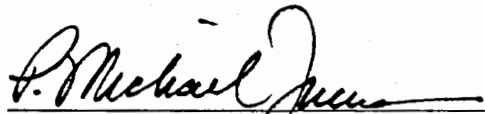


GLEN ALLEN INCIDENT
ENTRAPMENT INVESTIGATION

DATE: August 20, 1993
LOCATION: Los Angeles County
Angeles National Forest

GLEN ALLEN INCIDENT
ENTRAPMENT INVESTIGATION

Report Accepted:



P. MICHAEL FREEMAN
Chief, Los Angeles County Fire Department

10/22/93
Date



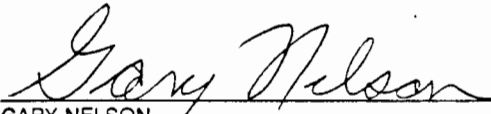
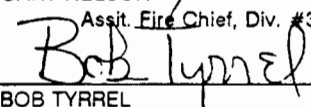
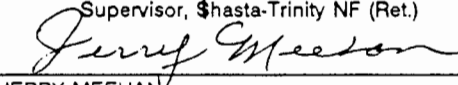
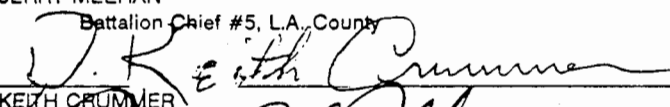
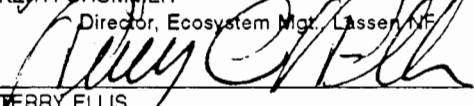
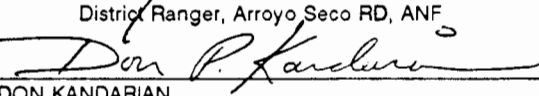
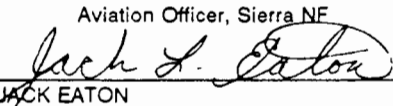
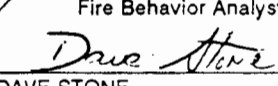
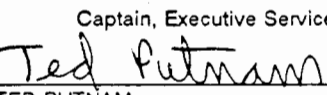
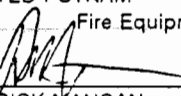
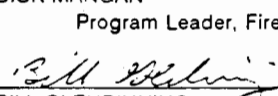
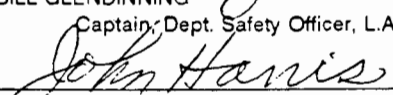
FOR RONALD STEWART
Regional Forester, Pacific Southwest Region
USDA - Forest Service

10/20/93
Date

INVESTIGATION REPORT
GLEN ALLEN FIRE ENTRAPMENT

Location: Los Angeles County
Angeles National Forest

Date: August 20, 1993

 GARY NELSON Assit. Fire Chief, Div. #3, L.A. County	Co-Chief Investigator
 BOB TYRREL Supervisor, Shasta-Trinity NF (Ret.)	Co-Chief Investigator
 JERRY MEEHAN Battalion Chief #5, L.A. County	Deputy Investigator
 KEITH CRUMMER Director, Ecosystem Mgt. Lassen NF	Deputy Investigator
 JERRY ELLIS District Ranger, Arroyo Seco RD, ANF	ANF Forest Supervisor Rep.
 DON KANDARIAN Aviation Officer, Sierra NF	Team Member
 JACK EATON Fire Behavior Analyst, Sequoia NF	Team Member
 DAVE STONE Captain, Executive Services, L.A. County	Team Member
 TED PUTNAM Fire Equipment Specialist, MTDC - USFS	Team Member
 DICK MANGAN Program Leader, Fire & Aviation Mgt, MTDC - USFS	Team Member
 BILL GLENDINNING Captain, Dept. Safety Officer, L.A. County	Team Member
 JOHN HARRIS Captain, Superintendent Camp 15, L.A. County	Team Member

FORWARD

By its very nature fire fighting is a dangerous undertaking. Wildland fires are especially so because they are dynamic and constantly changing as a result of even slight variations in wind, fuel, topography, humidity and so forth. Unfortunately, sometimes wildland fires bring death and injury to fire fighters who rely on their resourcefulness, knowledge, experience and raw courage during the battle.

The Los Angeles County Fire Department has successfully fought more than 30,000 wildland fires since the last time a fire fighter lost his life in a brush fire. A quarter of a century separates that tragedy and the Glen Allen Fire; the names are different, but the sense of loss and sadness are the same; the date and location are different, but the lessons to be learned are very similar.

No amount of second-guessing or armchair quarterbacking will bring back our deceased brothers or heal all the physical and emotional scars. Still, the gallantry and spirit of Art Ruezga, Christopher Herman and their fellow crew members energize us to study this incident, to learn from it, to share its lessons so that in their name other fire fighters may engage and conquer wildland fires without paying such a dear price.

A difficult and complex fire fighting engagement has been professionally investigated, documented, evaluated and reported by the investigation team, and we are grateful for their efforts. The investigation which follows is comprehensive and factual. The report follows a format used by the National Wildfire Coordinating Group designed to identify and present the facts. Consistent with my objective of being completely candid about the Glen Allen Fire and its lessons, I have accepted this blunt yet effective teaching tool with full knowledge that it can be interpreted as being critical of many things. Yet, this tragic incident and this report must form the "anchor point" from which we shall progress, redoubling our efforts to prevent others from losing their lives in wildland fire fighting.

It is my hope that no one in the fire service ever goes so far as to think that he or she is invincible or that something like this could not happen to them. This was an experienced crew, and they were good at their jobs. Having made a safe landing, well away from the fire, they had contained the head of the fire and had cut several hundred feet of fire line.

Some 35 minutes into their work, during a short break, the fire was evaluated, options and safety considerations were weighed, and the decision was made to continue a downhill cut along an underslung line. The record will show that within the next five minutes, two men would lose their lives, two would be seriously burned and five others would narrowly escape unharmed.

In the "context" of what Crew 2-2 was doing there were numerous mitigating factors that gave them a false sense of safety. It was only seconds before the entrapment that they realized that they were in danger. In retrospect it would become clear that:

- the terrain was extremely steep and the soil so loose as to make escape to safety difficult to impossible
- a ridge prevented a full view of the fire below which was still active although laying down
- the black or burned "safe zone" was not really safe because there were unburned fuels below the intended safe zone
- the crew was cutting a direct line in a small draw (chimney)

On that fateful afternoon, no one on Crew 2-2 intended to take extraordinary risks or to place themselves in jeopardy; none of them displayed reckless disregard for their safety. Yet the sad outcome is now history. So that history does not repeat itself, this report must be accepted, not as a personal criticism of any individual or group, but as a recognition and sad reminder that the dynamics of a wildland fire have the capacity to mislead, deceive, maim and kill experienced, aggressive fire fighters.

P. MICHAEL FREEMAN, FIRE CHIEF
LOS ANGELES COUNTY FIRE DEPARTMENT

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NARRATIVE

1. Incident Overview:

At 1511 hours on Friday, August 20, 1993, Ms. Catherine Ryker (Reichert) reported a car and brush fire across the street from 1886 Glenn Allen Lane in Altadena, California. Los Angeles County Fire Department dispatched Engines 11 and 66 to the scene and notified Battalion Chief 4. At 1516 hours, LAC Engine 11 requested a first alarm brush response and to have JPL set up helispot 82A. LAC Engine 11 was the first on the scene and reported approximately 2 acres of brush and a car on fire. At approximately the same time, the Angeles National Forest dispatched a full brush assignment consisting of 5 engines, a dozer, and a hotshot crew to the scene. Los Angeles County also responded a full brush assignment which consisted of 5 engines (including the two already sent), 4 hand crews, Helicopter 15 with Crew 2-2, and supporting overhead.

Upon arrival at the scene, Copter 15 circled the fire three times while Pilot Dunbar, Crew Supervisor Neville and Crew Leader Ruezga discussed the fire activity and a safe off-loading area for the crew. After agreement, Pilot Dunbar landed the copter in a safe area approximately 300 feet from the fire. Copter 15 contacted the LAC dispatch (TRO) and informed them that he was landing the crew and they acknowledged receipt of the message. After leaving the helicopter, Crew Supervisor Neville, Copter 15, and TRO 10 communicated on radio channel Blue 6. The plan was for Copter 15 to return with a load of water by the time Crew 2-2 reached the fire edge. By the time Crew 2-2 reached the fire, Copter 15 had in fact returned with a load of water.

In the time between the start of the incident and approximately 1600 hours, these forces fought the fire and nearly had it contained within a ten acre area. However, approximately 35 to 40 minutes after Crew 2-2 off-loaded the fire became active along its west flank. During the next five to ten minutes the fire expanded to its eventual full size. At the commencement of this new activity both the Angeles National Forest and LAC ordered second alarms for this incident. During this period, Crew 2-2 operated essentially without radio contact with the rest of the forces on the fire scene except for Copter 15. The crew had advanced down the western side of the ridge that they were on and arrived at the Altadena Crest Trail. After a short break, some planning and assessment of alternatives, they decided to continue on down the hill cutting fire line along the advancing edge of the fire. Their strategy was direct attack (one foot in the black). This put them in the drainage that burned subsequent to the initial fire run. They left the trail and started to work downhill after posting a lookout at the point where they left the trail. This action occurred shortly after a 1607 hours request by the crew for water drops in the area below their position. The next contact with the crew occurred between 1614 and 1616 hours when the Crew Supervisor reported an entrapment and burnover incident.

Helicopter 15 immediately came to the support of the crew and tried to ascertain their position and the extent of injuries. He also commenced water drops to protect and cool the crew. Other crews immediately started moving in that direction to assist in rescue and medical evacuation. At 1654 hours after necessary dust abatement work was accomplished, paramedics were dropped into the rescue location and also commenced rescue and evacuation operations. The first victim was evacuated to Sherman Oaks Burn Center by Air Squad 9 at 1724 hours. At 1747 hours Los Angeles City Fire Department Copter 2 departed the incident enroute to Sherman Oaks with the second victim. At 1811 hours the third was transported to Verdugo Hills Hospital. The fourth and last victim was lowered to the bottom of the canyon and carried out to 1781 Skyview Drive at 2045 hours.

The Glen Allen Fire was declared under control at 2144 hours on August 20, 1993.

2. Team Formation:

During the evening of August 20, 1993, Co-Chief Investigator Bob Tyrrel and other Forest Service team members were called by Lyle Shook, USDA Forest Service, Region 5 Occupational Health and Safety Officer, to represent the Forest Service in the investigation of the firefighter entrapment¹ associated with the Glen Allen Incident on the Angeles National Forest.

The initial team briefing was conducted by Greg Greenhoe, Assistant Angeles National Forest Fire Management Officer, on August 21, 1993 at 0900 hours in the Angeles National Forest Supervisors Office. The briefing was recorded on video tape. A copy, titled "Glen Allen Investigation, Tape #1", is included in the Glen Allen Incident Entrapment Investigation File.

It was agreed that the team would be a joint effort between the Los Angeles County Fire Department and the Forest Service with L.A. County designated as the lead agency since the fire started on County protected lands and the entrapment occurred to County firefighters.

Los Angeles Fire Department Assistant Fire Chief Gary Nelson was assigned as Co-Chief Investigator at 0930 on August 21. He was briefed by Angeles National Forest Fire Management Officer Tom Harbour at 1130 hours that same day.

The Investigation Team set up their headquarters at Los Angeles County Fire Camp 2 in LaCanada-Flintridge where both County and Forest Service facilities exist side by side.

¹**Entrapment:** *A situation where personnel are unexpectedly caught in a fire behavior-related, life-threatening position where planned escape routes or safety zones are absent, inadequate, or have been compromised. An entrapment may or may not include deployment of a fire shelter for its intended purpose. These situations may or may not result in injury. They include "near misses." As defined by the National Coordinating Group in Fire Entrapment Investigation and Review Guidelines.*

3. Team Membership:

<u>Name</u>	<u>Official Title</u>	<u>Team Position</u>
Gary Nelson	Assistant Fire Chief, Los Angeles County FD	Co-Chief Investigator
Bob Tyrrel	Forest Supervisor (Retired), Forest Service	Co-Chief Investigator
Jerry Meehan	Battalion Chief, Los Angeles County FD	Deputy Investigator
Keith Crummer	Ecosystem Manager Forest Service, Lassen NF	Deputy Investigator
Terry Ellis	District Ranger Forest Service, Angeles NF	Angeles National Forest Forest Supervisor's Representative
Don Kandarian	Aviation Officer Forest Service, Sierra NF	Fire Safety
Jack Eaton	Fuels Specialist Forest Service, Sequoia NF	Fire Behavior Analyst
Dave Stone	Captain, Executive Services Los Angeles County FD	Fire Safety
Ted Putnam	Fire Equipment Specialist Forest Service, Missoula TDC	Personal Protective Equipment Specialist
Dick Mangan	Program Leader, Fire & Aviation Forest Service, Missoula TDC	Equipment and Fire Organization
Bill Glendinning	Captain, Safety Officer Los Angeles County FD	Fire Safety
John P. Harris	Captain, Camp 15 Superintendent Los Angeles County FD	Wildland Fire Training

4. Investigation Report Task Assignments:

A. Narrative	Crummer
B. Findings	Mangan (draft), Team (final)
C. Causal Factors	Team
D. Sequence of Events	Stone
E. Site Investigation	Meehan/Kandarian
F. Witness Statements	Team
G. Memorandum of Interviews	Team
H. Fire Behavior	Eaton
I. Personal Protective Equipment	Putnam/Mangan
J. Maps and Photo Record	Crummer

5. Team Advisors:

Will Shaw	Team Facilitator, Forest Service
Jean Ryan	Clerical Support, Forest Service
Mike Alt	Law Enforcement Investigator, Forest Service
Rita Plair-Wears	Law Enforcement Investigator, Forest Service

6. List of Contacts

Sandy Elm	Cal OSHA, Los Angeles Office 8/21/93, 0830 by Bill Glendinning
Tom Gessner	District Attorney 8/21/83, 0900 by Bill Glendinning

Jeff Molton, OGC, contacted Ben Greenwell, Regional Office OSHA. Greenwell said we did not need to contact Federal OSHA because the deceased employees were not Federal employees.

To cover all options, Bob Tyrrel contacted Federal OSHA Field Office in San Diego. No one answered, but he left the above message on their machine, provided telephone number of the Arroyo Seco District Ranger if there were any questions.

