

SOUTH CAROLINA FORESTRY COMMISSION'S COMPUTER AIDED FOREST FIRE DISPATCH SYSTEM

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ABSTRACT

In 1993, the South Carolina Forestry Commission began the progression from a statewide network of fire towers to 3 regional dispatch centers. This was made possible through the use of airplanes, a statewide radio network and a Computer Aided Dispatch System (CADS) for forest fire detection and dispatching. CADS was implemented in 1997 and consists of data entry screens, a replicating database between dispatch centers, and mapping of data with the aid of a Geographic Information System (GIS). Future enhancements to the system include greater integration with current GIS capabilities, displaying aerial photography, utilizing satellite technology for fire detection, adding automated vehicle location technology, internet access, and a more intuitive user interface.

INTRODUCTION

The South Carolina Forestry Commission was created on April 26, 1927 with a mission to: "Provide for the protection of the forests in South Carolina...take such action and afford such organized means as may be necessary to prevent, control and extinguish fires..." One of the key elements of State's fire protection plan was detection, and fire towers would play a major role.

The Tuxberry Lumber Co. established the first fire tower on private lands in Berkeley County in 1928. It was a 100' wooden tower. Unfortunately, as an example of how rampant wildfires were then, it was destroyed in a woods fire shortly thereafter. In 1929 the West Virginia Pulp & Paper Co. financed the first steel tower in South Carolina on lands near Summerville.

The first Forestry Commission fire tower was erected in August 1930 near Camden. It was a 100' steel tower, apparently purchased as a kit and assembled on site by the Kershaw County Forestry Association. The cost of the tower itself was \$1,072; freight and labor ran the total expenditure to \$1,639. A full-time tower operator was hired on January 1, 1931. His wages were "not to exceed \$2.00 per day or \$50.00 per month." While the very first tower was steel construction, many of the early South Carolina towers were built from wooden beams. The beams were joined with steel plates and bolts, and heavy cable guy wires provided additional support. Eventually, all wooden towers were replaced by steel structures.

South Carolina towers ranged from about 20' tall (atop Sassafras Mountain in Pickens County) to 120' tall. The taller towers were generally in the flatlands of the Coastal Plain. Most tower sites consisted of 10 acres of land, the tower, and a year-round dwelling for the operator. The size of the property allowed tower operators to grow their own vegetables and feed for their domestic livestock. In the early days, most tower families had a milk cow, chickens, and raised a few hogs for their own use.

The tower operator's hours in the tower cab depended on the fire danger. If it was raining, they didn't go up at all; if danger was low, they might make a short check in the morning and afternoon; when danger was high, they might spend as much as ten hours per day in the cab. Towers were not routinely manned at night. During moderate to high danger, operators were required to make a "night check", climbing the tower after dark to check for glows.

Towers were the public's fire reporting contact point, and served as the communications link for firefighters in the field. Beginning around 1930, the Forestry Commission started building a network of telephone lines to link its fire towers with its firefighters. Agency personnel cleared rights-of-way, cut poles, strung wire, and maintained the lines. When a smoke was spotted, each of two towers would record its direction using a large compass table and a sighting device called an alidade. The fire was located at the spot where these readings crossed when plotted on a map. The tower operators would dispatch the firefighter by telephone. Some firefighters were even equipped to climb the poles, tap on to the lines, and make reports back from the field.

At its peak, this telephone system consisted of more than 2,000 miles of telephone line. This may have been the very first telephone service to rural SC; it was certainly the first to much of the state. When Forestry Commission changed from telephone dispatch to radio in the early 1950's, local phone companies and co-ops purchased many of the lines. By 1956, a basic radio plan was completed which provided two-way radios for all towers, district offices, rangers, fire wardens and portable units for aircraft.

In 1950, the Forestry Commission tested the use of aircraft in Forest Fire Protection. The test proved that aircraft could not only supplement fire towers in fire detection, but identify what was burning, provide a better location of the wildfire, provide an appraisal of suppressing needs, provide directions to crews on how to best reach the wildfire, identify dangers and patrol for breakovers. Aircraft was added as a full time forest fire protection tool in 1952, and by 1993 it was a primary means of fire detection in the state.

By 1950, there were 157 fire tower in South Carolina. The Forestry Commission owned 133, three were privately owned but operated by the Forestry Commission, and 21 operated by the US Forest Service. Over the next 40 years, this number began to dwindle as towers were phased out due to increasing population in the rural areas of South Carolina, implementation of County 911 systems, and aerial detection.

On October 1, 1993, the Forestry Commission closed the remaining fire towers and implemented 14 Area Dispatch Centers and one statewide nighttime Dispatch Center. A statewide network of 22 radio repeaters replaced the 120 fire towers for communications. Toll-

free phone numbers were established to each Area Dispatch Center. Calls to these numbers were then forward to the nighttime Dispatch Center. Each center operated by paper forms and paper maps. Contract and Forestry Commission aircraft provided statewide aerial detection coverage on days of wildfire potential.

