FIRE CONTROL NOTES

An international quarterly periodical devoted to forest fire control

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Wilderness Fires Allowed To Burn More Naturally

David F. Aldrich and Robert W. Mutch

Firehawks often confused us . . . by deliberately setting fire to grass and bushland to assist their scavenging. I have seen a hawk pick up a smouldering stick in its claws and drop it in a fresh patch of dry grass half-a-mile away, then wait with its mates for the mad exodus of scorched and frightened rodents and reptiles. When that area was burnt out the process was repeated elsewhere.

The observation about firehawks in Australia from Lockwood's book, *I, The Aboriginal,* may appear far removed geographically from the fire study in the Selway-Bitterroot Wilderness. But this account does provide a dynamic expression of interrelationships among fire, flora, and fauna. In our own country, and drawing from a more passive example than the firehawk, we now recognize the role that fire plays in maintaining Kirtland warbler habitat in Michigan. Furthermore, a recent study in California describes a considerable diversity in bird species due to the variety of habitats that resulted from the Donner Ridge fire.[1]

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The upper end of the White Cap Creek drainage of Idaho's Selway River in the Selway-Bitterroot Wilderness. White Cap Creek is a 66,000 acre study area in which Forest Service Region 1 is studying fire's role in wilderness in order to establish guidelines to assist land managers to prepare prescriptions to allow wilderness fire to more nearly assume a natural role.

Not All for the Birds

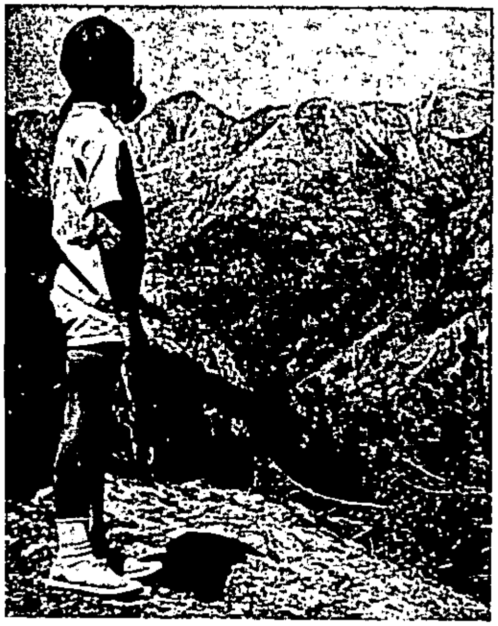
But what do firehawks and Kirtland warblers and bird species diversity in California have to do with wilderness management and with Region 1's management study? Certainly these examples are representative of fire-perpetuated food chains and habitats; and if birds are thus affected, what of other living forms up and down the food chain? The Wilderness Act of 1964 directs us to consider such questions in the administration of the National Wilderness Preservation System:

> An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; . . .

Protection from Man Needed

Ironically, it is our traditional approach to protection that is being questioned today with regard to management of national

[1] Carl E. Bock and James F. Lynch. Breeding bird populations of burned and unburned conifer forest in the Sierra Nevada. Condor 72(2): 182-189, 1970.



A view of the upper White Cap Creek showing areas of relatively low production of vegetation. This and the previous photo present graphically a variety of opportunities and challenges for fire management.

National Forest Administration [and] the Intermountain Forest and R[ange] Experiment Station are conduct[ing] the Wilderness Fire Management Study, in the Selway-Bitterroot Wilderness, Bitterroot National Forest, Region 1, to assist in implementing new Regional policy that "in wilderness, fire will be allowed to more nearly play its natural role".[2]

parks and wildernesses. Rather than just protecting these wildlands from fire, insects, and disease, we are beginning to discuss strategies to protect these areas from ourselves and man-centered goals.

Fire To Play Its Natural Role

Participants in Region 1's Wilderness Workshop in Missoula in 1970 recognized that fire control as practiced today is a most unnatural action in wildernesses. The group contributed to a new Regional policy that "fire will be allowed to more nearly play its natural role" in wilderness. Implementing this policy is contingent on an approved plan describing fire management directions for the wilderness. Region 1 wilderness fire policy points up that the influence of fire on vegetation diversity in the northern Rocky Mountains is being recognized administratively. This is an interesting departure from our traditional approach to fire control, but not a departure without precedent. In 1963 the Leopold Committee said that "reluctance to undertake biotic management can never lead to realistic preservation of primitive America, most of which supported successional communities that were maintained by fires, floods, hurricanes, and other natural forces."

A Study Evolved

The Wilderness Fire Management Study is an outgrowth of the Wilderness Workshop in Missoula. Specific objectives of the study are to:

1. Develop inventory methods that relate fire management to the wilderness resource.
2. Determine relationships between fire and wilderness ecosystems.
3. Develop analytical procedures to aid in determining strategies for a more natural regime of fire in wilderness.

The 66,000-acre White Cap Creek drainage in the Selway-Bitterroot Wilderness, Bitterroot National Forest, was designated as the primary study area. This drainage offers a variety of biological and physical conditions for study—from ponderosa pine savannas on the western edge of the study area to stands of sub-alpine larch along the rocky crest of the Bitterroot Mountains in the eastern portion of the drainage. Dr. James Habeck, plant ecologist at the University of Montana, is participating in the study by conducting a reconnaissance of plant relationships through the Selway-Bitterroot Wil[der]ness.

Several studies are providing the basic information required to determine when and how to return to a more natural sequence of fire incidence: geology, landform, soil, and hydrologic analysis; vegetation; fire history; fuel appraisal; and fish habitat. Vegetation analysis includes a description of the potential vegetation, successional studies in low-elevation and high-elevation forest zones, and the phytosociological reconnaissance. Fire history is being determined from existing records and techniques of dendrochronology. Fuel appraisal techniques, developed for fire planning and fire-danger rating are also being applied. This appraisal will provide estimates on fire growth and fire-intensity potential in the White Cap drainage.

These studies started durin[g]

[2] USDA Forest Service Manual No. 5102, R-1 Supplement 35, April 1970.

