The FIRESCOPE geo-referencing locator grid incorporates the simplicity of Public Lands Survey or the Thomas Brothers System, the precision and digital capacity of a true geographic coordinate system and the universal application of a UTM or "Texas Numbering" grid system. Based on normal longitude and latitude values, GEOLCC provides positive identification of a unique geographic unit (grid cell) in which a specific point (fire incident) lies.

Paramount to the FIRESCOPE program is that the GEOLOC system is easy to use, both at the local city or county response level and is fully applicable to a large locator system for regionwide use. GEOLOC fulfills all the FIRESCOPE program design intentions by being consistent, standardized, digitally capable, and applicable to not only the FIRESCOPE Region, but also to the State of California and entire United States. Cartographers have long dealt with the dilemma of applying a large locator scheme over both a large and small area -- GEOLCC solves this problem. The advantages of the GEOLOC system over other coordinate systems is listed in Figure 14.

The GEOLOC system will receive its greatest use as a locator system at all levels of emergency response in the FIRESCOPE area and eventually, the entire State of California. In multiagency incidents and in mutual aid situations, the common GEOLOC system, in conjunction with common map products, will increase the efficiency of communication and reduce response time.

3.5.3 FIRESCOPE Communications

Planning and responding to major multijurisdictional incidents requires use of a common communications plan among all participating agencies. This plan is necessary to link the tactical and support units of the responding agencies and to maintain communications discipline, especially in the use of radio. The task of bringing order to its communications process was assigned to the Communications Specialist Group, as part of the FIRESCOPE decision process. Communication officers from each agency were charged with the responsibility of designing systems and procedures, using "state-of-the-art" equipment, that would improve multiagency communications. They not only accomplished their task but further demonstrated the underlying concept of FIRESCOPE -- that technical specialists from various agencies could work together for mutual benefit. Meeting about 1 day a month, these specialists planned agency radio purchases, standardized communications vehicles, agreed on "clear text" or "plain language" for all radio messages, developed an Incident Radio Communications Plan matrix for frequency sharing during major incidents, and implemented a plan to use mobile synthesizer radios, capable of transceiving up to 9600 frequencies. All of this planning and resource data was entered into FIRESCOPE's resource data base.

FIGURE 14

GEOLOC SYSTEM ADVANTAGES

- Can be directly applied to all other grid systems based on known coordinates.
- Can locate within .15 square mile (approx. 100 acres).
- Most maps are already in this format.
- Mapped and maintained by all Federal and State agencies and private companies. (Integral to the National Mapping Program.)
- Complete application for anywhere in the world.
- Computer application easy for computer conversion -- pure mathematics.
- The geo-referencing system can be broken into parts to correspond with the need or level of application. For example:

  -- Fire smoke jump area
  -- Structure response in urban area
  -- Actually a customized grid with integrity at a county level.

- Non-confusion over meridians.
- Has measurable accuracy – adjustments easily made, e.g., 1983 NA Datum adjustment.
- Easy to remember – maximum usage would require 7 alphanumeric to locate to .15 square mile in North America.
- The base format is already generally well-known 7.5 minute quadrangles.
- Easy to locate a small place in a large area.
- Easy to construct a usable atlas with sequential numbers.

3.5.3.1 Radio Networks and Frequencies

Radio networks for large incidents normally are organized as follows:

- Command Nets link incident command, key staff, section chiefs, division and group supervisors
- Tactical Nets take several forms. They may be established around agencies, departments, geographical areas, or specific functions. How Tactical Nets are set up is a joint planning/operations functional decision
- Support Nets are established primarily to handle changes in resources status, requests for support, and certain other nontactical or command functions
- Ground to Air Nets are designated frequencies for that purpose. Regular Tactical Nets may be used to coordinate ground to air traffic
- Air to Air Nets normally are predesignated and assigned for use at an incident.

EXAMPLE:

Radio frequencies used by the State of California Department of Forestry (CDF) are licensed by the Federal Communications Commission under Call Sign KA3134. With some exceptions, CDF is licensed to use them "in California and Vicinity." FIRESCOPE partner agencies, subject to the same exceptions, may use these frequencies on "CDF Partner Agency Fires" with permission of the CDF Command Center responsible for the fire.

The following remote weather stations are operational and transmit data directly to the National Weather Service.

Lake Casitas - Los Padres N.F.
Temescal - Los Padres N.F.
Warner Springs - Angeles N.F.
Chailo - Angeles N.F.
Mill Creek - Angeles N.F.
San Dimas - Angeles N.F.
Yucaipa - San Bernardino Co.
Hesperia - San Bernardino Co.
Anza - Riverside Co.
Juniper Flats - Riverside Co.
Rancheta - San Diego Co.
Valley Center - San Diego Co.
Potero - San Diego Co.

3.5.3.2 Communications Hardware

A wide range of communications vehicles and hardware are utilized to facilitate communications at any type of major disaster -- fire, flood, earthquake, etc. "Caches" of personal-portable radios of 20-40 units each are transported to disaster areas, with or without communications vehicles, to provide dispersed communications capabilities. Infrared telemetry systems also are transportable and utilized on major wildland fires to communicate fire perimeter spread and hot spot information through clouds and/or smoke and at night. Needed hardware is available through responding local and county agencies, the California Office of Emergency Services, California Department of Forestry and the U.S. Forest Service.

3.5.4 FIRESCOPE Meteorology Program

Meteorological data on a real time and forecasting basis is crucial to command decisions in response to and control of single and multijurisdictional incidents. Wind speed and direction, for example, can have a devastating impact on command decisions and tactics to control fire spread or hazardous material incidents. FIRESCOPE's meteorological strategy called for the procurement and installation of remote automatic weather stations at about 30 locations. These stations would monitor and report meteorological data via an associated transmitter to the Geostationary Operational Environmental Satellite (GOES). GOES transmits the digital data to a central earth station where it is sent via convential telephone lines to a computer in the National Weather Service Offices, reprocessed, and displayed for use.

This GOES data is used with other regional weather information collected through the facilities of the National Weather Service. A meteorologist at the OCC uses the collected data to prepare fire weather forecasts and to assist user agencies in fire modeling activities. (See 3.5.4.1, below.) By 1981, FIRESCOPE acquired their first set of automatic stations with microprocessor capabilities to arithmetically average wind speed and direction for more applicable estimates of these factors for sophisticated fire behavior models. A computer software program was developed which converts GOES data from a hexidecimal format to integers. This system was given to National WX Service for their personal support to the MACS/GHQ operations. They attend in Mode 4.