7. Investigation Sequence by Days:

August 20	2000 - 2100	Team Notified
August 21	0900 1100 1430	Briefing - Team Introduced Visited Incident Site Team Meeting Process Identified Needs-Identified
	1830	Orders Placed Interview List Determined Things To Do List Established Meeting Adjourned
August 22	0700 0930 1600 1800	Team Meeting Interview Topics Decided Interviews Began Team Meeting Meeting Adjourned
August 23	0700 0900 1600 1800	Team Meeting Interviews Continued Equipment Inspected/Photographed Film Obtained Team Meeting/Review Meeting Adjourned
August 24	0700 0800 1600 1800	Team Meeting Summarized Interviews Viewed Videos of Incident Breakout Groups Reviewed Team Findings Completed Interviews Identified Causal Factors Team Meeting Meeting Adjourned
August 25	0700 0730 1600 1800	Team Meeting Contributory Causes Reviewed Sequence of Events Documented Photos Selected to Mount for Printing Site Investigation Narrative Reviewed Findings Reviewed Team Meeting Meeting Adjourned

<i>August 26</i>	0700 0800 1300 1800	Team Meeting Causal Factors Reviewed Findings Finalized Meeting Adjourned
<i>August 27</i>	0700 1000 1300	Team Meeting Causal Factors Finalized Recommendations Finalized Sequence of Events Finalized
	1900 2400	Site Investigation Narrative Finalized Medivac Timelines Established Final Draft Completed for Printing Adjourned
<i>August 28</i>	1000	Close Out with Los Angeles County and Forest Service
<i>September 9</i>		Nelson, Harris, Stone, Glendinning and Meehan Met at Camp 15
<i>September 10</i>		Captain Harris Interviewed Homeowner James Link
<i>September 17</i>		Team Meeting (Nelson, Ellis, Glendinning, Stone, Ryan)
<i>September 20</i>		Captains Harris and Glendinning Interviewed FSA Christopher Barth at Sherman Oaks Burn Center
<i>September 25</i>		Captains Harris and Glendinning Interviewed FSA Larios at Sherman Oaks Burn Center.
<i>September 26</i>		Captains Harris and Glendinning Drafted Sequence of Events Narrative
<i>September 27</i>		Team Meeting (Glendinning, Harris, Meehan, Ryan)
<i>September 28</i>		Team Meeting (Harris, Meehan, Ryan)
<i>September 29</i>		Team Meeting (Ellis, Meehan, Stone, Glendinning, Harris, Ryan)

FINDINGS

The findings listed in this report are supported by interviews, witness statements, physical evidence, standard Forest Service forms and other information which are held in the Glen Allen Incident Entrapment Investigation File.

1. FIRE BEHAVIOR

- a. The fire behavior was in a manner consistent with expected burning conditions based upon terrain, weather and fuels.
- b. Prior to entrapment, fire overhead assessed that the fire was laying down.
- c. The prevailing winds were southwest 5 to 6 mph before the entrapment.
- d. Fire backing down ridges had flame lengths of 2 to 3 feet.
- e. The fire rapidly increased in size from 10 acres to 50 acres in a 5 to 10 minute period at approximately 1614 hours.
- f. Fire burned up east facing slope of the entrapment canyon in approximately 1 minute (opposite slope of entrapment).
- g. Flame lengths during flare-up, on the east facing slope, ranged from 15 to 35 feet with some fire whirls.

2. ENVIRONMENTAL

- a. The fire burned in a mixed fuel type of NFFL Model 1 (grass) and Model 4 (brush).
- b. Slopes were 80 to 110 percent.
- c. Temperatures at the incident scene were 80 to 90 degrees Fahrenheit.
- d. The fire area previously burned in 1979 (Pinecrest Fire).
- e. There were no "Red Flag" warnings issued by the National Weather Service.
- f. Spot weather forecasts were not requested.
- g. Humidities ranged from 35 to 45 percent.
- h. Soils were loose, decomposed granite, held on the slope by the root system of the existing undisturbed vegetation, which is typical for the foothills of the San Gabriel Mountains.

3. MANAGEMENT

- a. The incident began as an automobile fire in Los Angeles County Fire Department's (LAC) protection area at 1510 hours on Friday, August 20, 1993.

- b. The fire spread onto Angeles National Forest (ANF) before the first responding units reached the scene.
 - c. LAC and ANF have a Cooperative Fire Protection Agreement dated 2/28/85 and an approved 1993 Operating Plan.
 - d. Radio frequencies were being very heavily used.
 - e. A parallel incident management organization was established at Noyes School, 1919 East Pine Crest Drive, Altadena.
-
- f. Crew 2-2 was dispatched to the Glen Allen Fire at 1517 hours via Helicopter 15.
 - g. Helispot 1 was chosen after discussion between the Pilot, the Crew Supervisor and the Crewleader, as a zone of safety for Crew 2-2 pending the return of Helicopter 15 for water support.
 - h.
 - Crew 2-2 off loaded at Helispot 1 (H1) at 1533 hours and proceeded down the ridge to attack the head of the fire.
 - After controlling the head of the fire Crew 2-2 started working the west flank with support from Copter 15.
 - After constructing approximately 300 feet of line Crew 2-2 reached the Altadena Crest Trail.
 - Prior to working below the Altadena Crest Trail, Crew 2-2 took a break and discussed tactical options and some safety issues, but did not have a formal safety briefing.
 - When Crew 2-2 reached the Altadena Crest Trail the fire perimeter extended from 30 to 300 feet below their position on the trail.
 - After Copter 15 knocked down active fire on the northern end of the underslung line, Crew 2-2 started downhill line construction in a small, unrecognized chimney without discussion of the greater hazard.
 - Approximately 40 minutes after Crew 2-2 was off-loaded, the flareup started at the bottom of the entrapment canyon and ran up canyon towards them.
 - The lookout alerted the crew of the flareup and all crewmembers acknowledged and started evacuation.
 - i. The ANF IC and Ops Chief had no radio contact with Crew 2-2.
 - j. LAC was managing two other wildland fires at the time the Glen Allen Fire began (Catalina and Mills).
 - k. ANF Ops Chief and LAC Crew Coordinator had frequent face to face communication regarding crew locations.

- l. LAC Crew Coordinator was unable to establish communication with Crew 2-2.
- m. ANF was managing one other incident at the same time (Mills).
- n. Strategy was aggressive control of the fire with structure defense. Tactics were direct attack.

4. CONTROLS

- a. There were nine members of Crew 2-2 including the Crew Supervisor.
- b. There were two radios (UHF, VHF) on Crew 2-2, both held by the Crew Supervisor.
- c. Crew 2-2 was not in communication with adjacent ground resources.
- d. LAC has specific guidelines for downhill fireline construction.
- e. A lookout was posted on the Altadena Crest Trail.
- f. LAC radio communication for the Glen Allen Incident was operating on a verbal communication plan including a Tactical Radio Operation (TRO) frequency (Blue 6) and one tactical frequency (White 4).
- g. ANF radio frequencies for the Glen Allen Incident were ANF 1 and TAC 2.
- h. Helicopter 15 was using White 3 because pilot never received notification to go to White 4.
- i. The TRO frequency (Blue 6) was also used for another wildfire (Mills), routine radio traffic, and other emergencies for Battalions 2, 4, 10, and 12.
- j. Under the parallel organization, agency specific divisions were established.
- k. The Crew Supervisor was not the regular Crew Supervisor for Crew 2-2.
- l. Crew 2-2 was not in communication with any ground unit on the Glen Allen Incident prior to the entrapment.
- m. Helicopter 15 reported position of Crew 2-2 to the TRO Operator only, on Blue 6.
- n. The crew did not have a formal safety briefing prior to starting the undercut line operation below the Altadena Crest Trail.
- o. LAC IC's span of control was within Incident Command System (ICS) guidelines.
- p. Crew 2-2 did not give status reports to LAC IC or Crew Coordinator prior to entrapment.
- q. Crew Coordinator was able to establish contact with all LAC crews on the incident, except Crew 2-2.
- r. Crews have been cautioned by management to minimize radio traffic during incident operations.

- s. Radio traffic on TRO frequency (Blue 6) was very heavy during the incident.
 - t. There was significant radio interference on LAC White 4 and ANF 1 in the form of Spanish language.
 - u. The southwest edge of the fire was not visible to Crew 2-2 because of a spur ridge and vegetation.
 - v. Approximately 40 minutes passed from the time of the burnover until emergency medical evacuation help arrived at Crew 2-2's location.
-
- w. Crew 2-2 had difficulty reporting their emergency situation.
 - x. There is not a standing written medical evacuation plan for initial attack incidents for LAC Fire or ANF.
 - y. The incident was not using standard ICS radio nets.
 - z. Crew 2-2 was working direct line construction (one foot in the burn).
 - aa. On September 25, 1993 radio tests were conducted for clarity at the Glen Allen Incident site, and all radio transmissions were loud and clear except the following:
 - 1. Radio tests from the Altadena Crest Trail at the Crew Supervisor's location, failed on the first attempt, but were successful on the second attempt on each White radio frequency.
 - 2. From the entrapment area below the trail, the Blue radio network repeater was activated on Channel 4, but not on Channel 5, 6, and 12.
 - bb. High steep ridges on each side of the entrapment area prevented several radio transmissions from activating repeaters.

5. PERSONNEL

- a. The fatally injured personnel were:
 - Christopher Herman, age 25
 - Arthur Ruezga, age 33
- b. The injured personnel were:
 - Christopher Barth, age 25
 - Hector Larios, age 19
- c. Four other crewmembers and the Crew Supervisor were entrapped but not injured.

- d. Crew 2-2 personnel and Crew Supervisor met LAC qualifications for the positions they filled.
- e. Crew 2-2 personnel were trained in fire shelter use.
- f. Crew 2-2 had been on shift since 1000 hours on Friday, August 20, 1993.
- g. Although the Crew Supervisor of Crew 2-2 was qualified for the position, Crew Supervisor was not his regular work assignment.
- h. Crew 2-2 participated in mandatory physical fitness activities.
- i. Crew Supervisor had previously served for 3 years as a crew supervisor and had worked intermittently in that role during the past one year.
- j. Crew 2-2 Fire Suppression Aides' experience ranged from 1 to 23 years.
- k. Crew 2-2 had been assigned to the fire for approximately 40 minutes prior to the entrapment.
- l. ANF overhead were qualified in Red Card System for the positions they held.
- o. Some LAC overhead were not qualified for the positions they held in accordance with ICS 310-1.
- p. Crew 2-2 was assigned as a ground crew for Friday, August 20, 1993.

6. EQUIPMENT

- a. Members of Crew 2-2 were wearing personal protective equipment as specified in LAC Department manuals.
- b. Fire shelters carried by Crew 2-2 were made under contract to GSA according to Forest Service specifications.
- c. None of the personnel fully deployed their fire shelters.
- d. Entrapped crewmembers below the trail did not open their fire shelters.
- e. Personal protective equipment functioned within design limits.
- f. Some individuals had difficulty removing their fire shelters because of the bulkiness of their gloves.
- g. Some crew persons wore forest worker gloves because they provide greater dexterity than the LAC structural gloves.

- h. Some crewmembers used their fire shelters as heat shields to walk behind.
 - i. Crew was tooled appropriately for expected fuels and assignments.
 - j. Crew was not carrying equipment to aid in access/egress on steep terrain.
 - k. Initial rescue efforts did not utilize all available rescue and extraction equipment.
 - l. Air Squad paramedics did not unload all necessary equipment from helicopter.
-
- m. Normal first alarm dispatch by ANF and LAC would have provided three (3) helicopters within approximately 20 minutes rather than the one (Copter 15) supporting the incident.
 - n. Los Angeles City Fire Department provided one water dropping helicopter (Fire Copter 4).
 - o. LAC Copters 17 and 18 were committed to the Catalina Incident.
 - p. San Bernardino Copter 305 responded in place of ANF Copter 531.
 - q. - Copter 12 was dispatched to the Glen Allen Incident at 15:17 but was still on the ground at 15:28.
- LAC Air Squad 9 (Copter 12) was diverted from the Glen Allen Incident at 15:30 and dispatched to the Mills Incident.
 - r. ANF Copter 531 was committed to the Mills Incident.

7. MEDIVAC

- a. Immediately after the entrapment, several crews went to the aid of Crew 2-2 (15-1, 15-2, 19-2, 19-5, LAC E-12, ANF E-17, LAC SU 12). Some personnel were qualified paramedics, and one was a former paramedic.
- b. LAC Air Squad 9 (also known as Helicopter 12) was released from the Mills incident and reassigned to the Glen Allen rescue.
- c. LAC Helicopter 15 applied water drops to the entrapment site to cool down the area and did dust abatement on the medivac helispot.
- d. An additional medical emergency occurred to a crewmember assigned to Light Force 82 at the same time as rescue operations were beginning for Crew 2-2.
- e. Dust prevented Air Squad 9 from accomplishing either a hoist rescue or a normal landing at the site.
- f. Four out of the five helicopters on incident undertook dust abatement actions on helispots until landings were possible.
- g. Los Angeles City Fire Department provided one rescue helicopter (Fire Copter 2) with two paramedics.

- h. Fire Copter 2 was unable to establish radio contact with Copter 15 for an extended period of time.
 - i. Air Squad 9 paramedics (2) hover-jumped onto scene with medical equipment.
 - j. Ongoing fire activity in the entrapment canyon and immediately below the rescue site, extremely steep slopes and sheer cliffs, and loose sandy soil delayed the progress of rescue personnel and medical equipment to the entrapment site and subsequent evacuation.
 - k. Aerial fire suppression activities were suspended in order to expedite aerial medical evacuation.
-
- l. Radio frequency overload prevented effective communications between incident overhead, Crew 2-2 and Copter 15.
 - m. Some LAC personnel demonstrated a lack of radio discipline after emergency radio traffic was requested and/or announced.
 - n. The first burn victim was aurally medivaced from the scene approximately 70 minutes after the entrapment. (Air Squad 9)
 - o. The second burn victim was aurally medivaced from the scene approximately 93 minutes after the entrapment. (Fire Copter 2)
 - p. The third burn victim was aurally medivaced from the scene approximately 117 minutes after the entrapment. (Air Squad 9)
 - q. The fourth burn victim was declared dead at the scene, transported by Stokes litter down the canyon to the southern edge of the fire, and removed by the coroner.
 - r. Los Angeles County Sheriff's Air 5 was not available for this incident because it was assigned to the Catalina Incident.

8. SAFETY FACTORS

The following section deals with standard interagency fire service guidelines and orders that were compromised or not followed. Some of these are also included in the Causal Factor section.

STANDARD FIRE ORDERS (1, 4, 5, 6, 7, 8)

The following standard fire fighting orders were compromised:

- 1. Fight fire aggressively but provide for safety first. Attack was aggressive but did not provide for an adequate margin of safety.
- 4. Ensure instructions are given and understood. Safety zones, escape routes were not given. It was assumed that everyone knew these zones and routes.
- 5. Obtain current information on fire status. There was no information from adjacent resources at the bottom of the draw nor was the lookout in a position from which to adequately see the main fire.

6. Remain in communication with crewmembers, your supervisor and adjoining forces. There was no communication with adjoining resources or supervisor.
7. Determine safety zones and escape routes. The crew was not briefed about escape routes and safety zones prior to leaving the Altadena Crest Trail.
8. Establish lookouts in potentially hazardous situations. A lookout was posted but not in a position to see what the fire was doing.

WATCH OUT! SITUATIONS (1, 3, 5, 7, 9, 12, 17)

The following Watch Out! Situations were not recognized, or appropriate action was not taken:

1. Fire not scouted and sized up. Fire in drainage below not scouted or properly sized up.
3. Safety zones and escape routes not identified. No safety zones or escape routes were specified; some crewmembers assumed that the escape route was back up the line to the Altadena Crest trail and the safety zone to be in the burned area.
5. Uninformed on strategy, tactics and hazards. There was no discussion between incident overhead and Crew 2-2 on strategy, tactics and hazards.
7. No communication link with crewmembers and/or supervisors. Crew 2-2 did not have communications with incident overhead.
9. Building fireline downhill with fire below you. Some of the guidelines for downhill fireline construction were not followed.
12. Cannot see main fire, not in contact with anyone who can. No one on Crew 2-2 could see the lower area of the fire and they were not in contact with anyone who could.
17. Terrain and fuels make escape to safety zones difficult. Loose soil and very steep slopes prevented some crewmembers from moving quickly uphill to the Altadena Crest Trail.

9 Guidelines for Downhill & Indirect Handline Construction (Fireline Safety Reference, NFES 2243, April 1992 NWCG) and **7 Guidelines for Downhill Fireline Construction** (*Fire Crew Supervisor Training Guide*, LAC)

The Forest Service follows procedures for building downhill fireline found in 9 Guidelines for Downhill & Indirect Handline Construction (referred to hereafter as NWCG). Los Angeles County Fire Department uses procedures found in 7 Guidelines for Downhill Fireline Construction (referred to hereafter as LAC). The following seven of the 9 Guidelines and five of the 7 Guidelines were not adhered to:

1. The decision is made by a competent firefighter after thorough scouting. (NWCG)
Same as above. (LAC)
Firefighters were competent but line was not thoroughly scouted.
2. Downhill line construction should not be attempted when fire is presently below the proposed starting point. (NWCG)

The crew was working on a line that was uncontrolled at the bottom, and there was fire below the crew's location.