1971 field season. Preliminary guidelines will be proposed in time to begin phases of wilderness fire management in Region 1 during the 1972 field season. Guidelines will be refined as experience and new information are obtained. At no time will the guidelines provide a mechanical procedure for obtaining "the answer." Skill and good judgment will be essential to implementation of guidelines and policy.

What Else Is Going on

Let's look at other operational efforts to return fire to the landscapes of wildernesses and national parks: The Rincon fire occurred in the Gila Wilderness in New Mexico in August 1970. The decision to delay action on this fire was in accordance with Region 3 fire-control policy, which recognizes that action to suppress a wildfire may be delayed under specified conditions. Fire growth continued over 32 [illegible] with limited suppression action, reaching a final size of about 900 acres. Smoke from this fire was visible to most travelers at the nearby Gila Visitor Center and reports of the fire numbered in the hundreds. Explanations by Visitor Center personnel of the role of fire in wilderness were accepted almost without exception.[3]

The fire program in Sequoia and Kings Canyon National Parks in California consists of two fire control strategies on park lands.[4] A zone of approximately 553,000 acres above the 8,500-foot contour has been designated as a noncontrol area. All lightning fires within this zone are allowed to run their course with little or no interference by man. In 1970 the largest fire in this zone was 452 acres. The remainder of fires were 20 acres or less in size. In the more productive forest zones at lower elevations fire is being returned to the sequoia groves through prescribed burning. Sequoia and Kings Canyon have aggressively pursued education programs regarding these fire policies, and public reaction has generally been favorable.

Fire Fits the Environment

While we have traditionally viewed fire largely as a negative and destructive force, we need to develop the tolerance to view fire as an environmental factor which has contributed to ecosystem diversity over evolutionary periods of time. This changing attitude does not mean that we will relax any of our fire prevention efforts or completely turn our backs to naturally occurring fires in areas of wilderness. In the future each fire should either be aggressively fought on every acre or simply let run in wildernesses. The more difficult job for fire management specialists, and the more challenging job, is to work hard at understanding the functioning of ecosystems so that we can prescribe a biologically defensible balance between fire protection and fire incidence. The Wilderness Fire Study, along with the studies in the Boundary Waters Canoe Area[5], will provide inventory and planning tools needed by managers to provide for a more natural regime of fire throughout the Wilderness Preservation System. △

[3] E. L. McCutchen. Rincon burn report. 1970. (Unpublished material on file at Northern Forest Fire Laboratory, Missoula, Mont.)

[4] Bruce Kilgore. Restoring fire to the Sequoias. Nat. Parks and Conserv. 44(277): 16-22, 1970.

[5] M. L. Heinselman. Diary of the canoe country's landscape. Naturalist 20(1): 5-13, 1970.

A view of the lower reaches of White Cap Creek showing land capable of producing relatively large volumes of vegetation. Forest cover types represented range from ponderosa pine and Douglas-fir on the south slopes to Douglas-fir, grand fir, lodgepole pine, and sub alpine fir on the other slopes.

Portable TV Camera-Videotape System Used For Fire Control

John D. Dell and Raymond T. Steiger

Use of a portable TV camera-videotape system by the fire behavior-intelligence team in a multifire situation on the Okanogan National Forest in July 1970 is discussed. The authors describe the complexity of the fire situation and the use of the video system. They also discuss new developments in videotape equipment and potential fire control uses for these systems.

During the 1970 fire season in the Pacific Northwest Region (Region 6), the authors had an opportunity to work together in exploring a relatively new technique for gathering important fire behavior and intelligence information. We used a compact portable TV camera-videotape system (fig. 1).

On the morning of July 16 an intense, dry lightning storm set 227 fires on Washington's Snoqualmie, Mount Baker, Wenatchee, and Okanogan National Forests. This storm also caused more than 100 fires on National Park, State, and Indian lands. The greatest concentration of fires was on rugged, remote areas of the Okanogan National Forest in north-central Washington. On the morning of July 17, there were 55 uncontrolled fires, 14 already of project size, that is, requiring outside help.

A prolonged drought, tinder-dry fuel, and steep, rough terrain (much of it inaccessible except by foot, pack animal, or helicopter) combined to make this one of the most serious fire situations in the Region's history. A typical example was the Bunker Hill Fire in the Pasayten Wilderness which burned partly in Canada and was 18 miles from the nearest road in the United States. Another fire, the Hungry Creek, was in such steep terrain that several areas could be reached and controlled only by mountain climbers. On the neighboring Wenatchee National Forest, smokejumpers attacked the Safety Harbor Fire, and followup crews were transported by boat across Lake Chelan. Many other fires burned.

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We Needed Information

Determining expected behavior on these fires and gathering accurate intelligence data was extremely difficult because of the many fires, overloaded communication facilities, and differences in fuels and topography on each fire. Even if a fire behavior officer had been at each remote fire, his effectiveness would have been limited since he would have had almost no opportunity to consult with a meteorologist at a fire weather mobile unit. Inaccessibility of these fires and limitations on use of helicopters for reconnaissance of fuels and topography would have further restricted his effectiveness. (On two of the more accessible fires, fire behavior officers were assigned. On the 2,080-acre Bunker Hill Fire, a fire behavior officer and a meteorologist with a special portable weather unit[1] were flown in.)

Figure 1.—The battery-powered TV camera and audio-videocorder unit is compact and portable. On the numerous Okanogan fires, videotapes were made several times each day from aircraft with the fire behavior officer narrating key information on each fire as the cameraman recorded it for immediate reviewing at general headquarters.

It was immediately apparent that gathering much of the information for the rest of the fires would be done by observation aircraft, from which a coordinating general headquarters (GHQ) fire behavior officer could view all the fires, get back to a headquarters base to consult

[1]See: Howard E. Graham. A portable fire weather unit for use on back country fires. Fire Contr. Notes 25(3):11, 1964.

h meteorologists, then relay ical information to the various fire camps and spike camps —either by radio or, as happened in most cases, by dropping messages from aircraft. The GHQ fire behavior officer and the intelligence officer teamed up on aerial reconnaissance flights and reported jointly to the GHQ fire coordinator and plans chief. The information from the report was further relayed to fire bosses on each individual fire that had project potential.

