a. Technical expertise on the installation, operations, and maintenance of electronic subsystems.

b. Training materials to be used by each agency to familiarize line personnel in the MACS/ICS systems.

c. Fiscal data required to substantiate expenses incurred during MACS/ICS operations and maintenance which can be used in long range planning of down year expenditures.

d. Planning information required to synchronize the operations and maintenance of the MACS/ICS systems between agencies.

2.6.4.5 Authorities

The specialist groups receive non-technical direction from the Task Force. Direction must be within the guidelines established by a Board of Directors approved charter or plan of work.

Actions taken by a specialist group are coordinated through the Task Force Chairman to assure that such actions conform and are compatible with the overall MACS/ICS concept. Current specialist groups are:

- Automated Data Processing
- Communications
- Hazardous Materials
- Information
- Mapping
- Training
- Weather.

Details on each of these specialist groups and current activities are discussed in the next section, "Operational Concepts."

3.0 FIRESCOPE OPERATIONAL CONCEPTS AND SYSTEMS

3.1 Operational Concepts

FIRESCOPE's basic concept encompasses timely commitment of needed multiagency resources, within the context of common procedures and organizational structure, to respond to all incidents which exceed, or threaten to exceed, the capability of any single fire protection agency. The concept goes beyond fire incidents to other, multijurisdictional incidents.

3.2 Operational Systems

3.2.1 Multiagency Coordination System (MACS)

MACS is the "managerial" element of FIRESCOPE which melds the day-to-day operations of member agencies and guides their application. MACS performs a range of functions, including:

- Improved agency coordinations at top levels
- Allocation and timely commitment of multiagency resources on problem incidents
- Advanced electronic systems to store and retrieve status of regional emergency resources, display physical, and environmental data bases, perform real time fire behavior predictions, and assess current regional fire danger
- Centralized coordination of emergency information
- Pre-suppression planning assistance to fire protection agencies.

MACS does not have independent operational authority. It is unique in a number of aspects, including:

- It is dependent on the voluntary cooperation of its members
- It is an extension of the formally defined command function of its member agencies
- It is a user-managed system
- It is service-oriented designed to enhance agency operations
- It does not compromise or usurp individual agency authority.

The decision levels outlined earlier -- Board of Directors, Operations Team, Task Force and Specialty Groups -- comprise the MACS operational process. Specifically, the Multiagency Coordination System provides:

- Comprehensive and current geographic data base which includes site-specific information on cultural features, fuels, topography, risk, and values in a uniform format for all jurisdictions
- Centralized collection, processing, and display of current information on local weather, status of agency resources, and fire activity (including incident command data for major fires) for Mutual Aid Regions I and VI
- Improved support for individual incidents through capability to predict, and assess probable consequences of, local weather, fire behavior and spread potential, and resource effectiveness

- Dynamic centralized evaluation of major and multiple-incident situations, with the capability to coordinate agency requests for assistance and to determine the best allocation and assignment of resources to meet individual incident needs

- Administration of ICS and MACS programs, including document control; training coordination; and data base, software and equipment maintenance

- A cumulative accounting of costs and their allocation during a multijurisdictional incident response.

3.2.2 Operations Coordination Center (CCC)

MACS functions are implemented through the Operations Coordination Center. OCC provides an integrated communication system with existing agency dispatch centers and individual incident command posts. CCC provides a central information and resource coordination point for MACS, maintaining relevant geographic and environmental data bases and resource activity information for the FIRESCOPE region. All agency requests for assistance are coordinated through the CCC. Since OCC serves as the nexus for current regional information from all agencies and jurisdictions, it is able to provide situation summaries to cooperating agencies, the media, and other information users. Of greatest importance, the OCC provides the central point from which top command personnel from involved agencies can coordinate and direct integrated operations in a major emergency. The Operations Coordination Center operates full-time with readiness levels appropriate for expected system workload and related response-time requirements.

Figure 3. illustrates the Multiagency Coordination System and the central role of the Operations Coordination Center in maintaining an information base, receiving requests for information, and dispatching resources.

3.3 Incident Command System (ICS)

3.3.1 ICS Conceptual Basis

The Incident Command System is both a conceptual and operational system. At the conceptual level it represents agreement on the common organizational procedures and terminology necessary for multiagency personnel to efficiently plan and coordinate resources and activities at a major fire or other incident involving two or more fire or emergency protection agencies. The concept of ICS encompasses not only emergencies caused by fires, but floods, tornados, hurricanes, earthquakes, riots, and other natural or man-caused incidents. The Incident Command System (ICS) works with and parallel to the Multiagency Coordination System (MACS) in defining and focusing information collection, processing resulting data, and identifying transfer requirements for FIRESCOPE system operation and related human and hardware needs. The effectiveness of ICS relies heavily on voluntary acceptance of the integration of system terminology and concepts into the daily operations of each agency--from small, single-agency incidents to broader, multiagency operations.