The toe of the fire is anchored. (LAC)

The toe of the fire was not anchored in canyon.

3. The fireline should not lie in or adjacent to a chimney or chute that could burn out while crew is in vicinity. (NWCG)

Same as above. (LAC)

Crew was constructing line in a chimney.

4. Communication is established between the crew working downhill and crews working toward them from below. When neither crew can adequately observe the fire, communications will be established between the crews, supervising overhead, and a lookout posted where the fire's behavior can be seen. (NWCG)

Same as above. (LAC)

Crew 2-2 was not in communication with adjacent resources. Lookout could not see fire behavior on the main fire.

5. The crew will be able to rapidly reach a zone of safety from any point along the line if the fire unexpectedly crosses below them. (NWCG)

Same as above. (LAC)

Crew could not reach a safe area because of terrain, soil, and fire rate of spread.

6. A downhill line should be securely anchored at the top. (NWCG)

Line was anchored at the top, so this does not apply.

Direct attack will be used whenever possible. (LAC)

Direct attack was used, so this does not apply.

7. Line firing should be done as the line progresses, beginning from the anchor point at the top. The burned area provides a continuous safety zone for the crew and reduces the likelihood of fire crossing the line. (NWCG)

This does not apply.

If direct attack is not possible, the fireline should be completed between anchor points before being fired out. Firing operations should proceed with assured access to the burned out part of the fireline or other safety zones. (LAC)

This does not apply.

8. Be aware of and avoid the Watch Out! Situations!. (NWCG)

This is discussed in Findings.

9. Full compliance with the Standard Fire Orders. (NWCG)

This is discussed in Findings.

CAUSAL FACTORS

The Investigation Team has determined that the following direct and contributory causes led to the entrapment.

I. DIRECT CAUSES

The investigation team determined that the direct causes of the entrapment were:

- A. The fire spread so fast in the chimney that the victims did not have sufficient time to escape.
- B. The terrain features were not recognized by Crew 2-2 as a hazardous situation.
- C. A rapid evacuation to a safe area was prohibited by steep slope and loose soil.
- D. Crew could not see the fire below their location and were not in contact with anyone who could.
- E. There was not an adequate safety zone or escape route.

These are supported by the following Findings:

- 1f. Fire burned up east facing slope of the entrapment canyon in approximately 1 minute (opposite slope of entrapment).
- 1g. Flame lengths during flare-up, on the east facing slope, ranged from 15 to 35 feet with some fire whirls.
- 2b. Slopes were 80 to 110 percent.
- 4c. Crew 2-2 was not in communication with adjacent ground resources.
- 4p. Crew 2-2 did not give status reports to LAC IC or Crew Coordinator prior to entrapment.
- 4u. The southwest edge of the fire was not visible to Crew 2-2 because of a spur ridge and vegetation.

II. CONTRIBUTORY CAUSES

A. Communications

- 1. The lack of a radio prevented the lookout from moving to the location that would be most advantageous.
- 2. The design and management of the radio network, including outside interference, created communication problems on the incident.

These are supported by the following Findings:

- 3d. Radio frequencies were being very heavily used.
- 4b. There were two radios (UHF, VHF) on Crew 2-2 both held by the Crew Supervisor.
- 4i. The TRO frequency (Blue 6) was also used for another wildfire (Mills), routine radio traffic, and other emergencies for Battalions 2, 4, 10, 12.
- 4q. Crew Coordinator was able to establish contact with all LAC crews on the incident except Crew 2-2.
- 4s. Radio traffic on TRO frequency (Blue 6) was very heavy during the incident.
- 4t. There was significant radio interference on LAC White 4 and ANF 1 in the form of Spanish language.
- 4w. Crew 2-2 had difficulty reporting their emergency situation.

CHRONOLOGICAL SEQUENCE OF EVENTS

- 15:11** On Friday, August 20, 1993, Ms. Catherine Ryker (Reichert) reported a vehicle and brush fire across the street from 1886 Glen Allen Lane, Altadena. Los Angeles County Fire Department dispatched two Engines, 11 and 66, to the scene. Battalion 4 Chief notified.
- 15:13** Engines 11 and 66 dispatched to a grass and vehicle fire at the above location.
- 15:16** Engine 11 requested a first alarm brush assignment that should have included: included five engines (including Engine 66), four hand crews, one dozer, two helicopters with crews, two crew superintendents and one battalion chief.
- 15:17** Engine 11 requested Forest Service start a first alarm brush assignment which included five engines, one dozer and one hotshot crew.
- 15:18** Engine 11, on scene, reported approximately 2 acres in light to medium brush running uphill with a southwest wind at approximately 10 mph.
- 15:28** Copter 15 with Crew 2-2 arrived on scene.
- 15:30** Helicopter Air Squad 9 diverted to Mills Incident to fill out a second alarm brush request.
- 15:33** Crew 2-2 disembarked from Copter 15 at Helispot #1.
- 15:47** Glen Allen LAC IC notified of diversion of Helicopter Air Squad 9.
- 16:06** Copter 15 attempted to notify Glen Allen LAC IC that L. A. City Copter was on scene. LACC notified Copter 15 that they are unreadable.
- 16:07** Copter 15 asked LACC to relay information.
- Copter 15 stated: "That's the Forest Service helicopter above the fire and he's in contact with me. He's gonna put his crew up where I put mine and they're gonna work their way down the east side. My crew's working their way down the west side."
- LACC acknowledged message but it was not relayed to Glen Allen LAC IC.
- 16:07** Crew 2-2 radioed Copter 15 to make a drop in the canyon bottom below them.
- 16:14** Flareup and entrapment occurred sometime between 16:07 and 16:14.

16:14 Crew 2-2 sent garbled message.

16:16 Crew 2-2 requested "emergency traffic - men trapped in the fire."

16:19 Copter 15 asked if TRO10 dispatched an air squad. TRO10: "Affirmative, we have an ambulance and air squad enroute. Crew 2-2, be advised, Copter 15 is enroute, and we are trying to get a hold of L. A. City Fire 4 above you to drop their water on you."

16:22 Mills IC released Air Squad 9 for medical run to Glen Allen Incident.

16:26 Air Squad 9 responded with two paramedics.

16:54 Paramedics are dropped into the incident and commenced rescue and evacuation operations.

17:24 First victim was transported to Sherman Oaks Burn Center via Air Squad 9. ETA was 10 minutes.

17:47 L.A. City Fire Copter 2 enroute to Sherman Oaks Burn Center with second fire victim.

18:11 Air Squad 9 enroute to Verdugo Hills Hospital with third fire victim.

20:45 Fourth victim lowered to the bottom of canyon and carried out to 1781 Skyview Drive.

21:44 The Glen Allen Fire was declared under control.



Order in which Crew 2-2 started constructing line below the Altadena Great Trail and the tool each was carrying:

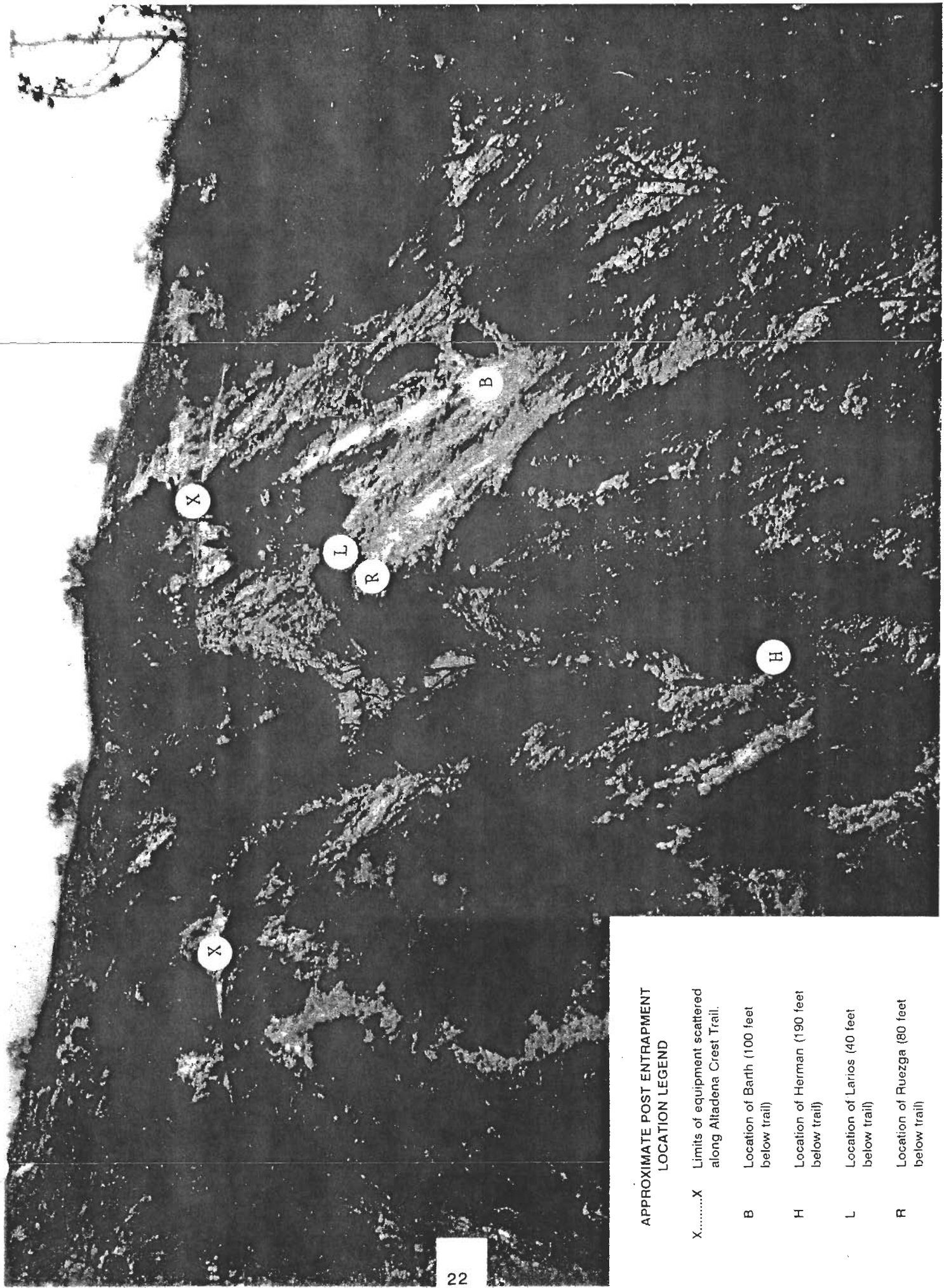
- 9 Palomarez (Shovel)
- 8 Rodriguez (Pulaski)
- 7 Goodrich (McLeod)
- 6 Neville (McLeod)
- 5 Kuch (McLeod)
- 4 Ruezga (Shovel)
- 3 Larlos (McLeod)
- 2 Barth (Bucker/Pulaski)
- 1 Horman (Chainsaw)

APPROXIMATE CREW LOCATION AND TOOL ORDER, BEFORE ENTRAPMENT.



APPROXIMATE ENTRAPMENT
LOCATION LEGEND

- B Location of Barth
- H Location of Herman
- L Location of Larios
- R Location of Ruezga



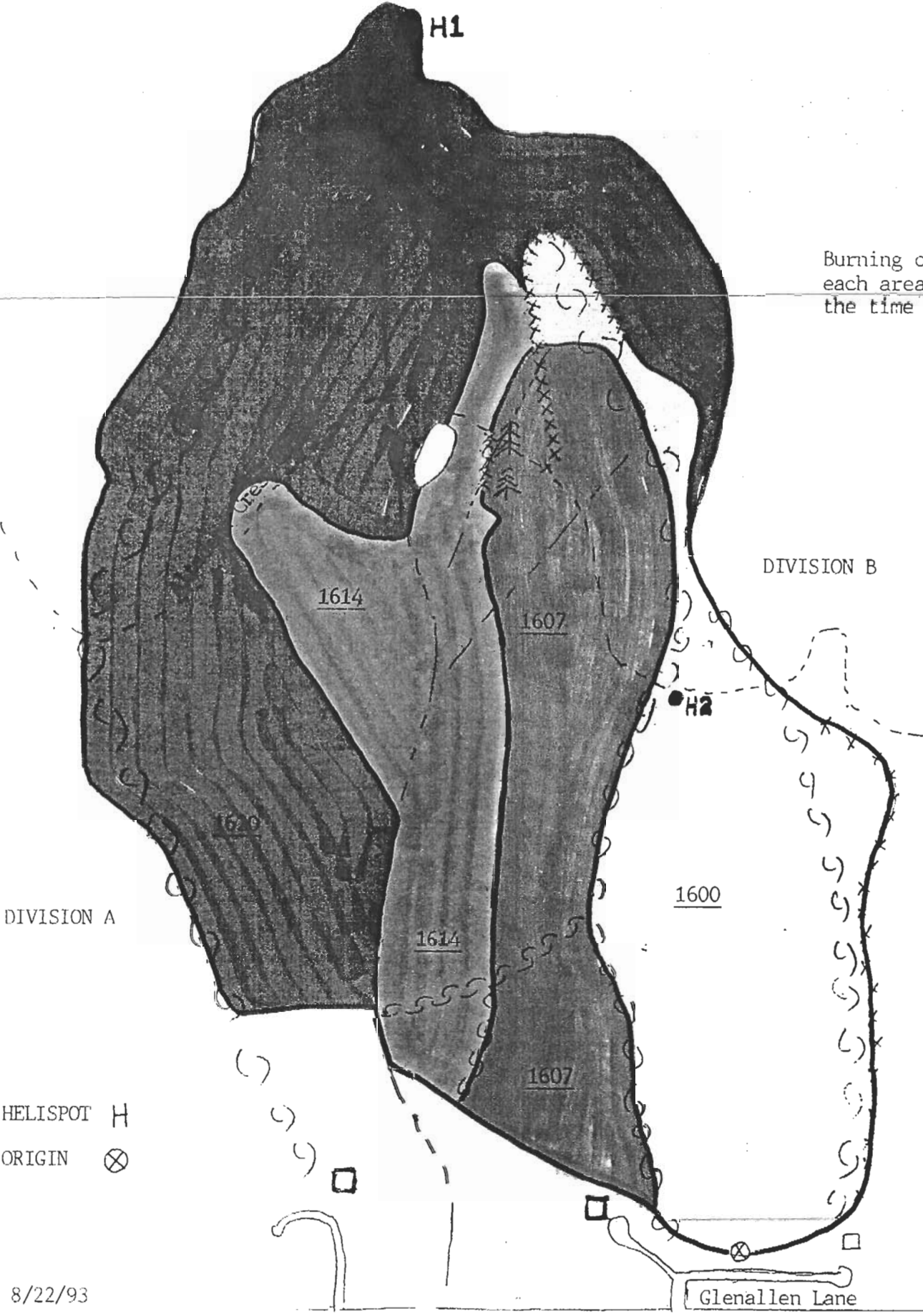
APPROXIMATE POST ENTRAPMENT
LOCATION LEGEND

- X.....X Limits of equipment scattered along Altadena Crest Trail.
- B Location of Barth (100 feet below trail)
- H Location of Herman (190 feet below trail)
- L Location of Larios (40 feet below trail)
- R Location of Ruezga (80 feet below trail)

N

APPROXIMATE FIRE SPREAD MAP
(SCHEMATIC DRAWING)

Burning occurred in each area prior to the time indicated.



