L. A. Carter

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FIRE CONTROL NOTES

A PERIODICAL DEVOTED TO THE TECHNIQUE OF FOREST FIRE CONTROL

FOREST SERVICE • U. S. DEPARTMENT OF AGRICULTURE

FORESTRY cannot restore the American heritage of natural resources if the appalling wastage by fire continues. This publication will serve as a channel through which creative developments in management and techniques may be communicated to and from every worker in the field of forest fire control.

Volume 12 Number 4

FIRE CONTROL NOTES

A Quarterly Periodical Devoted to the

TECHNIQUE OF FOREST FIRE CONTROL

The value of this publication will be determined by what Federal, State, and other public agencies, and private companies and individuals contribute out of their experience and research. The types of articles and notes that will be published will deal with fire research or fire control management: Theory, relationships, prevention, equipment, detection, communication, transportation, cooperation, planning, organization, training, fire fighting, methods of reporting, and statistical systems. Space limitations require that articles be kept as brief as the nature of the subject matter will permit.

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PLANNING HELIPORT SITES

CAL FERRIS

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Contemporary forest administrators have experienced an entire decade wherein the principles, practicability, and economy of almost limitless movement over the earth's surface via helicopter have been demonstrated and developed. Therefore, the wishful thinking and general plans of the past must now be reexamined in the interests of future developments in forest transportation.

Conception of the helicopter phases for project or fire planning can be relatively simple if the proper use is made of available data. This data concerns helicopter performance and operation in combination with the established factors of load, ceiling, range, ground speeds, costs, and flight limitations.

EQUIPMENT CHARACTERISTICS

When considering the performance of aircraft it is important to remember that the weight-sustaining capacity of air varies significantly with barometric pressure and temperature. This capacity decreases with an increase in either temperature or elevation. Therefore, the weight-sustaining capacity of the air at flight terminals is of vital importance in problems involving the landing of men and supplies. Once under way a helicopter can safely carry loads at altitudes under atmospheric density conditions in which it would be impossible to take off, hover, or land. Therefore, planners of heliports should have at hand guides for calculating these effects on standard helicopter performance. The Forest Service will include this essential information in an Aerial Operations Handbook it is preparing.

It appears now that helicopter designs suitable for use by the Forest Service will be standardized along the line of the Bell, Hiller, and Sikorski models. These models all have a single main horizontal rotor of two or three blades with a small vertical two-bladed, antitorque tail rotor. Maximum dimensions of these types are length, 40 to 60 feet; span, 30 to 50 feet; height, 8 to 12 feet; maximum gross weights, 2,500 to 6,000 pounds. The choice of landing gear installations is optional and includes skids, floats, or tricycle and quadruped wheel installations. Average pay loads vary from 400 to 1,600 pounds. Cruising ground speeds are approximately 50 miles an hour, block to block. Useful range is about 2 hours' flying time. Useable ceiling is around 9,500 feet. Operating cost runs from $40 to $160 an hour for integral equipment and $60 to $225 for contract and chartered helicopters and crews.

PLANNING CONCEPTS

Most planned transportation systems include access roads and trails which are added primarily for fire, project, or some other one-shot purpose. Such plans should be critically examined to determine whether these roads and trails can be eliminated and aerial methods of coverage substituted. Also, a skillfully managed over-all helicopter operation would obviate the necessity for maintaining many existing roads and trails. Obviously, savings would result in both construction and maintenance costs.

It should be remembered that helicopter planning encompasses area or radial coverage in contrast to the strip type of coverage usually provided for; this may result in a certain amount of allowable overlap in controlled area.

The heliport plan should provide for three basic site classes, permanent, semipermanent, and opportune. These are summarized in the following tabulation and shown in figure 1.

Class	*Development*	*Name*	*Designation*[1]	*Facilities provided*
I	Permanent	Base heliport	BLIP (◈)	Maintenance, servicing, communications, housing, parking, air markers and navigation aids, safety devices.
II	Semipermanent	Satellite heliport	SHEL (O)	Maintenance, servicing, communication.
III	Opportune	Helispot	HIPO (X)	Only as needed.

A fourth site class, undesignated emergency spots (EMOT), covers a large number of locations that are developed and used to accommodate some special demand for helicopter service. Although records of these sites should be carefully maintained, such sites need not be considered under any but the most intensive type of transportation plans.

Mapped locations (fig. 1) should be further described in accompanying notes to include essential information. An example follows:

BLIP #1 System

Identification	*Location*	*Elevation*	*Description*	*Remarks*
SHEL-B	Dome Rock	4200′	Raised rock dias at peak. Wind sock 50′ E.	10% slope E. Critical temp. 48° F. 1 drum, 80 oct.
HIPO-3	Blue Lake	3750′	Marked by buoy in S cove—40′ from beach.	Floats only 3′ water (4-2-51 F)

Correction sheets are necessary to keep the records accurate between regular revisions.

AREA PLANNING

For the present, helicopter facilities should be planned primarily for all areas below 7,000 feet elevation which are inadequately served by other existing or planned transportation. Those areas deemed especially suitable for development should be outlined on a standard scale topo-

[1] The system of phonetic identification serves to minimize confusion in identifying specific locations. For example, "As soon as the dozers are finished at SHEL-Dog, send one to help the crew on the job at Charlie-HIPO-five."

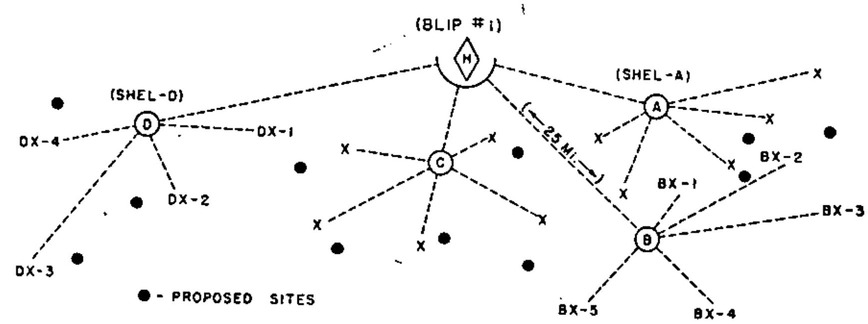


FIGURE 1.—Schematic diagram of proposed sites in a heliport plan. Blip (◈), permanent base heliport; Shel (O), semipermanent satellite heliport; Hipo (X), opportune helispot. (Phonetic identification clockwise.)

graphic map. In this planning, ground control areas should be examined for the possible elimination of nonessential roads and trails. Only very special sites, such as airports or flight strips, large lakes, or meadows should be considered for elevations above 7,000 feet.

