

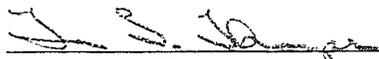
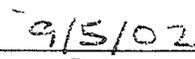
Stanza Fire Engine 11 Accident Investigation Report

July 28, 2002

Accident Investigation Factual Report

Accident: Stanza Engine 11 Investigation
Location: Happy Camp Ranger District, Klamath National Forest
Date: July 28, 2002

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United States Department of Agriculture
Forest Service

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Accident Investigation Factual Report

**Stanza Engine 11 Investigation
Happy Camp Ranger District
Stanza Creek Drainage
Klamath National Forest
Region 5
Happy Camp, California
July 28, 2002**

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**Stanza Engine 11
Investigation**

**Accident Investigation Factual
Report and Management
Evaluation Report**

**Stanza Creek Drainage
Klamath National Forest
Happy Camp Ranger District
Happy Camp, California**

July 28, 2002

**Forest Service
United States Department of Agriculture**



Executive Summary

On July 28, 2002, three Forest Service fire engine personnel sustained fatal injuries when their vehicle rolled off a steep road during fire suppression activities at the Stanza Fire, in the Stanza Creek drainage on the Klamath National Forest, about 20 miles south of Happy Camp, California.

The fire was started by lightning on July 22, 2002. Initial suppression efforts began that evening, and additional resources were immediately dispatched to the site. The fire grew until a Type 2 Team was called in to manage the incident. The team took over command on July 26, 2002.

Engine 11 (E-11) from the Lassen National Forest was part of a strike team that was dispatched to the fire on July 26, 2002. It is a 2 wheel drive Model 61 engine equipped with a manual transmission and 500 gallon water tank. It took the Engine crew of five people most of the day to reach Happy Camp; they were briefed and sent out on the fireline to support a burnout operation during the night shift. The country is rugged and mountainous, with steep slopes and rock outcroppings. E-11 went to work mopping up hot spots, watching for slopovers, and patrolling the line. They were assigned to Road 15N03A, a winding dead end spur road with steep dropoffs which served as a control line for the fire. The roadway was narrow (from 10-12 feet in width) with sloughing rocks and logs placed to catch burning debris. The crew took a long rest break in the early morning of July 27, before being released from the line around 0630.

The crew drove back to camp, where they were off duty from approximately 0830 hours until their next shift began at 1730 hours. They were again assigned to patrol Road 15N03A, and reached the site around 1930 hours. The crew of E-11 worked along the road in support of the Kentucky 8 handcrew and the Plumas Hotshots. They drove the road several times as they carried out their assigned duties. Shortly before midnight they filled their water tank and stopped to eat lunch. At 0100 hours they continued their patrol. After returning to the junction of 15N03 and 15N03A (Drop Point #1) at approximately 0145 hours, they waited until just a few minutes before 0200 hours to make another trip out 15N03A. On this trip, at about 0200 hours, the Engine slid off the edge of the road and rolled down a steep hill. It came to rest 1,059 feet below the road.

All occupants were wearing seatbelts. Three crewmembers were ejected from the vehicle and fatally injured as it rolled down the hill. Two crewmembers survived the accident, and crawled out of the wreckage. Members of the Kentucky 8 crew found the E-11 crewmembers shortly after the rollover. The survivors were placed on backboards and carried down the hill to Road 15N03, where they were transferred to ambulances and transported to Norcross Campground. From there they were flown by helicopter to hospitals in Redding, California.



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FACTUAL REPORT

Stanza Engine 11 Accident

Stanza Creek Drainage
Klamath National Forest
Happy Camp Ranger District
Happy Camp, California

July 28, 2002

Forest Service
United States Department of Agriculture



Overview of the Stanza Engine-11 Accident

Summary

On July 28, 2002, Engine 11 from the Lassen National Forest rolled down a hill while on duty fighting a wildland fire. The fire, started by a lightning strike, was located 20 miles south of Happy Camp, California, in the Stanza Creek drainage. Five crewmembers were involved in the rollover. Three of the individuals died, and two sustained non-fatal injuries. The Engine was completely destroyed.

The following is an overview of the events and actions that took place related to the Stanza Incident. This overview is based on interviews with twenty-eight individuals, and the analysis of fire documents, dispatch logs, weather conditions, road conditions, training records, and vehicle performance specifications and maintenance records. Additional detailed information that is relevant to the identification of causal factors that led to this incident is included in the appendices and in the Findings section of this report.

Initial Actions

The Stanza Fire started from a lightning strike on July 22, 2002, in Stanza Creek on the Happy Camp Ranger District of the Klamath National Forest (Figure 1). The fire location was discovered at 1955 hours that day, and was approximately ¼ acre in size. A strike team of crews was ordered at 2000 hours by the Klamath National Forest. A five-person initial attack crew from the Klamath National Forest (Initial Attack Incident Commander Arnold Durazo) arrived at the fire at 2300 hours.



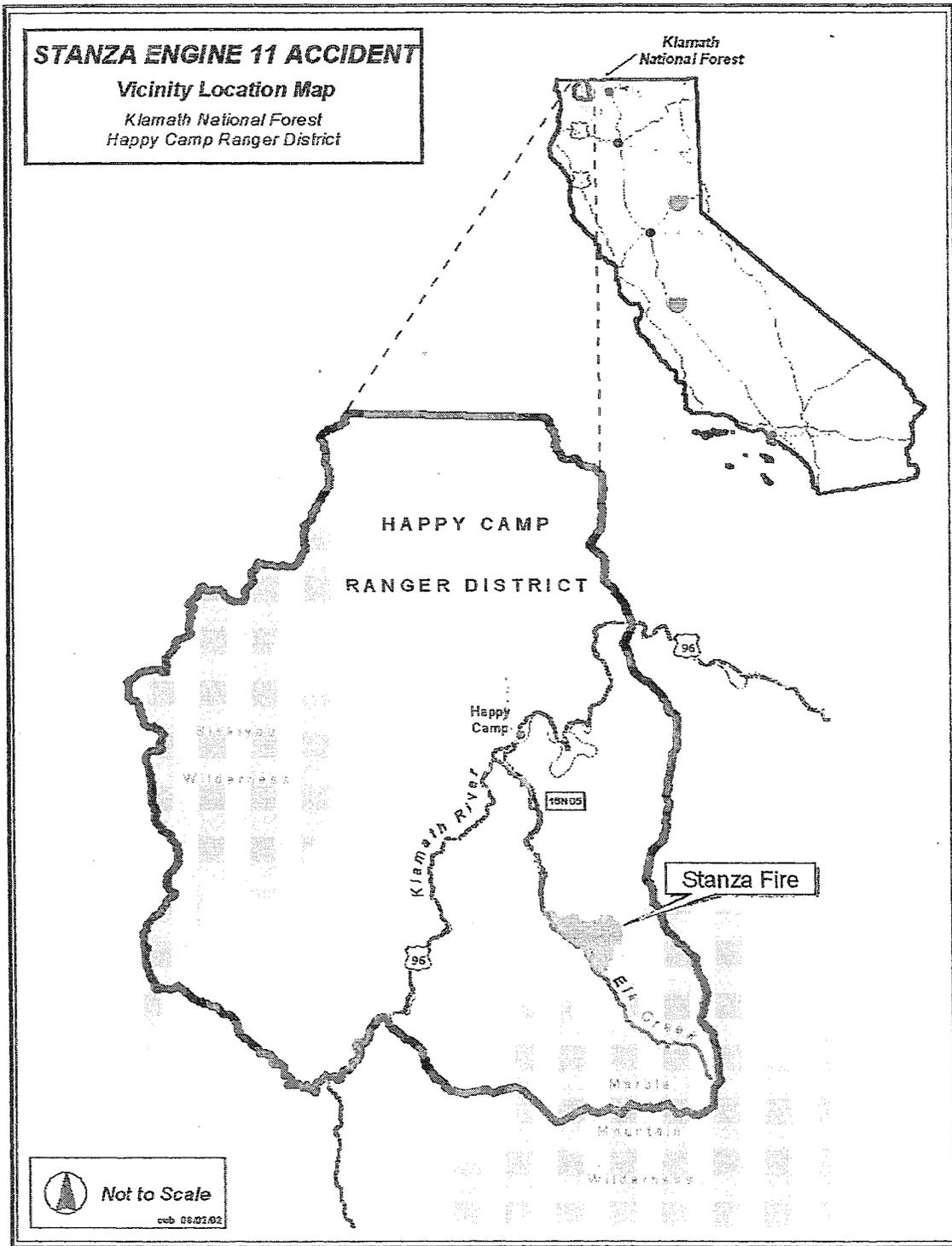


Figure 1. Location of Stanza Fire.



Stanza Creek is a tributary to Elk Creek. Elevations range from 2400' to 4654'. It is steep, rugged, and has limited access. Slopes range from 40 to 90 percent, with rock outcroppings and talus slopes. Vegetation varies from timbered to brushy conditions. The area has had logging activity in the past, and some 1980s timber harvest units lie along the few roads. These units are generally brushy, with small conifer trees that were planted after the harvest. Roads are narrow and winding, often with precipitous dropoffs. The lack of access precludes efficient use of heavy equipment such as bulldozers, and creates logistics problems for fighting wildland fires.

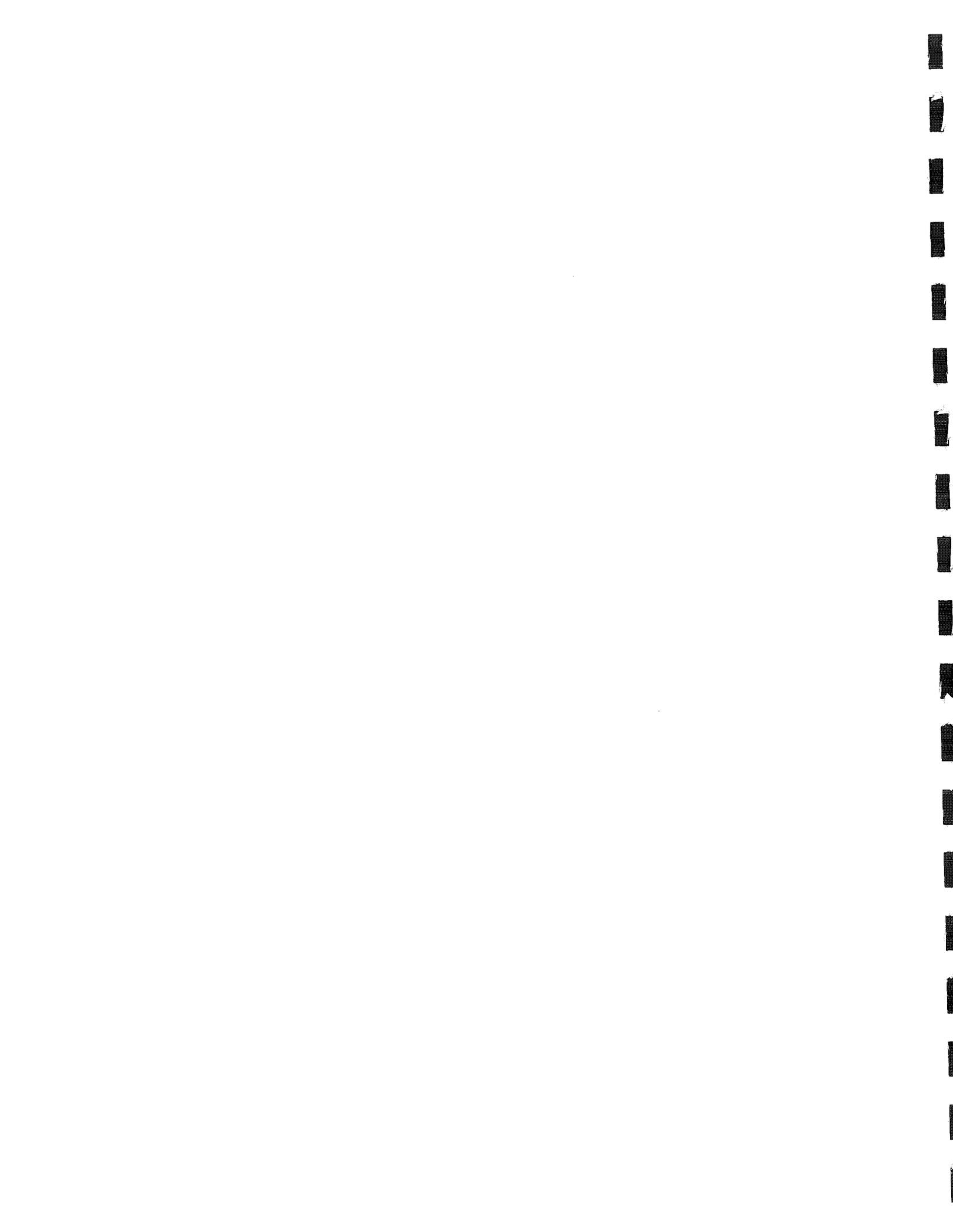
At 0330 hours on July 23, the fire was approximately 10 acres in size and burning actively downhill from its origination point. Although there was a line around the fire, the crew had difficulty holding it. Within the fire there were several snags on fire and burning debris was rolling downhill. Later that day, a strike team of hand crews ordered from the California Department of Forestry (CDF) arrived on scene and began working. By the evening of July 23, the fire was actively burning outside the lines, and all personnel were disengaged and there was no night shift. Later that evening the Happy Camp District ordered a Type 3 Incident Command Team.