Information Was Videotaped

The Okanogan's information and education specialist, Raymond Steiger, who was serving as public information officer, decided this would be a good time to hire a local cooperator, Mr. Bill Houston, who owns his own portable TV camera and audio-videotape equipment, to record on videotape some of the fire activities for the Forest's historical files. Since the fire behavior-intelligence team was making observation flights two or three times daily, they took Houston with them to film some of the fire action.

The fire behavior officer, John D. Dell, soon realized that this equipment was extremely useful for recording up-to-the-minute progress and behavior of each fire from the aircraft. Instead of taking notes on a number of different fires and trying to piece them together back at GHQ, he quickly developed a sight and sound system of narrating and identifying each fire on the audio portion of the videotape. When the cameraman started to film a fire scene, the fire behavior officer noted the time of observation, name of the fire, and direction of view. He then described the fire's current behavior, expected behavior (based on latest weather briefing), and the topography and fuels in and around the fire as the cameraman filmed it. He also recorded fire intelligence information such as progress of line building, possible control lines, potential helispots, spike camps, and other key information. The videotape was later replayed to the GHQ fire coordinator and his staff.

Visual Orientation Made Available

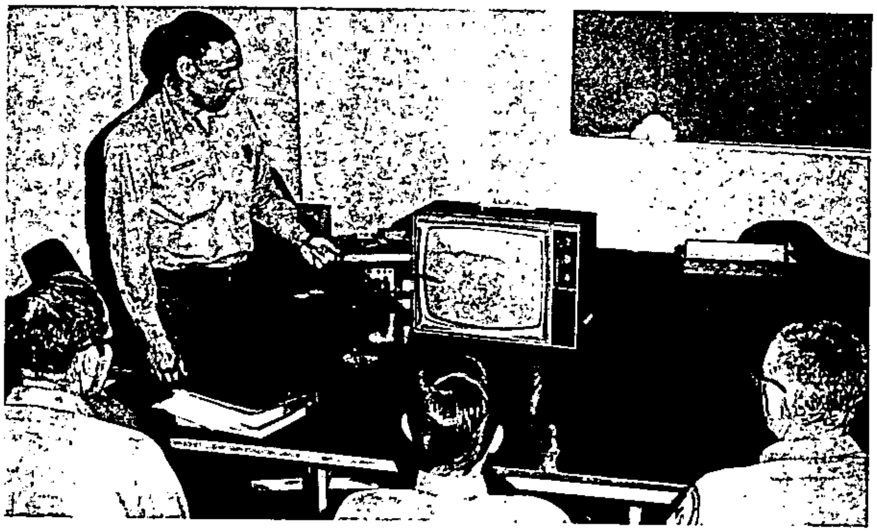
This system was used effectively also as a means of visually orienting new overhead teams arriving at GHQ for assignment to fires. Many of these people were flown in from other regions and were unfamiliar with local weather, fuels, and terrain. The fire behavior officer met with a number of the teams and, while the fires were being viewed on the TV monitor (fig. 2), explained the general fire situation, characteristics of local weather, topography, fuels, and expected fire behavior. In most cases, these fires had been flown over and taped within the past few hours.

What Did We Use?

The equipment consisted of a Sony battery-powered, portable (shoulder pack) videocorder and attached hand-held video camera (Model DVK-2400/VCK-2400) with zoom lens, pistol-grip handle, and unidirection microphone and hookup. A playback unit (Model CV-2600) and an 18-inch TV monitor-receiver for viewing the tapes completed the setup (fig. 3). The unit uses ½-inch-wide magnetic videotape, which runs at 7½ inches per second and plays for about one-half hour. The tapes require no processing and are playable immediately after recording.

Houston supplies his equipment to the Forest on a contract, rental-agreement basis. He charges $40 for 1 day of camera-videocorder use plus 2 days of playback unit-TV monitor use. His services, when needed, are paid for on an hourly basis and are not included in the contract rate. The videotapes, which play for about one-half hour, are purchased by the Forest for about $15 each. Portable videotape recording systems are available from a number of domestic and foreign manufacturers at vari-

Figure 2.—Current fire behavior and intelligence information is played back on the TV monitor for an outgoing fire team at GHQ in order to orient the team to fuels, topography, expected fire behavior, and other key information.



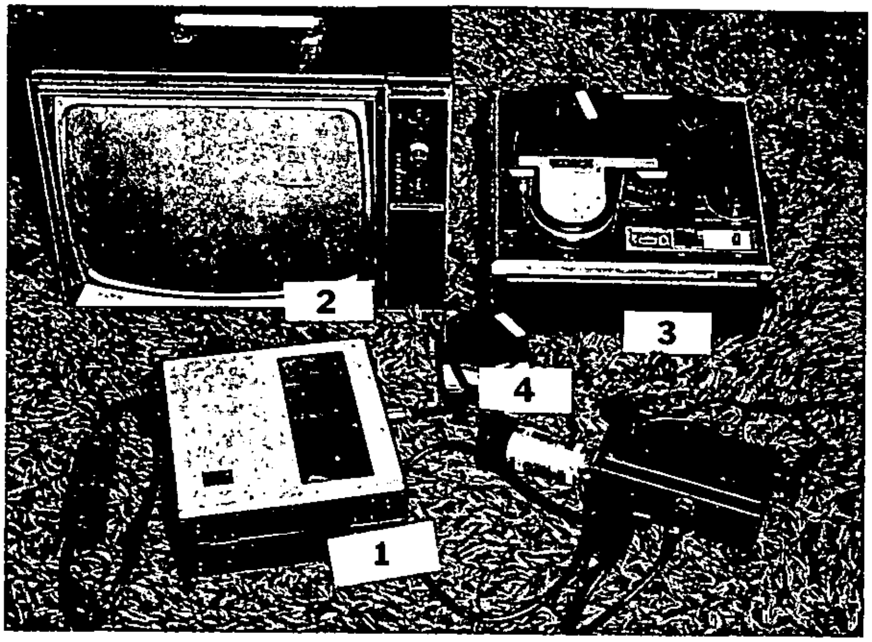


Figure 3.—The equipment used on the Okanogan fires consisted of: (1) A portable videocorder and video camera with microphone hookup, (2) an 18-inch TV monitor-receiver, (3) a playback unit, and (4) ½-inch magnetic videotape.

ous prices. Some of them are on Government Services Administration contract lists.