Altitude zoning can be accomplished through the simple expedient of coloring all areas red on the base map above 7,000 feet and hence unsuitable. The zone between 4,500 and 7,000 feet, which is considered suitable for marginal or reduced services, can be cross-hatched or a cautionary color, such as yellow, used.

Another very essential part of the base map is the precise location of air hazards such as power and telephone lines, spans, and trestles, and known ground hazards, such as fences, wet or gullied meadows, hidden slash, stumps or rock outcrops, crusted areas, and submerged hazards.

Designated heliport sites can be indicated on the base map, but are preferably shown on a transparent overlay that permits easier revision, reproduction, and interpretation.

The over-all spacing of site locations varies according to individual situations, and is discussed later in detail.

Consideration of site suitability with regard to accessibility should be considered next by the planners. This entails a careful study of factors such as adjacent obstructions, wind currents and other hazards, and site surfaces; and evaluation of use patterns including concentration of users, available transportation facilities, such as roads, trails, airports, waterways and lakes, and values to be protected or managed.

GENERAL CONSIDERATIONS FOR SITE LOCATION

If possible, place the heliports above the areas they will serve and where they can be quickly and easily reached by complementary ground travel. Because a very real hazard to personnel is always present in the moving rotors, every possible precaution must be taken to minimize this potential danger. This includes placing marshalling areas for any significant assemblage of personnel, stock, or equipment at least one-tenth of a mile away from the spot; providing for ground access routes well below the plane of all rotors and from directions easily visible from the control station in the machines; safeguarding against injuries to eyes and lungs, which can be

caused by dust blown from untreated surfaces by rotor blasts. Operating areas should be fireproofed to protect valuable equipment, and in addition, portable extinguishers should be provided to the necessary servicing facilities.

It has been suggested that three categories be established for determining the priority of heliport development, viz., (1) earliest possible, (2) probable future, (3) upon special demand. Where proposed sites are questionable for any reason, a general helicopter pilot or his technical equivalent should be consulted before final approval for development is granted.

PERMANENT AND SEMIPERMANENT HELIPORT STANDARDS

In selecting a heliport site, consideration should be given to (1) the type of service expected; (2) number and kinds of helicopters anticipated; (3) clear channels of approach; (4) surrounding obstructions and their effect on air currents; (5) surface conditions.

With present equipment, a heliport should have approaches to permit landings and take-offs at angles from the outer limits of the touch-down pad of 10:1 into the prevailing wind directions and 5:1 in other directions. These minimum angles will permit safe and economical operations under all conditions.

The touch-down pad should have a minimum diameter of 50 feet where not more than one helicopter is to land at a time. The safety area that surrounds the pad will vary depending upon obstructions and dust conditions. This area should extend a minimum of 50 feet from the outer edge of the touch-down pad, be restricted by a low barrier, and it should be dust and fire proofed. Above 6,000 feet this site must have a very smooth, extended surface to facilitate running take-off techniques. The sharpest possible contrast between the pad and the safety zone should be obtained for easy air identification under all conditions. When this is not feasible, the heliport may be marked by a circle with an "H" in the center. Where night operations are anticipated, a distinctive flashing beacon, boundary, wind indicator, and obstruction lights should be provided.

Roof, platform, or other structural heliports must be stressed to withstand impact load strains equivalent to ¾ × the gross weight of the helicopter on any one square foot of surface, in addition to existing dead loads.

Easily visible wind-direction and velocity indicators, either small socks or flags, should be provided for all heliports.

A diagram for heliport site improvement is shown in figure 2. The requirements illustrated are for normal conditions. Allowances to compensate for any variance will be necessary.

TEMPORARY LOCATIONS AND STANDARDS

Helispots are ordinarily located at opportune sites that require a minimum of improvement for their occasional use. These spots should be prospected and charted in anticipation of convenient development. No maintenance is normally contemplated. When one is improved, the records of its characteristics and use should be kept for future reference.

Open ridges with opportunity for horizontal or descending take-off in either of two prevailing wind directions represent suitable sites. These sites

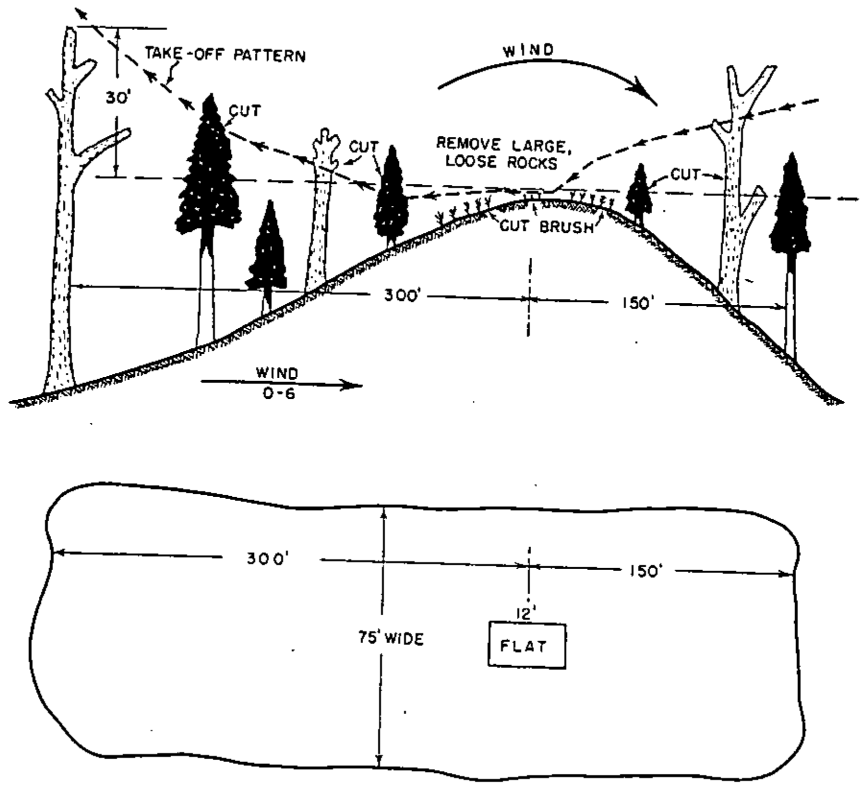


FIGURE 2.—Heliport site improvement plan.

must be free of brush, trees, or other obstructions protruding above the level of the touch-down pad.