On July 24, the Type 3 Team arrived on the site (Rich Farmer Incident Commander). Resources consisted of Eldorado NF Interagency Hotshot Crew, Klamath NF Crew 4, CDF Strike Team 9241G, Golden Eagle Type 2 handcrew, Yosemite NP Crew 7 Type 2 handcrew, 9 smokejumpers, KNF Type 2 handcrew, air support H-553 Type 3, H192CH Type 1, HT-745 and helitender, and KNF Engine 26. Terrain was very steep, there were snags on fire, and debris rolling across the line was spreading fire downhill. The fire was burning at moderate intensity. Due to concerns for crew safety, most resources were not engaged. The fire was estimated at 70 acres at this time.

At 1530 hours on July 24, the Wildland Fire Situation Analysis (WFSA) for the Stanza Incident was drafted by James Perkins, Acting District Ranger, Happy Camp Ranger District; Perkins signed it on July 25th (Appendix A). The WFSA called for direct attack strategies to be employed; however, if those methods failed to hold the bottom and flanks of the fire, the WFSA directed that indirect strategies (Alternative B) should be initiated.

At 1730 hours on July 24 the Klamath National Forest ordered a Type 2 Incident Management Team. At 1200 hours on July 25 the Type 2 Team transitioned with the Forest. The Forest delegated authority to Howard Carlson, Incident Commander, NORCAL Incident Management Team 2. The objectives for the management of the Stanza Wildfire Incident were documented in the Delegation of Authority signed by Michael P. Lee, Deputy Klamath National Forest Supervisor, for Margaret J. Boland, Klamath National Forest Supervisor (Appendix B).

The decision to employ indirect strategies was made on July 26th, and the subsequent WFSA (Appendix C), signed on July 27th by John R. West, Acting Happy Camp District Ranger, documents the utilization of indirect strategies beginning that day.



At 0600 hours on July 26, the Type 2 Team assumed command of the incident. At 2146 hours on July 25, E-11 from the Lassen National Forest was ordered as part of Strike Team 3615C, assigned to the Stanza Incident on the Klamath National Forest.

Background on E-11

The Crew

E-11 was stationed at the Almanor Ranger District in Chester, California, and had a complement of seven personnel, each of who had two days off per week. They included:

Jerry Herring: Supervisory Fire Engine Operator (aka Captain); provided leadership and supervision of the crew. Herring was on an off-Forest detail and was not present at the Stanza Fire.

Steve Oustad: Fire Engine Operator (aka Engineer); provided leadership, supervision and direction for the engine module two days per week in the absence of the Captain. He had been serving as Acting Captain for several months in Herring's absence, and was in that role on this assignment.

Heather DePaolo: Senior Firefighter; provided oversight and direction to crew members on projects and routine fire assignments (such as line construction and mop up) in the absence of the Captain and Engineer. On this assignment, she was Acting Engineer.

Ryan Smith: Forestry Aid (Firefighter): Performs fire fighting and projects as assigned.

John Self: Forestry Aid (Firefighter): Performs fire fighting and projects as assigned.

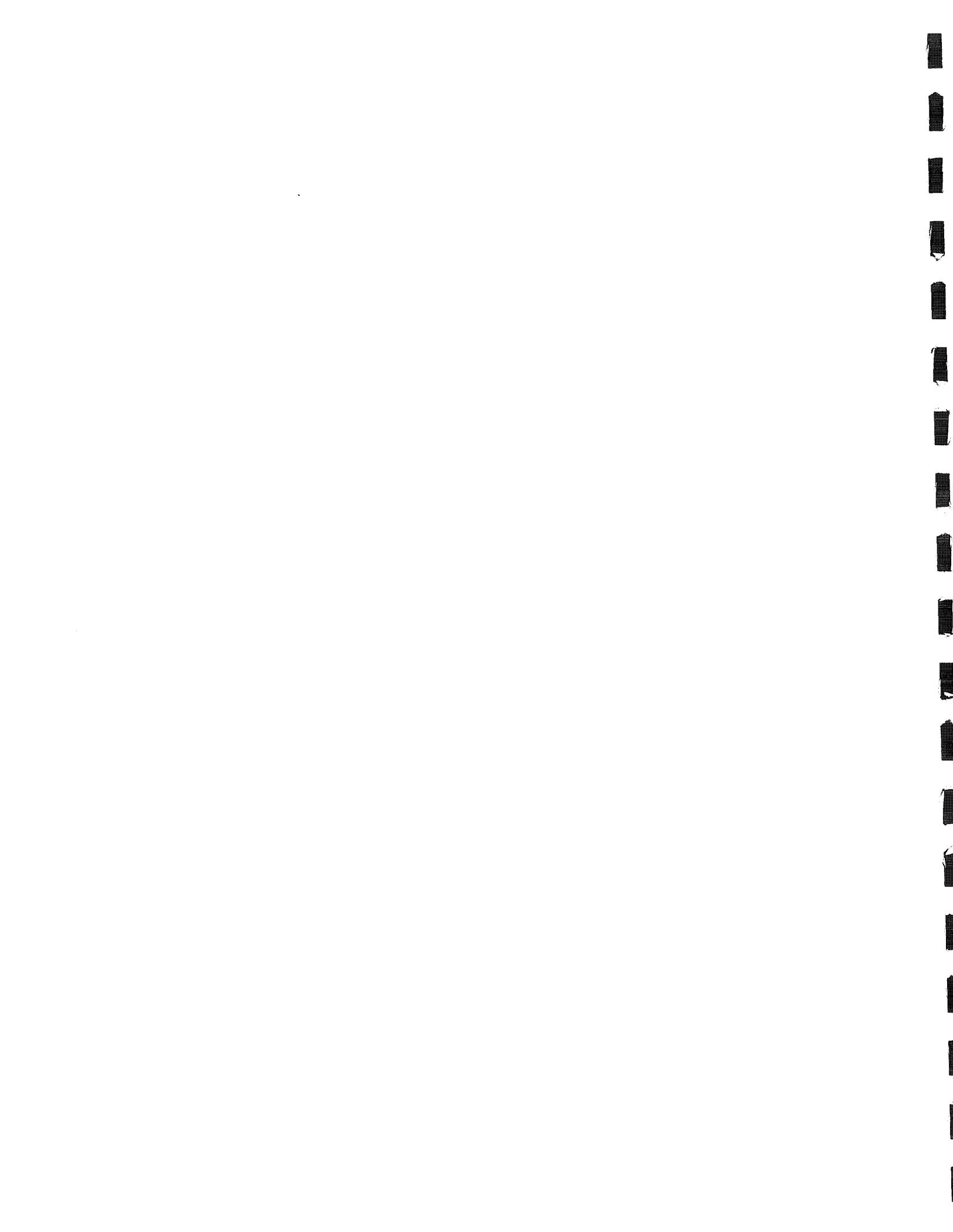
Alex Glover: Forestry Aid (Firefighter): Performs fire fighting and projects as assigned.

Tim Langrehr: Forestry Aid (Firefighter): Performs fire fighting and projects as assigned. Langrehr was on his day off and was not present at the Stanza Fire.

Jerry Herring had been on assignments which kept him off the Forest for several months. In his absence, Steve Oustad had taken on the leadership of the engine module. Oustad conducted training, provided for engine maintenance, and was the supervisor for the five firefighters. This was John Self's second fire season; it was the first season for Smith, Glover and Langrehr. DePaolo had three seasons with the Bureau of Land Management (BLM). The crew had a mix of experience with seasoned leadership in Oustad.

The Drivers

At the Stanza Fire, Steve Oustad and Heather DePaolo were the only two drivers on E-11 with a valid state license to operate the engine. Witness statements indicate that DePaolo did much of the driving while en route to and during the Stanza Fire. She was driving at the time of the accident.



Heather DePaolo started her federal fire career with the BLM, and had three and one-half years of experience with that agency. In February 2000, while working for the BLM, DePaolo obtained her Class B Fire Drivers License, which included a restriction to automatic transmission operation only. On May 17, 2002, she completed the Department of Interior (DOI) Engine Academy, where she was trained and tested on an engine with an automatic transmission. The Academy does not provide experience in nighttime driving on narrow roads. Her former BLM supervisor, Garth Jeffers, and BLM State Training Officer Gary Cardoza, indicate that, although DePaolo had all the classroom training and was one of the top students in her class, they felt she needed more time to gain the experience needed for this type of equipment (Type III engine with manual transmission).

DePaolo was hired by the Forest Service on June 16, 2002 as a Forestry Technician GS-0462-05, Senior Firefighter. She passed her physical and a written test, and completed an AD-184, Application for OF-346 (U.S. Government Motor Vehicle Operator's Identification Card) on June 21, 2002. For operation of this type and size engine, the Forest Service requires a commercial license. DePaolo applied for and received a California State learner's permit for a Class B Commercial Drivers License (CDL), which restricted her to operating an engine only when accompanied by a fully licensed driver with the same type of license. Steven Oustad had a Class B CDL license, which met the restriction requirement on DePaolo's license.

Forest Service regulations (FSH 7109.19) require Forest Service employees to have "in their possession an identification card (Form OF-346) or similar document for the type and size of vehicle being operated." The OF-346 for DePaolo had not been signed or issued pending driver's record information requested from the State of California. DePaolo did not have a signed OF-346 in her possession at the time of the accident. Steven Oustad had a current OF-346.

DePaolo had been working for the Forest Service on E-11 for five weeks at the time of the accident. E-11 has a manual transmission, and DePaolo had little experience with manual transmissions. She also had minimal nighttime driving experience, and limited experience driving on narrow mountain roads. This was her first off-Forest assignment for the Forest Service as an engine driver.

Steven Oustad was a long-time (23-years) Forest Service employee and had worked on this type engine module for 14 years. He was an experienced, qualified engine driver with experience on many fire assignments in a variety of terrain and visibility conditions. He was qualified as a Strike Team Leader and was a Division Supervisor Trainee. Oustad recognized the need for DePaolo to get experience driving the Engine, and had provided opportunities at the Ranger District on various types of terrain for her to acquire that experience.

The Engine

E-11 was a 1991 two-wheel drive Ford F-800 Model 61, Type III Fire Engine (Figure 2). It was equipped with a 6-cylinder diesel engine and a 6-speed manual transmission. It was comprised of a fire engine body (with a crew compartment that is designed as an integral part of the body), a 500 gallon baffled steel water tank, and utility type body compartments. Overall length of the truck was 22 feet, wheel base was 166 inches, and the width measured between the outsides of the rear dual tires was 93 inches. The width of the front tire track is approximately two inches less. For more information, see Specification Sheet in Appendix D.

To the date of dispatch, E-11's vehicle history records were complete. Annual inspection and repairs and monthly preventive maintenance checks were all completed on schedule (Appendix E). The annual inspection for the 2002 field season was completed in December 2001; tread on all tires was measured at that time and found to be between 15/32 and 22/32 inch in depth.



Figure 2. A 1991 two-wheel drive Ford 800 Model 61, Type III Fire Engine.
This engine is the same model as E-11.



Dispatch to the Stanza Fire

On the night of July 25, 2002, about 2200 hours, Steven Oustad, Acting Engine Captain for E-11, notified crew members that the engine had been dispatched to the Klamath National Forest.

For the Stanza Fire, E-11 had a 5-person crew, consisting of an Acting Captain (Steven Oustad), an Acting Engineer (Heather DePaolo), and three firefighters (John Self, Ryan Smith and Alex Glover).

Around 0830 hours on July 26, the E-11 crew left the Almanor Ranger District in Chester, California en route to Yreka to join the rest of the strike team. E-11 stopped in Red Bluff for fuel around 1000 hours, and continued driving to Yreka, CA where all five engines of the strike team assembled around 1230 hours. The Strike Team Leader (STL) was Doug Young. Between 1230 and 1400 hours, the crew of E-11 took a 30-minute lunch break, fueled up, and met with the other strike team members. The strike team left Yreka for Happy Camp about 1400 hours, arriving at the Incident Command Post (ICP) about 1600 hours. Total driving distance from Chester, CA to Happy Camp, CA is 272 miles (Figure 3).