FIGURE 3

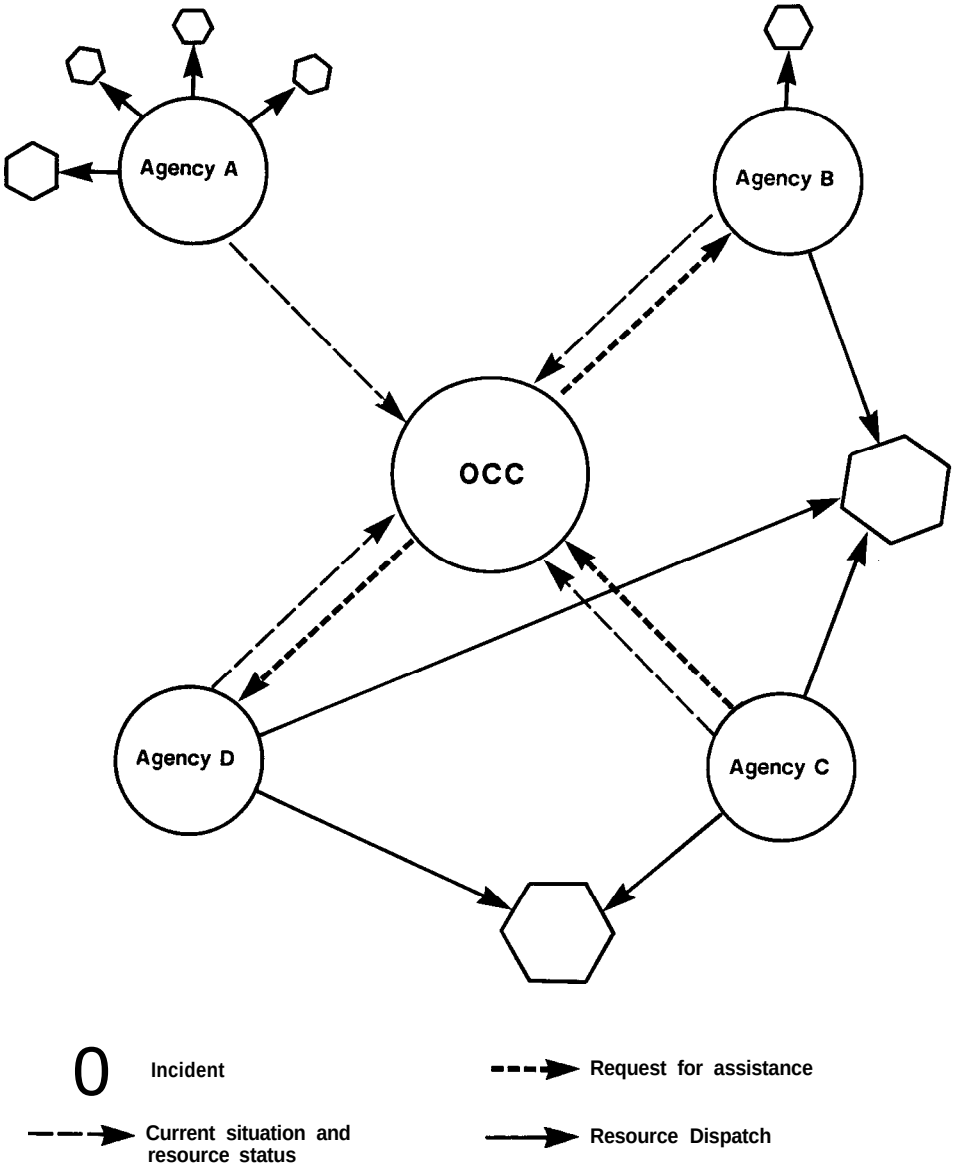


Figure 3--Multiagency Coordination System (MACS) operation. MACS activity is centralized at the Operation Coordination Center, designed to maintain current information from all jurisdictions and to assist in coordinating requests for information. (Adapted from R.A. Chase, "FIRESCOPE: A New Concept in Multiagency Fire Suppression Coordination," General Technical Report PSW 40, U.S. Forest Service, U.S. Department of Agriculture, May 1980, p. 4.)

The lack of the ICS unifying concept and operational components created considerably less than an optimum response to the 1970 fires. Equipment would pass each other going North and South many more miles than necessary when they could have been dispatched to a fire much closer to home. Similar problems surfaced in the use of close to 100 different mapping systems, confusion on nomenclature for equipment, lack of compatability of communication frequencies, and disparate incident command and span-of-control management used by the responding fire agencies.