DIVISION A

DIVISION B

HELISPOT H
ORIGIN ⊗

8/22/93

Glenallen Lane

Loma Alta Drive

TEAM SITE INVESTIGATION

August 21, 1993

At 0900 hours the team convened at the Forest Supervisor's Office of the Angeles National Forest in Arcadia, California for the initial briefing. The briefing was conducted by Greg Greenhoe, Assistant Fire Management Officer, Angeles National Forest.

At approximately 1100 hours the team (excluding J. Harris, G. Nelson, and T. Ellis) made a site visit (conducted by Jerry Meehan) at 1886 Glen Allen Lane.

The team drove to Glen Allen Incident site in Altadena from Forest Supervisor's Office in Arcadia.

The team walked up to point of origin (photo point #2), a burned vehicle on Glen Allen Lane. They talked to investigators Bill Franklin (L.A. County Arson Investigator) and Mike Alt (Initial Attack Arson Investigator, Forest Service). According to the investigators, the fire started in engine compartment. The fire, the weather, and how the fire burned were discussed.

The team walked up to end of cul-de-sac past an engine crew doing some mopping up on the fire. The team walked straight up right flank (Division B). The terrain was very steep; team members had to use hose to help them get up the hill. The team walked up to Altadena Crest Trail and over to entrapment site (photo point #7) on trail. Observed the site and looked at flagging where victims were found. Looked at shelter deployment site. Went through entrapment scenario with Dickie Palomarez (Crew 2-2 crewmember) and the rescue sequence with Dickie, Ross Marshall (Camp Superintendent), and Don DeYoung (Crew Coordinator). Walked around to opposite canyon (photo point #8 and #9). Team walked back down the same way except Jerry Meehan went down the trail to the road.

When team arrived at road, they went through back yard of structure on left flank (Division A) and followed hose lay into main canyon where the flare-up occurred. Viewed area from mouth of canyon. Vehicle was impounded for investigation. Clothing and shelters brought to Camp 2 for investigation.

August 23 and August 24, 1993

Ted Putnam examined victim's clothing and shelters.

August 25, 1993

The following team members flew to view incident scene via Helicopter 15:

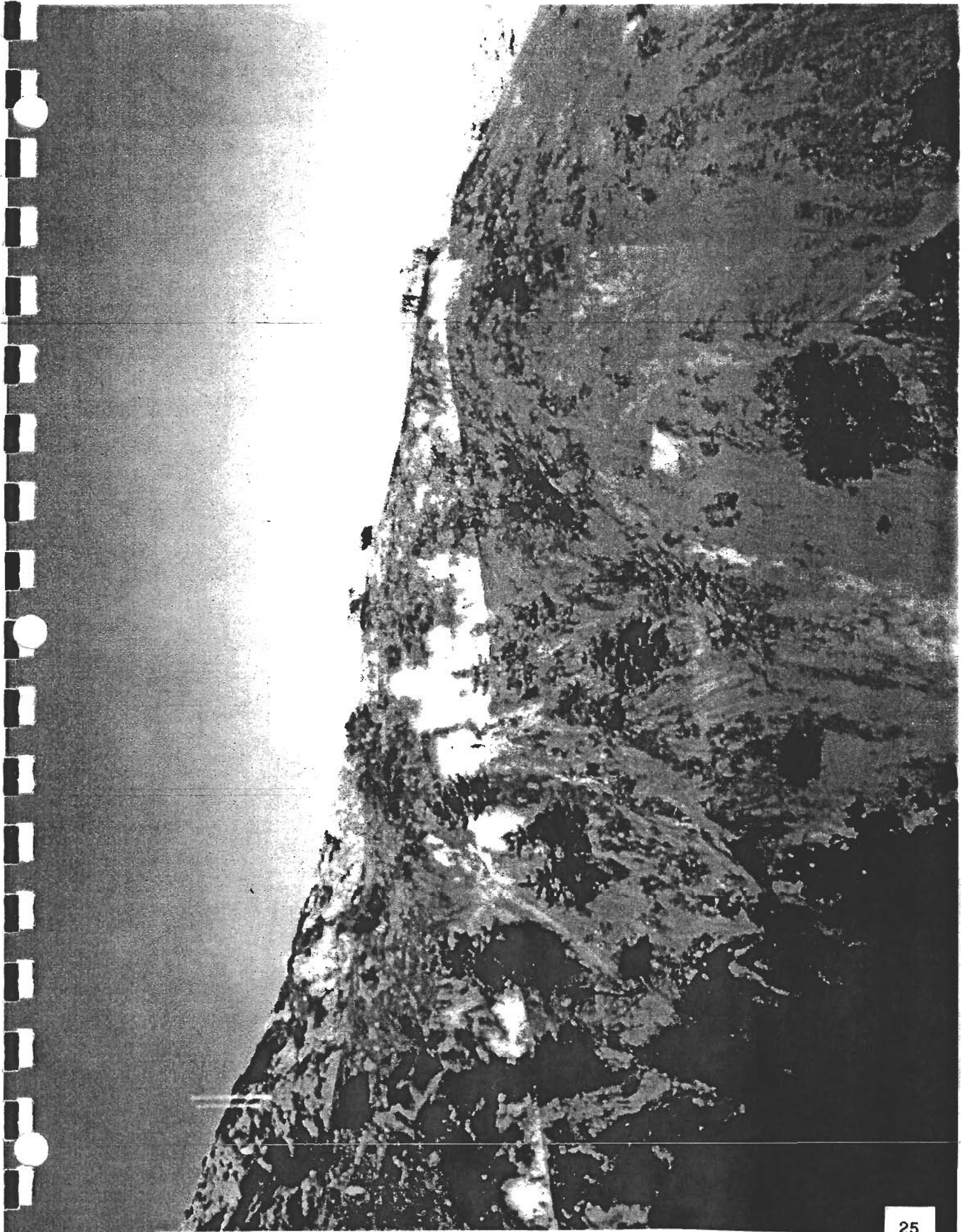
Gary Nelson
Terry Ellis
Bill Glendinning
Keith Crummer
John Harris

Also present was L.A. County Fire Chief P. Michael Freeman.

Aerial panorama type pictures and some ground photographs were taken.

Landed at Helispot 2 (photo points #3 and #4) walked down trail down to photo points #5, #6, and #7.

Walked back up trail and returned to work location (Camp 2).



PHOTOGRAPH SHOWING INITIAL RESCUE EFFORTS

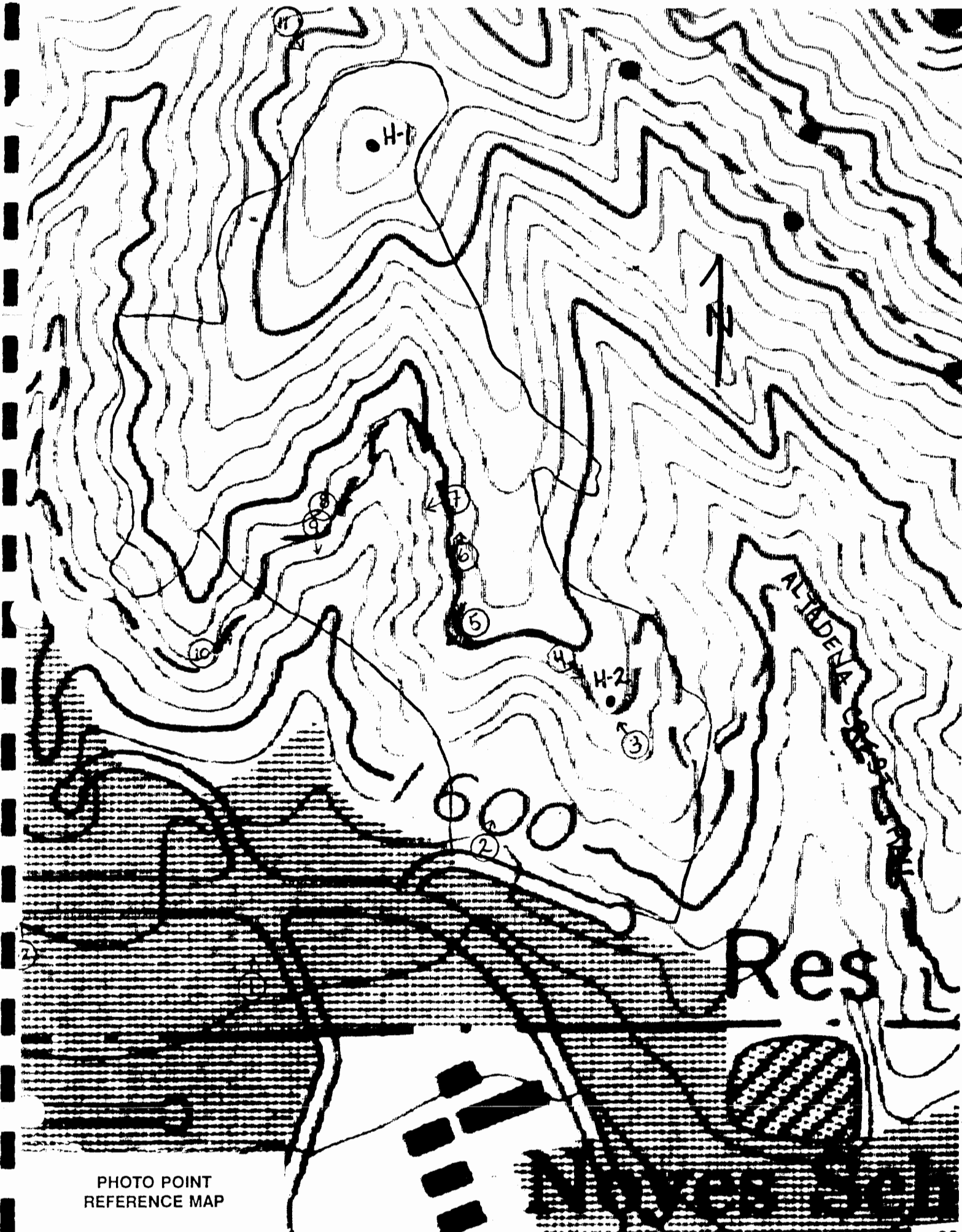


PHOTO POINT
REFERENCE MAP

INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Bill Glendinning DATE TAKEN August 25, 1993

WEATHER CONDITIONS Clear and Dry

PHOTO NUMBER 1



SCENE DESCRIPTION:

Aerial view of Glen Allen Fire.

Canyon in center, just below the

Altadena Crest Trail, on the

right side, is where the

entrapment occurred.

CAMERA WAS POINTED: (N) S (E) W

REMARKS:

Camera pointed NNE.

INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Bill Glendinning DATE TAKEN August 21, 1993

WEATHER CONDITIONS Clear and Dry

PHOTO NUMBER 2



SCENE DESCRIPTION:

Fire origin. Shows first
canyon involved, area of initial
suppression action.

CAMERA WAS POINTED: (N) S E W

REMARKS:

Photo taken from Glenallen Road.

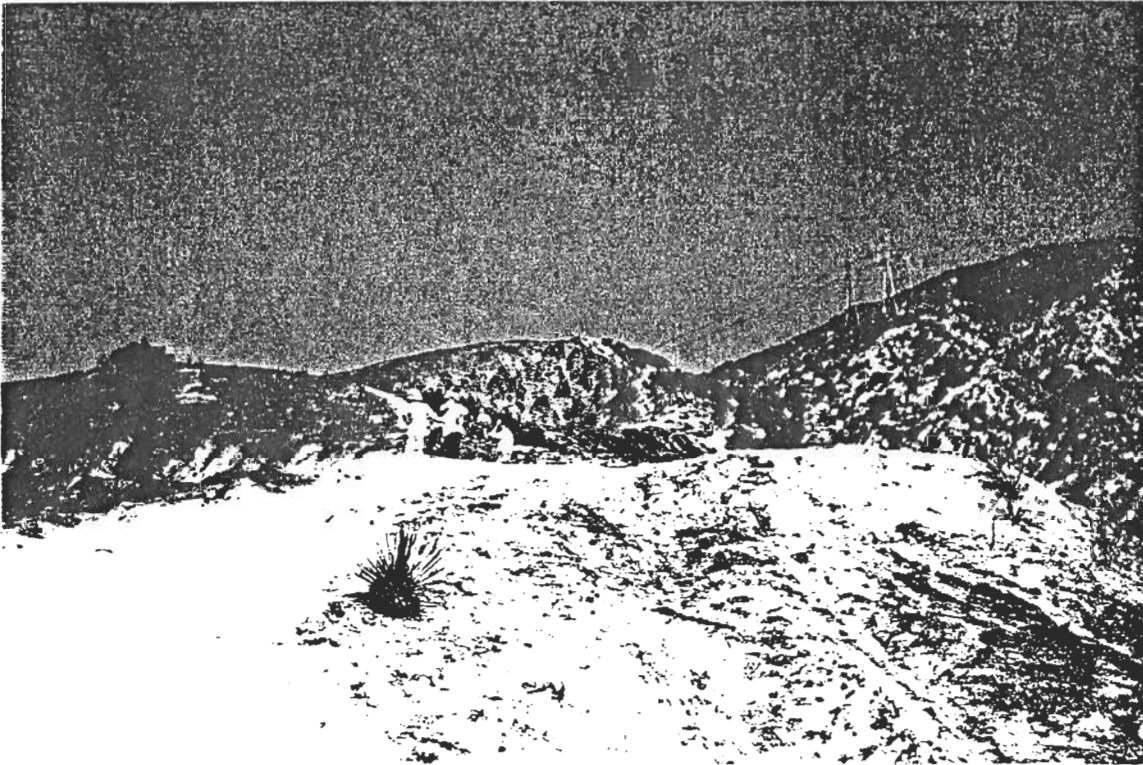
INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Dave Stone DATE TAKEN August 21, 1993

WEATHER CONDITIONS Clear and Dry

PHOTO NUMBER 3



SCENE DESCRIPTION:

Looking up slope across
Helispot #2 toward Helispot
#1, at the top of the fire.

CAMERA WAS POINTED: N S E W

REMARKS:

Camera pointed NNW.

INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Dave Stone DATE TAKEN August 21, 1993

WEATHER CONDITIONS Clear and Dry

PHOTO NUMBER 4



SCENE DESCRIPTION:

Helispot #2 from which most
evacuations took place.

CAMERA WAS POINTED: N (S) (E) W

REMARKS:

INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Bill Glendinning DATE TAKEN August 25, 1993

WEATHER CONDITIONS Clear and Dry

PHOTO NUMBER 5



SCENE DESCRIPTION:

Looking down "nose" of rounded
spur ridge, from Altadena Crest
Trl. This ridge prevented Crew
2-2 from seeing the fire burning
below from left to right in
canyon below.

CAMERA WAS POINTED: N (S) E (W)

REMARKS:

INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Dave Stone DATE TAKEN August 21, 1993

WEATHER CONDITIONS Clear and Dry

PHOTO NUMBER 6



SCENE DESCRIPTION:

Altadena Crest Trail where
burnover occurred. Note
fire shelters and equipment
belonging to Crew 2-2.

