty of opportunities to prove the usefulness of having GIS Technical Specialists responding as an Initial Attack resource to wildfires.

INTRODUCTION

Southern California is a unique wildland fire environment because of its Mediterranean climate, highly combustible brush, frequency of interface zones, and complexity of its terrain. The term "Initial Attack" describes the resources that respond to the first phases of a wildland fire incident. Initial Attack engines, bulldozers, helicopters, hand crews, and overhead are dispatched to commonly chaotic and fast moving events. Rapidly spreading wildland fires often do most of their total damage in the first few hours. The Incident Commander (IC) makes critical decisions about the allocation of resources and incident strategy and tactics based on his awareness or understanding of the situation. Geographic Information Systems (GIS) can provide the IC with additional situational awareness by collecting and displaying timely and relevant information about topography, fuels, political boundaries, resource locations, fire perimeter, and assets at risk.

Initial Attack GIS is a new term that has been introduced to the fire service within the past few years. The Initial Attack GIS concept was originally coined by Ventura County Fire Department several years ago by Jim Kniss, GIS Analyst. Since then, this concept has gained acceptance and popularity amongst neighboring fire agencies in Southern California. Recently, both Los Angeles County and Kern County Fire Departments have felt the need to implement Initial Attack GIS. The 2002 and 2003 fire season gave the County of Los Angeles Fire Department (LACFD) plenty of opportunities to prove the usefulness of having GIS Technical Specialists respond initially to the first stages of a wildfire. During the 2002 and 2003 fire season, the LACFD GIS teams responded as an initial attack resource to more than 30 wildland fires and extended attack to a dozen more.

How it all Began

- 1996 Grand Fire - First incident that electronic mapping was used on in Ventura County
No Portable Equipment.
First maps were created by gathering GPS points via helicopter then using a non-GIS mapping program produced a clear overlay. These overlays were then placed over a topographic map and traced onto the existing mapping product.

- 1997 First Initial Attack mapping vehicle (Map 1) in use.
1995 Chevrolet Blazer.
All mapping was done in the outside elements.
486 Laptop computer.
ArcView 2.8.
Ventura County computer aided mapping vector files converted to ArcView shape files.
Trimble ScoutMaster GPS used as handheld GPS of choice. 300' plus/minus error
SureMap! Digital topographic maps used as backdrop. 150 DPI
HP 340 portable printer used, No large format printer available on scene

- 1998 Development of incident mapping tool "PFE Tools" set for ArcView 3.0 begins.

- 1999 12 passenger van purchased to replace 1995 blazer
Interior designed, built and installed, Items include
"L" shaped work space used with two bench seats from original van configuration

12 hour stand alone battery .

shore power.

Power inverter.

VCFPD department radio with companion hand held device.

HP 450 plotter.

Small printer.

2000 GPS selective availability turned off by United States Government. GPS accuracy improves to 15' to 30'.

Incident mapping application matures into current "Ventura Tools" product. Modified to perform across the United States as well as in California.

HP 750 plotter Installed in MAP 1.

2001 Custom configured Notebook computers used for incident response. Best Available Cell phone installed in rear of Map 1.

FAX/Printer/Copier replaces small printer.

Internet can be accessed through cell phone.

VCFPD mapping unit added to all second alarm brush responses in Ventura County.

Initial Action Map (IAP) must be completed within 45 minutes of arriving on scene.

1995 – Present

At the same time that the hardware needs were being defined the FIRESCOPE GIS advisory group (firescope.oes.ca.gov) was developing operational standards and a training program for incident mapping GIS professionals. These dedicated volunteers have now trained over 400 incident mapping GIS technicians across the United States.

HOW IT'S DONE...

The goal of the LACFD GIS teams is to produce a working incident map within 45 minutes of arrival. Within the first hour of a wildfire, having a map with the current fire perimeter can prove to be invaluable to the IC and the initial attack resources. A map of the fire helps in providing for firefighter safety by giving the firefighters a visual tool and something to reference when determining expected fire behavior and identifying safety zones. It also aids in informing firefighters of important geographic features that may delineate Division breaks that display where firefighting resources are assigned.