On sharp ridge tops below 6,000 feet where brush and trees are not a problem, a nearly level spot surface about 10 by 15 feet is normally adequate for one-ship operation. On areas where low brush or trees are not more than 10 feet tall, the cleared landing spot below 4,500 feet should be at least 60 feet in diameter. Where obstructions or elevations are higher, the diameter of the cleared area must be increased to conform with the appropriate translational lift and rate of climb tables.

No landing spot should be considered in the plan that has more than 10-percent surface slope. Emergency landings can be made on steeper slopes, but such slopes are in the "critical landing" class and have no place in a preplanned system.

A smooth, flat surface is not essential to a landing spot if the pilot is fully aware of what he is settling down on. Emergency operations are frequently conducted from boulder strewn, gravel washes and sand bars. The key is to insure that no rocks or stumps stand high enough to touch the supporting structures of the alighting gear. Special care should be taken to guard against soft or crusty spots in the touch-down surfaces. Brush stubs and rock piles must be leveled to reduce skid rocking, tire and float puncture, or snagging of occupants.

If a landing spot is on a sharp knob or a ridge, the ground effect will be lost very soon after take-off. In all probability this will occur while the helicopter is undergoing the critical transition between hovering flight on a column of compressed air and translational flight which derives lift from relative motion through the air. To compensate for this, the area in front of the landing spot should be cleared a bit lower than the site level for at least 100 feet from pad boundaries along the departure routes.

Brush, tall grass, or other protruding obstructions must be cleared out from approach zones so that the tail rotor (clearance less than 3½ feet) will not hit anything during the flare-out for landing. Care should also be exercised to avoid pockets, saddles, bluffs, and other spots which are normally subject to unforecastable bad air currents.

PLANNING THE LOCATION OF LANDING SPOTS

Planning for the spacing of site locations consists largely of applying old, established principles and logic in such a way as to exploit the unique advantages of the helicopter. In addition to the general factors discussed earlier, there are a few basic systems used for planning heliport networks. These systems vary because they are designed to fit individual situations.

The first and most widely accepted system is employed in the California Region. This region's primary objective is to achieve hour-control over areas where existing and planned transportation facilities are deemed inadequate. The question of adequate hour-control coverage is determined by a careful study of all implications involved in the various combinations of flammability types—values that could be affected through a changeable use pattern. The risks and hazards resulting from a changeable use pattern must also be considered. This system lends itself very well to the adjustments required where lower priority control zones, i.e., lesser values and/or occurrence, are encountered. Theoretically, in areas where characteristics are uniform, this system results in locating heliports in places equivalent to approximately twice their allowable attack radius.

Similarly, some other controlling factor in heliport placement, such as normal rates of spread, will serve. When the least favorable circumstances are selected as a controlling factor, the number of bases should be held to a minimum by strategic adjustments suited to the various flammability zones. As an example of this system, in a 30-minute zone, the bases might be spaced about 40 to 50 miles (1 hour) apart. This would mean that even peripheral deliveries from adjacent bases to spots nearest a fire could be accomplished in 20 minutes and so allow sufficient time for ground travel. Where innumerable chances exist for the use of smoke-hopping techniques, the location of bases at radial extremities near 25 miles might be possible.

Secondary satellite bases can be spaced inversely proportional to rates of spread. This will result in a greater number of bases in brush than in timbered country. Cover types, topography, values, benefits, and costs are given increasing weights in considering these developments. Such landing spots should be planned so that they are strategically interspersed and complement the more permanent facilities. Frequently these spots are located only to accommodate some specialized function, such as critical points along a fire line, rescues and evacuation of personnel, or as the result of emergency landings.

Another basic system for planning and selecting heliport locations is becoming increasingly popular and successful in highly developed parts of the western regions. This system is planned by geographical drainage or value units, and is especially applicable to areas where moderately intensive transport, management, and protection already exist. It employs the same fundamental plans of location and construction already discussed.

Intimate field knowledge of all the aspects of the terrain involved, along with the real nature and value of the associated resources, is prerequisite for selecting this system. When considered for, or applied to, relatively undeveloped areas, the additional planning investigations necessary to assemble the required data are expensive, time consuming, and often prohibitive.

Such a system frequently requires greater liaison between districts and forests to provide for joint controls and development of boundary areas. In aerial operations, the importance of artificial boundaries is secondary. In other words, under this drainage system, don't terminate plans along a stream that separates two units when desirable landing spots are available on the other side.

An additional factor in strategic placement under this system is to locate Class I and II heliports at easily accessible spots along the major divides. This will make it possible for the helicopters to drop off into the various areas with the least delay and greatest ease.

For areas that approach the ultimate intensity of planned coverage, special heliport systems can be devised wherein the fullest possible use is made of pertinent data already assembled. Examples of this type of planning may be found in areas undergoing development similar to the upstream flood control established for the Los Angeles River drainages. This project combined the acme of present planning concepts, based on intensive evaluation studies, with an intimate knowledge of fire occurrence and behavior.

As a result of the careful correlation of all factors, both real and implied, local fire protection authorities were able to complete their collective protection strategy and actually pre-locate fire lines which are now being developed as fast as possible. Helispots are located wherever necessary to fill in transportation time gaps and provide economical services. Such planning has made possible the simultaneous construction of improved helispot facilities at frequent intervals along actual fire lines which, fortunately for this purpose, follow the ridges in flash-fuel cover types. Since both the crews and equipment are "on location" for this special type of associated construction, helispot construction and improvement costs are advantageously reduced to an absolute minimum. As an example, Angeles National Forest reports average helispot construction costs in medium brush at $12 for hand labor and $9 for tractor. A complete discussion of the development of this system appeared in FIRE CONTROL NOTES, April 1951.

In addition to the essential preparations of basic data already described, the following actions should be employed wherever necessary to insure the easiest evolution of the complete plan.

1. Make a vellum overlay for each sheet of the planned road system status map, with match marks and other data necessary for its accurate use over the base maps.

2. Consider the possible elimination of questionable corollary projects at this stage, and include any actions shown in the current record correction notes.

3. Show on the transparent overlay new roads, airstrips, artificial lakes, or any other especially suitable facilities not included on the base maps, excluding field headquarters, commercial heliports, military installations, etc.

4. Show on the overlay locations temporarily selected as suitable. These selections can be based on personal knowledge and consultation, careful study of topographic maps, or interpretation of aerial photographs.

5. Shift proposed locations to improve the pattern. The center of a movable transparent disk, with the radius determined by control factors, can be shifted among the proposed site locations for a rough illustration of theoretical time-zone coverage limits.

6. Reexamine the preliminary proposals, fill in the gaps, reduce congestion and overlap. An acceptable academic coverage pattern should result.