3.5.4.1 FIRESCOPE Firemodeling (FIREMOD)

Firemodeling is a method of predicting forward and lateral fire spread. A computerized firemodeling program named "FIREMOD" was created to provide fast and accurate firespread prediction. As with any computer modeling program, data values and definition are critical to the degree to which the model predicts reality. For FIREMOD, data needed to produce a "Firespread Prediction" include:

- Fuel Type. This is fuel actually carrying the fire and includes annual grasses, chamise, and brush (mostly chaparral).

- Slope of Topography. This initially is determined by establishing the approximate point of origin on a topographical map located in the OCC and using a U.S.G.S. land, area and slope indicator. Other criteria such as uphill and downhill slopes also are considered.

- Fuel Age. Fuel age is determined from fire history maps located in the OCC. Grasses, being annuals, always are entered as one year old. Many types of brush and chamise may burn similar to grass and, therefore, may require different predictions for the model data input.

- Fine Fuel Moisture and Wind Speed. This data is obtained twice daily from the National Weather Service and the remote, automated weather stations in the FIRESCOPE region.

- Month and Day. FIREMOD recognizes changes in warming and drying conditions as the fire season progresses and which are reflected in the firespread estimation.

As resources are applied to control the fire, additional data such as fire line intensity (BTU/SEC/FT), flame lengths (FT), and perimeter measurements (Length and Width in FT) are included in the prediction formula. Figure 15. illustrates actual vs. FIREMOD projection of firespread for the 1976 Coyote Fire in San Bernardino County.

3.5.5 FIRESCOPE Training and Certification Program

The FIRESCOPE training and certification program provides the training aids and support necessary to complete training in all aspects of the implemented FIRESCOPE design. It also coordinates and integrates all training efforts with external organizations. Elements of the training and certification program include:

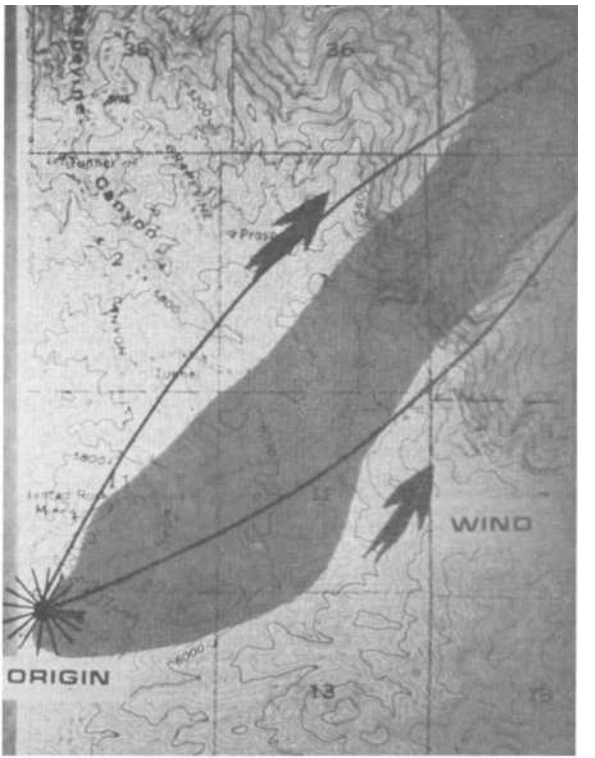
- Lesson Plan Development and Review
- ICS Course Delivery System
- Certification of Instructors
- Certification of Qualifications.

3.5.5.1 Lesson Plan Development and Review

The successful implementation of the MACS/ICS concept requires agreement on standardized roles and functions of all personnel involved in multijurisdictional response to an incident. Therefore, it is necessary to standardize the training of these personnel who will function in one of some two dozen roles in the MACS/ICS process. Appendix A contains summary paragraphs of the functions of these personnel. Course development is the responsibility of the Training Specialty Group which follows a rigorous

FIGURE 15

Actual Vs.: FIREMOD Firespread Projection



Coyote Fire, San Bernardino County, July 8, 1976. 4,825 acres burned.

PREDICTED: ACTUA

development and review process. Once the training need is established, a combination of academic and subject matter experts develop course subject-matter and appropriate aids for distribution and review. The review is conducted by the Task Force, Training Specialty Group and Operations Team. Comments are returned to the course developers for analysis and appropriate revisions. The final product is reviewed by the Task Force and Operations Team for adoption and implementation.

3.5.5.2 Course Delivery System

There is no formal course delivery system for member agencies for multiagency training in the FIRESCOPE region. A range of existing delivery systems are provided the MACS/ICS materials developed for use by member agencies and other State and Federal agencies, including educational institutions. These include: the training officers in the FIRESCOPE member agencies; California State Fire Marshal's Office, (Fire Service and Education Delivery System); Southern California Interagency Fire Training Coordinators Group; California Fire Academy; California Specialized Training Institute; Crafton Hills College and other community colleges.

3.5.5.3 Certification of Instructors

Certified instructors are necessary to facilitate MACS/ICS training needs in the FIRESCOPE region and statewide. Member agencies are responsible for submission of certification requests to the FIRESCOPE Support Services Manager for submittal to the State Fire Marshal's Office. Agencies with responsibilities outside the FIRESCOPE Regions submit requests for certification directly to the State Fire Marshal's Office; i.e., OES, CDF, USFS.

3.5.5.4 Certifications and Qualifications

A certification and qualification system is in development now for member agency use. A Wildland Fire Qualification and Certification System, developed by the FIRESCOPE Decision Process, is nearing completion of a 2-year test and evaluation by the California Department of Forestry and the United States Forest Service. Results will be incorporated in the FIRESCOPE system.

3.5.6 FIRESCOPE Automated Data Processing (FADP)

Computerized collection, processing, updating, storage and display of data on firefighting resources, weather, fire spread, and overall incident situations support the FIRESCOPE effort. FADP provides the hardware and software for Initial Attack Assessment, Resource Keeping, Terrain, Weather and Fuels Data Base, GEOLOC Mapping System, and large fire modeling to member agencies.