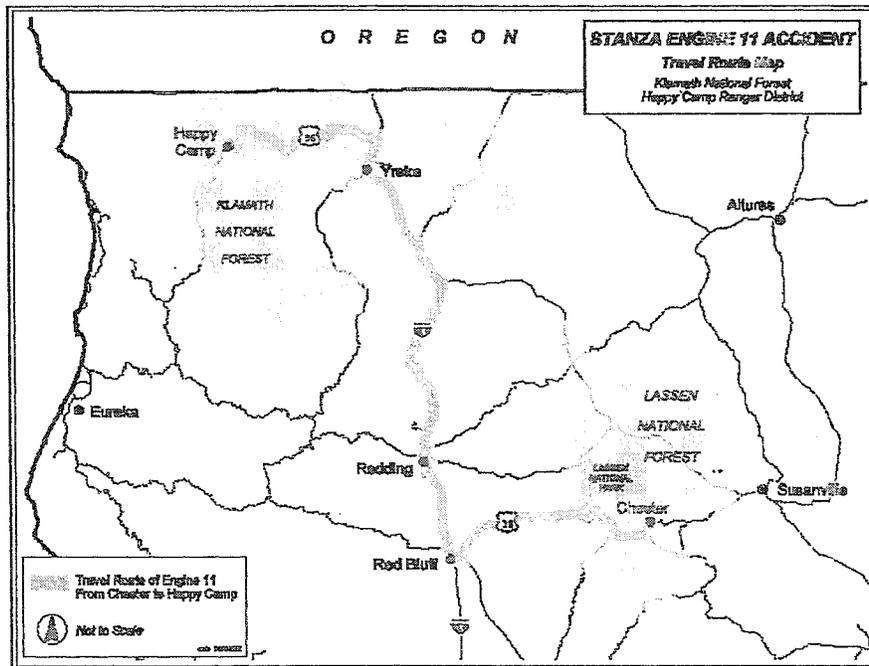


Figure 3. Route taken by E-11 from Chester, California to Happy Camp, California on July 26, 2002.



A complete chronology of E-11's duty time between July 26 and the time of the rollover is included in Appendix F.

Night Shift, July 26-27

Fire Situation

When E-11 arrived at the ICP, the Stanza Fire was approximately 440 acres in size. Indirect strategies had been effective in securing line along existing roads. The fire was growing slowly to the west, backing downhill into Stanza Creek. Safety concerns included steep, inaccessible terrain, rolling rocks and debris, burning snags and narrow roads.

Strike Team Briefing and Assignment

Lassen Strike Team Leader Young was informed that the strike team would be sent to the fireline. Young indicates that he notified the Operations Section that this would exceed "work/rest guidelines". He recalls that he was given verbal approval to proceed with the night shift, and assumed the Incident Commander had approved it. (There are conflicting views of these early conversations between Young and Operations. See Post Accident Investigation Section.)

Shift Chronology

Operations directed the strike team to proceed to the fireline for the night shift assignment. After a briefing, the strike team left for Division B at 1800 hours.

E-11 was assigned to support the burnout operation along Road 15N03A (also referred to as "Spur road A", or "the A Spur"). The road is a winding, dead-end road, 0.7 mile in length with a native soil surface (Figure 4a). It was constructed in the 1980s for timber hauling, with an average width of 14 feet, including shoulders. Sloughing rocks and debris from the fire had narrowed the road in places, and it measured anywhere from 10 to 12 feet in width (Figure 4b). Although the road had been graded on July 25, 2002, rocks continued rolling down onto the travelway as the fire and fire suppression activities progressed. There was a steep dropoff on one side.

A 4,000 gallon water tender (White's Water Tender, E-41) and portable tank were located at a landing at the end of the road, and Drop Point #1 was established where the road intersected with 15N03 (Figures 5 and 6). Steve Oustad told Division Supervisor Dan George that he had a fairly inexperienced driver, and that he intended to have the Engine patrol the road by driving through and turning around at each end. Young, Oustad, Rich Davis (Strike Team Leader Trainee) and Matt Hennessey (Captain of Engine 12) looked at the road together and conferred on safety issues. They established trigger points at which they would pull back to Drop Point #1, agreed only to use engines when needed, "and positively no backing up." E-11 went to work mopping up hot spots, watching for slopovers, and patrolling the line. Due to the narrowness of the road, the



Engine always drove the full length of the road, so that it could turn around without backing up.

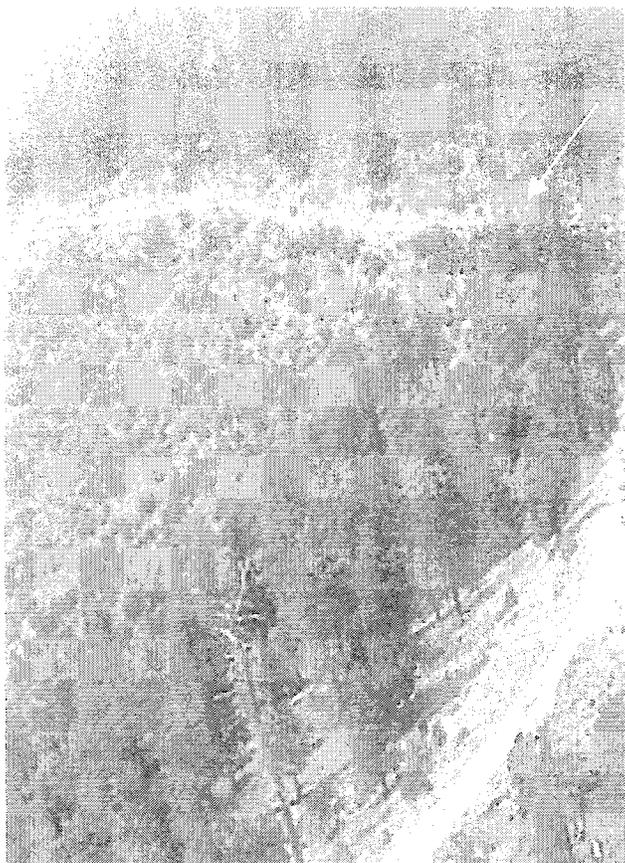


Figure 4a. Overview of Road 15N03A looking southwest. Fire is uphill to the right. End of road is at upper left, Drop Point #1 is out of the photo at lower left. Arrow indicates site of rollover.

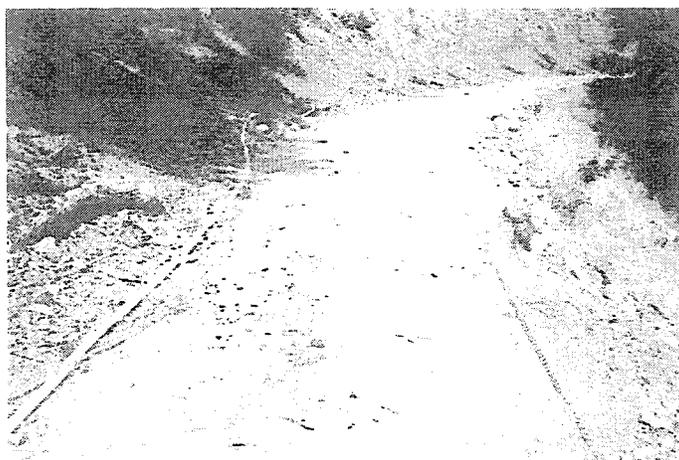
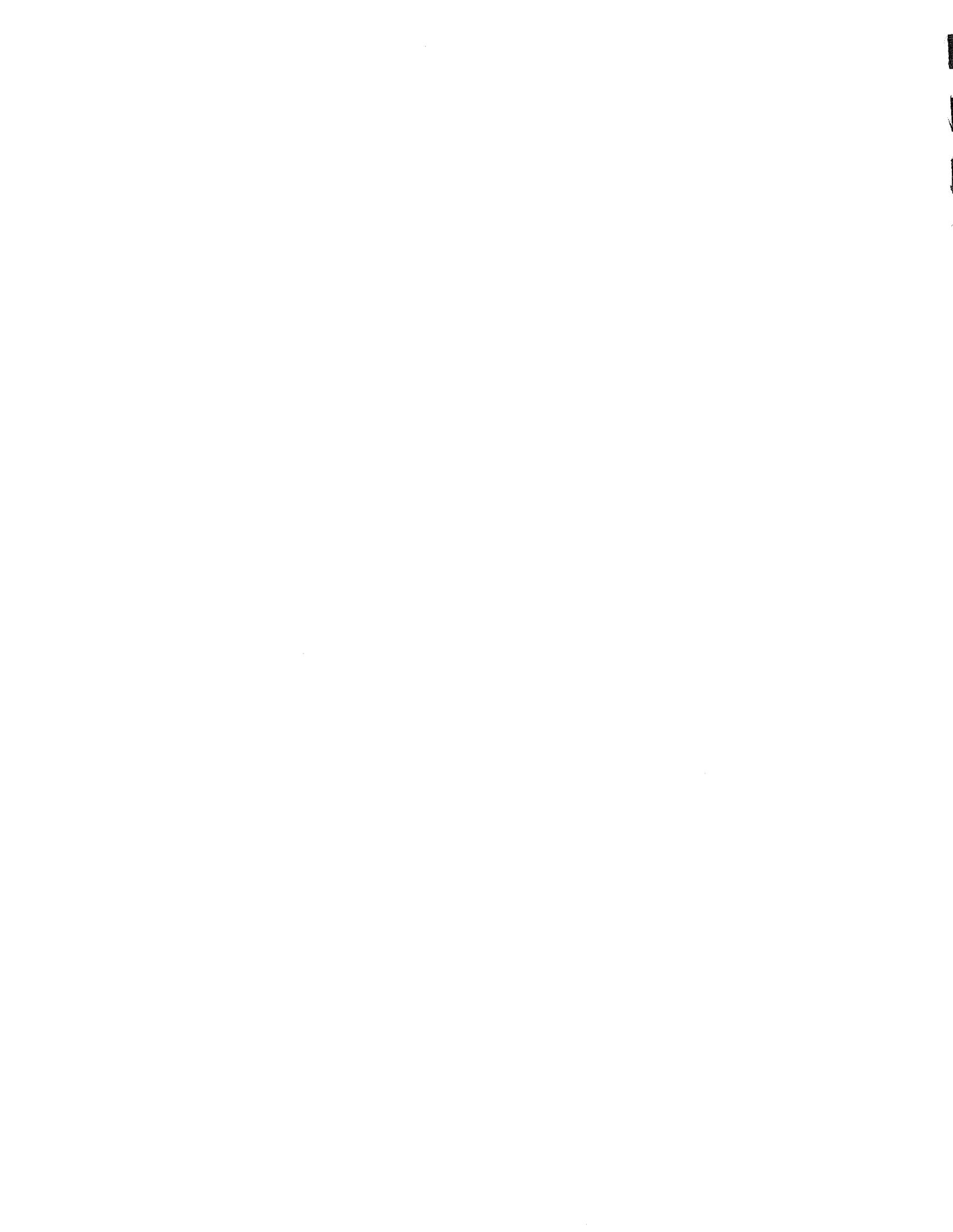


Figure 4b. Closeup of road surface on 15N03A. Note: Hose at left was not present at time of accident.



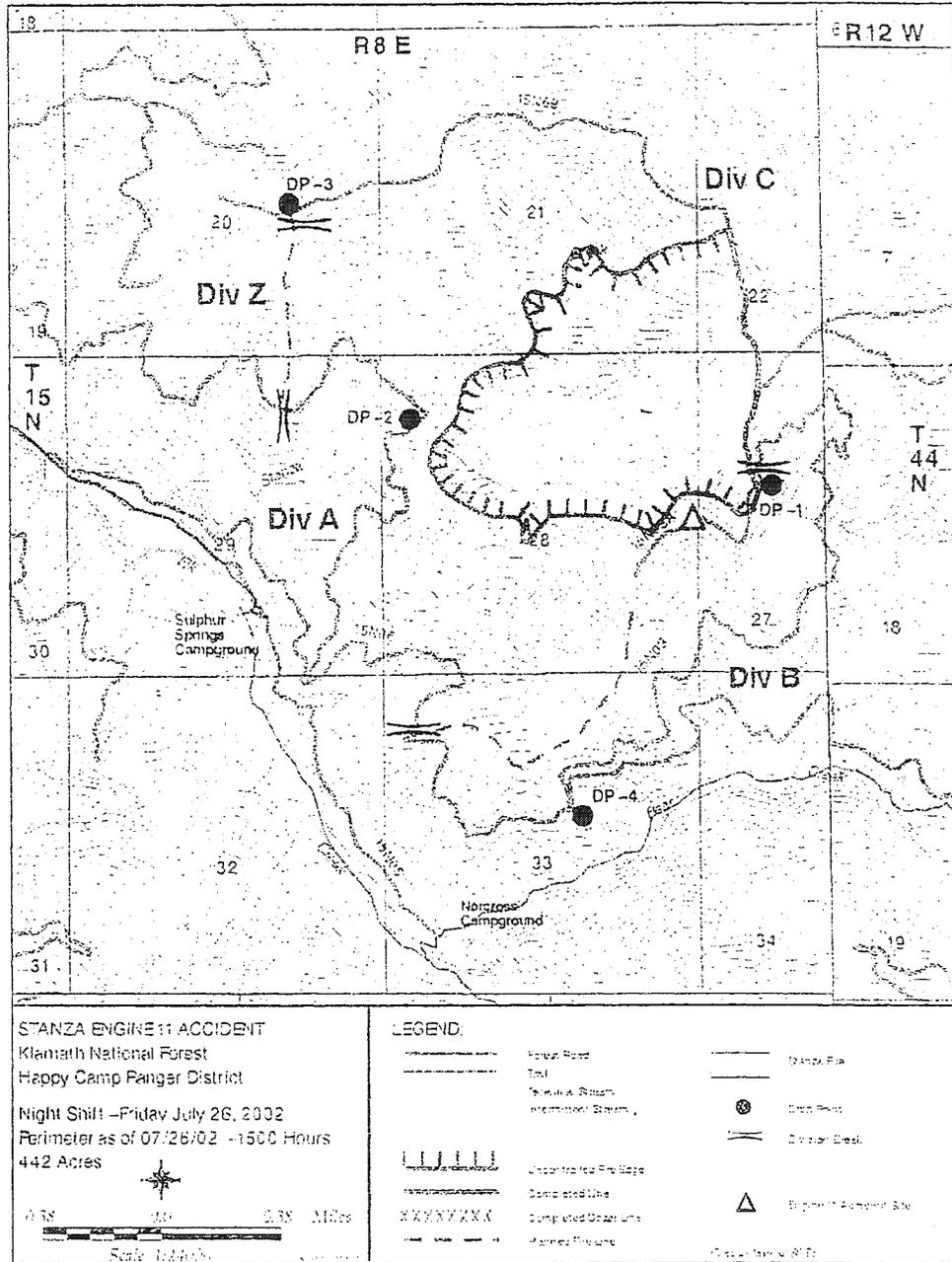


Figure 5. Stanza Fire Situation on July 26-27, with location of Road 15N03A relative to Drop Point #1.