CAMERA WAS POINTED: (N) S E W

REMARKS:

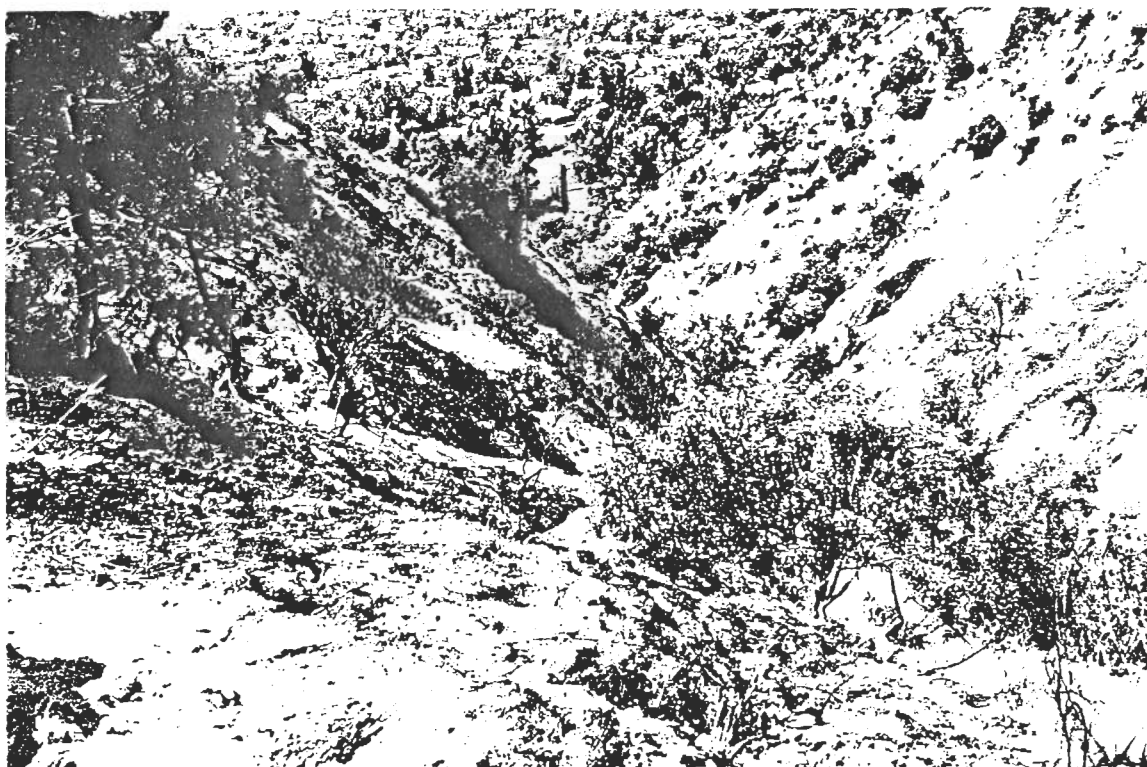
INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Ted Putnam DATE TAKEN August 21, 1993

WEATHER CONDITIONS Clear and Dry

PHOTO NUMBER 7



SCENE DESCRIPTION:

Photo taken 8 feet to the right
of where crew dropped off the
Altadena Crest Trail

CAMERA WAS POINTED: N (S) E W

REMARKS:

Note that view of lower end of
canyon is blocked by spur ridge
on the left. See Photo #5.

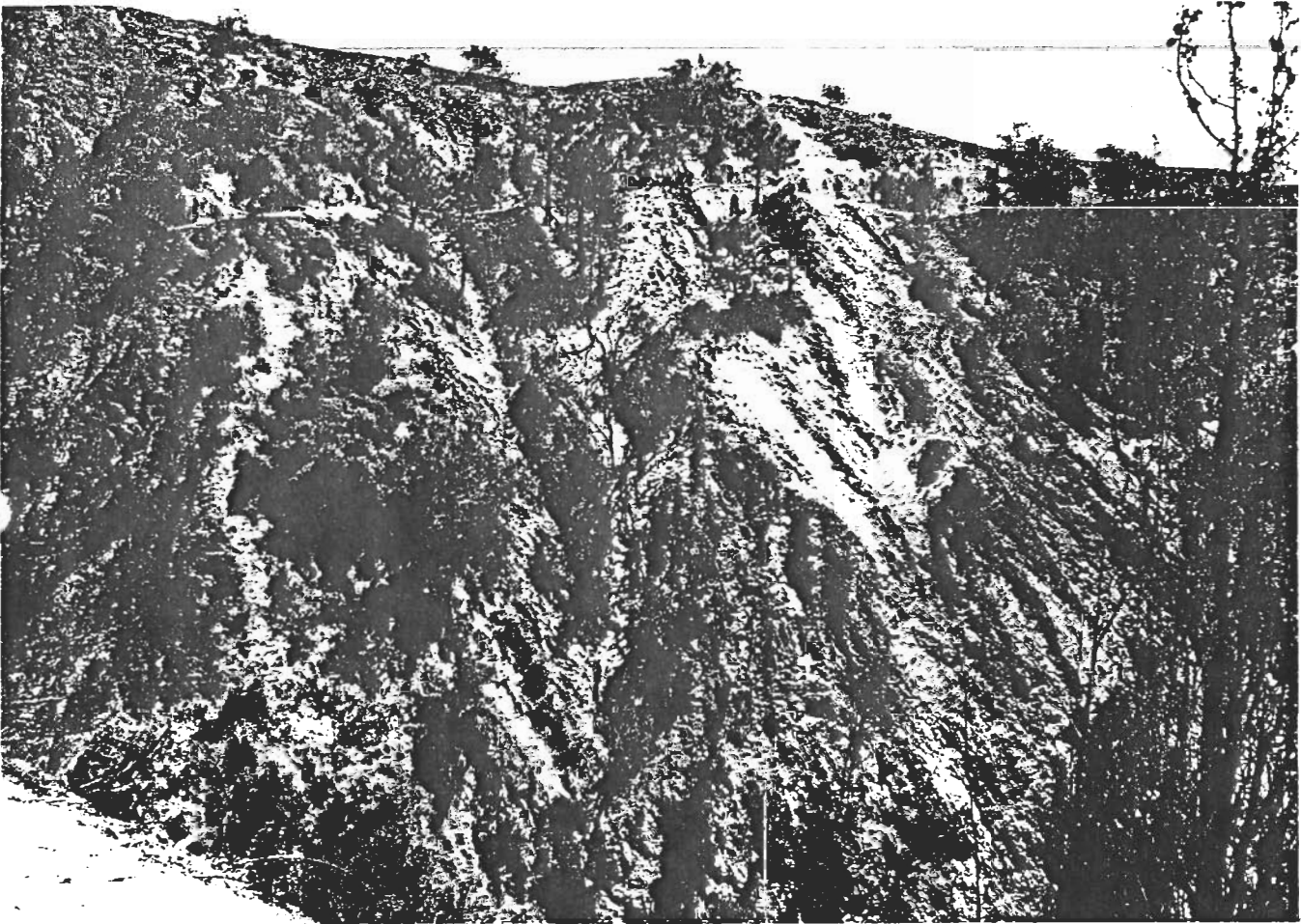
INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Bill Glendinning DATE TAKEN August 21, 1993

WEATHER CONDITIONS Clear and Drv

PHOTO NUMBER 8



SCENE DESCRIPTION:

Taken from same location as Photo #9.

Location rejected as potential

lookout as it was too dangerous.

CAMERA WAS POINTED: N S (E) W

REMARKS:

Note green brush to left

protected by water drops.

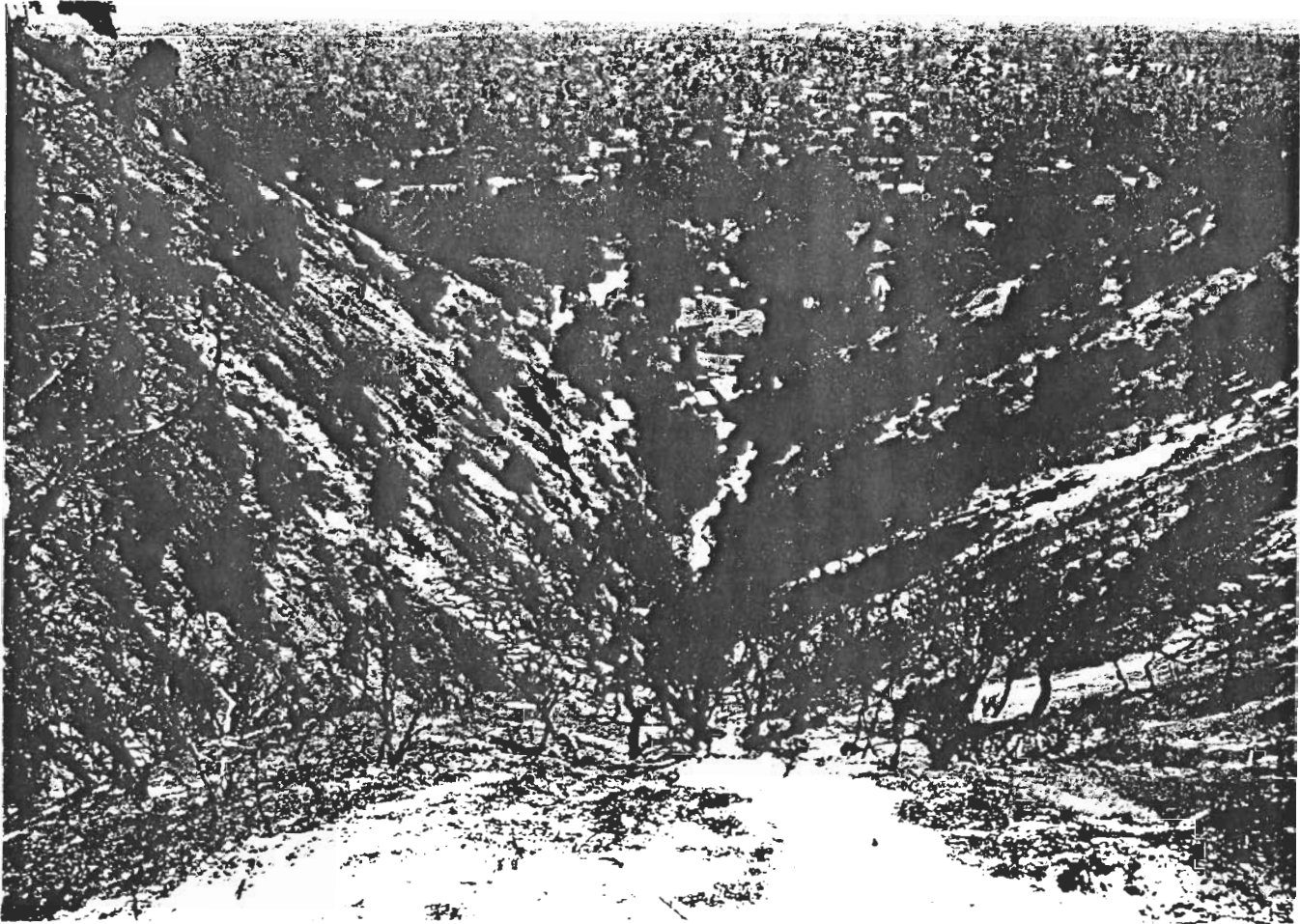
INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Bill Glendinning DATE TAKEN August 25, 1993

WEATHER CONDITIONS Clear and Dry

PHOTO NUMBER 9



SCENE DESCRIPTION:

Taken from same location as
Photo #8.

CAMERA WAS POINTED: N (S) E W

REMARKS:

Location rejected as potential
lookout as it was too dangerous.
From mouth of canyon to this point
was consumed by fire in 30 seconds.

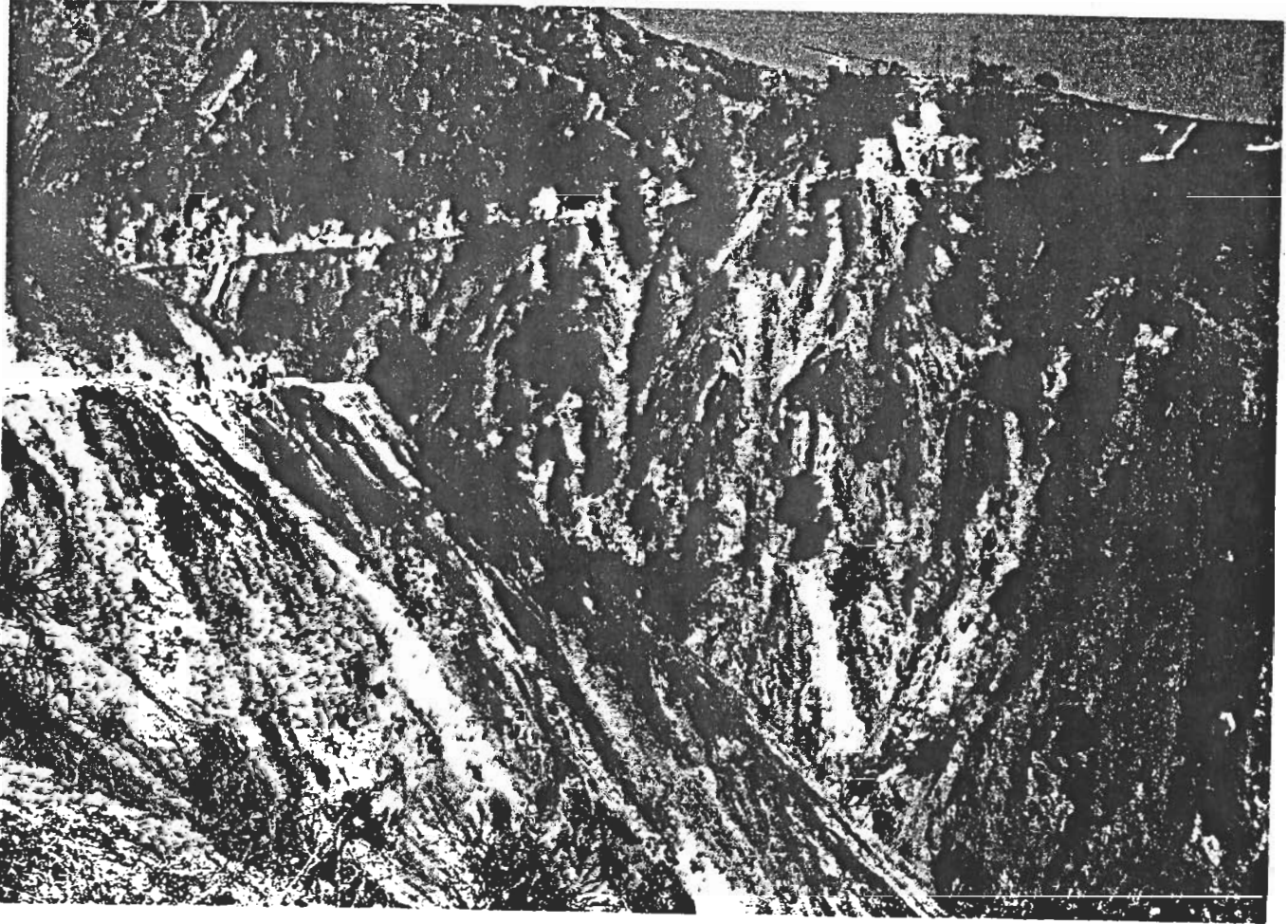
INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Bill Glendinning DATE TAKEN August 25, 1993

WEATHER CONDITIONS Clear and Dry

PHOTO NUMBER 10



SCENE DESCRIPTION:

Taken from Altadena Crest Trail
which is continuous to upper right
of photo.

CAMERA WAS POINTED: N S (E) W

REMARKS:

Note steepness of slopes and
ravelling of soil.