3.5.6.1 Hardware

Hardware clusters in three categories: Fire Information Management System (FIMS); Terminal; and, Communications. FIMS hardware consists of a

Prime 550 Minicomputer, two 800/1600 bpi tape drives, two 80 megabyte disk drives, and two 600 lpm printers. Terminal hardware includes 35 Hewlett Packard 2621 crt terminals, 30 Ventel 212+ modems, 7 Texas Instruments Silent 700 hard copy terminals, and two Diablo letter quality printers. Communications hardware includes eight 9600 Baud hardwired lines, seven 1200 Baud dial-in-lines, 14 300/1200 Baud dial-in-lines (Telenet), and one synchronous communication line for direct computer-to-computer interface.

3.5.6.2 Software

Some ten software programs are in place to support the MACS/ICS process. These are:

- Weather Forecast
- Incident Status Report #209
- Red Flag Alert
- User-to-User Electronic Mail Communications
- Resource Keeping (Restat)
- GEOLOC - Grid Mapping System
- Fire Modeling (Manual Input)
- Fuels Data Base (About a third complete)
- Resource Data Base
- Rate of Spread Processor.

Efforts are under way now to expand the computer data base to include information necessary for applications to all risks such as earthquakes, hazard materials, etc., and acquisition of supporting hardware and software.

4.0 FIRESCOPE IMPACT

4.1 Decision Process, Operational Systems, and Technologies

Programs as broadly conceived and implemented as FIRESCOPE start with mutual need recognition by people and agencies directly concerned with its solution. Meeting the mutual need also depends on acceptance of the reality that no one agency or combination of agencies may have all the solutions to the need. What exemplifies the FIRESCOPE concept is this recognition by the agencies involved in its implementation and maintenance. The Decision Process, from FIRESCOPE's inception to the present, relies primarily on those jurisdictions with the greatest need to determine standards for planning and responding to multijurisdictional incidents. As appropriate, outside experts also may be involved from member agencies or contractors.

The operational systems represent not only agreement by member agencies on the specifics for mutual response to incidents but acceptance of the standardized systems within the member agencies operations. In effect, the cooperative decision process and decisions arrived at carried enough merit for the member agencies to adopt for their own use. The initial activity of FIRESCOPE focused on research and development for appropriate technologies to support the decision process and operational systems. This ranged from an attempt to use aerospace technology to "bomb" wildfires with huge, water-filled plastic bags to continuing research in fuel types and behavior for firespread prediction and control.

Probably the most salient feature of the FIRESCOPE process is the degree to which all member agencies cooperated, pooled their resources, and continue to plan, implement and refine an effective response to wildfires and other incidents and emergencies. FIRESCOPE represents a model of local, State and Federal agencies working across jurisdictions for mutual benefit. The fact that the decision process, operational systems, and technologies have impacted agencies within Mutual Aid Regions I and VI, other California counties, other states, other Federal agencies, and other countries attests to the continuing merit of FIRESCOPE as an effective solution not only to fire but other incidents and emergencies too.

4.2 FIRESCOPE Decision Process Impact

4.2.1 National Interagency Incident Management System (NIIMS)

The Federal wildland fire protection agencies and some state forestry agencies have, for many years, operated under the Large Fire Organization (LFO). This organization, when coupled with the National Interagency Fire Qualification System (NIQS) developed by the National Wildfire Coordinating Group (NWCG), is a complete fire management system. However, terminology and organizational structure presented barriers to coordination with non-Federal fire agencies and other emergency systems and services. The NIFQS qualification and certification system caused difficulty in integrating state and local forces in mutual suppression efforts. During the time the LFO system was developing, FIRESCOPE also was developing and by the late 1970's had evolved the MACS/ICS decision process and standardized nomenclature and support technologies so effective in responding to the fires of 1980. However, FIRESCOPE lacked a qualification and certification system.

By 1980, NWCG realized that two parallel systems were being developed and commissioned a study to: 1) analyze fire suppression systems developed and in use; and, 2) pull together the best parts into a single system that would have national acceptance. The National Interagency Incident Management System resulted from that effort and was adapted by the USFS in 1982.

The basic management and incident command concepts and processes present in FIRESCOPE are present in NIIMS. This includes: details of the Incident Command System; Training; Qualification and Certification; Publications Management; and, Supporting Technology. A NIIMS "Information and Guides" publication (April 1983) details the major subsystems with extensive

explanations and details of standardized roles for NIIMS personnel, incident command operational configurations, glossaries, and other relevant detail on support technologies. The parallel to FIRESCOPE is not accidental.

Essentially, all USFS regions became operational in NIIMS and ICS between 1983 and 1985. FEMA's National Fire Academy adopted ICS in 1983. State and local agencies have been particularly strong supporters of NIIMS, for they can see the advantage to them in their responsibility for day-to-day emergency responses. For example, Florida reports that although 1985 fire losses exceeded the recordsetting year of 1981, working relationships and interagency support were a lot better through the NIIMS concept of preplanning and resource sharing. Minnesota had six "overhead" teams which severely strained their resources. NIIMS enabled a reprogramming of resources to three teams. Not only did the application of NIIMS prove cost effective, but response to firefighting with people from different agencies "worked real well."

Perhaps the most gratifying benefit of NIIMS implementation, according to the USFA, is illustrated by the experience in our 20 Northeastern states. The work on actual incidents in Wisconsin, Michigan, Pennsylvania, New England, and other states where persons from various jurisdictions meet and work together on the same crew or overhead team, exemplifies the core concepts of a unified decision process and incident command system.

One non-fire application of the ICS concept adopted by NIIMS occurred last year in a large-scale and extensive Water sampling-Western Lake Survey in Colorado. This joint Colorado USFS-EPA survey showed the strengths of using the ICS organizational model regardless of the type of project. These strengths included:

- People know who does what
- There is one incident command center to call for information, supplies, or if an accident occurs
- Foresters know whom to call
- People know the flow of information (whom from and whom to)
- Field staff know to whom they are responsible and report
- The ICS organizational model is adaptable to meet changing demands and unplanned exigencies
- Information flow is enhanced, fewer people lost, and fewer water samples lost compared to other incident command systems
- Rated as the best project in Western high mountain lake sampling, largely because of the use of ICS.