New Equipment Is Now Available

A brief survey of the TV tape recorder market indicates that newer videotape recording systems, much improved over the system used on the Okanogan fires, are now available. The new units will play ½-inch tapes recorded on any manufacturer's machines (on older units, tapes were not interchangeable). The new units produce sharper images, with 300-line resolution, compared with 220 lines on the older units. The need for a playback unit (item 3 in fig. 3) is eliminated in most of the new systems. Tapes are played directly from the videocorder into the TV monitor-receiver.

Special features now include stop action, audio that can be added after recording of video, and an electronic viewfinder in the camera eyepiece that can be used for instant playback to check the tape as soon as it has been recorded. One manufacturer is producing a new cartridge-loading system that will have tapes that record at two speeds and will have slow-motion capabilities. Also available are battery-operated TV monitors for immediate viewing of tapes at remote field locations, such as fire camps, where electric power may not be available. The prices of the new units are comparable with the older model we used. Color systems are not available in portable, lightweight, battery-powered units as yet, but this is the next step in videotape recorder engineering.

Forest Service Region 6 (Division of Fire Control), Portland, Oreg., recently purchased its own new portable TV camera-videotape system, including two TV monitors, for a total cost of $2,075. A cadre of technicians has been trained in proper use and care of the equipment, and as needed, these individuals will be dispatched with the equipment to problem fires.

Videotape Has Potential

In this paper we have described some of the special problems encountered by the fire behavior-intelligence team in a critical multifire situation and how a portable TV camera-videotape system was used to improve the effectiveness of this team. We recognize that techniques of using equipment and methods of recording important fire information can be improved. Based on the considerable experience with the system in 1970, we see significant potential for it in fire control work.

In addition to the uses we made of it, this equipment offers a whole new range of possibilities for training programs. To get feedback and review of performance, we see use for the equipment in fire investigation work, damage appraisal, fire reviews, accident investigation, and slash smoke management. We also see use by public information officers in describing current fire situations to press and public. Videotape recording has considerable potential in many other phases of forest management and research work. It is another product of the electronics age that can be used to improve and streamline the complex job of land management. △

Time Is Factor In Aircraft Tracking System

Fred E. McBride

The Boise Interagency Fire Center (BIFC) now boasts an electrical aircraft tracking system that is easy to use, includes both an "aircraft-due" alert system and closed-circuit TV viewing of the tracker, provides "ready-recall," and, most important of all, incorporates the factor of time.

Keeping close track of aircraft movements is a must for any office controlling aircraft in flight. Most existing tracker systems lack one essential item, "real time;" are bulky; are limited in the number of aircraft they are capable of handling; or do not incorporate "ready-recall." New expensive computer systems incorporate the missing time element but at a cost ranging from $20,000 to $100,000!

Time Tamed

BIFC has overcome most of these obstacles by devising a flight tracking board incorporating time with a 24-hour horizontal clock. The clock has a vertical 6-foot pointer (fig. 1). The pointer travels horizontally across a magnetic board which is divided into 24 equally spaced hour columns. Thirty-six horizontal lines allow simultaneous tracking of 36 aircraft (fig. 2).

The communicator enters the departure location, destination, and aircraft "N" number (fig. 1B). This information identifies the flight. Placing a magnetic indicator in the "up" position in the appropriate time block shows estimated departure time. Placing a magnetic indicator in the "down" position in the appropriate time block shows the estimated time of arrival.

Any indicator left of the right-hand edge of the clock-driven pointer represents action, corrected if necessary, already happened. Any indicator to the right of the edge represents future action. When the pointer is between two magnetic indicators on one level the elapsed time from takeoff to the present can be determined directly from the horizontal clock.

Alerts Signalled

Time was thus incorporated into a flight tracking system. However, we felt we needed another item, an alert system.

The alert system we devised is a panel with a series of lights wired to the magnetic board. Each light corresponds to a horizontal line on the board. Each

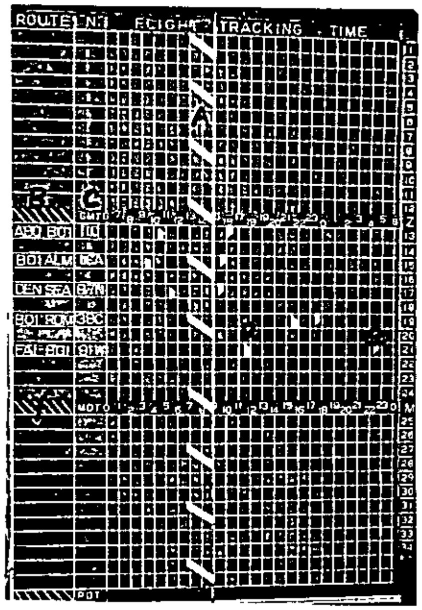


Figure 1.—Overall view of the magnetic aircraft tracking board showing its various components: (A) Clockdriven pointer, (B) route designator column, (C) aircraft identification column, (D) estimated-time-of-departure designator, (E) estimated-time-of-arrival designator, and (F) time designator line.

Fred E. McBride is chief BLM, USDI, dispatcher, Boise Interagency Fire Center.

line has a low DC volt. The clock pointer has the remainder of the circuit necessary to light the light.

Because the pointer and the lines on the board normally do not come in contact with each other, the lights on the panel are usually off. An electrode attached to each magnetic indicator indicates estimated time of arrival (ETA). When the pointer comes in contact with a magnetic arrow, the light is turned on. Through a series of relays, the light stays on until the dispatcher cancels it.