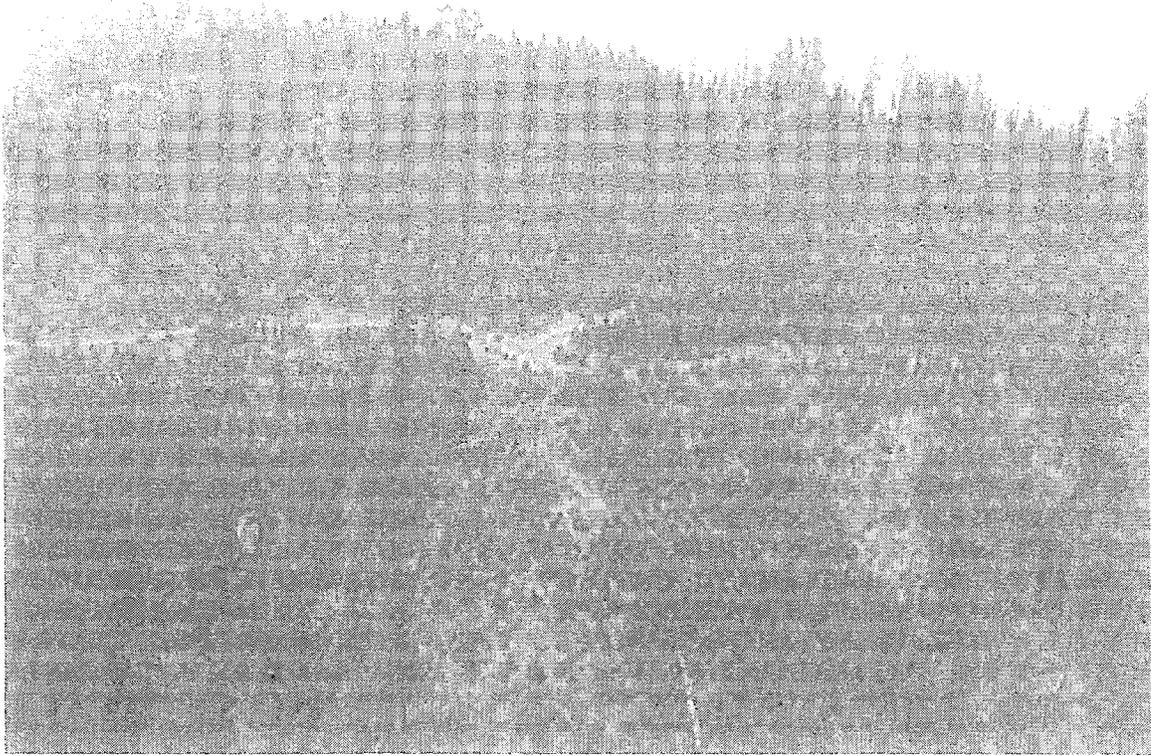


Figure 6. Intersection of Road 15N03A (to left) and 15N03 (to right and up). Drop Point #1 was located at this intersection.

Sometime during the night Young requested that the strike team be allowed to sleep in Norcross campground (a spike camp) rather than drive another hour back to the ICP. The Operations Chief denied the request because the Incident Logistics group couldn't support the strike team at Norcross.

The burnout along 15N03A started at 2200 hours and terminated at approximately 0300 hours on July 27. E-11 bedded down at Drop Point #1, and rested until approximately 0600 hours. E-11 was released from the fireline at 0630 hours and the Engine returned to the ICP, arriving at approximately 0830 hours.

E-11 and crew worked on the Stanza Fire from 1800 hours on July 26 until 0830 hours on July 27. From the time they left the Almanor Ranger District on July 26 until their shift was over on the morning of July 27, they had been on duty for 24 hours. The crew was off duty at the fire camp in Happy Camp from approximately 0900 until their next shift started at 1730 hours. Sleeping facilities were located in the air conditioned gym at the school. The site was described as an excellent facility, cool and quiet.



Night Shift, July 27-28

Fire Situation

At the start of the night shift, the fire was still backing downhill slowly into Stanza Creek. It had grown in the last day and a half and was now over 650 acres in size. There was some spotting across the lines on the west side.

The Incident Action Plan (IAP) for the night shift of July 27-28 shows E-11 (with ST 3615C) assigned to Division C (Appendix G). However, the Operations group decided to use the strike team to support operations in Division B, since the personnel had experience in the area and were already familiar with the operation and safety issues. The Division Assignment List for Division B for the night of July 27-28 lists control operations as "Fire and hold A-spur [15N03A]and handline". E-11 was again assigned to patrol Road 15N03A in support of the Kentucky 8 and Plumas Hotshot crews (Figure 7).

During its shift, E-11 drove the road between Drop Point #1 and the end of the road, with DePaolo doing most of the driving. During the night, the drivers were observed occasionally napping during their rest periods. Several Kentucky 8 crewmembers working along the road saw E-11 drive past the rollover site during the night and didn't notice anything unusual.

Before midnight they filled the water tank on E-11, and shortly thereafter, the E-11 crew took a break at Drop Point #1 where they ate lunch. Temperature was around 60° F, humidity was around 40%, and there were light north to northwest winds.

Shortly after 0100 hours, E-11 proceeded back down 15N03A to the end of the road, turned around and drove back a short distance. At 0120 hours, Young picked up lunches for the Plumas Hotshot crew at Drop Point #1, and drove them down 15N03A for delivery to the crew at the end of the road. Before he reached the landing, Young's pickup met E-11, which was parked on the road while the crew worked. He parked his truck, and with Davis and Oustad carried the lunches to the Plumas crew on the landing. Young and Davis returned to their vehicle, and backed it out of the way of E-11, which proceeded towards Drop Point #1. E-11 was parked at Drop Point #1 when Young and Davis drove past on their way to Drop Point #5. Moments later, WT21 drove up and proceeded out towards the end of 15N03A. Joseph Wilkenson, driver of WT21, stated that as he passed the narrow rollover site in a southerly direction, he saw two members of the Kentucky 8 crew standing on the uphill edge of the road near the trench and log. They did not move off the edge of the road, and he drove the water tender towards the outside road edge to be sure he would miss them. He stated that it was a full moon and he could clearly see in his driver side mirror that his outside rear dual tire was directly on the edge of the road. He said that he saw his dual wheel "throw a large rock or something off the road at the same point where E-11 rolled off the road." He proceeded to the end of the road. This occurred 10-15 minutes prior to the accident.

At about 0155 hrs on July 28 E-11 left Drop Point #1 and started back towards the end of the road, traveling southerly along Road 15N03A. DePaolo was driving, Oustad was in the front passenger seat, Glover was in the rear seat immediately behind the driver, Smith was in the center of the rear seat and Self was directly behind Oustad. Two crewmembers from the Kentucky 8 crew, Gary Oney and Bridget Abernathy, were sitting or standing in the small trench above the road as E-11 approached the rollover site, about 4 feet from the travelway. Oney stated that the Engine seemed to be unusually close to the outside edge of the road. Both Oney and Abernathy stated that the Engine was going very slowly at this point. As the Engine passed Oney and Abernathy, Glover and Smith both felt the rear tires slide off the road on the driver's side and heard DePaolo exclaim, "Oh no!" At approximately 0200 hrs on July 28, 2002, E-11 left road 15N03A and plunged down the steep hillside (Figure 9).





Figure 9. Rollover site showing slight curve in road and slide marks made by E-11.
Engine was driving towards the left side of the photo.

Accident

At the time and place of the accident, the situation was as follows:

- It was a clear night with a full moon and some smoke in the area.
- The road surface (native soil) was firm and dry.
- There were logs lying along both sides of the road.
- Road width was 10 feet wide from inside to outside logs.
- There is a slight inside curve.
- Two people were sitting in a small trench about 4 feet away from the road surface on the uphill side of the road.
- The water tank on E-11 was almost full.
- E-11 was traveling very slowly southwest.
- E-11 was nearly stopped at the time of the rollover.
- All occupants of E-11 were wearing seatbelts.



The facts of the accident are:

- The accident occurred at about 0200 hours on July 28, 2002.
- E-11 slid off the road on the driver's side.
- The back driver's side tires slid off road first.
- As the back tires slid off the road the driver said "Oh no!"
- Initial slide of E-11 was perpendicular to road with only minimal forward motion.
- E-11 driver side tires slid down slope approximately 8 feet as the rollover began.
- The two surviving passengers felt the Engine shift and begin to tilt and roll.

E-11 left Road 15N03A on the south side and rolled numerous times down the slope through and along the edge of a timber harvest unit. The slope was very steep (up to 90% in places). The vehicle hit standing trees and rocks as it rolled. Driver Heather DePaolo was ejected from the vehicle at a point approximately 600 feet down the slope and was deceased on scene. John Self was ejected at a point approximately 831 feet down the slope and died approximately 45 minutes after his ejection from the engine. Steven Oustad was ejected at a point approximately 1,004 feet down the slope and was deceased on the scene (Figure 10).

The vehicle came to rest on its roof in the drainage 1,059 feet below the road (Figures 11a and 11b). Alex Glover and Ryan Smith remained in the vehicle for the duration of the rollover.



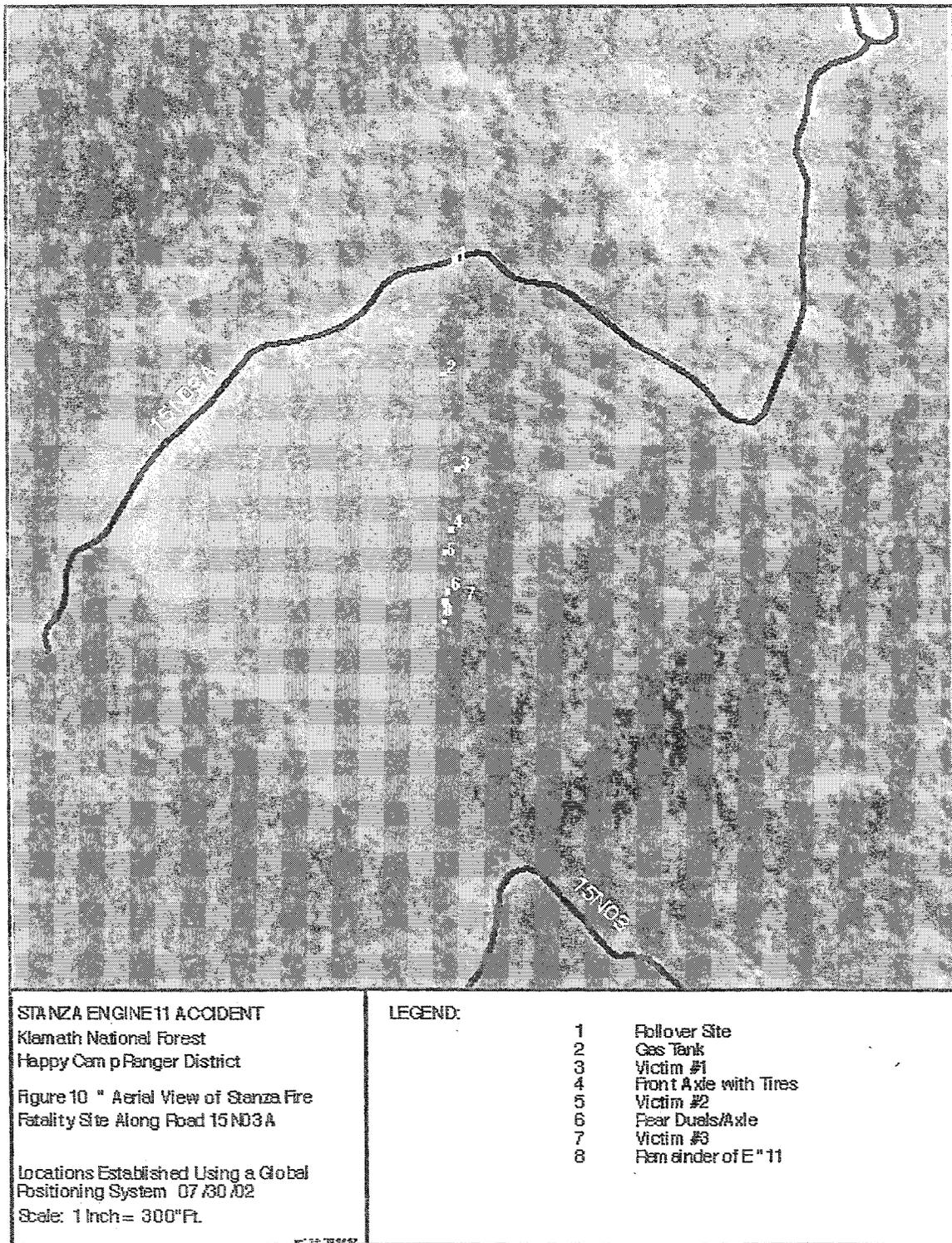


Figure 10. Aerial view depicting rollover route of E-11 down the hill.