4.2.2 Mono County Caldera Initial Response Plan

The California Office of Emergency Services developed "Plan Caldera, May, 1984," which detailed a scenario for the Mammoth Lake Area in Mono County for earthquakes of varying intensity and a possible eruption from an eruptive vent in the immediate Mammoth Lakes area. Figure 16. illustrates the Mammoth Lake Eruption Scenario Location.

The following year, an Initial Response Plan for the Mono County Caldera was developed. This reflected the multiagency, organizational, roles and assignments, checklists, operational plans, and support requirements necessary to respond effectively to a verified threat of volcanic action in a 24-hour period prior to eruption. The Initial Response Plan includes:

Part I: Planning Basis and Intent. Includes Authorities and References, graphic of Mammoth Lakes scenario (Figure 16.1, additional applications of the plan (for earthquakes, major fires, etc.), Activation Criteria, and Warning Systems description.

Part II: Action Plan and Support Requirements. Includes Unified Command objectives, organizational charts, positional assignments and checklists. Part II also contains the Evacuation Strategies and Movement Operations for all Mono County communities in the threat area, and Public Education and Information strategies and plans. A Communications Plan also is included here.

Part III: Facilities Plan. Describes the facilities required for each part of the organization at the Incident Command Post in Bridgeport (Figure 16.).

Part IV: Mutual Aid, State, and Federal Agency Instructions. Describes the role of each requested supporting agency, check-in procedures, and assignments within the local organization.

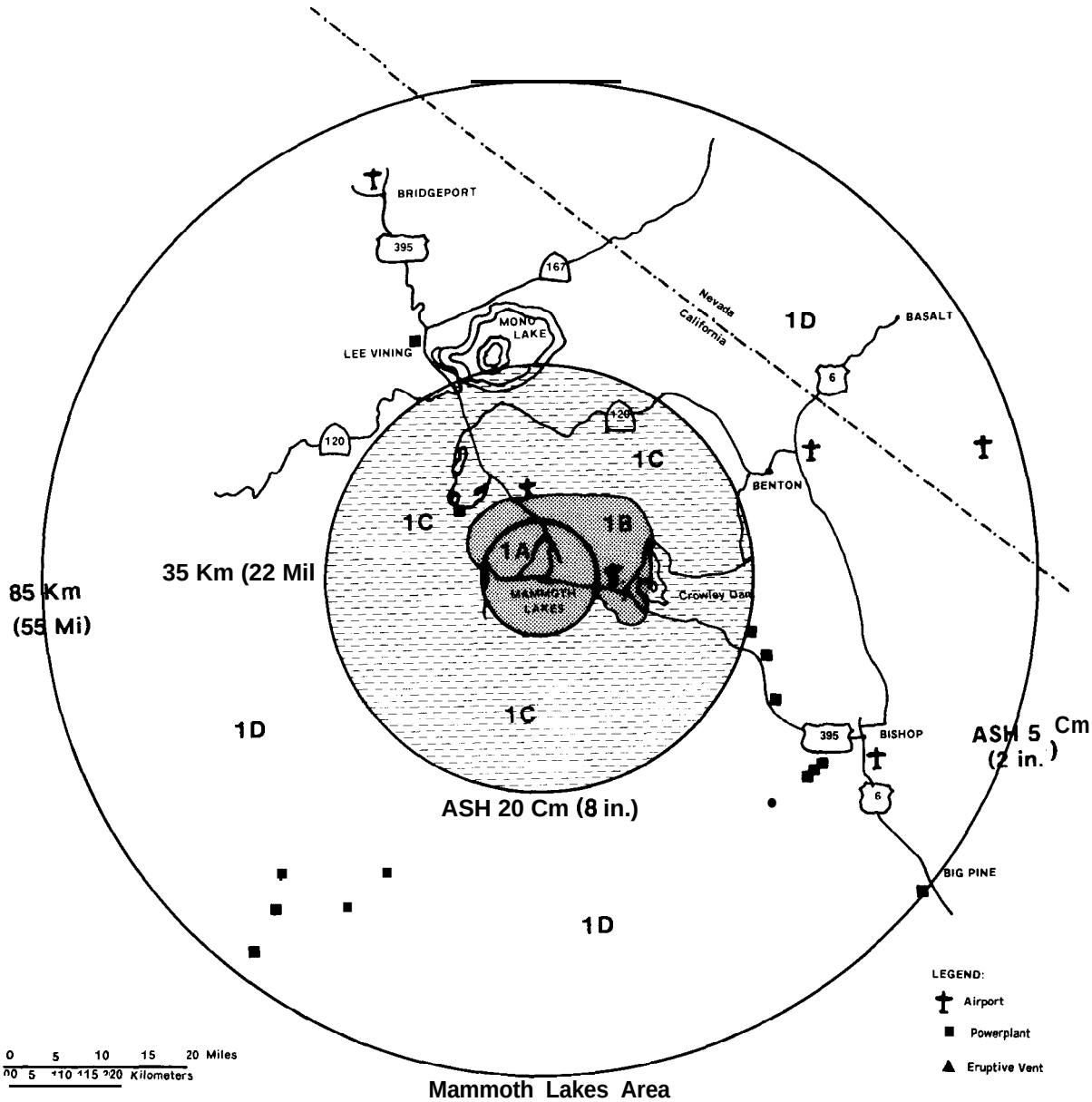
In compliance with the Mono County Basic Emergency Plan of April 1984, the Plan uses the Incident Command System and its Unified Command Concept as the organizational structure for response and supporting activities.

4.2.3 Application to Law Enforcement

In 1984 the San Bernardino County Sheriff's Department undertook a project to develop an incident management system applicable to the diverse emergencies which confront law enforcement agencies. The Sheriff's Department is involved in a wide range of emergencies and disasters including: earthquake, flood, volcanic activity: and man-caused emergencies such as fire, hazardous materials incidents, search and rescue operations, hostage situations, and other major crimes. The need was apparent for a method of effectively coordinating the efforts of multiple jurisdictions as well as multiple disciplines; i.e., emergency medical providers, firefighters, coroners, etc.