Review Possible

To provide the "ready-recall" mentioned earlier, BIFC has made one further refinement of the flight tracking boad. A closed circuit television was installed, which transmits an image of the board to those offices needing to review flight actions. No longer are additional boards nor the men to update them needed.

Time Most Important

More important than the other features of BIFC's aircraft tracking system is the feature of time. Without considering time, tracking is only partly done. Look at your tracking system. Whatever it is, however well it works, does it include time? It should. △

Figure 2.—Pointer drive system (cover removed): A motor driven windlass operates the timing pointer. The motor is a 115 volt A/C electric synchronous motor; the speed is 1-r.p.h; the motor drive is a .477 in. diameter pulley which acts as a windlass drive drum. One loop of .0018 in. diameter nylon cord is the drive line.

Lit Long Ago,

Mine Fires Still Burn

Paul D. Brohn

To have an uncontrolled fire burning in a forested area since 1884 seems incredible in this age of modern fire fighting techniques. Yet such a fire is burning on the Athens District of the Wayne National Forest in southeastern Ohio.

The fire is in an old, underground coal mine, and for the past 90 years it has burned through several hundred acres of abandoned shafts. It is one of several going mine and waste coal fires in the Athens District. And despite the District's many attempts to put them out, these mine fires continue to burn.

Miners on Strike Light Fires

Coal production was the main industry of the Hocking Valley area of southeastern Ohio during the late 19th and early 20th centuries. Hundreds of underground mines were dug throughout the region. Large portions of the now mined-out areas lie within part of the Wayne National Forest.

During 1884, striking miners in New Straitsville, Ohio, started the fire that has burned the longest in Ohio. Miners set coal cars on fire and pushed them into various mine entrances. Their actions are still being felt whenever a road or house sinks into the ground or a forest fire starts.

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Other mine fires started differently. One near Murray City, Ohio, began shortly after World War II when coal strip miners lit their warming fires too close to an exposed coal seam. Forest fires also touched off some mines by igniting exposed coal seams on unreclaimed strip mines or in abandoned, underground mine entrances. Coal refuse piles in the forest serve as a smouldering source of fires; they catch on fire by spontaneous combustion or from forest fires.

Crevices Create Hazard

The old mines in this area of Ohio are near the surface and are known as drift or horizontal mines. This means the coal vein lies horizontally anywhere from 20 to 100 feet below the ground surface. Mine fires and resulting ground subsidence open fissures, often undetectable, from the old passageways to the surface. Because of the chimney-type draft, flames from fires smoldering in the mine shoot up through fissures as the fires burn under them. When they reach the surface, this eruption of flames ignites dry leaves and other forest vegetation. Fissure eruptions are unpredictable, making each

See MINE, p.14.

Smoke drifting to the surface from a mine fire. Notice how close vegetation is to the hole.

More Accurate Scanner, Faster Aircraft Tested

R. F. Kruckeberg

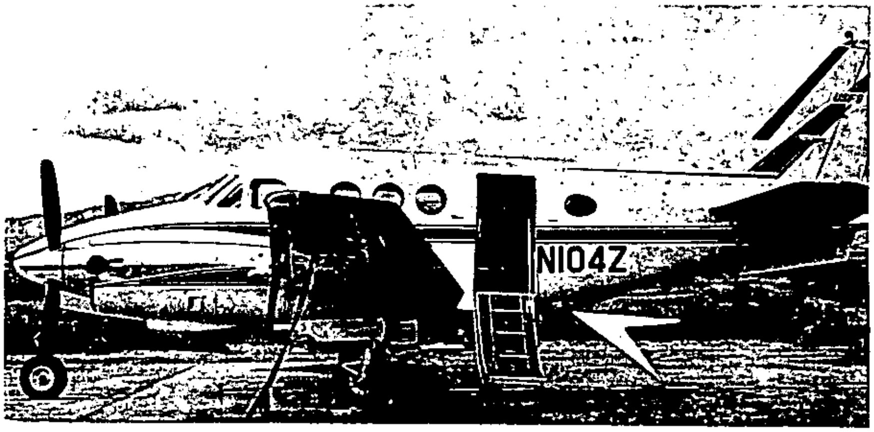

Figure 1.—Beechcraft B90 King Air. Scanner port is indicated by arrow.

The personnel of Project Fire Scan field tested an improved infrared (IR) forest fire detection system in 1970 and found that the equipment could identify and mark latent fires as small as 1 square foot in a forest environment. Approximately half of the fires in the test area were scanned by the airborne equipment and over 50 percent of these were detected.

Now, if you will think back a few years, you will realize that I am not telling you anything new; similar success was reported by Losensky in 1969 [1]. At that time you learned that an IR system *could* find fires and that these fires could be located accurately. But, you also learned that the target discriminator (TDM) was marking a rather large number of false alarms, some of which were causing suppression crews to lose valuable time in unsuccessful searches.

Since the 1967 tests, a number of improvements have been made in the IR system. The 1970 flights were designed to (1) test the improvements and (2) to provide answers to questions about operational procedures that might be used during actual fire detection patrol missions.

The major changes in the system were (1) the development of a two-detector receiver that eliminates false alarms by automatically identifying 1-square-foot, 600° C., targets from their much cooler, 0° to 50° C., thermal backgrounds and (2) the installation of the equipment in a pressurized, twin turboprop aircraft (Beechcraft King Air) that could average 230 m.p.h. groundspeed up to 28,000 feet above m.s.l. (mean sea level) (fig. 1).

The test area was in western Montana and northeastern Idaho where there is a high occurrence of fires caused by lightning. This test area covered about 8,000 square miles in the Clearwater, Nezperce, Bitterroot, and Lolo National Forests of Region 1 of the Forest Service. Elevations ranged from 1,300 to 10,211 feet. (Small parts of the Salmon, Payette, and St. Joe National Forests were also flown over, but the fires detected there are not included in this summary.)

Several flight routes were set up across the area (fig. 2); these consisted of parallel strips having centers 9 miles apart. Flights at 23,000 feet above m.s.l. provided at least 10-mile-wide coverage with some overlap. By alternating between routes 1 and 2 on successive nights, areas of low detection probability near the edge of one strip were given high detection probability by being near the center of the strip on the next night's patrol. Infrared patrol flights were made, supplementing the existing visual detection system which consisted of 57 lookouts and seven patrol planes.