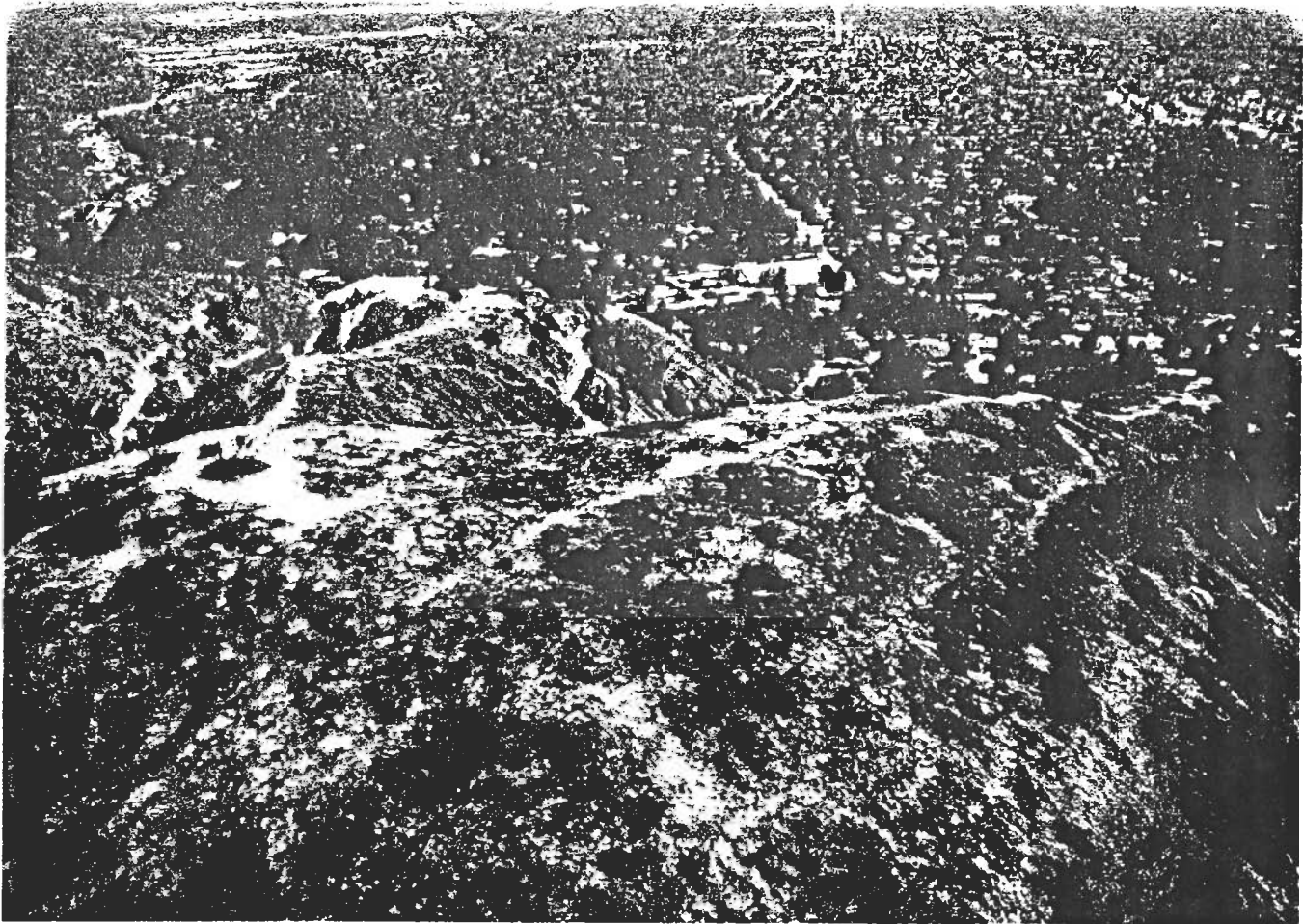
INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Bill Glendinning DATE TAKEN August 25, 1993

WEATHER CONDITIONS Clear and Dry

PHOTO NUMBER 11



SCENE DESCRIPTION:

Aerial view of ridge top
helispot (H1) where Crew 2-2
landed and started to work down
ridge to the left.

CAMERA WAS POINTED: N (S) E W

REMARKS:

Landing point was small gray spot
in the left center of the photo.

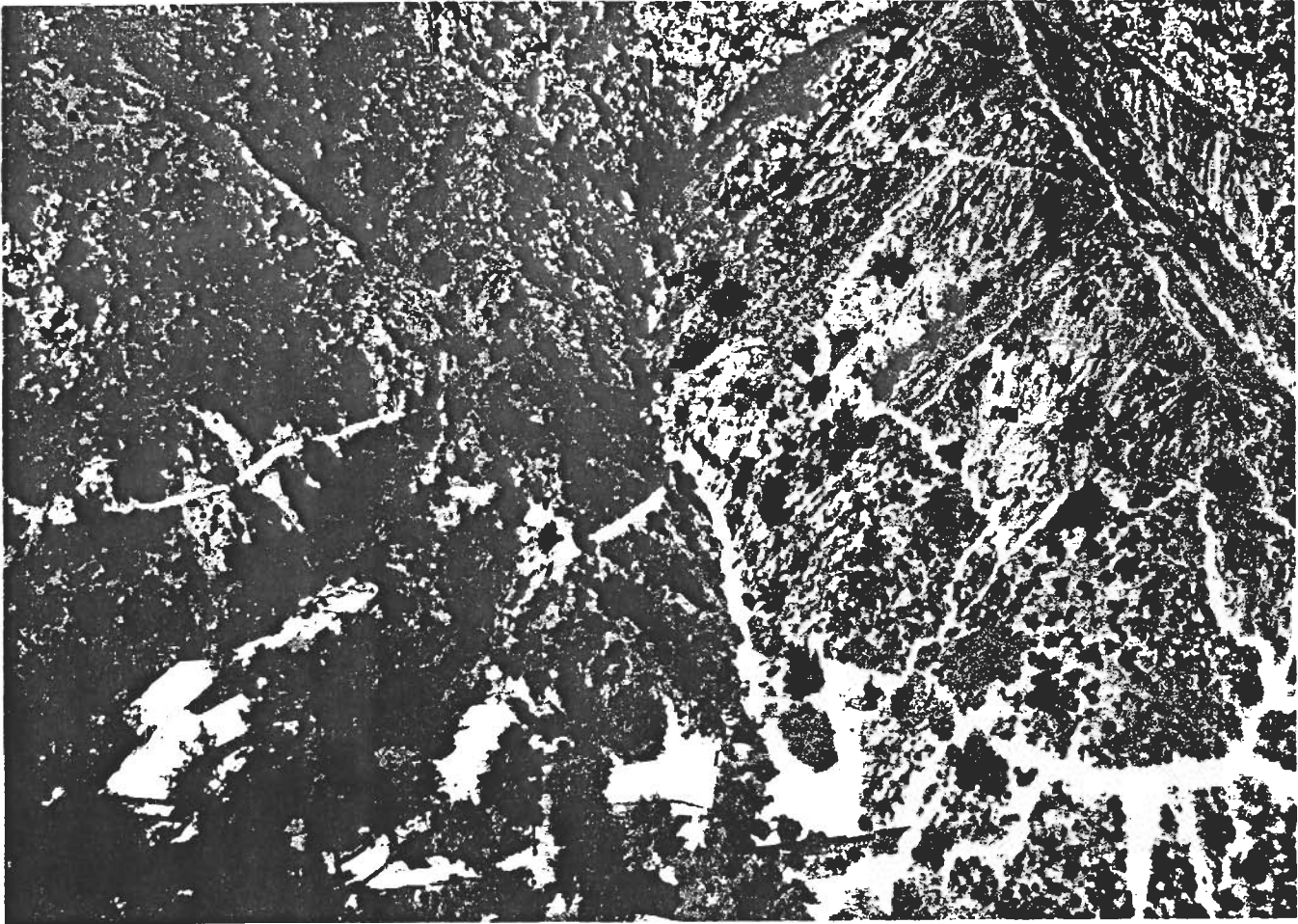
INCIDENT DOCUMENTATION AND PHOTO PRESENTATION

INCIDENT NAME Glen Allen INCIDENT DATE August 20, 1993

PHOTO(S) TAKEN BY Bill Glendinning DATE TAKEN August 25, 1993

WEATHER CONDITIONS Clear and Dry

PHOTO NUMBER 12



SCENE DESCRIPTION:

Aerial view of unburned canyon
to the west of the fire.

CAMERA WAS POINTED (N) S E W

REMARKS:

Note fuel types and proximity of
structures.

ANALYSIS OF PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

An analysis of personal protective clothing and equipment (PPE) at the entrapment site and recovered from victims showed they all were wearing and using required items. Further analysis indicated that the PPE all functioned within its design limitations. When nine crewmembers were entrapped, five of them partially deployed shelters on the Altadena Crest Trail. Four crewmembers were caught below the trail; of these, two were seriously burned and two were fatally injured.

RESPONSE TO ENTRAPMENT

When Crew 2-2 was overrun by rapid, upslope flames their initial action was to attempt to escape along the fireline to the trail. Due to the steep slope and short amount of time available (15 to 30 seconds), only five people were able to get up the fireline to the trail before the flames arrived. These five individuals opened their fire shelters into large rectangles and used them as heat shields because they thought they needed to move further south for a safer deployment area.

The four persons unable to reach the trail were caught by varying degrees of a flame front. These people then moved south towards the area previously burned; two suffered burn injuries and survived, two others died as a result of their burn and inhalation injuries.

DISCUSSION

For shelters to be effective in providing the greatest protection against heat, hot gases and smoke, full deployment is necessary. In this case, those who used the shelters as heat shields risked that hot, toxic gases would not reach their location. Fire fighters must balance their desire for a better location against the probability of being exposed to heat by remaining in an unprotected standing or crouching position. When in doubt, one should deploy fully on the best available site.

The four people caught below the trail were those furthest down the hill and were unable to make it back to the trail because of steep terrain and loose soil. The steepness resulted in three of the four sliding back down the hillside during or shortly following the entrapment. Given the speed of the flame front and the steep, loose terrain, their remaining option was to get low to the ground.

FINDINGS

1. None of the crewmembers fully deployed their fire shelters.
2. Some fire crewmembers used their fire shelters as heat shields.
3. There was no evidence the four crewmembers caught below the trail deployed their fire shelters (these crewmembers were hit by heat and flames within 15 to 30 seconds).
4. Two crewmembers caught below the trail survived without fire shelters.
5. Steep terrain, loose soils, and hot embers made it very difficult to lie prone on the ground prior to arrival of flames and hot gases. This situation drastically reduced survival chances and increased burn injury.

6. None of the crewmembers dumped their packs prior to arrival of the flame front.

RECOMMENDATIONS

1. Re-emphasize the critical necessity of being on the ground prior to arrival of flames or hot gases.
2. Stress the importance of fully deploying shelters and getting under them as quickly as possible.
3. Encourage removal of packs when they may be hazardous or may slow escape from a dangerous area.
4. Stress the importance of having shelters ready for deployment when fire fighters are moving towards a planned deployment area. They must be able to remove shelters from the protective pack and plastic pouch while on the run and be prepared for rapid deployment at the best available location if conditions prevent a successful escape.
5. Stress that if there is not sufficient time to get shelters deployed initially, the most important action is to get flat on the ground, cover head, remove fusees and fuel, then fully deploy shelter while lying on the ground, once the flame front passes. These actions are discussed in "Your Fire Shelter" and "Your Fire Shelter - Beyond the Basics."
6. Train so that there will be an awareness of the effect that terrain and slope may have when lying prone and deploying shelters.

FIRE BEHAVIOR BURN SEQUENCE

The Glen Allen Fire was reported to L.A. County Communications Center (LACC) at 15:11.

LAC Engine 11 reported the fire to be approximately 2 acres which was burning in light to medium brush running uphill at 15:18.

Helicopter 15 reported at 15:33 that the fire was 10 acres and burning in medium brush.

At 15:47 Glen Allen IC reported to LAC the status of the fire at 15 to 20 acres.

At 16:07 Crew 2-2 requested a water drop on the canyon bottom just below them.

At 16:14 Crew 2-2 came on the radio, but was unreadable.

At 16:16 Crew 2-2 confirmed they had been burned over by the fire.

It is estimated that Crew 2-2 was located approximately 8 chains (528 feet) from the southwest corner of the fire's bottom edge.

The rate of fire spread during the burnover ranged between 3.7 chains/minute (234 feet/minute) to 5.4 chains/minute (356 feet/minute).

From the time the burnout began until the fire overran Crew 2-2 took less than 90 seconds.

Written statements from Crew 2-2 established that the crew was overran by the fire in 15 to 30 seconds after they were told to pull back to the horse trail. This suggests the fire was within 3 chains (198 feet) of the crew when they began to pull back to the horse trail.

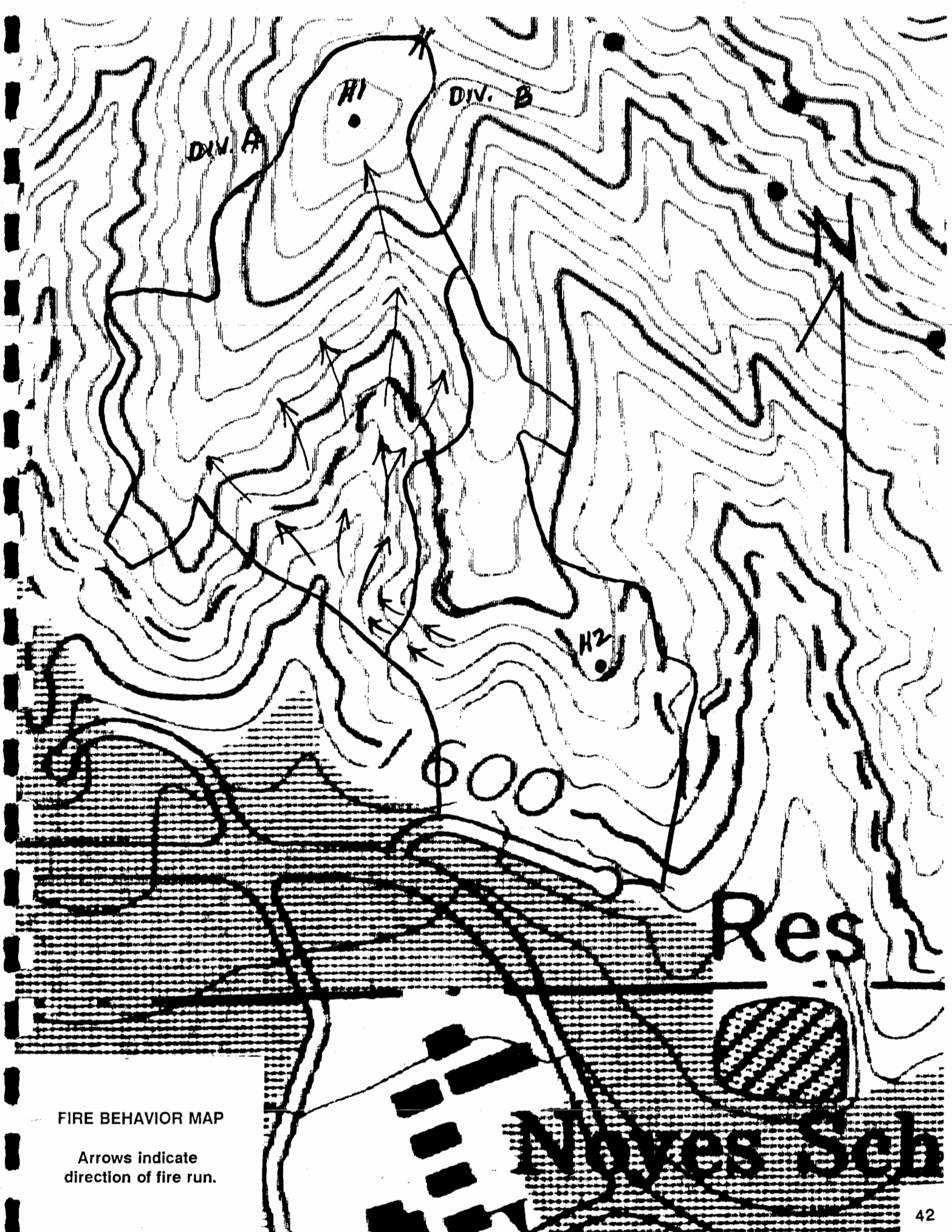
The fire consumed between 35 to 40 acres in less than 6 minutes.