3.3.2 ICS Operational Components

The Incident Command System has eight components which work interactively and provide the basis for implementation of its conceptual basis. These components are:

- Common Terminology
- Modular Organization
- Integrated Communications
- Unified Command Structure
- Consolidated Action Plans
- Manageable Span-of-Control
- Predesignated Incident Facilities
- Comprehensive Resources Management.

Common Terminology. Common terminology is essential in joint operations by diverse users for such critical elements as: organizational functions; resource identification, classification, and allocation; and, facilities. Terminology is standardized for all ICS organizational units. For example, all equipment carry a designation by "Type" and characteristics rather than by name. An "engine" could mean any number of different kinds of equipment. "Crew" could mean a wide range of experience and training for any equipment requested. Therefore, strike team types and equipment and crew minimum standards were set to ensure that Incident Commanders who requested specific equipment and crews received what they needed through the Operations Coordination Center. Figures 4., 5., and 6. illustrate: FIRESCOPE Strike Team Types and Minimum Standards for engines, crews and dozers; standard nomenclature for primary mobile suppression units; and, other support resources. Similarly, a standard set of major functions and functional units has been agreed upon. For example, a Glossary of Terms contains comprehensive definitions of all FIRFSCOPE terms frequently used in ICS documentation. The definitions range from "Agency Representative" to "Water Tender." Appendix A contains the full Glossary. Similar organizational designators are used for Southern California agencies, fire agency radio frequencies, and ICS position checklists. Resource elements, then, can be allocated as to capability with

FIGURE 4

STRIKE TEAM TYPES AND MINIMUM STANDARDS

KIND	STRIKE TEAM TYPES	NUMBER/TYPE	MINIMUM EQUIPMENT STANDARDS							MINIMUM MANNING		
			Pump Capac.	Water Capac.	2½" Hose	1½" Hose	1" Hose	Ladder	Heavy Stream	S/T Leader	Per Single Resource	Total Per-sonnel
ENGINES	A	5-Type 1	1000 GPM	400 Gal.	1200 Ft.	400 Ft.	200 Ft.	20 Ft. Ext.	500 GPM	1	4	21
	B	5-Type 2	500 GPM	400 Gal.	1000 Ft.	500 Ft.	300 Ft	20 Ft. Ext.	N/A	1	3	16
	C	5-Type 3	120 GPM	300 Gal.	N/A	1000 Ft.	800 Ft.	N/A	N/A	1	3	16
	D	5-Type 4	50 GPM	200 Gal.	N/A	300 Ft.	800 Ft.	N/A	N/A	1	3	16
CREWS	G	Hand crew combinations consisting of a minimum of 35 persons (Do not mix type 1 and Type 2 crews)	Type 1 Handcrews have no restrictions on use							1	N/A	36
	H		Type 2 Handcrews may have use restrictions							1	N/A	36
DOZERS	K	2-Type 1 1 – Dozer Tender	Heavy Dozer (i.e., D-7, D-8 equivalent) or							1	2/1	6
	L	2-Type 2 1 – Dozer Tender	Medium Dozer (i.e., D-5, D-6 or equivalent)							1	2/1	6
	M	2-Type 3 1 – Dozer Tender	Light Dozer (i.e., D-4 or equivalent)							1	2/1	6

FIGURE 5

PRIMARY MOBILE SUPPRESSION RESOURCES

GROUND

RESOURCE	RADIO CALL	COMPONENTS	TYPES 1	2		4
Engine Company	Engine	Pump Water Tank Hose 2½" Hose 1½" Hose 1" Ladder Heavy Stream Personnel	1000 GPM 400 Gal. 1200 Ft. 200 Ft. 20 Ft Ext. 500 GPM 4	500 GPM 400 Gal 1000 Ft 500 Ft 300 Ft. 20 Ft Ext. – 3	120 GPM 300 Gal 1000 Ft. 800 Ft – 3	50 GPM 200 Gal. 300 Ft. 800 Ft. – 3
Truck Company	Truck	Ground Ladder Aerial/Snorkel Personnel	163 Ft 75 Ft 4	163 Ft 50 Ft 4		
Water Tender	Water Tender	Pump Water Tank	300 GPM 1000 Gal	– 1000 Gal		
Brush Patrol	Patrol	Pump -15 GPM Hose 1" - 150 Ft Tank -75 Gal Personnel- 1				
Rescue Medical	Rescue Amb Medic Squad	Transport capacity Personnel	2 Ambulance 2 (1 EMT-I & 1 EMT-II)	0 Squad 2 (1 EMT-1 & 1 EMT-II)		
Bulldozer	Dozer	Size Personnel	Heavy (D-7, D-8) 2	Medium (D-5, D-6) 2	Light (D-4) 2	
Bulldozer Tender	Dozer Tender	Fuel-100 Gal Compressed Air (opt)				
Hand Crew	Crew #	Personnel, Tools and Transportatron	TYPE 1		TYPE 2	