Figure 11a. Final location of E-11, 1,059 feet below Road 15N03A.

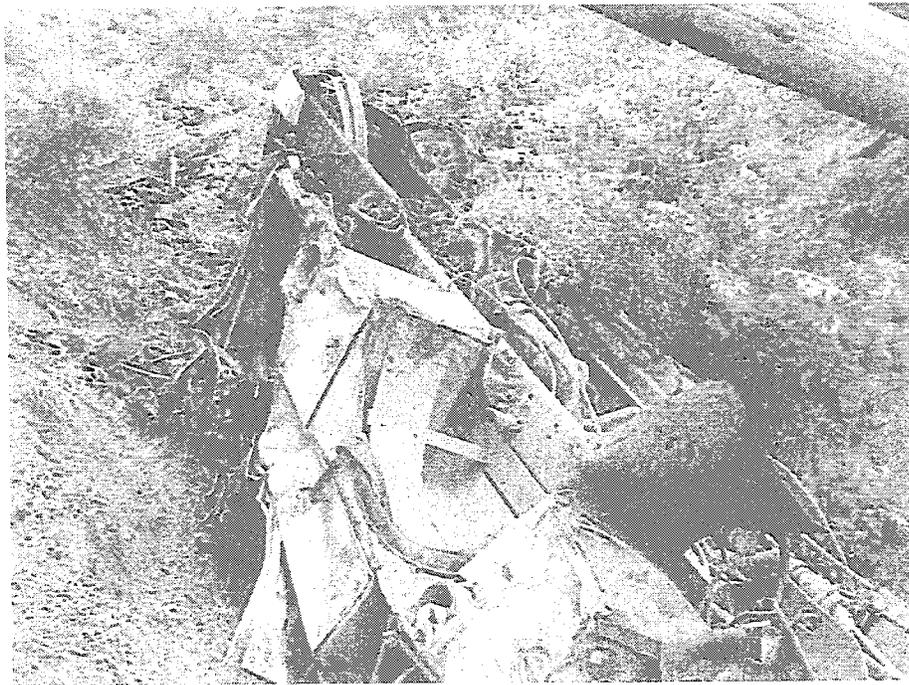


Figure 11b. E-11 lying 1,059' below Road 15N03A.



Rescue and Recovery

Once the vehicle came to a stop, Smith crawled out and asked, "Is anyone else alive?" Glover was hanging upside down by his seatbelt; he unlatched it, fell to the roof, and Smith helped him out of the truck to a flat spot where he could lay down. Both men could hear John Self calling from up the hill. Smith went up the hill to render aid to Self, but was not able to find him, and eventually couldn't hear him anymore. Smith found part of a medical bag and a headlamp that was turned on. Smith saw a light up the hill, and pointed his headlamp in that direction to summon help to his location. After he had climbed approximately 600 feet up the hill from the Engine, Smith met Troy Gullett, from the Kentucky 8 crew, who stayed with him until Robert Morgan, an Emergency Medical Technician, arrived and took charge.

Alex Glover smelled diesel fumes and heard what he believed to be the tanks on the SCBA (Self Contained Breathing Apparatus) leaking. He moved further away from the Engine and moved uphill in an attempt to find and assist John Self. He made it as far as the base of a rock outcropping, and was unable to go any farther.

Derrick Gabbard and Brady Goad, members of the Kentucky 8 crew, saw the Engine roll from about 200 feet away. They immediately went down the hill to render assistance. Gabbard located John Self, who appeared to be severely injured. Since Self was at risk of rolling downhill, Gabbard prevented him from rolling and provided him comfort. Goad joined them shortly thereafter, and both stayed with Self until there were no signs of life. Both crewmembers then continued down the hill searching for survivors. They came upon Alex Glover, and Goad stayed with him until he was transported off the hill. Gabbard continued searching for survivors.

Ryan Smith and Alex Glover were placed on backboards and transported down the hill to Road 15N03 by Emergency Medical Technicians from the Kentucky 8, Plumas IHC and Eldorado IHC. They were taken by ambulance to Norcross Campground, where at approximately 0700 hours they were flown by helicopter to medical facilities in Redding.

The bodies of the deceased were removed during the afternoon of July 28, 2002, through a joint effort of the U.S. Forest Service, and the Siskiyou County Sheriff's Department.

Post Accident Facts

Equipment

The forces generated on the Engine during its downhill roll caused the axle assemblies, motor and transmission to break away from the vehicle (Figure 12). The rear crew compartment, although deformed, remained relatively intact. Examination of the Engine revealed that all seatbelts had been in use at the time of the rollover. The front passenger seatbelt of Steve Oustad was severed by the force of the accident. The seatbelts holding Heather DePaolo and John Self were stretched, but the buckles were still engaged. The seatbelts for Smith and Glover were both still buckled when the Engine rolled to a stop, and were released by them to exit the vehicle.



According to maintenance records, the tires on E-11 had approximately 22,000 miles on them. However, examination at the accident site found the left rear inside dual tire was very worn (Figure 13a and 13b). The condition of this tire does not match the others; it appears to have been installed as a spare tire, but there is no documentation as to when it was installed. It is not mentioned in the latest Preventive Maintenance check. The tire that should have been on the Engine was later found in the warehouse at the Almanor Ranger District.



Figure 12. Rear axle of E-11 looking downhill; passenger compartment is beneath horizontal log at upper left.



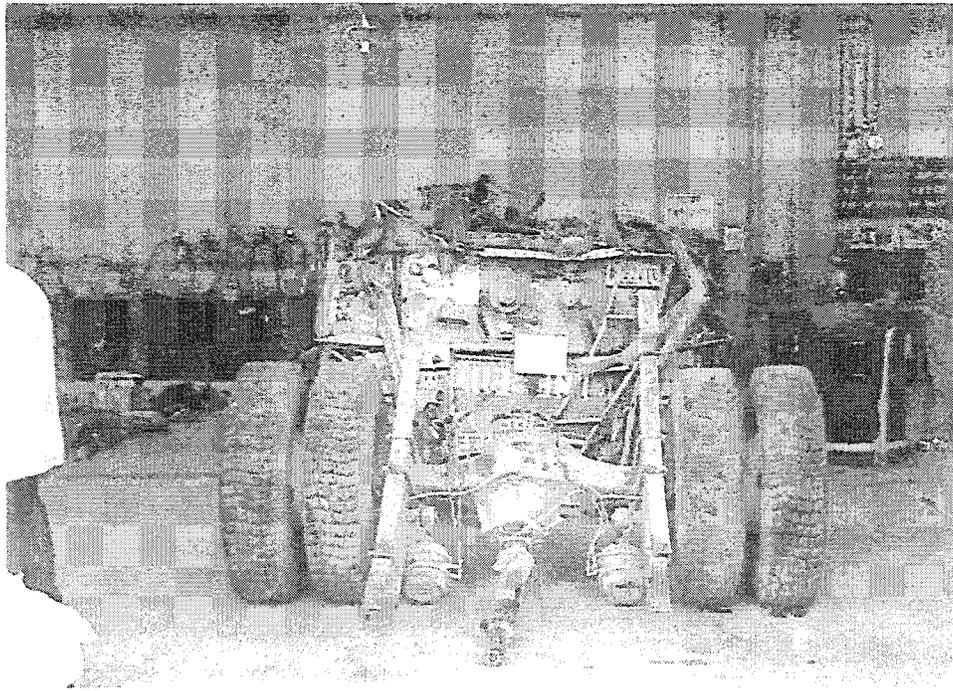


Figure 13a. Rear wheel axle of E-11. Driver's side dual tires are on the right.



Figure 13b. Rear driver's side dual tires. Outside tire is on the right.



Road 15N03A

Two of the log sections which had been placed along the outside of the road at the accident site remained in place after the rollover. The two segments are located between the two slide marks where E-11 slid off perpendicular to the road (Fig.14). There were larger log segments (up to 11 inches diameter) found over the road edge (Fig. 15).

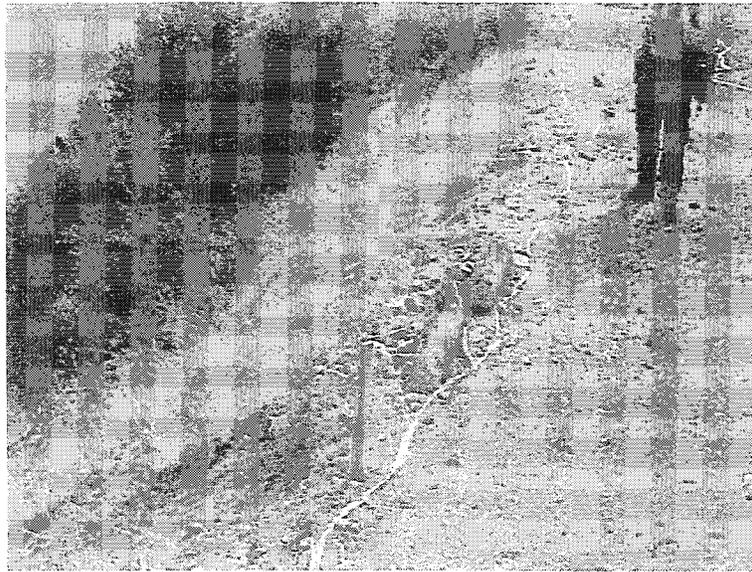


Figure 14. Logs along outside edge of 15N03A remaining after rollover. (Survey stake placed at location of rear outside dual slide mark.) Person is standing next to front tire slide mark.



Figure 15. Rollover site showing logs on outside edge of road and slide marks.



Road 15N03A has several other curves that have the same or nearly the same radius as the curve at the rollover site. The outside shoulders of Road 15N03A were hard and did not fail at the rollover site.