You may be asking yourself, how do you obtain the fire's perimeter when the fire is still raging out of control? There are several ways of doing this. Walking the fireline with a GPS unit is, most of the time, out of the question due to the danger. Therefore, there are only a couple of ways to get this information in a timely manner. One way is to get into a helicopter with a GPS and fly it or hand map from the air at a safe distance. This option, although not feasible most of the time, is preferred. Within the initial stages of a wildland fire, helicopters are usually busy dropping water. Since dropping water is more critical during the Initial attack stage of a fire, using one to fly a perimeter with a GPS is often unlikely. LACFD has bulldozers equipped with a built-in GPS system made by TRUCKBASE (Edmonton, Canada). The GPS data recorded on the GPS receivers in these bulldozers have a removable PC Type II card that can be processed using the TRUCKBASE software and can be exported to ESRI shapefiles. This system has proven to be extremely valuable because it takes the guessing out of where a bulldozer line exists.

However, most of the time this data only makes up parts of the fireline. The rest of the fire then has to be mapped by some other method. Mapping by hand or heads-up digitizing from a good vantage point allows the GIS technical specialist to map the fire and see the surrounding terrain. Although this option is not the most accurate or desirable, it is still the safest, most effective, and fastest way for getting a decent map into the hands of firefighting resources within a timely manner. Heads-up digitizing is usually one of the only options within the first few hours of an out-of-control fire. ArcPad installed on a PDA is a perfect tool that can assist in completing this task. Using Arcpad, a GIS Technical Specialist can directly digitize the fire perimeter. Once the fire perimeter is digitized and brought into Arcview 3.x the GIS Technical Specialist can then use the Ventura tools extension, developed by Ventura County Fire Department, to place the appropriate fire symbologies and line types on the map and calculate acreages and distances. This map is then printed at the incident, in the field, and handed out to firefighting resources as they arrive.

Another critical task of the Initial Attack GIS team is to answer the question: Is the fire near or on SRA or Federal Lands? State Responsibility Areas (SRA) are areas within the State of California that

the California Department of Forestry and Fire Protection (CDF) has primary responsibility for wildland fire and natural resource protection. Wildland fires in SRA lands can trigger the dispatching of initial attack CDF resources and equipment through contract agreements between the State of California and local fire agencies. These types of agreements have been established between Federal agencies and local fire agencies. Often, GIS Technical Specialists can determine if the fire is on or near SRA or Federal lands while en route to the wildfire incident by obtaining a latitude and longitude of the fires general vicinity and then bringing in the SRA or Federal jurisdiction layer to determine its proximity.

With the use of current aerial photographs as a base layer, the GIS Technical Specialists can display structures, roads, and fuel breaks that are near the fire. This information can be critical to firefighters that are not familiar with the area. Aerial photographs give firefighters an aerial view of the terrain without having to get into an aircraft. This information can be extremely useful to determine structures that are threatened or areas (i.e.: roads and fuel breaks) that can assist in control of the fire. Having layers that show vegetation, or fuels (vegetation classified by fire behavior attributes) as firefighters call it, can be displayed with a fires perimeter to help firefighters analyze and determine where they could expect different types of fire behavior. Using Digital Elevation Models (DEMs) helps show firefighters slopes and aspects that can affect the fires behavior as well. Many times this type of information will alert firefighters of areas that they need to be concerned with or be aware of. Fuels, slopes, and aspects are some of the most critical factors that can influence a wildfire. Being able to display this information as a base layer, such as a topographic map or an aerial photograph, within the initial attack stages of a fire can assist firefighters by allowing them to see what's over that next ridge or areas that they are not able to see.

WHAT IT TAKES...