Wildfires Detected and Interpreted Quickly

From July 7 through September 3, 1970, the project flew 41 patrol missions. Most of these were at night and took 4 to 5½ hours to complete. Interpretation of the imagery was done in flight because this would cut down on any delay between detection and reporting time. No problems occurred! Target locations could be relayed by radio to the National Forest concerned

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[1] B. John Losensky. An operational test of an infrared fire detection system. USDA Forest Serv. Fire Contr. Notes 30(2): 8-11. 1969.

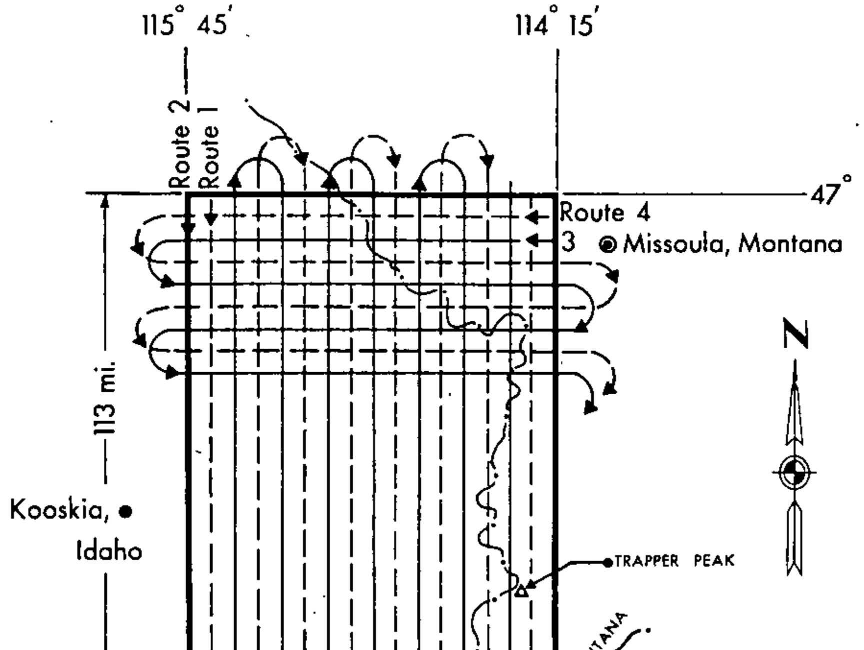

Figure 2.—Layout of the 1970 patrol routes.

at the end of each strip, providing accurate locations within 30 minutes of detection.

Post-season analysis shows 418 fires in the test area during the period of the field test; 12 of these were detected and extinguished while the aircraft was away for a periodic inspection. Of the 406 fires remaining, 203 were detected visually and were out before the IR aircraft had a chance to look at them. This leaves 203 that were burning undetected when the plane passed over. IR identified 103, or approximately 51 percent, of the fires scanned. Of the 100 fires missed, 62 were flown over only once before being seen visually and then extinguished.

As indicated by the following comparison between initial, inflight identification and post-flight analysis, there was little difficulty interpreting marks put on the image by the electronic equipment (fig. 3). Initially recorded and identified were 804 hot targets, 169 wildfires and 635 miscellaneous targets. Finally analyzed were 141 confirmed wildfires, 19 unconfirmed reports of fires, and 631 miscellaneous targets resulting in a discrepancy of only 13. (By unconfirmed, I mean no fire was found that required suppression action.)

The problem of false alarms that was so evident in the 1967 tests is solved for nighttime flights through the use of the two-detector receiver. During the high-altitude, daytime patrols, sunlight reflections are still a concern, but these can be minimized by flying east-west instead of north-south strips.

Fire Mapping Increases

The improved infrared (IR) system was also used in 1970 to map 13 large forest fires in Montana and Idaho during all phases of suppression activity and for mopup mapping on the fires north of Wenatchee, Washington. At daylight, imagery was usually delivered by light aircraft or helicopter to the fire camps where interpretation was done by anyone who had an aerial photography background and had had a minimum of interpretation instruction.

The ability of the equipment to mark the small, hot target (the unique detection capability of the target discriminator, an instrument that *marks* fire locations on the imagery even when the fires are too small to be *printed* on the imagery) is invaluable during mop-up. Fires too small to print on the imagery can be identified and found by suppression crews. This provides the fire boss with information never before available for making decisions on manpower needs and placement (fig. 4).

Let Airplanes Fly More Often

Several conclusions are evident after reviewing the 1970 data: An obvious one is that the projects' operational strategy must have been in error if it did not have the airplane up over half of the fires in the area. Strategy included plans to fly the entire test area on each patrol; however, by waiting for conditions that were just right, flights were sometimes delayed or even cancelled. Thus, between flights, many fires were seen visually and extinguished. Furthermore, fire occurrence patterns indicated that it was not

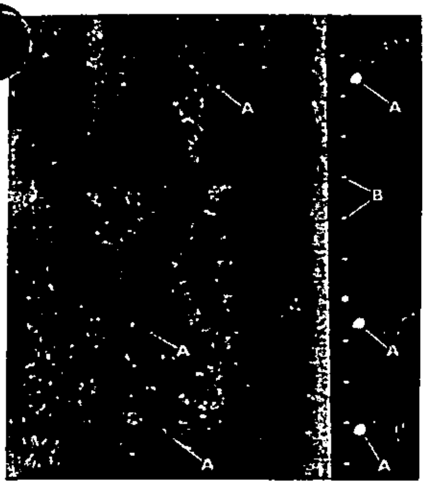

Figure 3.—1970 fire detection imagery, 15,000 feet over terrain. A, marks put on by target discriminator; B, navigation marks at 1 nautical mile. There were no fires large enough to print. Target 81906 is a campfire at trail junction; 81907 is a campfire at a lake; and 81908 is a wildfire on a southeast slope.