Work Rest/Duty Limitation Discussion

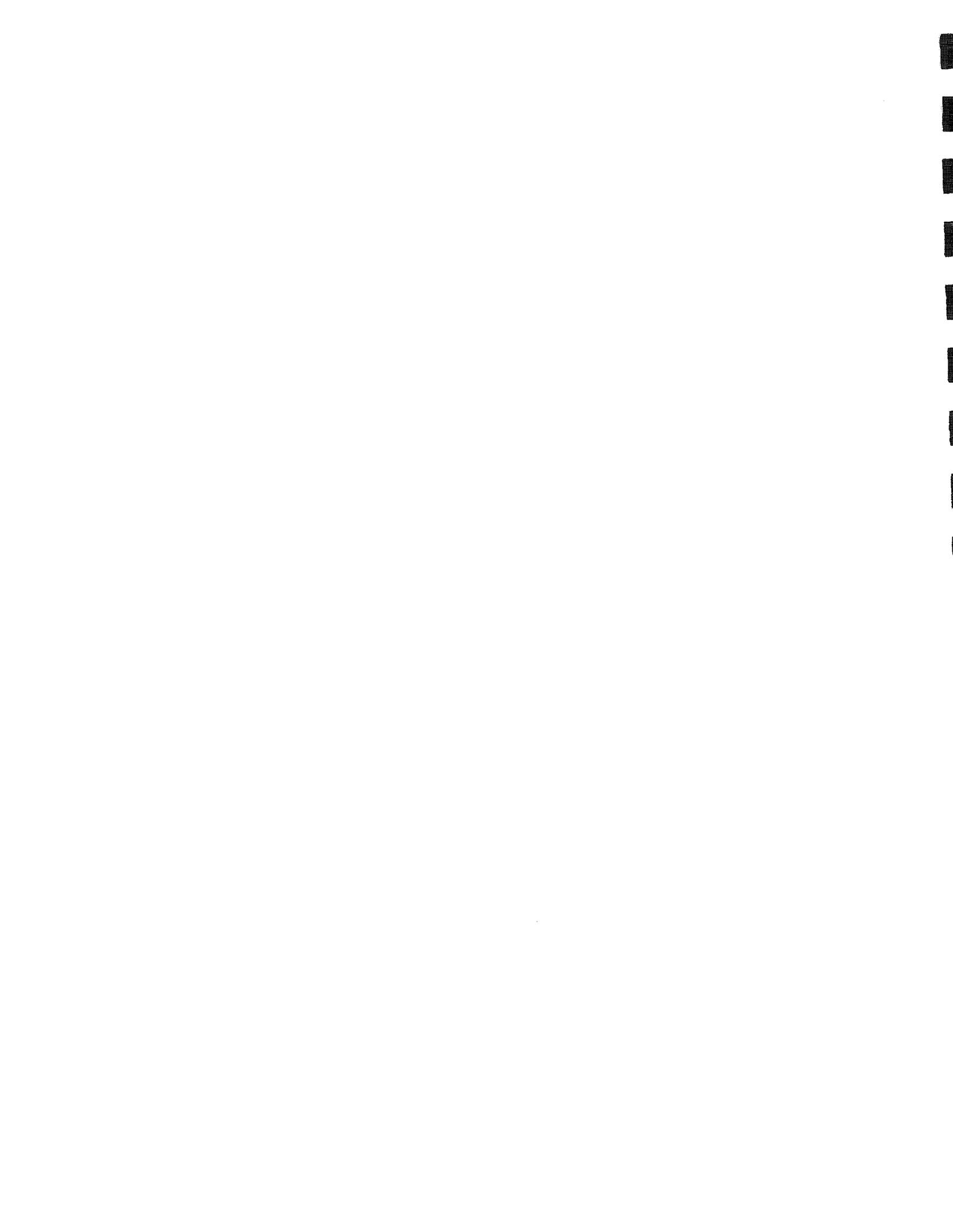
STL Young stated he informed someone at the ICP about impending work/rest limitations for his group upon arrival of the ST in Happy Camp on July 26. Young believed Operations intended to mitigate "work/rest guidelines" by advising the drivers to take advantage of slow periods during the shift to get some sleep. He also believed that Operations would try to release the engines back to camp early because the engines were needed to support the burnout operation on the next shift. The Operations Planning Chief did not recall being told about the pending limitation for Strike Team 3615C, and stated that he did not convey permission for extension of duty hours. The Incident Commander says that he was not advised of these concerns at any time.

The length of duty time for Strike Team 3615C drivers (including E-11 drivers) on the night shift of July 26-27 exceeded the standard driving duty limitation by approximately 8-9 hours. Members of E-11 had approximately three hours of rest from 0300 hours to 0600 hours on July 27 while parked at Drop Point #1, but they remained on duty. The non-driving members of ST3615C did not exceed the 24-hour limitation.

The crew of E-11 received 9 hours off prior to the night shift on July 27. Based on their work during the previous 24 hours, they would have required 12 hours of rest time to meet the required 2:1 ratio of work/rest time. STL Young indicates that the Strike Team received quality rest on July 27, and were refreshed and ready to go on duty at 1730 hours that day. This is substantiated by other drivers on the Strike Team.

Coordination with California Highway Patrol

The California Highway Patrol Major Accident Investigation Team (CHP MAIT) offered to conduct an investigation of the rollover, and the Forest Service transported the major components of E-11 to a secure site in Yreka where they will be analyzed. At the time of this report, the CHP and FS Investigation Team are in agreement regarding the facts and findings of the accident. The CHP investigation is ongoing, and the final MAIT report will be released in late September or October, 2002. Should that investigation produce any new information that changes any significant findings or facts, the Forest Service will amend this report.



Investigation Findings

The Investigation Team identified findings based on their review of the events that led to the Stanza Fire accident. As specified in the procedure established in the agency's Accident Investigation Guide (2001), the findings have been organized into four subject categories:

- Environment of the location of the accident
- Equipment involved in, or contributing to, the accident
- People involved in, or contributing to, the accident
- Management issues or principles associated with the incident

Findings are defined as fact-based conclusions, or relevant facts themselves. The findings, taken together, should provide a complete understanding of what occurred.

Summary of Significant Findings

Although there were findings identified for each of the four subject categories, the investigation team identified a smaller set of findings that were considered to be of significant importance to understanding the underlying causal factors associated with this accident. The significant findings are listed below.

Road Width

- Travelway width at the location of the rollover is 10 feet (120 inches) measured between the logs on both sides of the road.
- Engine 11 (E-11) measures 93 inches from left dual outside tire to right dual outside tire. At the rollover site the travelway is 27 inches wider than E-11.
- There is a slight inside curve at the rollover site on the drivers' side (outside slope).

Driver Experience

- Experience of the driver was minimal for this type of driving considering the narrowness of the road, the unforgiving dropoff of the travelway on road 15N03A, nighttime driving conditions, and long hours of driving.

Decision to provide on-the-job training on this incident

- The driver was hired as a Senior Fire Fighter and being trained to become a Fire Engine Operator. A decision was made by Acting Captain Steve Oustad to



provide continued on-the-job training in the operation and driving of E-11 on the Stanza Incident.

E-11 position on road immediately before rollover

- As the Engine approached the rollover location the driver and passengers could see the two people on the side of the travelway to the right. The driver adjusted the alignment of the Engine to the left to allow for perceived safe distance from the people on the passenger side (inside) of the road.
- The combination of changed position due to adjustment for people on the right and the visibility issues associated with darkness and the restricted view immediately in front and to the left of the Engine caused a momentary lack of orientation relative to the safe positioning on the travelway at the curve.
- The Engine position at this time was to the left edge of the road. As the Engine continued through the curve, tracking of the rear drivers' side dual cut the curvature and this combined with the position of the Engine on the outside edge of the travelway caused the tires to slide off travelway (Figure 16).

Environment

Topography

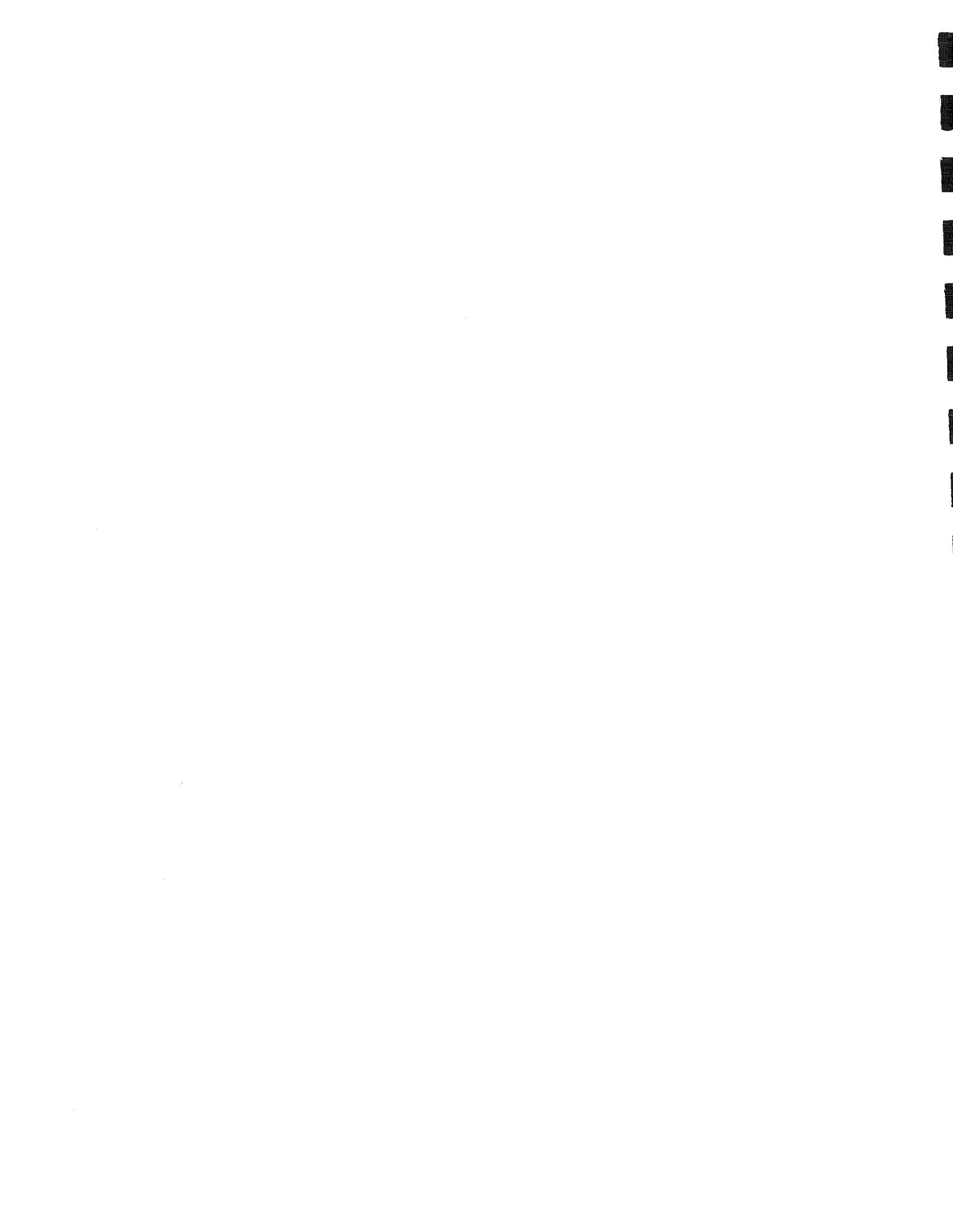
1. The topography in the fire area is steep and mountainous. There are rock outcroppings and talus (loose rock) slopes. Slopes generally vary from 40 to 90 percent. Vegetation varies from timbered to brushy conditions. (Aerial Photos Figure 10)
2. The topography below the road at the rollover site is a mid 1980's timber harvest unit (clear cut), with a slope of approximately 78%. (Aerial Photo including GIS data points dated 07/30/02, Survey dated 08/02/02, Figure 10)

Weather Conditions

1. On July 27-28 night shift, at approximately midnight, weather was clear, dry, with approximate 39% humidity, with a temperature of 60 degrees. Winds were light from the north/northwest. (Smith Statement)

Visibility

1. There were no indications of driver visibility problems due to smoke, dust or glare on the windshield. (Smith Statement, Oney Statement, Type 2 Team Statement)
2. Darkness, even with the full moon, would cause impaired lateral vision and position disorientation. (General night driving experience)



3. There was no vegetation close to road 15N03A within 200 feet of the rollover site in either direction that would impair driver vision. (Photographic Evidence Figure 17)
4. Two people sitting or standing above the road approximately 4 feet from the travelway were in the direct view in the headlights of E-11 as it approached the rollover site. (Wilkenson Statement, Smith Statement, Glover Statement)
5. The surface of the road is not visible less than 28 feet from the driver position due to the Engine hood configuration. (Measurements)

Road Conditions at the rollover site

1. At the time of the accident road 15N03A was dry, the surface was hard, the road had been graded to remove sloughing and rocks from the travelway after the fire incident started. The fill (outside) shoulders were hard and did not fail at the rollover site. (Zangger Statement, Photographic Evidence Figure 14, Young Statement, Fire Contract COR- Virtue)
2. At the site of the rollover, sections of fire debris logs (4 – 5 inches in diameter) had been cut and placed on the fill (outside) shoulder and two remained there after the accident. After the rollover, there were larger diameter sections (up to 11 inches) found over the edge. A segment of a log (11 inches in diameter with a fork) also remained on the cut (inside) slope. (Abernathy Statement, Oney Statement, Photographic Evidence, Zangger Statement Figure 15)
3. The road had a driving surface width that varied from 10-12 feet. Travelway width at the location of the rollover was 10 feet (120 inches) measured between the inside log and outside logs on both sides of the road. (Zangger Statement, Photographic Evidence)
4. E-11 measured 93 inches from left dual outside tire to right dual outside tire. At the rollover site the travelway was 27 inches wider than E-11. (Photographic Evidence, Measurements)
5. There was a slight curve at the rollover site on the drivers' side (outside slope). (15N03A Alignment Drawing, 8/4/2002 Figure 18)
6. There were several other curves on the 15N03A road with the same or nearly the same radius. (15N03A Alignment Drawing, 8/4/2002 Figure 19)
7. Due to topography and large cut (inside) slope, there was more slough at the rollover site than there was elsewhere on the road. The amount of this slough contributed to the narrower width at this location. The Kentucky 8 crew had cut a trench in the slough material along side the road to stop rolling debris and placed log material on the fill (outside) edge. (Photographic Evidence Figure 8, Abernathy Statement, Zangger Statement)
8. The two log segments remaining on the outside of the road were located between the two slide marks where E-11 slid off to the left (perpendicular to the road). (Photographic Evidence Figure 14)