TYPE 1

- Highest training level
- No use restrictron
- Fully mobilized
- Highest experience leve
- Fully equipped
- Permanently assigned
- Supervrsion

CDF
Inmate (15*)
CYA (15)
ccc (15)

USFS
Hotshot (20)
Regular (20)
Fly Crew (10

LAC
Paid (13)
Fly Crew(10)
Adult Inmate(13)

VNC
Paid (10)
Fly Crew (8

TYPE 2

- Minimum training or
- Some use restriction or
- Not fully mobilized or
- Moderate experience or
- Minimum equipment or
- No assigned supervision

CDF/EFF (15)
CCC/EFF (15)
USFS - Blue Card (20)

*Indicates average number of crew personnel including supervision.

Air Crash	Crash	Light water and/o protein foam with pump and turret.				
Fire Boats	Boat	Pump				
Foam/Carrier	Foam	Protein foam or light water	Light Water	High Expansion	Protein	
Dry Chemical	Drichem	500 lb.	Truck	Trailer		

FIGURE 6

PRIMARY MOBILE SUPRESSION RESOURCES

	RESOURCE	RADIO CALL	COMPONENTS	TYPES 1	2	3	A
AIRCRAFT	Air Tanker	Tanker Designator	Capacity	2000	1000	800	
	Helicopters	Copter	Seats, including pilot (minimum)	16	10	5	3
			Card weight capacity	5000	2500	1200	600
			Tank; gallons of retardant (minimum)	700	300	100	75
			Example	Bell 2 14 Heavy	Bell 204, 205,212 Medium	Bell 206 Light	Bell 47 Light
	Helicopter Tender	Helitender #_____	Fuel and Support Equipment				
	Helitack Crew	Helitack	3-Crew Personnel				

SUPPORT RESOURCES

RESOURCE	RADIO CALL	COMPONENTS	TYPES 1	2	3	4
Breathing Apparatus Support	Breathing Support		Compressed/ Cascade			
Communication	Repeater	Portable/Mobile Repeater Capabilitv	Truck	Trailer	Portable	
Crew Transport	Crew Transport	Passengers	30	20	10	
Field Mobile Mechanic	Repair #_____	Repair of Mobile Ground Equipment	2-5 Heavy Equipment	Light Equipment		
Food Dispenser	Food Dispenser #_____	Meal	150	50		
Fuel Tender	Fuel Tender Specify: Av Gas: Jet Fuel; Diesel; Gas	Fuel	1000 Gal	100 Gal.		
Heavy Equipment Transport	Transport #_____	Capacity	Heavy (D-7, D-8)	Medium (D-6)	Light (D-4)	
Illumination	Light	Portable Lights	Truck	Trailer		
Mobile Communications	Communications #_____		Truck/Van	Trailer		
Portable Pump	N/A	Pumping Capacity	500 GPM	250 GPM	50 GPM	
Power Generator	N/A	Generator	Truck	Trailer		
Refrigeration			Truck	Trailer		
Utility Transport			Over 1 Ton	Under 1 Ton		

assurance that what is requested is what will be dispatched. Common identifiers also are used for facilities such as "the Command Post, Incident Base, Staging Area, etc."

Modular Organization. The ICS organizational structure is functional and modular. The command structure is driven by the kind and size of an incident. The organization's staff builds from the top down, with responsibility placed initially with the Incident Commander. As the need arises, additional separate units can be developed based on the management needs of the incident or incidents. Figure 7. illustrates the Incident Command modular structure. By properly placing responsibility within the appropriate functional area it is possible to always maintain the size of the overall organization at the needed response level.