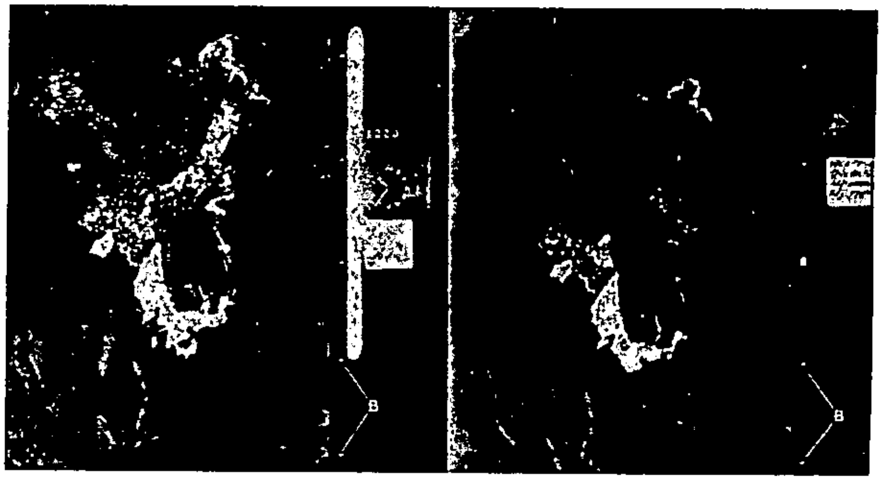

Figure 4.—1970 fire mapping imagery, 7,000 feet over terrain. Left-hand imagery is shown with marks put on by target discriminator (TDM) (note small targets marked do not show in imagery to right). Right-hand image is without TDM marks. Larger fires and fire perimeter are easy to see. Marks in margin at B are navigation marks 1 nautical mile apart.

necessary to fly the entire area after each storm. Lower level flights over a smaller area, below the cloud cover, might be one solution.

A second conclusion is that it is difficult to compare the relative effectiveness of two systems (i.e., visual and infrared) after only one season—especially when they operate on completely different principles. The fire season in the area was not critical, although a larger than usual number of fires started. Actually, during the test of the improved infrared (IR) system we did not prevent any big fires from developing. None of the fires that were discovered by IR but not manned until several days later following visual detection, became large. On the other hand, none that were missed by IR became large. In summary, although early detection by IR can be a factor in preventing development of large fires, in this particular study such was not the case.

Fifty percent of the fires in the test area were discovered by visual methods within 7 hours after originating (fig. 5). This indicates that many fires became visible quite rapidly following ignition, before an IR flight could be planned and flown.

All of these lead to one final conclusion—we need to continue IR detection system tests, under operational conditions, using revised strategy in combination with strategically located lookouts and well planned visual air patrols.

IR Used

The infrared detection system is now operational. As of July 1, 1971, the Forest Service Region 1 took over the program and is flying detection patrols over the same test area flown in 1970. This time, however, there are only 33 lookouts manned and the Forests are dependent on the results of the daily flights.

FIDO (Five-Forest Infrared Detection Operation) is manned by two crews, each consisting of a pilot and interpreter-equipment operator. A unit supervisor plans and coordinates the flights, makes sure that target information gets to the Forests, and provides general guidance and control.

New Recorder To Help Surveillance

In the near future, we hope to have a new recorder using a 9-inch-wide, heat-developed paper that will replace the present wet-chemical processor. Nearly current imagery (real time) will be available in a continuous strip, but it will be a positive image instead of the presently used negative.

It will be a fire surveillance system capable of detecting the small latent fire and of doing the best possible job of fire mapping for precontrol planning and postcontrol mopup! △

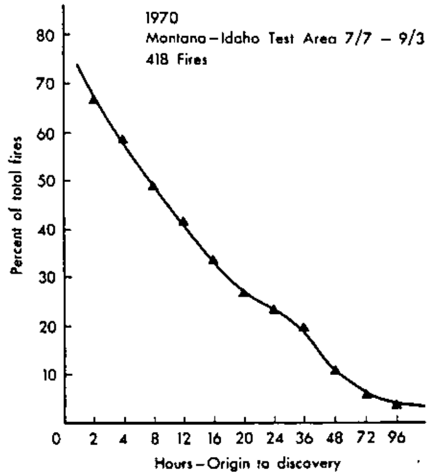

Figure 5.—Percent of fires remaining to be detected.

MINE, from p.10.

fissure a fire hazard. As many as six separate forest fires in one season have started this way, all from one mine fire.

Mine fires nearer the surface kill and injure trees by overheating their root zones. Gas emissions also injure trees by leaf contact. The sulfur dioxide sometimes emitted can be harmful not only to vegetation but to animals and humans as well.

Men fighting forest fires in the location of mine fires have more than the usual hazards. Many of the crevices above old works are large enough for an unsuspecting fire fighter to fall through. Even if crevices are not large enough to fall through, they may still be deadly traps that can suffocate or burn a person. Equally dangerous are old unmarked, unguarded air shafts located in many mine areas.

As a result of the fissure and shaft hazard, firelings are usually not constructed at night in mine areas. When a line must be built at night, the crews are instructed to stay at least 200 feet from the nearest known danger zone. During the day, line construction is kept at least 50 feet back from known danger zones. All fire crew leaders must be men experienced with the mine areas.

Barriers Failed

In the 1930's, W.P.A. programs combated mine fires in this area. USDI, Bureau of Mines officials, directing local labor forces, attempted to seal several underground sections of the New Straitsville mine fire. Concrete and brick barriers were constructed within the shafts. Those barriers were inserted well into the shale formation above and the clay formation below the coal vein. The fires burned through the shale and continued on.

Considerable effort was spent by local mining companies, with the Bureau of Mines, on attempts to stop coal fires on company strip mines. But fires still managed to burn.

Because nothing seemed to work, most attempts to control mine fires stopped.

Presuppression and Dozers Used

The District has six active mine fires. Each year, the sites are checked before both spring and fall fire season. The District fire control technician makes a thorough investigation to determine fire conditions. Mine fire progress is mapped and the need for presuppression action is decided. Maps showing the latest position of mine fires are used by the fire dispatcher to update his information. During critical fire danger periods, the mines are checked and reported on daily.