E-11 position on road immediately before rollover

1. As the Engine approached the rollover location the driver and passengers could see the two people on the side of the travelway to the right. The driver adjusted the alignment of the Engine to the left to allow for perceived safe distance from the people on the inside of the road. (Glover Statement, Smith R. Statement)
2. The combination of changed position due to adjustment for people on the right and the visibility issues associated with darkness and the restricted view immediately in front and to the left of the Engine caused a momentary lack of orientation relative to the safe positioning on the travelway at the curve. (Figure 16)
3. The Engine position at this time was to the left edge of the road. As the Engine continued through the curve, tracking of the rear driver side dual tire cut the curvature and this combined with the position of the Engine on the outside edge of the travelway caused the tires to slide off travelway. (Oney Statement, Goad and Gabbard Statement, Glover Statement, Smith Statement)

Equipment

Engine 11

1. There was no evidence of equipment failure on E-11. (*Pending* CHP Report)
2. The maintenance history of E-11 met all requirements and schedules. The documentation of maintenance records is thorough and complete. (Vehicle Maintenance Records Appendix D, Log Book)
3. E-11 traveled along 15N03A a number of times during its work shifts on the 7/26-27 and 7/27-28/02. (George Statement, Wilkenson Statement, Young Statement)
4. Water tender 21 and White's Water tender (E41), which are larger trucks than E-11, traveled on 15N03A and were on shift the night of the rollover. Water tender 21 Operator stated that his rear outside dual tire also was out to the edge of the road on his trip only 15-20 minutes before accident. (Wilkenson Statement, Vehicle Ordering Specifications Appendix C)
5. The replacement tire on the left rear inside dual tire has significantly less tread than the other tires (not enough tread to meet acceptable standards). (Photographic Evidence Figure 13b)
6. The water tank on E-11 was nearly full (500 gal maximum capacity) at the time of the rollover, which would raise the center of gravity of the vehicle. (Wilkenson Statement)
7. E-11 was traveling very slowly and had almost stopped when it began to slip and tilt off the travelway. Ryan Smith stated, "I think Heather was giving the engine a little gas..." just before the rollover. (Oney Statement, Goad and Gabbard Statement, Abernathy Statement, Smith Statement)
8. E-11 slid sideways 8 feet down the embankment before rolling, tumbling and sliding to a point 1059 feet below the road 15N03A. The forces generated on



this down hill roll caused E-11 axle assemblies, engine, and transmission to break away from the vehicle. (Photographic Evidence Figure 20)

9. All seat belts had been used. The front passenger seat belt was severed during rollover. (Photographic Evidence)
10. The crew compartment (rear portion), with two surviving passengers, was relatively intact with the doors missing. (Photographic Evidence Figure 21)

Communications Equipment

1. All communications equipment operated properly. (Radio Logs)

Human Factors

People

1. The driver was hired as a Senior Fire Fighter and was receiving on-the-job training in the operation and driving of E-11. (Herring Statement, Stockdale Statement)
2. The driver was qualified with a State of California Learner Permit for a Class B drivers license which restricted her to operate E-11 only while accompanied by fully licensed operator for this type equipment. Oustad was qualified and met this requirement. (DMV Drivers Record)
3. Experience of the driver was minimal for this type of driving considering the narrowness of the road, the unforgiving dropoff of the travelway on road 15N03A, nighttime driving conditions, and long hours driving. (Cardoza Statement, BLM Driving Records, Glover Statement)
4. The driver was operating E-11 with all documentation completed except the U. S. Government Motor Vehicle Operators Identification Card, OF-346. (District Driving Records, DMV Records, BLM Records)
5. Of the previous 42 hours, the driver DePaolo had been on duty for 33.5 hours. (Crew Time Reports, Glover Statement, Smith Statement)
6. Of the previous 42 hours, the Captain Oustad had been on duty for 33.5 hours. (Crew Time Reports, Glover Statement, Smith Statement)
7. Of the previous 42 hours, the crewmembers of E-11 had been on duty for 32.5-33.5 hours. (Crew Time Reports, Glover Statement, Smith Statement)
8. E-11 drivers had been off duty 16 hours immediately prior to the departing to the Stanza Creek fire July 26, 2002. (Crew Time Reports)
9. Because of duty limitations the drivers had only 6 hours of remaining duty time when they were deployed to the fire from Stanza Creek Incident Command Post in Happy Camp on E-11s' first shift 7/26-27/02. (Crew Time Reports, Young Statement, DOT)
10. The crewmembers had approximately 14 hours remaining duty time when they were deployed to the fire on E-11s' first shift 7/26-27/02. (Crew Time Reports, Young Statement)



11. When E-11 returned to the fire on their second shift 7/27-7/28/02. Strike Team Leader Young believed they had quality rest. (Young Statement)
12. There is reference of the tire deficiency (Equipment Finding E-11 #5 above on a daily inspection form for Engine 11 for the week of 6/23-29 with the comment that the "left inner dual needs replacing." This form has the initials of Heather DePaolo, driver. (Vehicle Log Book. Sean Johnny statement)

Responsiveness to Rollover Emergency

1. The response was immediate and appropriate. (Interagency Dispatch Time Log, Abernathy Statement, Goad and Gabbard Statement, George Statement.)
2. The Medical Plan was followed appropriately. (Interagency Dispatch Time Log, Stanza Night Shift Plan, July 27-28, 2002, Medical Plan)

Management

Rollover of E-11

1. The Type II Incident Command Team took control of the Stanza Fire on 7/26/02 at 0600 hours and was working to manage and institute appropriate actions to manage the incident as instructed. (Type 2 Team Statement, Stanza Incident Records)
2. A decision was made by Acting Captain Steve Oustad on this incident to provide on-the-job training for the trainee driver. (Operations Group Statement)
3. Strike Team management recognized that E-11 had an inexperienced driver and special accommodations were made to facilitate on-the-job training, i.e. no backing, etc. (Operations Group Statement, Young and George Statement)
4. There was recognition of hazardous conditions on roads, it was identified in safety briefings and efforts were made to evaluate and mitigate through on site review of the conditions, etc. (Type 2 Team Statement, Stanza Incident Records)
5. The management of the search, rescue and recovery was timely, and handled without incident. (Interagency Dispatch Log)
6. The Strike Team Leader and captains personally evaluated the road prior to use to assess the safe assignment of engines and these were mitigated. (Young Statement)
7. The Strike team was having frequent safety briefings regarding driving, fire behavior and other safety issues.
8. EMT's were immediately available for emergency response from suppression crews assigned to the fire.
9. Plumas IHC had "high angle" rescue equipment available and it was used effectively during the evacuation.
10. Fire Team Operations adjusted shift assignments to allow crews to work in areas they were familiar with from prior shifts.



11. A review of the 10 Standard Fire Orders and the 18 Watchout Situations, found no violations of these safety provisions.

Work Rest and Duty Limitation Issues

12. The Type 2 Incident Command Team on 7/27 had a system for tracking work rest ratios and excess shift hours for all Incident personnel. There is evidence the system was in use on 7/27. (Type 2 Team Statement, Stanza Incident Records)
13. Managing and tracking of duty limitations and work rest cycle was complicated by transition from a Type 4 to Type 3 to Type 2 incident management in three days.
14. There was a concern for safety as indicated in the briefings. The concern for providing quality rest for the Strike Team was demonstrated by utilizing the local school gym. Reports from the Strike Team indicate the gym was a very satisfactory and a restful location. (Operations Group Statement, Type 2 Team Statement)

15. 7/26-27/02 Night Shift Situation

- A. The Strike Team Leader was aware of duty limitations and reported a concern to fire Operations, he referred to it as "work rest" however. (Young & Davis Statement)
- B. The Strike Team Leader reported to Tim Fike in fire Operations that the Strike Team duty hour limitations would be reached soon. He was given verbal approval to proceed with night shift and assumed the Incident Commander had approved it. (Young and Davis Statement)
- C. The Incident Commander and Operations Planning Chief do not recall being told of the pending duty limitations for the Strike Team. The Incident Commander granted no permission for extended duty hours. (Carlson and Fike Statements)
- D. The length of duty time for drivers for this shift exceeded the standard driving duty limitation of 16 hours with 10 hours driving. The possible exception of 2 hour extension for emergency was also exceeded. Both drivers of E-11 and all drivers in the Strike Team exceeded the driving limitation by approximately 8-9 hours. (Crew Time Reports, Young Statement, ICT Work Rest Tracking Process)
- E. Other than the drivers, assuming the Strike Team had been approved for a 24 hour shift, the crewmembers did not exceed the 24 hour limit.

16. 7/27-28/02 Night Shift Situation

- A. E-11 crew and other Lassen Strike Team member had 8-9 hours of quality rest before going on this shift. (Young Statement)



- B. To meet appropriate work/rest guidelines the Strike Team (including E-11) needed to be off duty until approximately 2100. They had worked 24 hours the previous shift, which required a corresponding 12 hours rest.
- C. Plans for the 7/27-28 shift, with the exception of being out of 2:1 ratio for work rest from the previous shift, appear to have been in order and would not have been a problem for staying within driver duty limitations.



Figures 16-21.

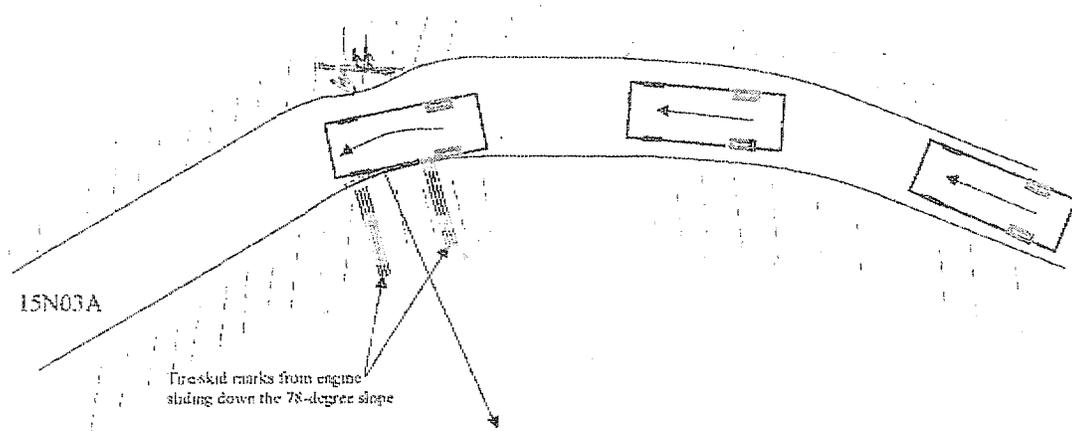


Figure 16. Projected drive path of E-11 at time of rollover (drawing not to scale)



Figure 17. View of rollover site. Note that there is no vegetation along edge of Road 15N03A to affect visibility.



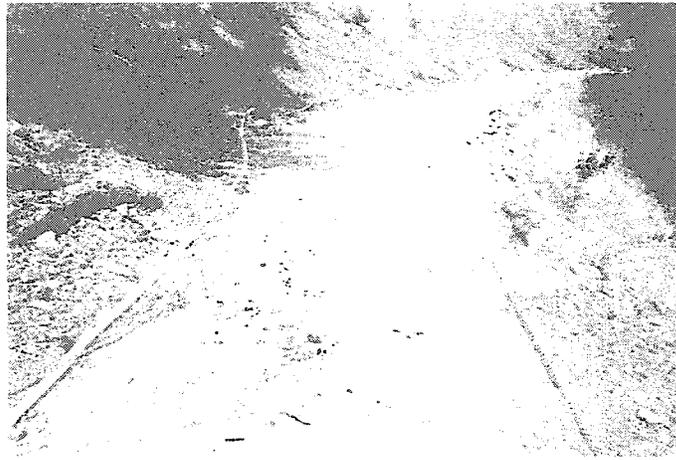


Figure 18. Road 15N03A at rollover site (hose was not present during rollover).

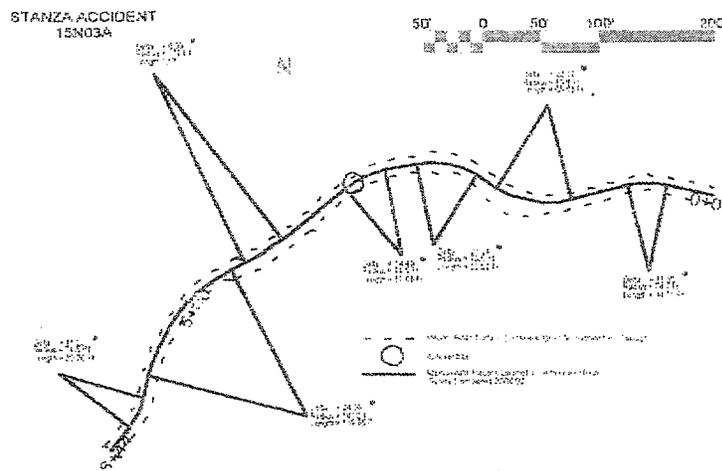


Figure 19. Road alignment schematic for 15N03A





Figure 20. Motor from E-11.