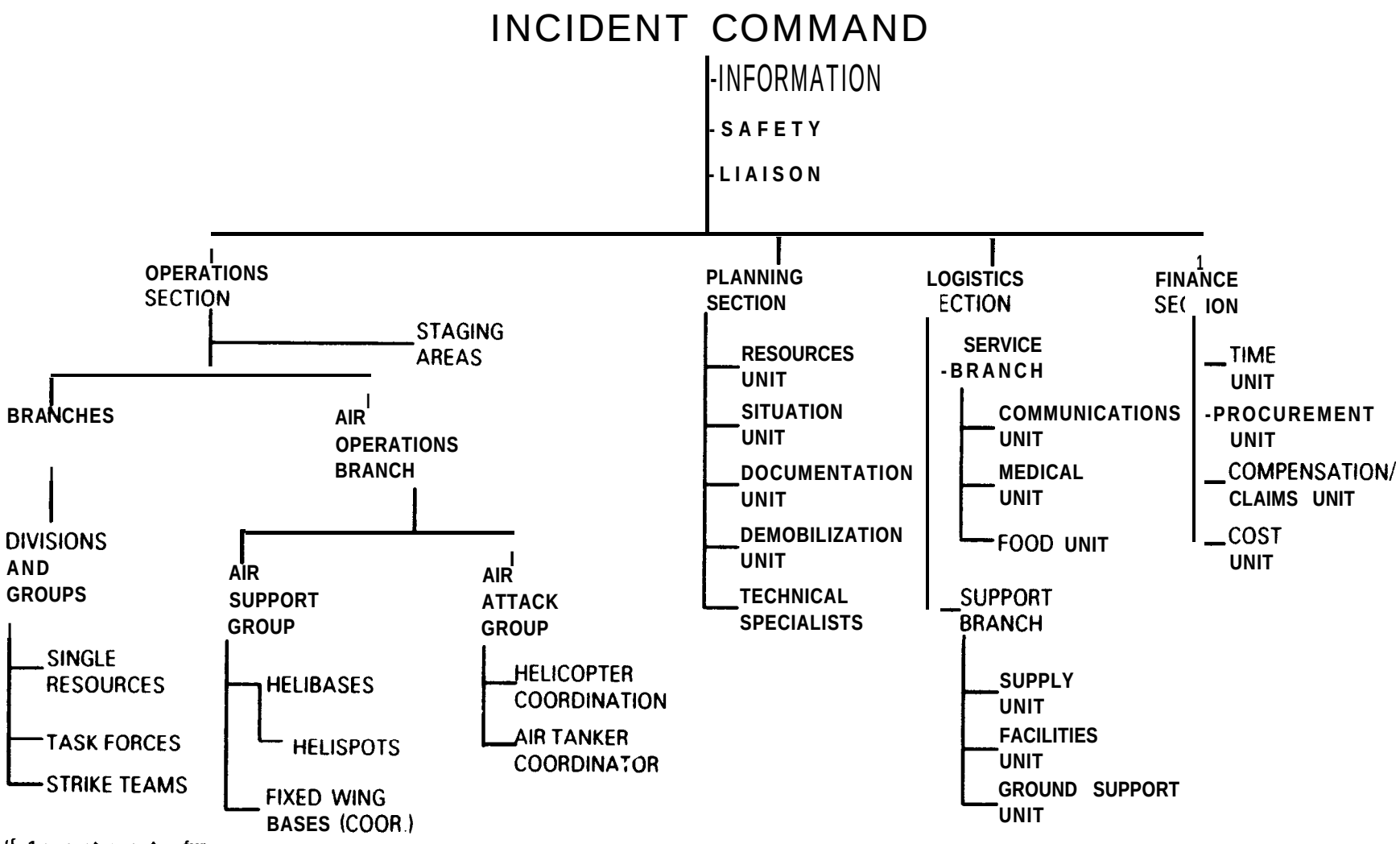
Integrated Communications. Integrated communications at the incident are managed through the use of a common communications plan and an incident-based communications center. The center is for the sole purpose of supporting the tactical and other resources assigned to the incident. All communications are in English and no codes are used. The Communications Unit is responsible for all communications planning at the incident. This includes incident-established radio networks, on-site telephone, public address, and off-incident telephone/microwave/radio sysytems. Specific radio networks for large incidents are organized into "Command Nets," "Tactical Nets," Support Nets," "Ground-to-Air Nets," and "Air-to-Air Nets," each with their specific combinations of command and support personnel, agencies, geographical areas, etc.

Unified Command Structure. Since incidents do not respect jurisdictional boundaries, and individual agency legal responsibility and authority normally is confined to a single jurisdiction, there is need for a unified command in multijurisdictional emergencies. The concept of unified command means that all agencies with jurisdictional responsibility at a multijurisdictional incident contribute to the process of:

- Determining overall incident objectives
- Selecting strategies
- Ensuring that joint planning for tactical activities will be accomplished
- Ensuring that integrated tactical operations are conducted
- Making maximum use of all assigned resources.