The following Fire Behavior Run Tables are based on "Findings" from statements, VHF tapes, and weather readings taken at 1300 hours for Area 624. The total time of the burnover is estimated at less than 6 minutes.

SLOPE PERCENT	GRASS NFFL FUEL MODEL 1			BRUSH NFFL FUEL MODEL 4		
	80	90	100	80	90	100
Rate of Spread ch/hr	255	298	397	188	217	248
Fireline Intensity BTU/ft/sec	541	634	737	11007	12668	14520
Flame Length (feet)	8.1	8.8	9.4	32.5	34.7	37.0
Scorch Height (feet)	61	68	76	478	525	576
Area Size (acres)	18	23	30	10	13	15

**TWO MODEL
50/50**

SLOPE %	80	90	100
Model 1 NFFL		1	GRASS
Model 2 NFFL		4	BRUSH
ROS 1	255	298	397
ROS 2	188	217	248
ROS	221	257	322



FIRE BEHAVIOR MAP

Arrows indicate direction of fire run.

DIRECT - SCORCH - WIND - SLOPE - RH - WORKSHEET

NAME OF FIRE Glen Allen FIRE BEHAVIOR ANALYST J. EATON
 DATE 8-20-93 TIME _____
 PNOJ. PERIOD DATE 6 MN. PNOJ. TIME FROM 1608 TO 1614

SCORCH MODULE

(KEYWORDS: INPUT, LIST, RUN, QUIT)

INPUT (INPUT, LIST)
 1 TEMP AMBIENT AIR TEMPERATURE (33-120°F) 75 75 75
 2 FL FLAME LENGTH (1-20 FT) 8.1 8.8 9.4
 3 MYS MIDFLAME WINDSPEED (0-10 MI/M) 4 4 4

OUTPUT (RUN)
 1 SCRH SCORCH HEIGHT FEET 61 68 76

¹ INPUT ONLY IF SCORCH IS USED AS AN INDEPENDENT MODULE.

DIRECT MODULE

LIST NUMBER

(KEYWORDS: INPUT, LIST, RUN, QUIT, SIZE, SCORCH, MAP, IN) NFFL
GRASS Model

INPUT (INPUT, LIST)

1	MODEL #	FUEL MODEL NUMBER (1-99)				
2	IH	1-H FUEL MOISTURE (1-60%)	<u>2</u>	<u>2</u>	<u>2</u>	
3	10H	10-H FUEL MOISTURE (1-60%)				
4	100H	100-H FUEL MOISTURE (1-60%)				
5	HERB	LIVE HERB MOISTURE (30-300%)				
6	WOOD	LIVE WOODY MOISTURE (30-300%)				
7	MYS	MIDFLAME WINDSPEED (0-99 MI/M)	<u>4</u>	<u>4</u>	<u>4</u>	
8	SLOP	SLOPE (0-100%/0-45 DEGREES)	<u>80</u>	<u>90</u>	<u>100</u>	
9	WDIR	DIRECTION OF WIND VECTOR, DEG. CLOCKWISE FROM UPHILL	<u>1</u>	<u>1</u>	<u>1</u>	

PREDICT AT MAX (Y/N) Y

10 SDIR DIRECTION OF SPREAD CALC. DEG. CLOCKWISE FROM UPHILL (OR FROM WIND VECTOR IF SLOPE IS ZERO)

OUTPUT (RUN)

1	ROS	RATE OF SPREAD CM/M	<u>255</u>	<u>298</u>	<u>397</u>
2	W/A	HEAT PER UNIT AREA BTU/FT ²	<u>116</u>	<u>116</u>	<u>116</u>
3	FLI	FIRELINE INTENSITY BTU/FT/S	<u>541</u>	<u>634</u>	<u>737</u>
4	FL	FLAME LENGTH FT	<u>8.1</u>	<u>8.8</u>	<u>9.4</u>
5	RI	REACTION INTENSITY BTU/FT ² /MIN	<u>1057</u>	<u>1057</u>	<u>1057</u>
6	EVS	EFFECTIVE WINDSPEED MI/M IN DIRECTION SDIR	<u>6.7</u>	<u>7.3</u>	<u>7.9</u>
7	MARD	DIRECTION OF MAXIMUM DEGREES SPREAD, DEG. CLOCKWISE FROM UPHILL	<u>0</u>	<u>0</u>	<u>0</u>

¹ INPUT ONLY IF CORRESPONDING FUEL LOAD IS NOT ZERO.
² INPUT ONLY IF MIDFLAME WINDSPEED (MYS) AND SLOPE (SLOP) ARE NOT ZERO.
³ OUTPUT ONLY IF CALCULATIONS ARE IN DIRECTION OF MAXIMUM SPREAD.

OUTPUT TABLES

LIST NUMBER

TABLE NO. TABLE ITEM ROW ITEM COL ITEM

COLUMN VALUES:

ROW NO.	ROW VALUE	TABLE VALUES
1.		
2.		
3.		

TABLE NO. TABLE ITEM ROW ITEM COL ITEM

COLUMN VALUES:

ROW NO.	ROW VALUE	TABLE VALUES
1.		
2.		
3.		

SIZE - MAP - CONTAIN

NAME OF FIRE Gley Allen SHEET 2 OF 5
 DATE 8-20-93 FIRE BEHAVIOR ANALYST J. EATON
 TIME
 PROJ. PERIOD DATE 6 MIN. PROJ. TIME FROM 1608 TO 1614

SIZE MODULE

(KEYWORDS: INPUT, LIST, CONTAIN, RUM, MAP, QUIT) NFFL
 LIST NUMBER _____
 GRASS model

INPUT (INPUT, LIST)
 1 ROS ²RATE OF SPREAD (.1-500 CH/M) 255 298 347
 2 EVS ²EFFECTIVE WINDSPEED (0-99 MI/M) 8.1 8.8 9.4
 3 ET ELAPSED TIME (.1 - 8 M) .1 .1 .1

OUTPUT (RUM)

0 NO MORE TABLES
 1 AREA ACRES 18 23 30
 2 PER PERIMETER CH 58 67 78
 3 L/W LENGTH-TO-WIDTH RATIO 3.0 3.2 3.4
 4 FSD FORWARD SPREAD DISTANCE CH 25.5 29.8 31.7
 5 BSD BACKING SPREAD DISTANCE CH 7.8 8.8
 6 MIV MAXIMUM FIRE WIDTH CH 8.7 9.6 10.6

¹ SIZE CAN LINK TO CONTAIN ONLY IF LINKED TO DIRECT.
² INPUT ONLY WHEN SIZE IS USED AS AN INDEPENDENT MODULE.

OUTPUT TABLES LIST NUMBER _____

TABLE NO.	TABLE ITEM	ROW ITEM	COL. ITEM
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____

MAP MODULE

LIST NUMBER _____

(KEYWORDS: INPUT, LIST, RUM, QUIT)

INPUT (INPUT, LIST)
 1 SCL OPT SCALE OPTION (1 OR 2)
 1 = REPRESENTATIVE FRACTION
 2 = INCHES PER MILE
 2 RE/1000 REPRESENTATION FRACTION/1000 (11-500)
 E.G., RF OF 1/24000 = 24
 3 IN/MI INCHES PER MILE (-.0625-9)
 4 UNITS OPT UNITS OPTION (1-3)
 1 = SPREAD DISTANCE
 2 = RATE OF SPREAD
 3 = SPREAD DISTANCE
 5 DIST SPREAD DISTANCE (0-1000 CH)
 7 ROS RATE OF SPREAD (.1-500 CH/M)
 8 TIME ELAPSED TIME (.1-8M)
 9 FSD FORWARD SPREAD DISTANCE CH
 6 BSD BACKING SPREAD DISTANCE CH
 7 MIV MAXIMUM FIRE WIDTH CH

OUTPUT (RUM)

1 FSD FORWARD SPREAD DISTANCE INCHES ON MAP (UNITS OPT = 1 OR 2)
 2 BSD BACKING SPREAD DISTANCE INCHES ON MAP (SIZE LINKED ONLY)
 3 MIV MAXIMUM FIRE WIDTH ON MAP (SIZE LINKED ONLY)

¹ INPUT ONLY FOR SCALE OPTION = 1.
² INPUT ONLY FOR SCALE OPTION = 2.
³ INPUT ONLY FOR UNITS OPTION = 1.
⁴ INPUT ONLY FOR UNITS OPTION = 2.
⁵ INPUT ONLY FOR UNITS OPTION = 3.
⁶ PASSED FROM SIZE FOR LINKED RUM ONLY. NO INPUT IS NEEDED.

TABLE NO.	TABLE ITEM	ROW ITEM	COL. ITEM
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____

DIRECT - SCORCH - WIND - SLOPE - RH - WORKSHEET

NAME OF FIRE Glenn Allen FIRE BEHAVIOR ANALYST J. EATON SHEET 3 OF 5
 DATE 8-20-93 TIME _____
 PROJ. PERIOD DATE 6 MIN PROJ. TIME FROM 1608 TO 1614

DIRECT MODULE

(KEYWORDS: INPUT, LIST, RUM, GUIT, SITE, SCORCH, MP, IND) LIST NUMBER NFFL
 INPUT (INPUT, LIST) BRASH Model

MODEL #	FUEL MODEL NUMBER (1-99)	LIST NUMBER
1 IH	1-H FUEL MOISTURE (1-60S)	<u>4</u>
2 IOH	10-H FUEL MOISTURE (1-60S)	<u>2</u>
3 IOOH	100-H FUEL MOISTURE (1-60S)	<u>7</u>
4 IHOH	100-H FUEL MOISTURE (1-60S)	<u>8</u>
5 IHWO	1-LIVE WOODY MOISTURE (30-300S)	<u>80</u>
6 IOWO	1-LIVE WOODY MOISTURE (30-300S)	<u>80</u>
7 MPVS	MIDFLAME WINDSPEED (0-99 MI/M)	<u>4</u>
8 SLP	SLOPE (0-100%/0-45 DEGREES)	<u>80</u>
9 SOIR	DIRECTION OF WIND VECTOR, DEG. CLOCKWISE FROM UPHILL (IF ZERO)	<u>90</u>

PREDICT AT MAX (Y/N) Y
 10 SOIR DIRECTION OF SPREAD (0-360 DEGREES) CALC. DEG. CLOCKWISE FROM UPHILL (ON FROM WIND VECTOR IF SLOPE IS ZERO) Y

OUTPUT (RUM)	NO MORE TABLES
1 ROS	RATE OF SPREAD CM/H <u>188</u> <u>217</u> <u>248</u>
2 M/A	HEAT PER UNIT AREA BTU/FT ² <u>370</u> <u>310</u> <u>3190</u>
3 FLI	FINELINE INTENSITY BTU/FT/S <u>11007</u> <u>12468</u> <u>14520</u>
4 FL	FLAME LENGTH FT <u>32.5</u> <u>34.7</u> <u>37.0</u>
5 RI	REACTION INTENSITY BTU/FT ² /MIN <u>14448</u> <u>14448</u> <u>14448</u>
6 EWS	EFFECTIVE WINDSPEED MI/M IN DIRECTION SOIR <u>7.5</u> <u>8.3</u> <u>9.1</u>
7 HIRD	DIRECTION OF MAXIMUM SPREAD, DEG. CLOCKWISE FROM UPHILL <u>0</u> <u>0</u> <u>0</u>

¹ INPUT ONLY IF CORRESPONDING FUEL LOAD IS NOT ZERO.
² INPUT ONLY IF MIDFLAME WINDSPEED (MPVS) AND SLOPE (SLP) ARE NOT ZERO.
³ OUTPUT ONLY IF CALCULATIONS ARE IN DIRECTION OF MAXIMUM SPREAD.

SCORCH MODULE

(KEYWORDS: INPUT, LIST, RUM, GUIT)

INPUT (INPUT, LIST)	NO. ORIENT AIR TEMPERATURE (33-120°F)	LIST NUMBER
1 TEMP	<u>75</u> <u>75</u> <u>75</u>	<u>15</u>
2 FL	FLAME LENGTH (1-20 FT) <u>32.5</u> <u>34.7</u> <u>37.0</u>	<u>4</u>
3 MPVS	MIDFLAME WINDSPEED (0-10 MI/M) <u>4</u> <u>4</u> <u>4</u>	<u>4</u>

OUTPUT (RUM)	FEET
1 SCRT	SCORCH HEIGHT <u>478</u> <u>525</u> <u>576</u>

¹ INPUT ONLY IF SCORCH IS USED AS AN INDEPENDENT MODULE.

TABLE NO.	TABLE ITEM	ROW ITEM	COL. ITEM	LIST NUMBER
1	ROW VALUE	TABLE VALUES		
2	ROW VALUE	TABLE VALUES		
3	ROW VALUE	TABLE VALUES		

TABLE NO.	TABLE ITEM	ROW ITEM	COL. ITEM
1	ROW VALUE	TABLE VALUES	
2	ROW VALUE	TABLE VALUES	
3	ROW VALUE	TABLE VALUES	

TABLE NO.	TABLE ITEM	ROW ITEM	COL. ITEM
1	ROW VALUE	TABLE VALUES	
2	ROW VALUE	TABLE VALUES	
3	ROW VALUE	TABLE VALUES	

TABLE NO.	TABLE ITEM	ROW ITEM	COL. ITEM
1	ROW VALUE	TABLE VALUES	
2	ROW VALUE	TABLE VALUES	
3	ROW VALUE	TABLE VALUES	

SIZE - MAP - CONTAIN

NAME OF FIRE Glen Allen SIZE 4 OF 5
 DATE 8-20-93 FIRE BEHAVIOR ANALYST J. Eaton
 PROJ. PERIOD DATE 6 MIN. TIME 1614
 PROJ. TIME FROM 1608 TO 1614

SIZE MODULE

(KEYWORDS: INPUT, LIST, CONTAIN, RUN, MAP, GUIT) LIST NUMBER _____
NFFL
Bush Model

INPUT (INPUT, LIST)
 1 ROS ²RATE OF SPREAD (.1-500 CM/N) 188 217 248
 2 EVS ²EFFECTIVE WINDSPEED (0-99 MI/H) 7.5 8.3 9.1
 3 ET ELAPSED TIME (.1 - 6 H) 0.1 0.1 0.1

OUTPUT (RUN)

0 NO MORE TABLES
 1 AREA AREA ACRES 10 13 15
 2 PER PERIMETER CH 44 49 56
 3 L/W LENGTH-TO-WIDTH RATIO 2.9 3.1 3.3
 4 FSD FORWARD SPREAD DISTANCE CH 18.8 21.7 24.6
 5 BSD BACKING SPREAD DISTANCE CH 6 6 6
 6 MFW MAXIMUM FIRE WIDTH CH 6.7 7.3 7.8

¹ SIZE CAN LINK TO CONTAIN ONLY IF LINKED TO DIRECT.
² INPUT ONLY WHEN SIZE IS USED AS AN INDEPENDENT MODULE.

OUTPUT TABLES LIST NUMBER _____

TABLE NO.	TABLE ITEM	ROW ITEM	COL. ITEM
1.			
2.			
3.			