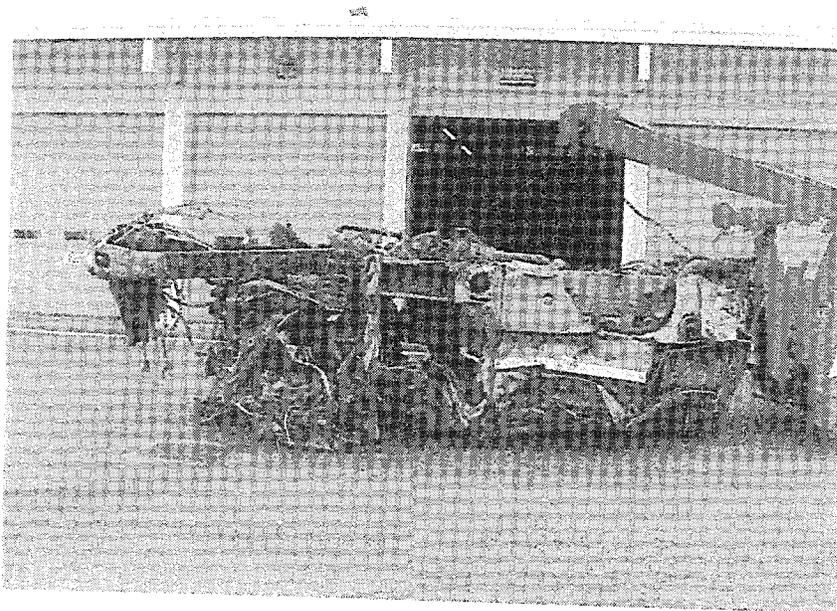


Figure 21. Passenger side view of E-11 (vehicle is upside down).



List of Figures

Figure 1. Vicinity and location maps for Stanza Fire.

Figure 2. A 1991 two-wheel drive Ford-800 Model 61, Type III Fire Engine same as E-11. This engine is the same model as Engine 11.

Figure 3. Map of the route taken by E-11 from Chester, CA to Happy Camp, CA.

Figure 4. Road 15N03A: (a) Overview of road looking southwest. Fire is uphill to the right. (b) Closeup of road surface.

Figure 5. Map of Stanza Fire July 26-27, 2002, showing Road 15N03 and Drop points (DP).

Figure 6. Intersection of Road 15N03 and 15N03A; location of Drop Point #1.

Figure 7. Map of Stanza Fire July 27-28, 2002, showing location of accident.

Figure 8. Rollover site along Road 15N03A showing the slough bank, short trench, and a single log located above the road surface. Short log sections were laying on the inside curve of the road surface.

Figure 9. Rollover site showing slight curve in road and slide marks made by E-11.

Figure 10. Aerial photo depicting route of E-11 down the hill.

Figure 11 (a) and (b). Final location of E-11 1,059' below Road 15N03A

Figure 12. Rear axel of E-11 looking downhill; passenger compartment is beneath horizontal log at upper left.

Figure 13. The rear wheel axle of the wrecked Engine 11. (a) Tread condition of all 4 rear tires. (b) Closeup of driver's side dual tires.

Figure 14. Logs along outside edge of 15N03A remaining after rollover

Figure 15. Rollover site showing logs on outside edge of road and slide marks.

Figure 16. Projected drive path of E-11 at time of rollover.

Figure 17. There was no vegetation along edge of Road 15N03A at rollover site that affected visibility.

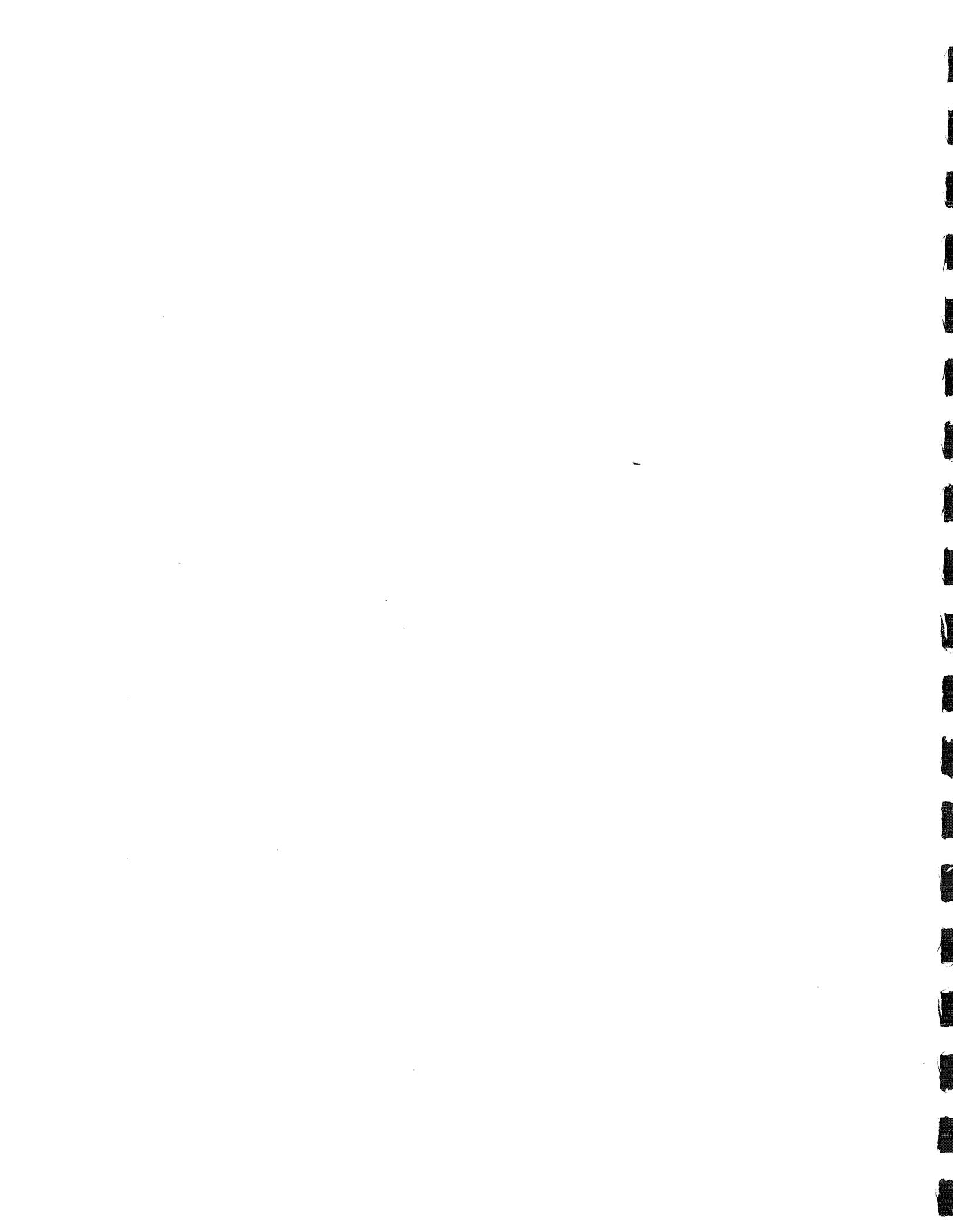
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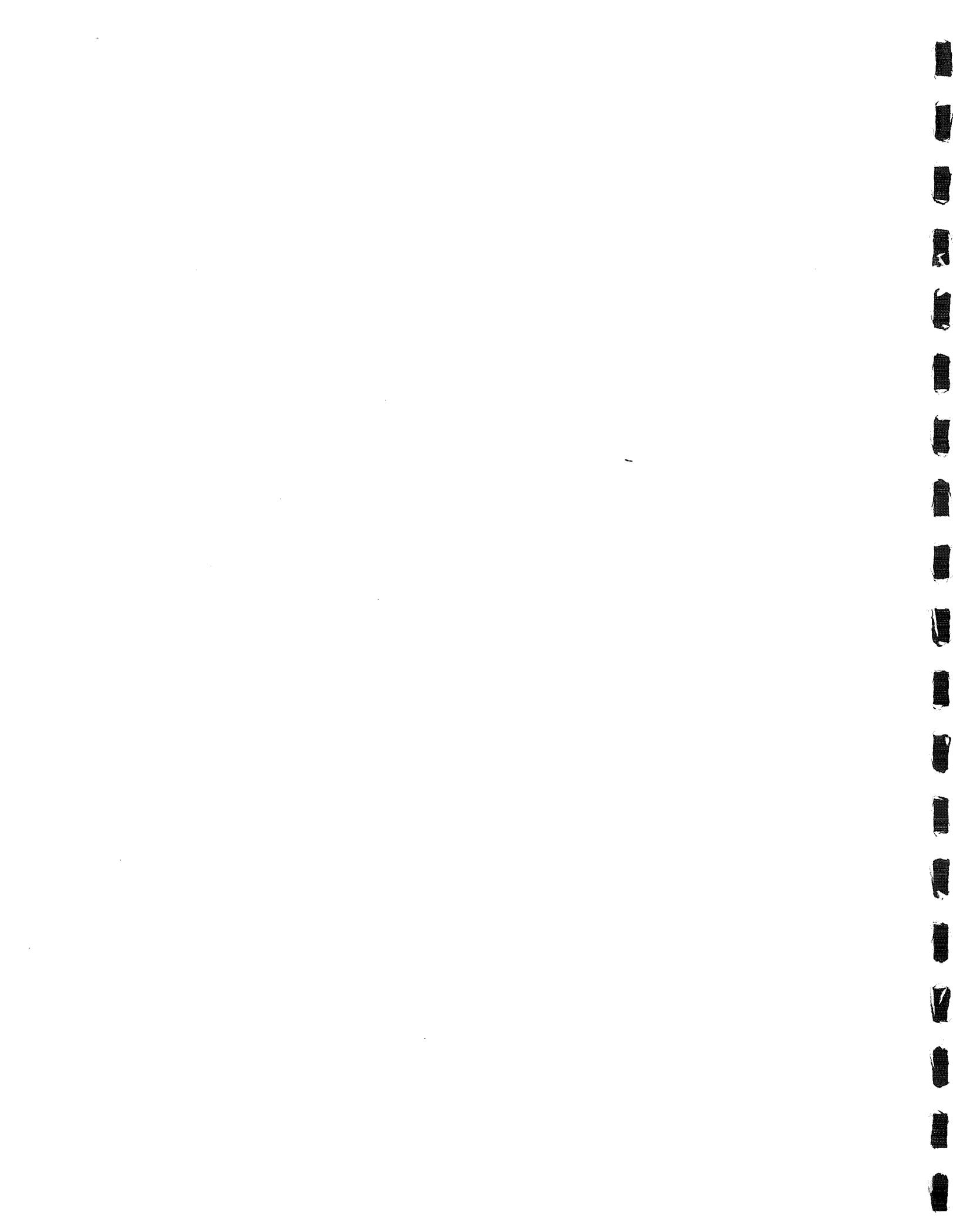
Figure 20. Motor from E-11.

Figure 21. Passenger side view of E-11 (vehicle is upside down).



Acronyms Used in This Report

15N03A – Forest Service road number
BLM – Bureau of Land Management
CDF – California Division of Forestry
CDL – Commercial Driver's License
CHP – California Highway Patrol
DIV – Division
DMV – Department of Motor Vehicles
DOI – Department of Interior
DOT – Department of Transportation
DP – Drop point
E-11 – Engine 11 from the Lassen NF (part of Strike Team 3615C)
EMT – Emergency Medical Technician
FS – Forest Service
GIS – Geographic Information Systems
IAP – Incident Action Plan
ICT – Incident Command Team
IHC – Interregional Hotshot Crew
KNF – Klamath National Forest
LNF – Lassen National Forest
NP – National Park
ST/STL – Strike Team/Strike Team Leader
WFS – Wild Fire Situation Analysis
WT – Water Tender



Glossary

Drop point: A point selected for its central location; a meeting and distribution point for personnel and materiel.

Incident Action Plan: Plan developed at the start of each 12-hour shift. It includes the organizational structure for the fire, objectives, tactics and strategies, shift assignments, safety messages, weather information, communication (radio frequencies, etc.), and medical plan.

Incident Command Team: An overhead team with an established set of positions and personnel that manages emergency situations. A Type 1 Team generally deals with large, complex incidents of national or social significance. A Type 2 Team manages incidents of local or geographical significance. A Type 3 Team manages extended attack incidents after initial attack strategies have failed.

Operations Section: The position on the Incident Command Team responsible for implementing tactics outlined in the Wildland Fire Situation Analysis. Also responsible for managing the firefighting resources.

Strike Team/Strike Team Leader: A strike team of engines is comprised of 5 engines of similar type under the command of the Strike Team Leader.

Travelway: The drivable portion of the roadway unencumbered by logs or rocks.

Water Tender: A truck fitted with a large capacity water tank for shuttling water to various locations during fire suppression activities.

Wildland Fire Situation Analysis: An instrument that documents the decisionmaking process for determining the appropriate suppression action and estimated cost of an incident which is expected to, or has exceeded, the action planned for in the fire management plan. A WFSA is completed when (1) wildfire escapes initial action or is expected to escape initial action; (2) a wildfire being managed for resource benefits exceeds prescription parameters in the fire management plan; or (3) a prescribed fire exceeds its prescription and is declared a wildfire. The WFSA is approved by a line officer.