Selection of the appropriate mix of participants to work within a unified command structure depends on the location of the incident -- political jurisdictions -- and the kind of incident -- which functional agencies of the involved jurisdiction(s) are required. The unified command structure could reflect key responsible officials from a number of jurisdictions or several functional departments within a single jurisdiction. The command structure also could include landowners or individuals or agencies having functional

FIGURE 7



INCIDENT COMMAND SYSTEM

expertise or capability. Common objectives and strategy on major multijurisdictional incidents are written which guide development of an action plan. Under the unified command structure of ICS implementation of the action plan is directed by the Operations Chief. The Operations Chief normally is from the agency with greatest jurisdictional involvement. This designation must be with the concurrence of all agencies having both jurisdictional and functional responsibility at the incident.

Consolidated Action Plan. Every incident should have some form of written action plan. Written action plans should be used when multiple agency resources are used, when several jurisdictions are involved, and when the incident requires changes in shifts of personnel and/or equipment. The Incident Commander establishes objectives and makes strategy determinations for the incident based on the requirements of the jurisdiction. In a unified command situation the incident objectives must reflect the policy and needs of all jurisdictional agencies. The action plan should cover incident tactical and support activities required for the operational period.

Manageable Span-of-Control. Safety factors as well as sound management planning will both influence and dictate span-of-control considerations. In general, within the ICS, the span-of-control of any individual with emergency management responsibility should range from three to seven, with a desirable span-of-control of five. The kind of incident, nature of the task, hazard and safety factors, and distances between elements all will influence span-of-control decisions. An important span-of-control consideration is to anticipate change and prepare for it. This becomes particularly important during rapid build-up of the response organization when good management is made difficult by the increase in reporting elements.

Designated Incident Facilities. Several kinds and types of facilities can be established in and around the incident area. The determination of kinds of facilities and their locations is based upon the requirements of the incident and the direction of the Incident Command. A number of kinds of facilities are defined for possible ICS use, including: Command Post, Incident Base, Camps, Staging Areas, Helibases, and Helispots. Their definitions are contained in Appendix A.

Comprehensive Resource Management. Resources may be managed in one of three ways, depending on the response needs to an incident:

- Single Resources are individual engines, bulldozers, crews, helicopters, plow units, etc., that are assigned as primary tactical Units. A single resource is the equipment plus the required individuals for its proper operation.

- Task Forces are any combination of resources which can be assembled temporarily for a specific mission. All resources within a Task Force must have common communications and a Leader. The Leader normally has a separate vehicle. Task Forces are established to meet specific tactical needs and demobilized as single resources.

- Strike Teams are set numbers of resources of the same kind and type, with an established minimum number of personnel. Strike Teams always have a Leader and common communications among resource elements. Strike Teams can be made up of engines, hand crews, plows, bulldozers, and any other kind of resource where a combination of common elements becomes a useful tactical resource.

The use of Strike Teams and Task Forces is encouraged, wherever possible, to effect maximum use of resources, reduce the management control of a large array of single resources, and reduce the communications load. Maintenance of up-to-date and accurate resource utilization status is accomplished through designation of three status conditions -- assigned, available, out-of-service -- and reporting changes in a resource's status to the appropriate functional unit.

3.4 Fire Information Management System (FIMS)

3.4.1 FIMS Data Bases, Software and Hardware

Information management is crucial to the FIRESCOPE concept and operations. Among the critical decisions faced in the first few years of development of FIRESCOPE was the kinds of data to be collected, processed, stored, retrieved and displayed to meet a variety of fire-oriented needs. Starting in 1980 and continuing to date, more than three-dozen agency coordination points have been tied into the FIMS network. MACS/OCC Procedures, previously in printed mode only, were translated into software programs for use with high-capacity mini-computers and comprehensive data bases. The computerized Fire Information Management System (FIMS) is part of the MACS Information Management System (IMS). FIMS currently serves as the primary means of communication of incident status information and agency resource status and commitments.

To accomplish this, a variety of data bases are maintained and kept current. These include basic management and resources information as well as computer programs and routines available for use from system terminal locations at the Fire Mutual Aid and Regional Operational Area Coordination Centers, California Department of Forestry Ranger Unit Headquarters, National Forest Headquarters, and all Firescope member agencies. These programs and routines and (file designations) include:

- Weather (WEATHER)
- Electronic Mail (MAIL AND SEND)
- Broadcast (VIEW)
- Red Flag Alerts (ALERT)
- Fire Modeling (FIREMOD)

- Air Flight Plan (AFPLAN)
- Situation Status Reports (INC209)
- ICS Advisors (ADVISORS)
- Resource Status Reports (RESTAT).

3.4.2 MACS Modes of Operation

Under MACS, four operating modes have been established for FIMS. The decision to change modes is made by the OCC Support Services Manager based on analysis of data received on any one or series of incidents.