FIGURE 16

MAMMOTH LAKES ERUPTION SCENARIO LOCATION



Mammoth Lakes Area
Mono-Mammoth Lakes Volcanic Hazard Planning Scenario
R.C. Martin and J.F. Davis
California Division of Mines and Geology
Department of Conservation

Erupt ion	Zone Characteristics
S1 Small but relatively frequent type eruption characterized by phreatic blasts and possible explosive ejection of pyroclastic material 0 to 0.2 KM^3 of magma expel led.	S1 Area subject to falling blocks of rock, and showers of hot pumice, cinders or ash, 6 mile radius

Erupt ion	Zone Characteristics
1 Moderate but less frequent explosive rhyolite eruption of about 1 KM' of magma. Occurs in three phases: 1) phreatic blasts, 2) pyroclastic flow and tephra eruptions, followed by 3) dome extrusion.	1A Area subject to falling blocks from phreatic blasts, 6 mile radius. 1B Pyroclastic flows to 12 miles (distribution control led by topography). 1C Tephra from 4 ft. to 8 in. thick down-wind to 20 miles. 1D Tephra 8 in. to 2 in. down-wind to 50 miles.

The FIRESCOPE Incident Command System was determined to be extremely close to what was needed. The ICS was used as the basis for the Law Enforcement Incident Command System (LEICS). In late 1985, the San Bernardino Sheriff's Department (SBCSD) published its, "Law Enforcement Incident Command System Field Operations Guide," which incorporates most of the applicable concepts of ICS and some other programs into a relatively simple modular system. LEICS is flexible enough for use in urgent situations ranging from a simple barricaded suspect to an 8.3 earthquake. LEICS retains the major management concepts developed during the FIRESCOPE project which made ICS such a success in its other applications.

In late 1984, the SBCSD persuaded the California Police Standards and Training Commission (POST) to sponsor training in LEICS. The course was designed through consensus of the law enforcement community and was announced in the June 1986 POSTScripts. The announcement stated:

> The Incident Command System (ICS) is an update on mutual aid response and is included as part of the POST-certified two-day program in emergency incident management. ICS is based on the...Firescope Project... implemented in California; the project model was adapted to law enforcement needs. ICS, an on-scene management system, is described as an all-risk incident management tool. It combines facilities, equipment, personnel, procedures, and communications within a common operations organizational structure to manage major incidents or disasters. The ICS basic operating system provides for: single agency/single jurisdiction, multiagency/single jurisdiction, an multiagency/multijurisdictional planning and response to major disasters.

The program is certified by POST for presentation by the San Bernardino County Sheriff's Department with three presentations scheduled for this fall and early winter next year.

The early LEICS model was applied to the U.S. Rock Festival held in San Bernardino County in 1983. In the May 27-30 period, over 450,000 young adults attended the concert. The application of the ICS process led to a remarkably low incident and crime event. The LEICS course also is being offered through the Florida POST.

4.2.4 Other Applications

The FIRESCOPE decision process has been applied in other settings and jurisdictional levels, including:

- Planning and management of an international food supply project.
- Extension of the FIRESCOPE technologies to the other four California Mutual Aid Assistance Regions.
- Preparation of an ll-county/cities communications management plan for 160 channels in a new spectrum (8Mhz ba) for approval by the Federal Communications Commission.

- Development of a Medical Casualty Plan by some 60 agencies in Los Angeles County.

4.3 FIRESCOPE Operational Systems Impact

Acceptance of the MACS/ICS decision process almost automatically guarantees acceptance of its operational systems and subsystems. This certainly is true for the FIRESCOPE member agencies. For example:

- The Santa Barbara County Fire Department was the first to use orthographic maps in response to incidents.

- The response to the Wheeler Springs Fire (118,000 acres) in 1985 by the Ventura County Fire Department also involved a Mode 4 decision. Three hundred engine companies were brought into the county through FIRESCOPE's Operations Coordination Center.

- Los Angeles City Fire Department has expanded application of the MACS/ICS operational systems and subsystems from brush fires to HAZMAT, mass casualty, high rise fires and harbor fires.

- A tailored version of ICS is used in a multiagency Campaign Against Marijuana Planting (CAMP) in 38 northern California counties. Over the last 3-years, the 102 Federal, State, and local agencies involved have confiscated over $80 million street value of marijuana.

- Incorporation of basic MACS/ICS operations systems and subsystems into standardized training programs.

- MACS/ICS elements are included in the foundation for the FEMA Integrated Emergency Management System (IEMS).

- Following an air burst of a USAF missile and some major fires on the missile base, the ICS system was installed with training based on the FIRESCOPE curriculum.

- In Colorado, where sheriff's have responsibility for wildland fires, ICS has been adopted by the Boulder Sheriff's Department.

- The U.S. State Department International Emergency Division has on detail from the U.S. Forest Service a former member of the FIRESCOPE original research and development phase. He is assisting the Division in application of MACS/ICS, with limited support technologies, to hurricane problems in the Caribbean Basin and wildfire mitigation in other countries. This includes training based on FIRESCOPE MACS/ICS curriculum.

4.4 FIRESCOPE Support Technologies Impact

Clearly identified impact can be demonstrated in two support technologies; Orthographic Mapping and Training.

4.4.1 Orthographic Mapping

4.4.1.1 California Office of Emergency Services (OES)

The California Office of Emergency Services (OES) has two FIRESCOPE projects in process: 1) OES, in cooperation with the U.S.G.S. Western Mapping Center, is updating 92, third-generation (1975, 1980, 1986) orthophoto quads in the FIRESCOPE Region. These all will be high resolution orthophotos; 2) OES is providing financial assistance to the Ventura County Fire Department to field test a response booklet of maps. Three hundred response booklets will be printed and distributed to county fire agencies. These booklets will be used at incident sites to facilitate command decisions.

During the past year, a select group of fire agency officials from Northern California have met to establish a program similar to FIRESCOPE. Incorporated in their discussions is the establishment of a common mapping system.

4.4.1.2 San Bernardino County Geo-Based Information Mapping System

San Bernardino County is completing the development of a mapping system for fire and emergency services which moves beyond available systems. The Geo-Based Information Mapping System (GIMS) builds on the currency and accuracy of the U.S.G.S. mapping system, the orthophoto and GEOLOC (Geographic locator grid-system of alpha-numeric indexing designed by FIRESCOPE) processes, and the field work by fire agencies.