7. Number 6 is an office phase of the planning and must be substantiated by objective field investigations of proposed sites. To accomplish the job of field checking all proposed sites solely by ground reconnaissance is impractical. A combined air-ground check will cover hundreds of sites in a short time, and information obtained by reliable air observers will be accurate enough to pin point most of the suitable spots and coordinate the proper interim development of other facilities. Checkers should be especially alert for unfavorable flying conditions such as down drafts, obstructions, and congested areas. Avoid spots that would involve difficult engineering projects, such as rock outcrops, and marshes, whenever possible.

8. As a result of the above actions, select, within allowable economic limits, the locations that are best suited to the standard of development proposed. Eliminate the unsuitable ones and readjust the pattern to fill any gaps.

9. Educate field personnel in the intricacies of recognizing low-standard sities and alert them to the necessity for studying their local areas for sites requiring minimum development. They should also be taught to note possible locations and forward pertinent records to the appropriate engineer.

As the heliports are developed or altered, they should be classified and identified for reliable reference; accurate maps of the locations and historical records of their prior uses should also be maintained. This is essential information for the local engineers and air officers. It may be desirable in some locales to planimeter the helicopter zones and determine such factors as the facility-square mile ratios, by zones, etc.

Improving Teamwork on Interagency Forest Fires

The suppression of many forest and range fires requires joint action by personnel of two or more protection agencies. To be most effective good teamwork and mutual understanding must be developed in advance. The usual formal written cooperative fire control agreements between agencies should be supplemented by local working arrangements. It is important that variations in policies, procedure, organization, and terminology be understood and reconciled in advance if delays and misunderstandings are to be avoided.

In order to study these problems and attempt to improve future joint suppression action, a very successful meeting was held in Yosemite National Park on April 19

and 20, 1951, attended by more than 60 Forest Service, National Park Service, and California State Division of Forestry officers. These men represented the Regional Offices and State Forester's Office, 3 National Forests, 4 National Park areas and 5 counties.

Each agency analyzed its fire and administrative organizational setup, procedures, fire overhead job descriptions, and terminology. Minor variations were noted but no serious obstacles to joint action were apparent so long as these differences were known in advance. Following this discussion the group divided into 4 teams, each composed of representatives from the several units of the three agencies. A sample large fire problem was worked out for manning, tactics, strategy, and supply. Each team solved the problem independently and, when later compared, all solutions were similar despite the diversity of organization and variation in general agency objectives and programs. In fire control all strive for the same result—reduction of losses.

Selection and designation of overhead positions on joint action fires was discussed in some detail. The accepted rule that one man must be given total command as fire boss on every fire was recognized. It was also agreed that the best man, regardless of official title or agency, should be selected and that this is the responsibility of top local administrators who should have an advance understanding in this regard. After a fire boss is designated it is his responsibility to make systematic division of work on the fire to utilize all men and facilities of all agencies to best advantage. Individual and agency responsibilities and their tie-in to the over-all plan must be clearly defined. A fluid and dynamic organization must be established and maintained. Many of these matters can be prepared for in advance by mutual discussions such as this meeting provided.

Perhaps the most difficult problem of fire suppression involving overhead from more than one agency is that the men may not know each other well. A fire boss must have confidence in his key assistants and they in turn must rely on his competence and judgment. Without this mutual reliance weaknesses develop in management of the fire. If no other value had been derived from this meeting of the three agencies, the fact that each man became acquainted with the others made the meeting worth while. Official titles and other formalities were promptly forgotten. From this acquaintance mutual confidence and understanding should be immeasurably increased.

The group recommended the holding of similar meetings annually. Others might benefit from this type of get-together.—L. F. COOK, *Assistant Chief Forester, National Park Service.*

FIRE PREVENTION NOTICES IN VIRGINIA

George Dean

State Forester, Virginia Forest Service

The posting of fire prevention notices along the highways has long been a standard public relations technique here in Virginia. During World War II a few roadside billboards were carrying forest fire prevention messages, but it was not until 1947 that more intense efforts of this kind were directed at the motoring public (fig. 1).

Metal highway signs, of which there are 5,600, are erected on all the primary and all paved secondary roads in the State. These signs, made of 16-gage steel, measure 24 by 30 inches, and have raised green lettering on white baked-on enamel background. The signs were made by the metal shop of the State penitentiary at an approximate cost to the Virginia Forest Service of $2.30 each. The signs are mounted on 4x4-inch pine posts ob-

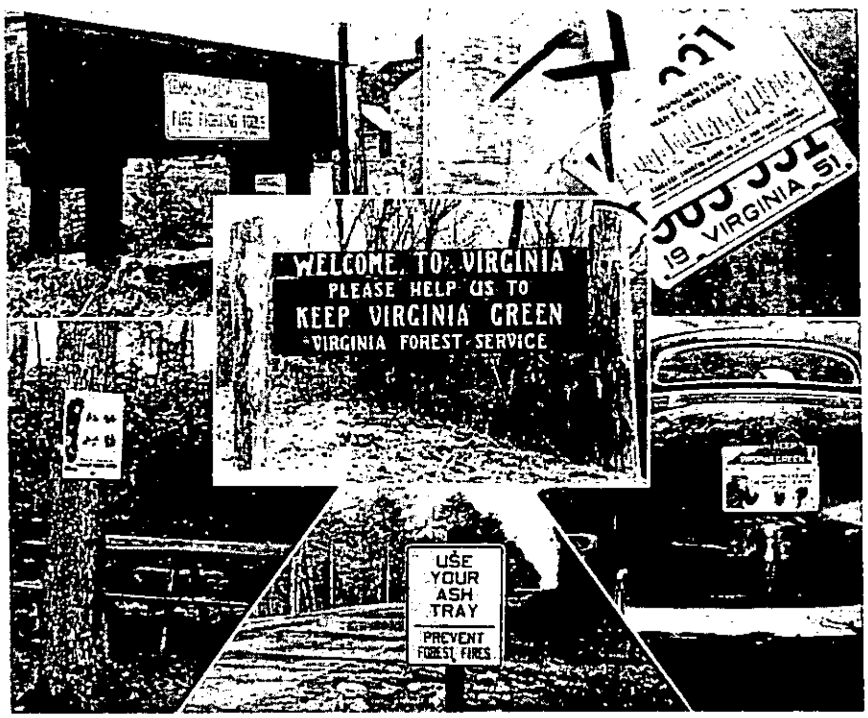


Figure 1.—Fire prevention notices in use in Virginia.

tained from and creosoted at the Buckingham State Forest. The coverage obtained from 5,600 signs is approximately 1 sign every 7 miles.