Modes 1 and 2 reflect a noncritical regional situation. In general, in Modes 1 and 2, there are no major multiple incidents which would require extended use of multiagency resources. Most of the MACS Coordination Points will be operational on a 24-hour-a-day basis in Modes 1 and 2, although several points will make alternate arrangements for traffic handling during nighttime and/or weekends. The basic difference between Modes 1 and 2 is seasonal.

Mode 3 is called to reflect a serious situation or the potential for a serious situation. A serious situation could be a high potential incident which involves the use of multiagency resources. Generally, a Mode 3 condition would prevail when one to three such incidents were occurring simultaneously. Mode 3 also could be called if the potential for an emergency situation would warrant; i.e., a tsunami or severe weather conditions. Mode 3 also would be warranted in a major commitment of fire suppression resources to out-of-region incidents.

Mode 4 signifies the existence of an all-out regional effort where resource use priorities require a concerted multiagency coordination effort. Under Mode 4, the MACS/OCC command conference room would be established as a regional general headquarters. In a Mode 4 situation, agency representatives to MACS/OCC GHQ should be authorized to speak and commit to their agency. Agencies in a Mode 4 status represent the eight members of the FIRESCOPE Program and any others that the group feels necessary to accomplish decisions in resource coordination and incident information.

FIMS provides the data base for decisions on changing modes and activating the MACS at the Operations Coordinating Center. A series of MACS/ICS forms routinely used in planning and operations further back up the FIMS. In addition, a variety of displays, inventories of resources, status cards for all human and material resources, weather reports, radio reports, maps, and MACS/GHQ meetings integrate, evaluate and update information on an ongoing basis at the OCC. Figure 8. provides summary information on the ICS forms which draw upon FIMS data and incident developments for response decisions.

FIGURE 8

INCIDENT COMMAND SYSTEM FORMS

Forms and records which are routinely used in the ICS are listed below. Those marked with an (*) are commonly used in written Incident Action Plans.

Incident Briefing	ICS Form 201
*Incident Objectives	ICS Form 202
*Organization Assignment List	ICS Form 203
*Division Assignment List	ICS Form 204
*Incident Radio Communications Plan	ICS Form 205
*Medical Plan	ICS Form 206
Incident Organization Chart	ICS Form 207
Incident Status Summary	ICS Form 209
Status Change Card	ICS Form 210
Check-In List	ICS Form 211
General Message	ICS Form 213
Unit Log	ICS Form 214
Operational Planning Worksheet	ICS Form 215
Radio Requirements Worksheet	ICS Form 216
Radio Frequency Assignment Worksheet	ICS Form 217
Support Vehicle Inventory	ICS Form 218
Resource Status Card (1-8)	ICS Form 219
Air Operations Summary Worksheet	ICS Form 220
Demobilization Checkout	ICS Form 221

3.5 FIRESCOPE Technological Support Systems

3.5.1 FIRESCOPE Infrared Sensing and Telemetry

Analysis of the 1970 fires demonstrated the need to improve the ability of fire personnel to assess rapidly and determine where to place emphasis on response to multijurisdictional incidents. In 1978 FIRESCOPE contracted for a comprehensive survey of infrared (IR) technology and its application to the early and ongoing assessment of fire situations. Early methods of delivery used aircraft which produced an infrared image on polaroid film of the fire, landed at a nearby airport, had it interpreted by a trained observer, and sent the photo and interpreted map to the incident by ground vehicle. This method took hours and was useful only to validate earlier incident assessments. The use of fire perimeter information collected by airborne infrared line scan fire mapping system has been improved considerably. Now a telemetry link permits transmission of the imagery to the ground immediately after the fire is mapped. This not only saves time but avoids other problems, including those where large areas are burning for extended periods of time and nearby airports are smoked in and closed intermittently.