GIMS integrates progressive parcel information with current county orthophoto mapping. GIMS has successfully provided County departments an automated means of mapping and manipulation of the data to accomplish diverse tasks. Initially, GIMS provided direct benefit to departments with land use needs. More recently, the system has met a wide diversity of geographic needs for a multitude of County departments and outside interest groups.

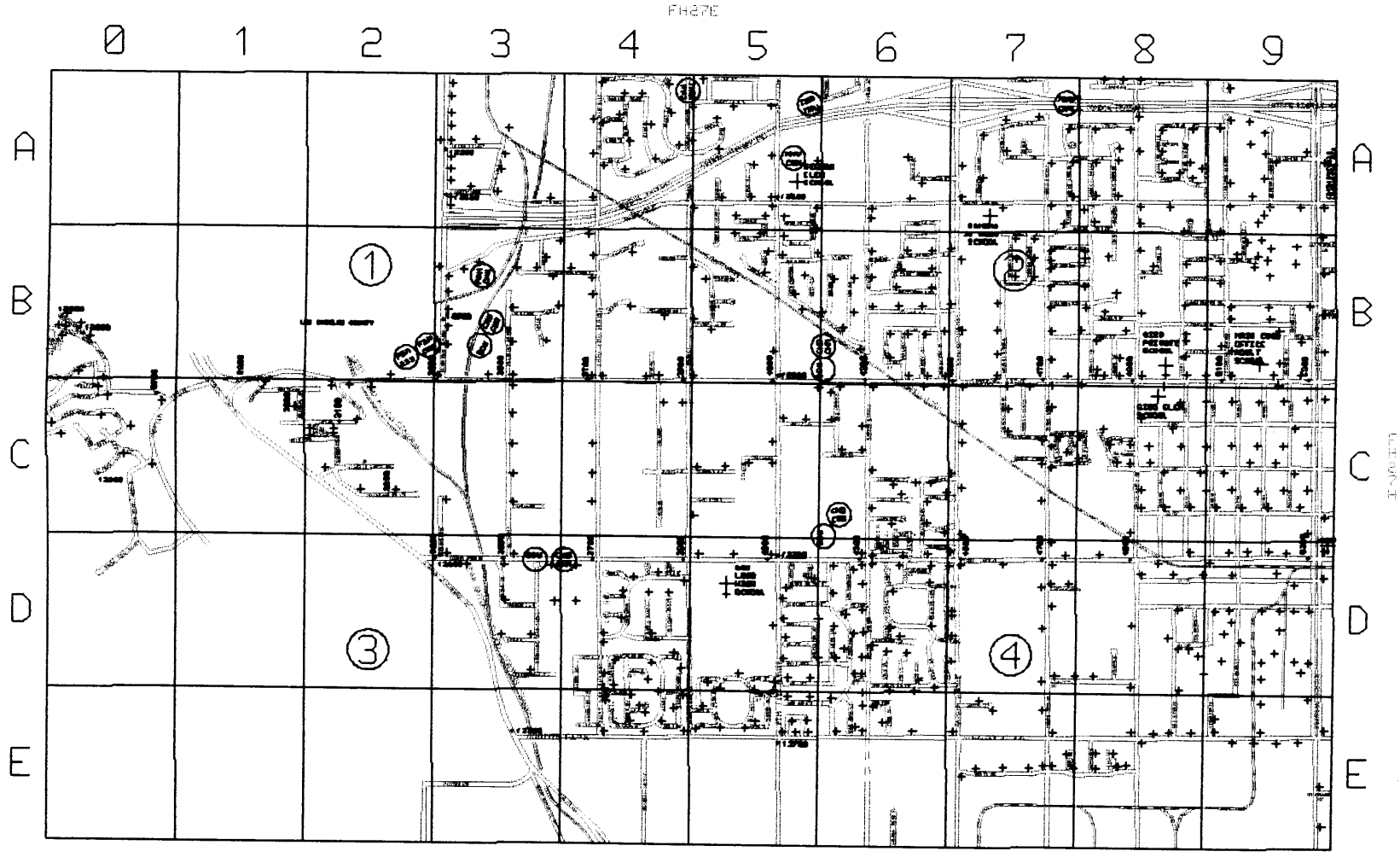
Current applications of GIMS include:

- Comprehensive Street File, a cooperative effort between city and County fire agencies, other County agencies, and public utilities.
- Community Plan Program, automated information about an estimated 200,000 parcels of land, including zoning, health and safety data, and master plans of highway networks.
- Housing Element, used to assess current housing stock, future capacity demand and availability.
- Emergency Response Mapping Program, which created a map atlas for use by police, fire, and other emergency response personnel. Basemap overlays locate fire hydrants, special hazards, substation locations, and other emergency response data, based on FIRESCOPE's orthophoto maps and GEOLOC system.

Figure 17. illustrates a basemap with emergency data overlay.

FIGURE 17

BASEMAP WITH EMERGENCY DATA OVERLAY



4.4.2 FIRESCOPE Training Impact

To date, some 50 training course outlines for the MACS/ICS support systems and personnel have been developed. Relevant personnel from the member agencies are assigned to specific courses which match their roles and responsibilities during a multijurisdictional incident.

A southern California Wildland Training Calendar is published each year which lists the ICS-focused courses. They are offered at one or more of eight locations.

- South Zone Training Center (Los Angeles County)
- Kern County Fire Training Center (Bakersfield)
- Kern River Community College (Fresno)
- Crafton Hills College (Yucaipa)
- Ventura County Sheriff Academy (Camarillo)
- Sequoia-Kings Canyon N.P. Ash Mountain Headquarters
- Los Angeles County Fire Department Headquarters
- Santa Monica Mountains National Recreation Area.

Course offerings range from "Basic ICS," "Base Camp Manager," "Incident Dispatcher," "Helibase Manager," to "Command and General Staff," "Operations Section Chief," and "Finance Section Chief."

The mix of courses includes residential and self-paced instruction instructors. Course participants represent local, State and Federal employees with program responsibility for wildland fire prevention and control.

4.4.2.1 Crafton Hills College Regional Emergency Research and Training Institute

The Institute is supported by city and county fire departments, the U.S. Forest Service, California Department of Forestry, the Bureau of Land Management, the Inland Counties Emergency Medical Agency, and the medical personnel of area base stations and trauma centers. The Institute serves a four-county area.