The next move to attract the attention of the motoring public was to make a unit of the fire warden tool box and warden flag and locate them conspicuously along the highway. A large metal sign, stating the fire fighting tools in the box are for use on forest fires, is mounted on the front of the tool box facing the highway. The warden's name is lettered on a paddle which is hung under the warden flag. This complete warden unit naturally causes local comment and also augments State-wide forest protection publicity.

All Virginia car owners are required to purchase license plates annually. Inserted between the new license plates he now finds a reminder on forest fire prevention. The appeal usually is directed to the use of the ash tray in the vehicle. This license stuffer reaches approximately 800,000 vehicle owners each year.

The Virginia Department of Highways has been developing picnic areas along all the major highways. There are now 1,243 such sites. At each of these areas the Virginia Forest Service has erected a poster board, made of wood, on which an outdoor fire prevention poster is tacked.

There are also, especially in the mountain section, developed vistas. Here, too, posting boards are erected. Truck pull-offs, usually at the top of a long grade, are excellent spots for these poster displays.

License plate attachments, made of light metal cut in the shape of the State and carrying the wording "KEEP VIRGINIA GREEN" on a forest green background, have been requested by a large number of people. Approximately 6,000 of these were given to vehicle owners by the Virginia Forest Service last year.

Large wooden, creosote-colored fire prevention signs, with routed 6-inch letters painted orange, have been erected on all the main highways leading into the State. These signs are very rustic in appearance, measure 8 by 3 feet, and are hung with large logging chain between 10-inch chestnut posts.

Smokers are responsible for approximately 38 percent of the forest fires in Virginia each year and it is believed that a good prevention program directed at the traveling public will probably reach most of the smokers. It is only through the splendid cooperation of the Virginia Department of Highways that this entire program has been possible.

Protection of Fire Tool Handles

To protect handles of fire tools carried in pickups and tanker tool boxes cut lengths of old cotton fire hose 1½ by 42 inches and slip them over the handles. This practice adopted on the Happy Camp District has lessened the problem of tool maintenance.—GIDEON S. PARKER, *Modoc National Forest.*

MACHINES AND THEORIES

FRANK J. JEFFERSON

Assistant Regional Forester, Region 5, U. S. Forest Service

We have available to the field of fire control today several relatively new machines. Our constructive thinking is lagging, however, as to which of these truly offer increased strength to fire control and how they can be used most beneficially. We are inclined to accept theories as facts and, because of this, apply them in an amateurish, unresultful way. We shy from going through the hard process of working out in detail the changes in organizational practices necessary to make these new machines of fullest use, and of evaluating the cost-benefit ratio. The pitfalls inherent in such a casual method do not show up much during an "easy" fire season, but they certainly raise hob with fire control effort when the chips are down and every move must be made with dispatch and sureness. For the purpose of this discussion, let's consider four items that have been much in the limelight in recent years. There are others.

HELICOPTER

The helicopter obviously can give all fire-fighting overhead, including fire boss, division boss, and sector boss, up-to-date information in a matter of minutes as to conditions on all parts of a fire line—even on a fire of 40-mile circumference, 40 miles in 40 minutes. A fire boss can get a quick picture of the entire situation; and remember he sees all of this himself, and can personally evaluate all observed situations as they relate to each other. Compare this with ground practices where scouts laboriously work over segments of line, send in their data by radio, telephone, or messenger. The fire boss and his assistants must then plan actions based on interpretation of information which in many cases is several hours old.

Well-coordinated use of helicopter and radio can reduce the force behind the line and improve surety and timeliness of action. The helicopter can provide quick transport of workers from one critical point to another, and the number of points where it can be landed on a fire line, if the pilot is skilled, is truly surprising. This machine can also make quick deliveries of water, tools, food, and other essential supplies to line workers by either landing or dropping, and men can be maintained close to their job if camp bases are properly selected.

To accomplish all of these things, however, in a degree that pays off in reduced cost and losses requires an operation planned and acted upon at the helicopter's speed level rather than one part at the helicopter's level and the other at truck speed. For example, last summer thirty-odd men were picked up one afternoon on a section of line, transported by helicopter several miles to a new sector, and sent into action immediately. Later in the afternoon a new camp was established by helicopter on that sector. Not until night came was it realized that the personal belongings, time slips,

and other important items had not been shipped to the new base. There were two results: a near riot on the part of the crew, whose first thought was no clothes, no pay, no nothing; and poor crew work and morale the next morning. All of this resulted from an incomplete helicopter-use plan.

In planning, it must be remembered that the possibility of any sort of air operation is controlled by visibility and air condition. Smoke, fog, darkness, or excessive wind rule out the air. So whatever the plan for air use is, it must be complemented by an alternate plan based on the old reliables of transport by truck, by tractor or by mule, and as a last resort, by man back-pack, if sureness of action is to follow. But first of all, if we are going to use helicopters, we must get thinking and actual planning fully attuned to the speed with which a helicopter can act. This requires methodical planning of the ways and means of running a helicopter operation and a methodical carrying out of the plan. The plan can't be "catch as catch can"; it must be completely fitted to the machine that it uses, or it will not pay off.

RADIO

What has been said about helicopter can well be applied to radio. This device can be one of the most helpful that we have for speeding up all phases of line action. It is a worthy complement to the helicopter, and together they can revolutionize the first suppression job. However, radio can likewise excessively complicate an undertaking by its very speed of action. The failure of a fire boss and others who give instruction by radio to promptly send instructions to *all* who are concerned with the action of an individual, or results of the action, may have serious consequences. Here again there is urgent need to figure out the essential procedures necessary to fit the speed of radio action and then sternly discipline ourselves to observe these procedures.

TRACTORS

We must learn to use tractors as a complement to man-power and not regard them as a complete substitute therefore. Tractors can build line but have never yet clean-burned one. They never will. Probably the greatest cause of line loss today is from unclean tractor lines. A few flights over major fires should convince anyone of this. The miles of lost tractor line are appalling. Here again is a device that can be a mighty ally. Its usefulness, however, is being negated because men, fascinated by its brute strength, noise, and ability to produce wide line quickly, are disregarding the basic principle that a safe fire line is a clean-burned one.

BOMBING PLANES AND OTHER AERIAL OPERATIONS

It is theoretically possible to put water on fires in practically unlimited quantities from the air. All that is needed is a sufficiently large fleet of planes equipped with big water bombs and a landing place with water supply close to the fire. Practicably, this means that the Nation would have to be covered by several thousand water-equipped bases, each with probably 10 large bombing planes and trained personnel available, to make the operation effective. The cost of such an undertaking would be staggering;

it would still be staggering if such operations were limited to the west coast. Therefore, this is one of the proposals that, while theoretically possible, is unsound economically.