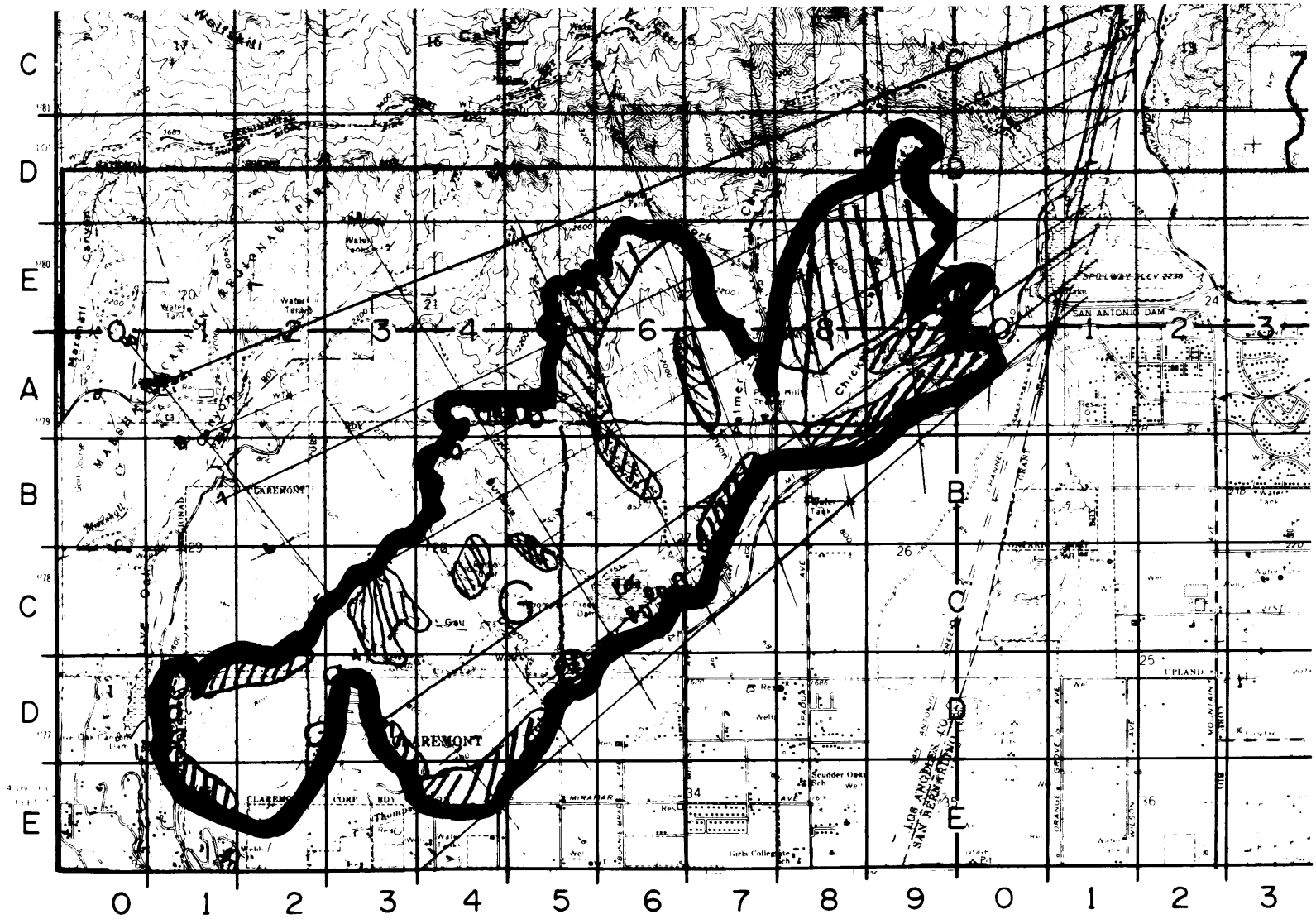
3.5.1.1 Infra-red and Telemetry Components

FIRESCOPE IR components include aircraft equipped with a line scan IR receiver, a film processor which creates a negative (black and white) IR film strip, a down link transmitter and ground station. Until 1982, the down link transmitter took the Line Scan Analog Data and transmitted it to a ground station. At the ground station, the data was recorded and recreated into a positive black and white image. The quality of imagery varied depending upon transmitting distances, equipment performance, and operator skill. In 1982, system improvements were implemented which allowed a video transmission of selected frames of the black and white film negative IR strip from the aircraft.

At the ground station, operators produce a hard copy of the video image with the use of a Polaroid camera. With the use of a Linear Measurement System (LMS), the positive print image is overlayed onto an area map utilizing FIRESCOPE's standard orthographic map quads. The operator manually transfers the heat line perimeter, hot spots, and other relevant information onto the base map for use by the incident planning section. One mobile ground receiving station is equipped and in service for use at incidents. A fixed IR receiving station with improved tracking antenna has been installed at the Operations Coordination Center. Two IR-equipped aircraft are available for use with this system. Figure 9. illustrates an integrated orthophoto map with heat perimeter and hot spot notations. The map plots the infra-red photo of the Millie Creek Fire, 23:03 P.M. PDT, September 19, 1979. The fire, at this time, burned 1,937.6 acres in the Claremont area of Los Angeles County, adjacent to San Bernardino County.

FIGURE 9

INTEGRATED ORTHOPHOTO MAP



Millie Creek Fire,
September 19, 1979