An Associate Degree in Wildland Fire Science is offered as is training in the National Interagency Incident Management System. Program staff are fire professionals from local, county, State and Federal firefighting agencies. Intensive training in the ICS system started in 1982. One part of the ICS training involves a command exercise including an audiovisual simulation of the incident which can be changed by the instructor

to reflect both expansion of one incident and/or addition of different incidents. Crafton Hills College cooperates with FIRESCOPE as part of their mutual aid relationship.

5.0 FIRESCOPE STATUS AND WHAT'S AHEAD

5.1 Estimated Level of Completion and Effectiveness

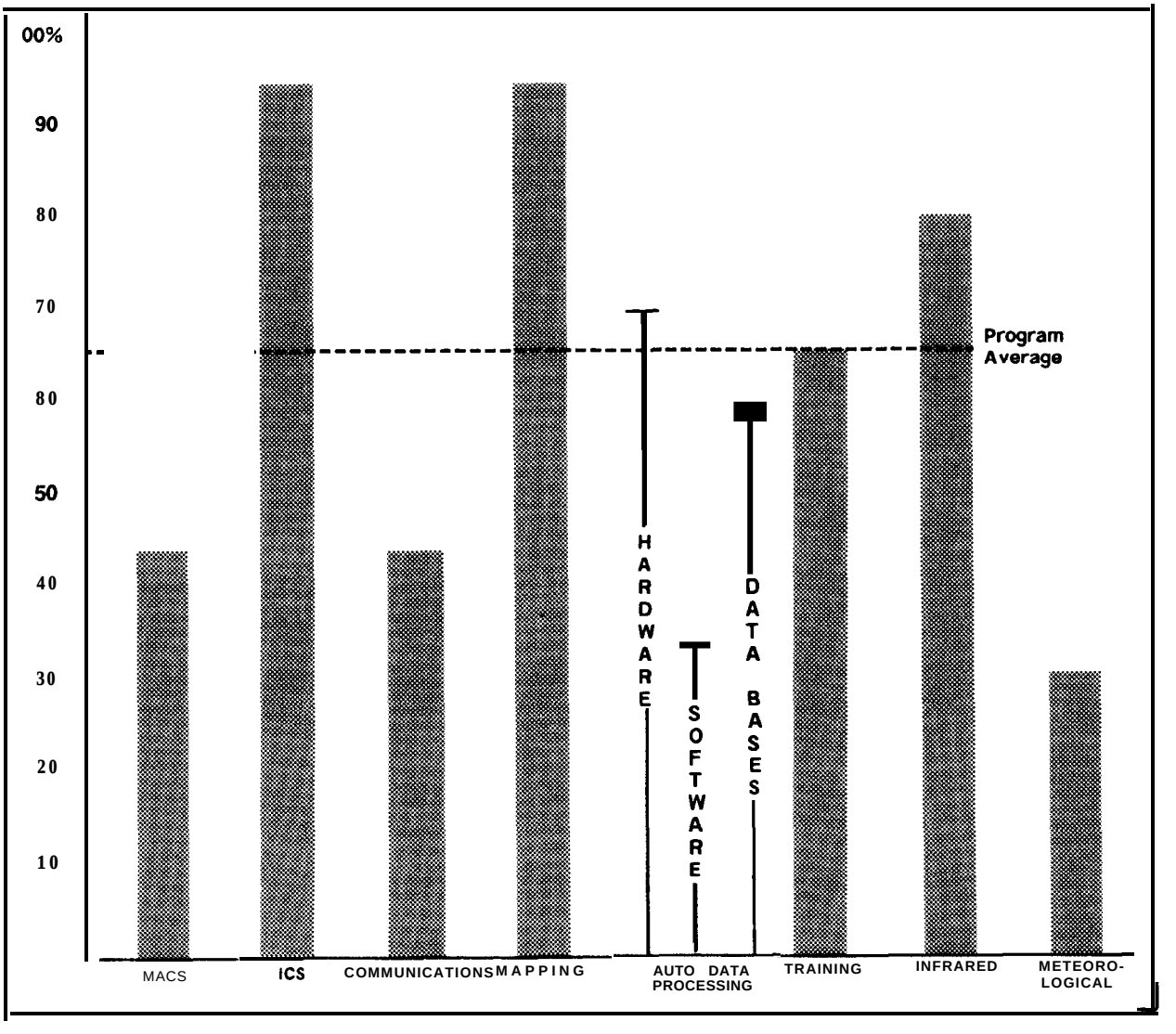
FIRESCOPE has accomplished much since its initial funding by Congressional action in FY 1972. The initial research and development phase, which was completed in late 1977, led to implementation of FIRESCOPE's major systems, subsystems, and supporting technologies. At this juncture in time, FIRESCOPE has completed about 65% of the program set forth 9 years ago. The estimated level of completion of the various program components is illustrated in Figure 18.

A series of major fires in 1980 and 1985 and FIRESCOPE's improved response to them, compared to the 1970 response, clearly demonstrates the effectiveness of the FIRESCOPE operation. While it is virtually impossible and risky to make across-the-board comparisons of 1 year against another because of the multiple variables present, there are some clear improvements to cite. For example, in 1980 there was a 60-percent increase in major fire activity over a comparable span of time in 1970 (14 days vs. 13 days). However, there was a 76-percent reduction in acres burned; 36-percent reduction in structures lost; and, a 69-percent reduction in deaths. The degree to which these reductions reflect application of FIRESCOPE's Southern California systems and technologies cannot be measured in detail. However, analysis of both the 1980 and 1985 "fire seasons" determined that: increased application and use of those systems and technologies throughout the State was the major contributing factor to reduction; i.e.,

- Use of ICS enabled agencies to work together more effectively with increased trust levels and improved overall performance
- The ICS Incident Action Plan and Frequency Management Plan facilitated a better understanding between agencies and improved the use of available radios
- There was clear improvement in coordination of aircraft and crews on a Statewide vs. southern California basis
- There was definite improvement in inter-agency contact and communication
- Agencies did more preplanning to meet regional needs
- The ICS procedure of classifying resources by capabilities facilitated their ordering and incident planning
- The strength and mobility of engine Strike Teams was evident and probably significant in reducing losses.