Perhaps the most important factor for an Initial Attack GIS operation to work is the individual GIS Technical Specialists experience. A GIS user can have all the best equipment in the world and the fastest and best computers. But none of this equipment means anything unless there is a well-trained and highly skilled GIS user to operate it. For the LACFD GIS Teams, the training started with FIRESCOPE's GIS Technical Specialist training. It is during this training that GIS users learn to adapt GIS to the firefighting world. The Ventura Tools are among many extensions that must be mastered in order to produce a map product under severe time crunches. This training helps the GIS Technical Specialist perform GIS on fires and other all risk incidents requiring a spatial component. Most GIS Technical Specialists are called in after the initial attack phases of a fire when time frames to produce a map are considerably more. Responding to a fire as an Initial Attack GIS Technical Specialist is a

completely different environment. Time is of the essence. It is critical to produce a map product within an extremely short amount of time. This includes troubleshooting and other problems that can occur along the way. Not only does the GIS Technical Specialist have to adapt and overcome software and hardware issues, but also deal the extreme dynamics and elements of a raging brushfire. Currently there is no official training offered to GIS users in the techniques and procedures of Initial Attack GIS.

Therefore, most experience and knowledge are gained from actually performing GIS in an Initial Attack situation. LACFD holds trainings periodically to drill its GIS Teams in producing various map products under pressure. These GIS teams are made up of two technical specialists, that are on a one week rotation and ready to respond to any emergency 24 hours a day. These team members are GIS users from the Forestry Division and Information Management Division within the County of Los Angeles Fire Department

OVERCOMING THE ELEMENTS...

One of the biggest challenges in making Initial Attack GIS work is to make it mobile and rugged. Most Initial Attack GIS assignments are in the roughest conditions. Los Angeles County Fire Department has constructed kits that enable the GIS Teams to take GIS equipment out of the office and into the wildfire environment. With the use of power inverters, powerful laptop computers, and various portable devices packed into ruggedized cases, the GIS Technical Specialists can turn any vehicle into a mobile GIS unit. Every piece of equipment is protected in a padded case that can withstand the brutal conditions of driving dirt roads and being exposed to smoke, ash, and dust. LA County Fire Department helped design a custom made plotter box for the HP 1055 enabling the GIS Technical Specialists to print large maps. Special water and tear proof paper is used for the maps that are sent out with the firefighters into the field. Both Ventura and Kern County Fire Departments have converted passenger vans into mobile GIS units, allowing them to respond to emergencies as an initial attack resource. Although a designated Mobile GIS unit is preferred, it is not necessary to start an Initial Attack GIS program.

WHAT THE FUTURE HOLDS FOR INITIAL ATTACK GIS...

Initial Attack GIS is here to stay. The beauty of GIS is that various types of information can be displayed with a fire's perimeter. This spatial information is becoming more accurate and available. As the need grows to have this information as quickly as possible on a fire, there will always be a use for an Initial Attack GIS response.

The County of Los Angeles Fire Department has responded to the need for more accurate spatial information by developing an Infra Red (IR) Camera/Mapping system that is compatible with GIS. The system incorporates the Aeronavitraker "moving map" software from Navitrak International Inc. (Halifax, Canada) with a sub meter differential GPS unit that is linked to a Wescam (Van Nuys, California) 16DS camera in a Bell 206 helicopter. This new platform enables IR camera operators to map fire perimeters through the camera's ground intercept point (GRIP) as opposed to aircraft position when flying directly over the fireline. This allows the IR camera operator to accurately map the fireline through smoke and allows the aircraft to operate at a safe distance from the fire and other firefighting aircraft. The Aeronavitraker software allows the operator to save and export the fireline as an ESRI shape file. This system will be first utilized in the 2003 fire season providing GIS Technical Specialist with real time, reliable, and accurate fireline data.

GIS, with its ability to display various spatial data, is merely another tool that can assist firefighters in making more informed decisions. However, not only wildfires are in need of spatial information in an extremely short amount of time. Initial Attack GIS can be applied to almost any all-risk incident, such as Search and Rescues, floods, or earthquakes. Spatial data on incidents like these can help provide rescuers with vital information that would aid in the rescue efforts.

More and more technology is entering the fire service and helping support emergency personnel in making decisions. New technologies, such as GIS, are only going to become more integrated into emergency and fire services. As this relatively new element of fire fighting gains acceptance, it will not only help fire fighters make critical decisions, but also assist in saving lives and property.