District crews perform presuppression work around mine sites, constructing fire breaks with dozers or hand tools. Fuels between fire breaks and mine fires are then burned. This procedure is very successful and also works with burning coal waste piles.

Another method of control has been to use heavy dozers smothering a fire in the coal vein. This can be done only where the vein outcrops in hollows or hilly terrain. Soil is pushed, mixed, and finally spread over burning coal at the outcrop. Ultimately, the fire is smothered, although it takes several years. Several mine fires on the District have been put out this way.

These methods are the only practical way the District has to stop or slow down mine fires. Nevertheless until better ways are devised, the Athens District will continue to use these methods to control mine fires. △

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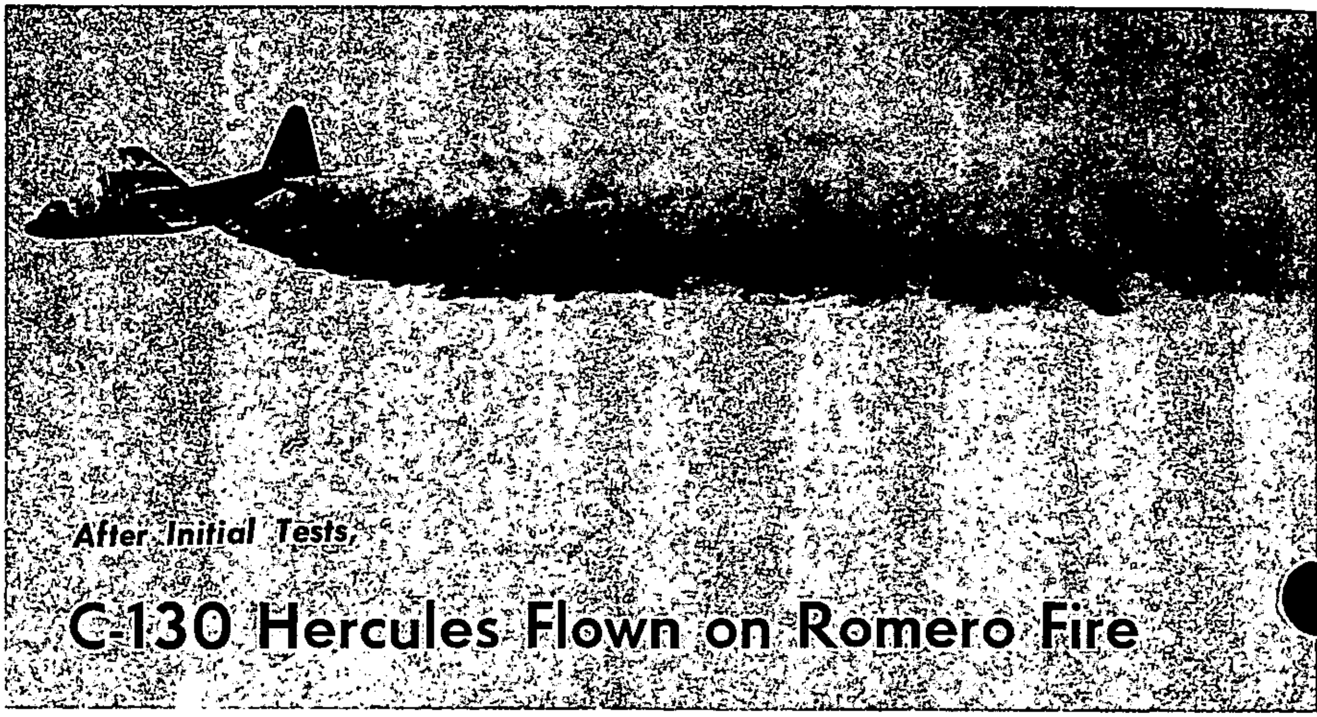


After Initial Tests,

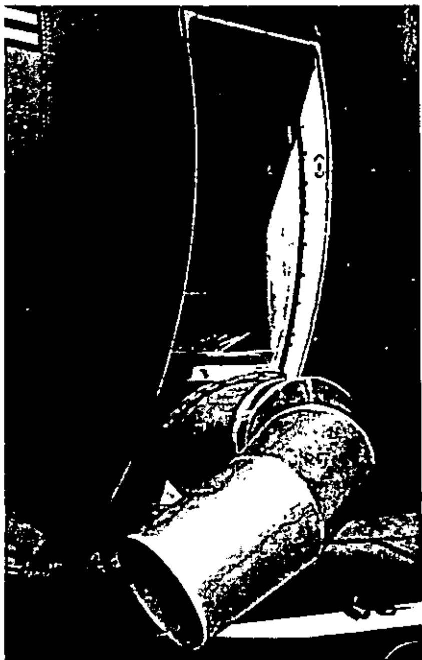
C-130 Hercules Flown on Romero Fire

Test and evaluation of a modular retardant dropping system in a C-130 Hercules was recently completed at Edwards AFB in California.

The dropping system consisted of five 500-gal. cylindrical tanks installed in a C-130. The tanks were valved into two 16-in. exhaust manifolds (discharge pipes), one on each side of the aircraft exiting out the troop doors. The total capacity of the system was approximately 3,000 gal., including tanks and exhaust manifolds.

The U. S. Air Force contracted the test and evaluation of the tanks. Technical guidance was furnished by the Forest Service, with actual retardant dropping conducted by the California Air National Guard of Van Nuys, Calif. Technical assistance also was furnished by U. S. Army flight test personnel of Edwards Air Force Base.

In addition to the successful testing of the system at Edwards, the aircraft was employed for test and evaluation purposes only on the Romero Fire at Santa Barbara, Calif. in October 1971. Results of Romero Fire testing have not been published yet. (The IR scanner, featured on p. 11 of this issue of Fire Control Notes, was also used on the Romero Fire.) △



One of two exhaust manifolds on C-130 through which retardant is dropped (see cover photo).