In the author's opinion, rain-making projects are likewise economically unsound as a generally planned-for fire control measure. Granted that under proper atmospheric conditions, and with proper equipment, rain can be made. However, it just isn't ever going to be possible, at a reasonable cost, to insure having the proper equipment and materials available at the proper time and place. And no man can arrange to have the proper type of cloud on hand at the time of a fire. In this connection, it is important to realize that while a day or so's difference in time isn't too vital in the case of rain for crop production, it is a tremendously important factor in fire suppression. In that day, fire is over the ridge and far away. So again we have a theoretical possibility that in application is limited.

There is loose thinking concerning the use of planes for observation purposes. All too many believe that the availability of a plane is the key factor. This belief is definitely wrong. A plane is necessary, of course, and it must be a plane that is *safe* for the proposed operation. The controlling factors from the fire-information standpoint, however, are the availability of pilots with the skill to safely put a plane in the right place for the observer's purpose, and observers with skill in the knowledge of fire behavior and the ability to interpret and accurately record fire facts that they see on the ground. These qualifications are infrequently combined in a pilot, and all too often casually assigned observers can't interpret or correctly record what they see. The result is misinformation and erroneous-action decisions.

Our use of the plane or helicopter for observation purposes will not be most productive until we develop an adequate corps of skilled pilots and properly qualified observers for each unit of organization, i.e., forest, county, or association area. This does not at all mean pilots and observers who are regularly on a fire control agency payroll. Many private pilots and their fellow workers can be trained in this field if adequate effort is made. Identification and interpretation of fire facts is not an esoteric art.

Principles of organizing
for F. F. Suppression.

Calif Region U.S.F.S.

THE FLANNELGRAPH AS A FIRE CONTROL TRAINING AID

ROBERT B. MOORE

Forester, Region 4, National Park Service

Fire control training officers search constantly for new methods or media to increase the effectiveness of fire control training. During a recent meeting devoted primarily to a review of the principles of fire management and the build-up of organization on large fires the flannelgraph proved to be an arresting and effective training aid.

The flannelgraph works on the principle that some materials have an affinity for each other. Flannel, felt, or sandpaper will stick to a background of flannel without an adhering agent even when the background is in a vertical position.

Flannelgraphs have many uses. They are at their best, however, as lecture aids, especially when used to show changes, tell progressive stories, or make comparisons.

Our flannelgraph story used the organization chart for large fire suppression from "Principles of Organizing For Forest Fire Suppression," California Region, U. S. Forest Service. Primary and subordinate functions for the respective fire positions were briefed and printed in large block letters on colored, medium-weight paper. One color was used for the top fire Management functions, another for Suppression, a third for Planning, and a fourth for Service functions. Job titles were printed on plain white paper.

Pieces of flannel were rubber-cemented on the backs of these separate "parts." A 3-foot-square piece of good grade white cotton outing flannel was used for background. The background flannel was stretched tautly and fastened securely to a smooth wall.

By adding, shifting or removing the parts as desired the training officer is able to present clearly and simply the progressive build-up of organization from a small one-man or one-crew fire to the more complex large fire organization. Uniform and clear-cut distribution of duties and definite channels of command can be emphasized graphically as the story unfolds. Functions that must be performed on every fire, regardless of its size, manpower and equipment requirements, can be effectively presented.

The flannel-backed parts sometimes require a slight hand pressure to adhere well to the background. Fine to medium grained sandpaper is said to work best of all as backing material.

The flannelgraph should be kept as simple as possible. Illustrations or lettering should be big and bold to be easily seen from a distance. Colors stand out. The flannelgraph should be well lighted. For the leader's convenience the parts should be numbered or otherwise identified or arranged for orderly use. Guide lines may be required on the background.

Admittedly we have but scratched the surface in the use and adaptability of the flannelgraph. We found it to be a most effective aid deserving of wider use in forest fire control training.

EASELS FOR FIELD USE

J. W. Mattsson

Forester, Fire Control, Region 4, U. S. Forest Service

Frequently we use easels in connection with field fire training. Regular blank newsprint is the material upon which we outline training plans, summarize discussions, etc. Also in our training, including safety training,

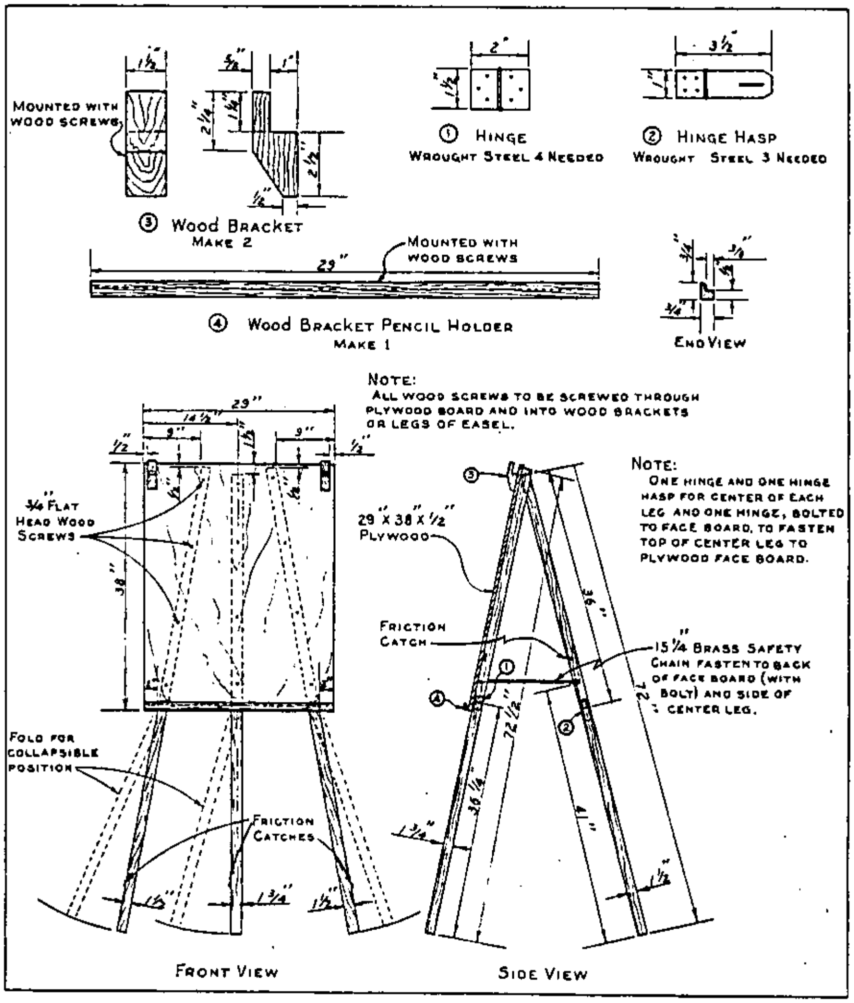


Figure 1.—Portable field easel.

of project personnel we have used easels right on the jobs. The easels available have usually been heavy, cumbersome structures that were hard to carry, especially when the training sites were some distance off roads.