MAP MODULE

LIST NUMBER _____

(KEYWORDS: INPUT, LIST, RUN, GUIT)

INPUT (INPUT, LIST)
 1 SCL OPT SCALE OPTION (1 OR 2) _____
 2 RF/1000 REPRESENTATION FRACTION/1000 (1-500) _____
 E.G., RF OF 1/20000 = 24
 3 IN/MI INCHES PER MILE (.0625-9) _____
 4 UNITS OPT UNITS OPTION (1-3) _____
 1 = SPREAD DISTANCE
 2 = RATE OF SPREAD
 3 = SPREAD DISTANCE
 5 DIST SPREAD DISTANCE (0-1000 CH) _____
 7 ROS RATE OF SPREAD (.1-500 CM/N) _____
 8 TIME ELAPSED TIME (.1-6H) _____
 5 FSD FORWARD SPREAD DISTANCE CH _____
 6 BSD BACKING SPREAD DISTANCE CH _____
 7 MFW MAXIMUM FIRE WIDTH CH _____

OUTPUT (RUN)

1 MFSO FORWARD SPREAD DISTANCE INCHES ON MAP (UNITS OPT = 1 OR 3) _____
 2 MBSO BACKING SPREAD DISTANCE INCHES ON MAP (SIZE LINKED ONLY) _____
 3 MFW MAP (SIZE LINKED ONLY) _____

¹ INPUT ONLY FOR SCALE OPTION = 1.
² INPUT ONLY FOR SCALE OPTION = 2.
³ INPUT ONLY FOR UNITS OPTION = 1.
⁴ INPUT ONLY FOR UNITS OPTION = 2.
⁵ INPUT ONLY FOR UNITS OPTION = 3.
⁶ PASSED FROM SIZE FOR LINKED RUN ONLY. NO INPUT IS NEEDED.

TABLE NO.	TABLE ITEM	ROW ITEM	COL. ITEM
1.			
2.			
3.			

FINE DEAD FUEL MOISTURE CALCULATIONS

- A. PROJECTION POINT _____
 - B. DAY OR NIGHT (D/N) _____
 - C. DRY BULB TEMPERATURE, °F _____
 - D. RELATIVE HUMIDITY, % _____
 - E. REFERENCE FUEL MOISTURE, % (FROM TABLE A) _____
 - F. MONTH _____
 - G. EXPOSED OR SHADED (E/S) _____
 - H. TIME _____
 - I. ELEVATION CHANGE
 B = 1000' - 2000' BELOW SITE
 L = ±1000' OF SITE LOCATION
 A = 1000' - 2000' ABOVE SITE
 B/L/A B/L/A B/L/A B/L/A
 - J. ASPECT _____
 - K. SLOPE _____
 - L. FUEL MOISTURE CORRECTION, % (FROM TABLE B, C, OR D) _____
 - M. FINE DEAD FUEL MOISTURE, % (LINE E + LINE I) _____
- NIGHT TIME CALCULATIONS**
- N. DRY BULB TEMPERATURE, °F _____
 - O. RELATIVE HUMIDITY, % _____
 - P. REFERENCE FUEL MOISTURE, % (FROM TABLE E) _____
- USE TABLE F ONLY IF A STRONG INVERSION EXISTS AND A CORRECTION MUST BE MADE FOR ELEVATION OR ASPECT CHANGE.
- Q. ASPECT OF PROJECTION POINT _____
 - R. ASPECT OF SITE LOCATION _____
 - S. TIME _____
 - T. ELEVATION CHANGE
 B = 1000' - 2000' BELOW SITE
 L = ±1000' OF SITE LOCATION
 A = 1000' - 2000' ABOVE SITE
 B/L/A B/L/A B/L/A B/L/A
 - U. CORRECTION FOR PROJECTION POINT LOCATION (FROM TABLE F) _____
 - V. CORRECTION FOR SITE LOCATION (L) (FROM TABLE F) _____
 - W. FUEL MOISTURE CORRECTION, % (LINE U - LINE V) _____
 - X. FINE DEAD FUEL MOISTURE, % (LINE P + LINE W) _____

TWO MODULE

(KEYWORDS: INPUT, LIST, RUN, QUIT)

PASSED FROM DIRECT (LIST)

- 1 MODEL1 FIRST MODEL RUN BY DIRECT 1
 - 2 MODEL2 SECOND MODEL RUN BY DIRECT 4
 - 3 ROS1 SPREAD RATE FOR FIRST MODEL 255 298 397
 - 4 ROS2 SPREAD RATE FOR SECOND MODEL 188 217 248
- INPUT (INPUT, LIST) 50% 50% 50%
- 5 COV1 PERCENT AREA COVERAGE [20-80%] 50% 50% 50%

FIRST MODEL

OUTPUT (RUN)

- 1 ROS RATE OF SPREAD CH/H 221 257 327
- SLOPE 80% 90% 100%

NIGHT TIME CALCULATIONS

TABLE NO.	TABLE ITEM	ROW ITEM	COL ITEM
1.			
2.			
3.			

COLUMN VALUES: _____

ROW VALUE _____

TABLE VALUES _____

OUTPUT TABLES LIST NUMBER _____

8 Sept - TCH

RADIO TECHNOLOGY/FREQUENCY/MANAGEMENT/ISSUES

Effective use of radio frequencies to communicate intra-agency and inter-agency is a subject of great concern amongst agencies responding to wildland fire within and adjacent to the Angeles National Forest and within or adjacent to Los Angeles County Fire Department jurisdiction.

Currently, the Angeles National Forest operates all "command and control" and tactical frequencies within the 154 to 170 MHz range (excluding the VHF frequencies - commonly called "Victor Frequencies" utilized in aircraft operations). All Angeles National Forest operations and status changes are accomplished with voice interaction. Los Angeles County Fire Department utilizes voice interaction and mobile data communication on a variety of frequencies. Los Angeles County utilizes tactical voice frequencies in the 154 to 170 MHz range and in the 470 MHz range. Los Angeles County Fire Department also utilizes Mobile Data Terminals (MDT's) operate on the 800 MHz band. Los Angeles County utilizes frequencies assigned by the California State Office of Emergency Services (OES) for tactical use and known as the "OES White Frequencies". Los Angeles County Fire Department (LAC) also utilizes other "white" frequencies (those in the 154-170 MHz range) which have been requested and assigned to the fire department.

In summary, currently utilized voice frequencies are:

ANF -	171.575 MHz	ANF Channel 1 (Simplex - Direct)
	172.375 MHz	ANF Channel 2 (Duplex - Repeat)
	169.950 MHz	ANF Channel 3
	168.500 MHz	ANF Channel 4 (Tactical - NIFC Frequency)
	170.000 MHz	ANF Air to Ground
LAC -	470 MHz	LAC Blue Channels 1 to 12
	154 MHz	LAC White Channels 1 to 7

Currently utilized data frequencies are:

ANF -	NO DATA FREQUENCIES	
LAC -	800 MHz	LAC MDT frequencies

Foothill Fire Departments utilize additional frequencies for dispatch and tactical operations.

Los Angeles City Fire Department utilizes 800 MHz frequencies for dispatch, data, and tactical operations.

During a dispatch to a brush incident, the ANF utilizes at least 2 frequencies, and the LAC utilizes at least 3 frequencies. None of those frequencies are common.

During wildland fire operations, after the initial dispatch, the ANF will utilize Channels 1 to 4 plus the 170.000 MHz air to ground frequency, the LAC will utilize an assigned blue tactical frequency, a white frequency, and frequencies to monitor helicopters and crews. As many as 8 (or more) frequencies can be used by the two agencies during a first and second alarm brush fire response. Additional frequencies will be used by cooperating foothill fire departments and/or Los Angeles City Fire Department (LFD).

A first alarm wildland brush fire response by both ANF and LAC will involve 10 engines, 5 crews, 3 helicopters, 3 water tenders, fire prevention personnel and investigators, air attack, 1-2 air tankers, and multiple Chief Officers (Battalion Chief for LAC, Battalion and/or Division Chief for ANF). A second alarm wildland brush fire will overlay an equivalent number of resources on the incident. By the end of the arrival of all second alarm

units, over 20 engines, several crews, and approximately 250-300 people will be involved in incident operations.

All ANF resources have the immediate access to LAC blue frequencies, all ANF frequencies, and some LAC white frequencies. All LAC resources have access to some ANF frequencies, and all the blue and white LAC frequencies.

ALL radios, both ANF and LAC, along with any other OES white frequency user suffer from frustrating, on-going, and dangerous interference from Mexican radio transmissions. Interference from Mexican transmissions occurs commonly, frequently, and at dangerous times. Evidently, the Mexican government has not had the ability to curtail transmitters and stations with powerful mountain locations. The interference is a great source of frustration to firefighters in the County. **IT IS A GREAT DANGER TO FIREFIGHTERS!** The constant interference from Mexico, along with its unpredictability, and the ability of that traffic to drown out emergency traffic, have caused fire fighters to lack confidence in many of the 154-170 MHz frequencies.

Radio traffic congestion is a large problem in the fire agencies, as fast moving brush fires, along with many pieces of equipment, and the need to move quickly with the situation, cause the need to transfer information via voice. Radio traffic congestion is severe on the ANF, where only 2 frequencies exist to exercise command and control functions, and only 1 frequency exists to utilize tactically. Additionally, the ANF must deal with coincident law enforcement radio traffic, which may involve threats to the law enforcement officers health and safety.

The need for agencies to establish common frequencies, to reduce confusion during mutual operations, is acute. No one human being can adequately monitor over 8 different radio frequencies and still conduct the complex command operations involved with wildland fire management in Los Angeles County.

Needs for both ANF and LAC include the ability to have:

- 1 each command and control frequency (may be unique to each agency)
- tactical frequencies for interaction between incident command and incident resources
- tactical frequencies for interaction within individual crews (squad to squad)
- air to ground frequency (incident command or operations to air attack)

Study is needed to how best determine how to interact efficiently on tactical frequencies for interaction between incident command personnel and incident resources. These tactical frequencies do not need to be agency specific, but do need to be incident specific.

Study is needed to determine how best to deal with the issue of interaction between agencies with varying levels of technology, i.e, the 154-170 MHz based system of the ANF, the 800MHz, 470 MHz, and 154-170MHz based system of the LAC, and the 800 MHz based system of LFD. Additionally Foothill Fire Agencies operate on a variety of differing frequency bases.

Action is needed to deter or stop the Mexican radio interference.

Action is needed to determine methods to reduce radio congestion.

GLEN ALLEN INCIDENT ENTRAPMENT INVESTIGATION RECORDS

Air Support Information	Los Angeles City Fire Dept and Los Angeles County Fire Dept (Copter 305 information found in Incident Report File, ANF)
Autopsy Report: Herman, Christopher	County of Los Angeles Department of Coroner
Autopsy Report: Ruezga, Arthur	County of Los Angeles Department of Coroner
Cooperative Fire Protection Agreement	County of Los Angeles and Angeles National Forest
Crew Operations and Procedures	Los Angeles County Fire Dept
Dispatch Transcriptions	Los Angeles County Communications and Crew 2-2
Dispatch Transcriptions	Los Angeles County Communications 15:11 through 18:17
Downhill/Indirect Line Construction Guidelines	Los Angeles County Fire Dept and Angeles National Forest
Entrapment Investigation Guidelines	National Wildfire Coordinating Group
Field Incident Report	Los Angeles County Fire Dept
Fire Cause Investigation Report	Department of Alcohol, Tobacco and Firearms.
Fire Investigation Report	Los Angeles County Fire Dept
Fire Investigation Report	USDA Forest Service
Fire Shelter Training Guide	Los Angeles County Fire Dept and Angeles National Forest
Fire Qualifications	Angeles National Forest
Incident Report and Dispatch Action	USDA Forest Service Angeles National Forest
Homicide Report	County of Los Angeles Sheriff's Dept

Mobile Data Terminal (M.D.T.) Call History	Los Angeles County Fire Dept
News Release	
Newspaper Articles	
Operating Plan - 1993	County of Los Angeles Fire Dept and Angeles National Forest
Organizational Chart (ICS)	
Response to Alarm Procedures	Los Angeles County Fire Dept and Angeles National Forest
Standard Fire Orders	Los Angeles County Fire Dept and Angeles National Forest
Team Member Information	
Validation of Radio Equipment and Communication Plan	Los Angeles County Fire Dept
Watch Out! Situations	Los Angeles County Fire Dept and Angeles National Forest
Weather Information	

H
W

HOT WIRE ELECTRIC CO.

13901 WEST STREET
GARDEN GROVE, CALIFORNIA 92643

(714) 839-2310

August 31, 1993

UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE
701 N. Santa Anita
Arcadia, CA 91006

Attn: Rita Wears

INVESTIGATION AND REPORT

This firm was contacted by Bureau of Alcohol, Tobacco and Firearms representative, Michael Gleysteen, to inspect and determine the cause and origin of the fire loss to the below described vehicle. As per Mr. Gleysteen's instructions, this firm was to contact Special Agent, Rita Wears, to coordinate the investigation of the described vehicle. An investigation was performed on the vehicle on August 25, 1993. Below are the details and results of that investigation.

GENERAL INFORMATION

Our file number	930823
Vehicle description	1984 Cadillac Beritz VIN - 1GGAL578XEE64428 DOM - 03/84 License - unknown Mileage - unknown
Date of loss	08/19, 08/20 approximate

The above described vehicle was examined. Photographs were taken for purposes of identification, preservation of evidence and to memorialize fire damages. The vehicle identification was recorded and verified. Initial examination of the vehicle indicated severe fire damage to the front section of the vehicle and portions of the interior.

The main portion of the fire was at the right section of the engine compartment. This fact is evidenced by the burn pattern of the top of the hood, as well as within the engine compartment. The heaviest burn was on the right side. The fire transferred from the engine compartment to the interior of the vehicle.

The fuel lines, both inlet and return, were inspected for failures. No malfunctions of the fuel lines were found.

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REPORT continued,
page 2

The electrical systems on the left, front and center sections of the engine compartment were inspected. No malfunctions were found.

The vehicle was raised in order to inspect the underside. No damage to the fuel lines or body were noted. The left and right tires and rubber bushings were consumed by the fire. The upper A-arm on the right front was distorted and warped by the intense heat of the fire. The water pump body had melted, allowing the water pump to fall free. The alternator, right side rear case, had melted away, allowing the alternator to fall from it's bracket. The battery, hold down and right inner fender were totally consumed by the fire. The air conditioning evaporator case was also consumed. The fire transferred to the vehicle interior in this area.

The wire harness and battery cables were examined. The fusible links for the main power supply had melted and burned away. This was due to the shorting of the main power wires during the fire. The starter solenoid cap had been subjected to extreme heat from the battery cable. The battery cable shorted out and burned away a portion of the cap.

The positive battery cable was removed from it's mounting bracket at the starter and was examined. The cable was found to be shorted at the bracket. Several strands of the cable were broken and melted. The balance of the strands were hard and brittle. This condition is an indication of the copper being subjected to extreme heat.

The ground cable was removed from the engine block. Other harness ground wire eye attachments were welded to the eye of the ground cable. The positive and negative cables were retained by Special Agent Rita Wears.

OPINION AND CONCLUSION

It is the opinion of this investigator that this fire occurred as a result of the shorting of the positive battery cable at the starter. This shorting caused the plastic inner fender and other plastic materials on fire. The fire rolled from right to left. As the fire progressed, it consumed the A/C evaporator case allowing the fire to spread to the interior of the vehicle.

Statements from the suppression crew place the total burn time at approximately one hour.

This fire was extremely hot on the right front of the vehicle. The passenger front door window was up at the time of the fire. The driver's door window was open or partially open at the time

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REPORT continued,
page 3.

of the fire. The side mirror on the right side had started to melt. The left side mirror was undamaged. The left front hubcap was sooty, but not burnt. The right front hubcap was burned and had been subjected to high heat causing it to turn blue.

The wind direction was coming from the rear of the vehicle forward. This condition was confirmed by Special Agent Wears.

Respectfully submitted,

William Schroeder,
Investigator

end of report.....