FIGURE 18

COMPLETION ESTIMATE FOR VARIOUS FIRESCOPE SYSTEMS AND TECHNOLOGIES



5.2 FIRESCOPE Cost Effectiveness

Although the program is approximately 65-percent implemented, the benefit/cost ratio appears to be rising. During the research and development phase, benefit/cost analysis projections were made that the program would be cost effective with only a 5-percent increase in fire service attributable to FIRESCOPE. With annual cost and losses averaging $45 million per year, reductions in acreage burned, structures lost, and lives saved, an annual cost-loss reduction approaching lo-percent appears likely.

This estimate does not factor in substantial savings to local jurisdictions resulting from using standardized maps, training, incident command procedures, radio communications, and participation in the other mutual assistance and coordination elements of FIRESCOPE.

5.3 The Continuing Process

The FIRESCOPE Program has demonstrated that it takes both time and patience to build a "user-driven" system. Multijurisdictional groups can work together effectively where common need exists if they do so with commitment and within a defined and cohesive organizational structure that does not threaten their respective autonomy. FIRESCOPE has produced positive changes both in personnel attitudes and agency relationships. The commitment of time and energy by all agencies to making an intergovernmental Decision Process work effectively is an investment which contributes significantly to all design, development, and implementation efforts. The FIRESCOPE Decision Process evolved from an early informal advisory role to a major and important technology which guided an orderly development and implementation process. Continuation of the Decision Process in seven key areas will guide future FIRESCOPE developments.

5.3.1 Program Planning

Complex intergovernmental development programs require a dedicated planning effort. The uncertainties associated with annual funding levels mandate a planning process enabling component parts to be integrated as they come on-stream. The process also must accommodate lack of funding for a specific component so that this eventuality will not degrade the total design effort. Multiple agency involvement and the use of the Decision Process dictates that the planning effort take more time and involvement than normal planning tasks do in individual agencies. The complexity of this planning process mandates adaptation to an ever-changing fiscal and user-driven environment.

Continuation of the FIRESCOPE central planning effort cannot be overstated. The continuing need for a central planning activity driven by the participating agencies at all government levels is the essential FIRESCOPE ingredient. The program planning process will continue to be driven by the FIRESCOPE Decision Process of the Board of Directors Operations Team, Task Force and specialty groups.

5.3.2 All-Hazards Incident Management

FIRESCOPE's original charter focused on Southern California wildland fires. However, fire agencies in Mutual Aid Regions I and VI are faced with a wide range of potentially hazardous situations which require effective and coordinated incident management. These include winter floods, hazardous materials situations, major high rise fires, harbor/refinery incidents, major aircraft crashes, volcanic eruptions, and an increasing danger of major earthquakes. While each of these emergencies will be tactically handled somewhat differently, the overall incident management approach will utilize the elements of the ICS. Similarly, each of these other situations may require a multiagency response, thus imposing the need for MACS. Further development activity will be aimed at ensuring that the MACS/ICS process is applied to other hazards and incorporated into the overall system.

5.3.3 Communications Redundancy

Interagency communications presently rely on telephone services (FTS/ATSS/commercial) and on a State-owned and operated microwave system. There is limited radio'backup and in some cases this is accessed via the commercial telephone system. These communications systems are as applicable in management of other emergencies as they are in fire incidents. Studies conducted by the California Departments of Mines and Geology and Communications, project a major earthquake in the Southern California area as a distinct possibility. Such an earthquake would disrupt both telephone and microwave communications for an extended period of time rendering interagency coordination useless. FIRESCOPE is developing a system to provide redundancy in communications systems which can survive the immediate effects of a major earthquake.

5.3.4 Specifications Documentation for ADP

User requirements and specifications associated with computerized software development must be carefully and completely documented. Establishing written requirements and specifications, based on user needs, is essential to effective program design and utility of data stored and retrieved for operational or other use. Further specifications documentation development for ADP includes:

- Large-scale fire modeling
- Initial attack assessment
- Validation of resource status keeping (Restat)
- Terrain data base
- Fuels data base
- Weather data
- Qualifications and certifications for training.

5.3.5 Design Evaluation

A considerable amount of work in developing conceptual and preliminary designs of systems and technologies was done under contract early in the program, Some of these designs often had no formal feasibility

evaluations built in. As a result, contractors were not always aware that an individual agency or all member agencies did not buy into implementation of that design. This lack of expedient feasibility evaluation of contractor end-products caused downstream delay and redesign efforts. When member agencies did become aware of what the design implications were to their own procedures, a "no-go" decision sometimes resulted. A more rigid and timely evaluation process during the conceptual design period would have avoided agency procedural conflicts or, at least, provided an earlier opportunity for agencies to explore accommodations to the design or design accommodations to agency needs. Future contract efforts which require product development will incorporate an evaluation and feasibility test as part of the required scope of work.

5.3.6 Meteorological

Further development of the meteorological program will focus on validating the number of Remote Automated Weather Stations (RAWS), development of surface wind model validation for application to FIREMOD, and the exploration of uses of weather data for other all risks situations.

5.3.7 Training and Certification

With the reductions in force that are occurring in fire suppression organizations in Southern California, and with increasing fire complexity, more people need to be trained to perform a variety of emergency and disaster response functions. Agencies no longer can afford to maintain single skilled firemen and maintain a viable response capability. The impacts of implementing the ICS also have increased the need for a more unified and intensive fire training and certification program.

Under consideration is the development of a new Southern California Interagency Fire Training Coordinators group (S.I.F.T.). S.I.F.T. would consolidate the needs, identify locations, dates, and course coordinators for training personnel from member agencies. Among the advantages to this approach are: reduced costs, non-duplication of effort, training would be user-driven, it is consistent with the MACS/ICS concept and process, and more training would be conducted on a local interagency basis.

5.4 Movement to Statewide Decision Process

The FIRESCOPE Decision Process is undergoing a major change at the Board of Directors level. It has been agreed, by the current FIRESCOPE Board of Directors and the California Office of Emergency Services Fire and Rescue Advisory Committee, to combine the two groups and form a single body to provide policy-level decisions for the FIRESCOPE Program and the extension of such program elements to the remainder of the State of California. This Advisory Committee now can be representative of the entire State and the Fire Services for program research, development, and the application of FIRESCOPE technologies. The Decision Process and Charter for the OES Fire and Rescue Service Advisory Committee will be finalized for acceptance in the fall of 1986.