In order to get an easel that was easy to carry, light and compact, yet rigid enough for field use, we designed one using 3-ply plywood as the backboard (fig. 1). The legs were made of 2x2-inch pine hinged where they extend away from the plyboard so they fold up to make a compact unit for transporting. Ordinary 1½-inch hinges were used on one side of the break in the 2x2-inch material with 3½-inch hasps on the reverse side. By setting the hasps so they fit very tightly no additional reinforcements of the legs are necessary. Friction catches hold the legs in place when folded back. A strip of molding serves as a pencil and chalk rail.

The materials necessary to construct such an easel are:

- 1 piece plywood, 29 by 38 inches
- 18¼ linear feet, 2x2-inch pine
- 1 piece molding, 29 inches
- 2 wood brackets
- screws
- 3 hasps, 3½-inch
- 4 hinges, 1½-inch
- 3 friction catches
- 1 piece chain

This Region has a number of such easels in use and they are proving mighty convenient. They cost about $10 each to construct, including labor. The approximate weight is 19 pounds.

Copies of the diagram are available from U. S. Forest Service, Ogden, Utah.

Published Material of Interest to Fire Control Men

Breaking Up Clouds Halts Fires, Science News Letter, Vol. 59, No. 26, June 30, 1951.

Forest Fire Insurance in Norway, by Julius Nygaard, Jour. Forestry, May 1951.

I Am a Smoke Jumper, by Bob Dolan, Mark Trail Magazine, Spring 1951.

Release of Sand Pine Seed after Fire, by Robert W. Cooper, Jour. Forestry, May 1951.

Scythette—the Motorized Scythe, Farm Implement News, May 25, 1951.

The 1950 *Forest Fire Record* [of the National Park Service], by L. F. Cook, National Park Magazine, Jan./March 1951.

Use of Fire in Land Clearing, by Arnold, Burcham, Fenner and Grah, California Agriculture, April and May 1951.

Use of Plane in Fire Patrol, by A. E. France, West Virginia Conservation, May 1951.

We Jump Into Fire, by Starr Jenkins, Saturday Evening Post, April 28, 1951.

Western Forestry and Conservation Proceedings of 1950 *Meeting*, contains articles on slash disposal, fire weather, snag problems, fire records, fire plans for logging areas, radio communication, mobile pumps, chemical fire extinguishers and fire problems of western state foresters, published by Western Forest and Conservation Association, Portland, Oreg.

COOPERATIVE FOREST FIRE CONTROL IN PENNSYLVANIA

C. L. KINNEY, *Resource Management Staff Assistant, Allegheny National Forest,* and A. H. VOGLER, *District Forester, Pennsylvania Department of Forests and Waters*

Pennsylvania was one of the first States to provide a State-wide system of fire protection for all its land. Under an act of its General Assembly in 1915 a fire control organization was assembled and trained, and since then it has expanded and improved until today it is one of the best in the country.

This organization is directed by the Chief Fire Warden in the Bureau of Forests, Department of Forests and Waters, at the State Capitol in Harrisburg. Line of authority is from Chief Forest Fire Warden to the State regional foresters (five in number) and thence to the man on the ground, the district forester. By State law the district forester is responsible for forest fire control on *all* land within his district whether it be delinquent land, game land, private estate, or national forest. He has a complete fire control organization: lookouts, inspectors (guards), wardens, cooperators, dispatcher, with the necessary tools and equipment.

Allegheny National Forest was established in 1923. Although the three quarters of a million acres of land within the new national forest was already protected from fire under the State law, it was agreed early that the United States Forest Service would be responsible for fire control. The reason was twofold: The Forest Service would thereby assume a fair share of the costs, and members of its staff would become familiar with the over-all fire control work.

The result was a hybrid Forest Service fire control organization dependent upon the State for part of the detection and dispatching, and for all of the labor. By law the Chief Forest Fire Warden was still responsible for the protection of the national forest, but by mutual agreement the Forest Service assumed responsibility for all its fires. This cooperative arrangement grew and functioned fairly well without benefit of written instructions. However, a series of misunderstandings occasionally resulted in a larger than average fire.

Two years ago the Chief Forest Fire Warden and the Forest Supervisor decided that a memorandum of agreement was long overdue, and on May 12, 1949, they signed such an agreement. A summary of the more important points follows.

1. The Allegheny Fire Protection Boundary is the property line except that all private land of 100 acres or less entirely surrounded by national-forest land, or lying between national-forest land and a natural barrier, is included in the protection boundary.

2. The Forest Service is responsible for the suppression of all fires inside the boundary and the State is responsible for all fires outside the boundary.

3. Each unit is responsible for suppression costs within its area except that the State pays labor costs on fires suppressed by the Forest Service on private land within the protective boundary.

4. Time of yearlong personnel is freely exchanged by the two organizations.

5. All fire wardens and crews are State-appointed but are on immediate call when needed by the Forest Service. Some crews are equipped with State-owned fire tools, some with Forest Service tools, and some with a part of their tool complement from each source.

6. Prevention plans are integrated so that there is no duplication or omission in movie, literature, and poster display.

7. Wardens are trained jointly by the two organizations.

8. The Forest Service reports to the State, on a State fire report form, all fires occurring within the protective boundary.

Of perhaps more importance than the points just summarized is the fact that the top-level agreement permits district foresters and district rangers to enter into written agreement on reporting and dispatching. This leads to greater efficiency because these men are closer to the multitudinous details that are complicated by an over-lapping of the districts of the two organizations.

Detection service is furnished by five lookouts owned and manned by the Forest Service, four by the State, and one financed jointly by the State and the Bradford Oil Producers Association. Three other State lookouts just outside the national-forest boundary also supply detection service. All towers are equipped with radio, and the State has two frequency channels neither of which are the same as that allotted to the forest. Reporting and dispatching are done by national-forest ranger districts.