In October of 1994, the Forestry Commission began making plans to move from 15 Dispatch Centers to 3 Regional Dispatch Centers. A \$1.5 million matching grant from the FEMA Hazard Mitigation Program helped to fund the migration. A dedicated T1 phone line to provide statewide repeater access and a wide area computer network would link each Regional Dispatch Center and the Forestry Commission's Headquarters. Computer data would be replicated to each site every 10 seconds so each would have a current picture of activity around the state. This would also allow any center to take over for another should that become necessary.

Other features of each Regional Dispatch Center include:

- ?? Five dispatching consoles
- ?? Eight incoming phone lines
- ?? Orbacom radio consoles providing statewide repeaters access
- ?? Intercom capability between centers
- ?? Phone and repeater patching
- ?? Dual monitor CADS workstations
- ?? Data entry
- ?? Mapping
- ?? Alphanumeric Paging

A statewide toll-free fire reporting number (1-800-777-FIRE) was established to provide 24 x 7 phone access for burning notifications and wildfire reporting. Calls are automatically routed to the appropriate Regional Dispatch Center and automatically routed to the nighttime Dispatch Center from 9 PM to 7 AM. A radio link or dedicated phone line links a statewide radio communication network of 24 repeaters to each Regional Dispatch Center. A wide area network allows any Regional Dispatch Center to cover the entire state. Should the wide area network fail, each center can operate their region independently.

The Computer Aided Dispatch System (CADS) consists of Dell 400MHz Pentium II workstations with dual monitors running Windows NT 4.0. These are connected to Dell PowerEdge 2300 Servers running Windows NT 4.0. The CADS software was custom developed using PowerBuilder for the data entry screens which link to an Oracle database. Oracle handles the replication of data between the various sites. A custom developed interface using MapInfo Professional provides the mapping/GIS side of the CADS application.

The CADS application consists of modules for taking burning notifications, dispatching resources and administrative functions. All burning notifications and emergency dispatches are plotted in the MapInfo Professional mapping/GIS interface of CADS. A Map Refresh button updates this information from the Oracle database.

The MapInfo Professional interface uses StreetPro Display (GDT Dynamap 2000 data enhanced for MapInfo Professional) for the various transportation layers, landmarks, political boundaries, water features, etc. MapMarker is utilized to locate a caller's address to a latitude and longitude position. The Forestry Commission has the ability to include large ownership information (i.e. National Forests, forest industry) in this mapping interface that it obtains through cooperative agreements from other sources. Additional GIS data, such as landmarks and fire stations, is collected and maintained by the Forestry Commission to aid in locating notifications and wildfires, and dispatching resources

In an average year, the three Regional Dispatch Centers will take 60,000 burning notifications (which include smoke management burns and SC Department of Health and Environmental Control regulated burns); 6,000 forest wildfire dispatches; and 20,000 non-emergency dispatches.

The S.C. Legislature enacted a statewide law in 1969 that required the Forestry Commission to be notified of an individual's intent to burn adjacent to woodlands. Prior to 1969, 34 of the 46 counties in South Carolina required some form of notification or permit. By 1990, the Forestry Commission was receiving over 150,000 burning notifications per year through its fire tower system. With the establishment of toll-free numbers and the Area Dispatch Centers, this number continued to increase dramatically. It wasn't unusual for some Area Dispatch Centers to be flooded with many hundreds of notification calls on Saturdays in the fall and spring. A creative solution was needed if only three Regional Dispatch Centers were to handle this volume of calls.

A voice mail system was established to automate the taking of backyard debris type burning notification. A Modular Voice Processor (MVP) from Glenayre was installed to handle these calls. A toll-free number was established for each county that was routed to the MVP over a T1 trunk phone line. This allows the system to handle 24 calls simultaneously. The system would provide the caller with a consistent fire message for the day based on current fire danger. The message could be customized for each county and provides the ability to have call forward to a Regional Dispatch Center. To satisfy the notification law, the caller would then leave his name, location of the burn and phone number. The system would provide the caller with a notification number. Currently this system is taking over 300,000 calls per year.

There are a number of areas that the Forestry Commission would like to see the Computer Aided Dispatch System enhanced in the future. These include:

- ?? Satellite Detection of Wildfires
 - ??USGS Hazard Support System
 - ??52 Systems integrated to detect wildfires
 - ??Weather satellites
 - ??Ballistic missile detection satellites
 - ??Lightning detection satellites
 - ??Provide latitude, longitude and probability down to 1/4 acre in size within 5 minutes
- ?? New Data Entry Interface (possibly using Visual Basic)
- ?? Improved Mapping Capabilities
 - ?? 911 Street and Address Data

- ?? Real-time refreshing
- ?? Automate Smoke Management Compliance
- ?? Vehicle and Aircraft Routing/Tracking
- ?? Internet Access of Data
 - ?? Oracle 8i
 - ?? Mapping enabled
- ?? Automated Vehicle Location (AVL)
- ?? Location or contact name/phone (cell phone location technology)
- ?? Satellite Imagery for Fuel Mapping
- ?? Smoke Modeling
- ?? Data Terminals in Units or PDA for Firefighters
 - ?? Transmit aerial photo of fire
 - ?? Directions or maps
 - ?? Reporting