A new officer in either the State or Federal service has much to learn in short order, but two things are immediately apparent to him. The first is that he has literally twice as much trained overhead as a fire control unit normally carries; and secondly, the arrangement works.

Are Snags a Fire Problem?

For many years fire fighters have singled out snags as troublemakers. A recent study of nearly 12,000 fires in the national forests of Region 1 indicates that the fear of snags is warranted. More forest fires start in snags than in any other fuel component. More than 34 percent of all fires in Region 1 originate in snags. On the other hand, less than 10 percent of the fires start in green tree tops. Obviously green trees generally outnumber snags in northern Rocky Mountain forests. But in spite of this numerical superiority snags hold over a 3-to-1 edge as a breeding ground of fires. The study showed that the highest percentage of snag fires occur in the grand fir type, with the white pine and subalpine types in second and third positions, respectively. The smallest percentage of snag fires occur in the ponderosa pine type.—Division of Fire Research, *Northern Rocky Mountain Forest and Range Experiment Station.*

FOOD POISONING IN FIRE CAMPS

JACK E. HANDY

Staff Assistant, Fire Control, Wenatchee National Forest

No one thing can disrupt the organization on a large fire more than to have the fire fighters all become sick after eating a meal in a fire camp. The most often used explanation is that soap was responsible for these outbreaks. This is seldom the true cause.

Lloyd C. Ajax of the Chelan County Department of Health is one of our best fire cooperators and has worked in many of our fire camps. After helping out on several fires, he wrote us a letter on what he considered to be the causes of sickness in fire camps. The contents of the letter are considered of sufficient value to all persons interested in fire control to be quoted here.

"While working in the fire camp at Hovey Creek it was called to my attention, by several officials of the Forest Service, that outbreaks of diarrhea were experienced in nearly every fire camp organized this year. These outbreaks were generally attributed to soap on dishes. This assumption was probably wrong, since single service paper eating utensils were used in at least one of these camps. Soap is often blamed for such outbreaks, but usually the real cause is food poisoning by contaminated and improperly stored food.

"Food poisoning may be produced in three general ways. The first is what is known as *food infection,* and is caused by eating food containing bacteria which cause illness after growing and multiplying following ingestion. There are several kinds of bacteria which may be the causative organism.

"The second type is known as *food intoxication,* and is caused by eating foods containing toxins produced by contaminating bacteria which grow in the food. The difference here is, that the illness is caused by the toxin rather than the bacteria. The staphylococcus bacteria, common in colds, sinus infections, and infected sores, is the most common causative agent. These bacteria will produce dangerous amounts of toxin in many foods in as little as 5 hours, if temperature conditions are favorable. After the toxin is produced, it is not destroyed by ordinary cooking or boiling, and remember, the toxin is what causes the trouble. The symptoms of food intoxication usually appear within 1 to 6 hours after eating food containing these toxins. Botulinus belongs in this classification but has entirely different characteristics.

"The third type is *chemical poisoning,* due to contamination of food by poisonous chemicals such as insect powders or from certain metallic utensils. It is important to know that the presence of these causative agents do not necessarily change the appearance or smell of food.

"To prevent food poisoning outbreaks, it is necessary to purchase sanitary food from reliable sources, see that it is handled by clean food handlers

in a sanitary manner, and store all perishable foods at a temperature below 50° F. Bacteria do not multiply or produce toxins rapidly below this temperature.

"From what I have seen of your fire camps, I would make the following suggestions to improve the sanitation and lessen the possibility of sickness in camp:

1. Be sure of a safe water supply.

2. Replace the cooking utensils having open, hard to clean, seams. Food remains in these seams and serves as a 'seed' for bacterial contamination.

3. Sanitize all eating and cooking utensils after washing, with water above 170° F., or use a warm (not hot) water rinse containing 1 tablespoonful of clorox or similar chlorine solution per gallon. Do not dry dishes with a towel. (Paper utensils are a simpler solution, when available.) The purpose of sanitizing eating utensils is to prevent the spread of communicable diseases.

4. Store utensils in a clean place and keep them covered.

5. Refrigeration—All perishable foods, such as potato salad, mayonnaise, prepared sliced meats, and all other meats and foods containing eggs and milk should be stored at 50° F., or less. Sandwiches containing these foods should not be without refrigeration for more than 5 hours. It would seem advisable to me to have a portable mechanical refrigerator for use at base camps where quantities of food must be kept for some time. This will save food as well as prevent sickness.

6. Storage of food—Keep all foods covered and protected from dust and flies.

7. Cleanliness of employees—Do not have any food handlers working who have a communicable disease or infected sores. See that only food handlers dish up food. Provide clean aprons and cloths for food handlers (it is easy for clothes to become contaminated with intestinal or other bacteria in a rapidly constructed camp). Provide separate hand washing facilities, including soap and sanitary towels, for food handlers, and see that they are used.

8. Camp sanitation—Take care of all wastes, garbage and sewage, to prevent the attraction of flies and rodents.

"In concluding, I would like to say that the general sanitation, other than food handling in these rapidly constructed camps, is very good. The food handling problem in a camp is always more difficult than in a permanent kitchen because of lack of proper equipment, location, and the fact that many camp cooks are not aware of the way food poisoning and diseases are spread.

"The danger of food poisoning is no greater now than in the past, but since we now know the cause and ways of preventing food poisoning, there is no reason to tolerate it. A man affected by food poisoning is worthless as a fire fighter for several hours or days."

MONTANA RURAL FIRE FIGHTERS SERVICE

George W. Gustafson

State Coordinator, Montana Extension Service

Prior to 1942 there was no plan for rural fire control for farm, range, and forest lands outside of organized fire protection districts. On February 11, 1942, the United States Secretary of Agriculture issued a memorandum assigning certain wartime responsibilities to State and Federal agencies, including that of organizing rural America for defense against destructive fires. Implemented by this memorandum, the State Board of Forestry sponsored a State-wide meeting in May 1942 to consider a rural fire control plan for the State. The Governor served as ex-officio chairman of the meeting and representatives of 14 Federal and State agencies were present.

The "Montana Forest Fire Fighters Service" was organized as a result of this meeting, an executive committee was elected, and a State coordinator employed. In the spring of 1945 the name of the organization was changed to the "Montana Rural Fire Fighters Service," dropping the word "Forest," because its primary function is protection from fire not only of forest but also of farm and range land.

The Montana Rural Fire Fighters Service is a voluntary organization maintained through the efforts and interests of the following agencies and associations:

U. S. Army
U. S. Department of Agriculture Council
U. S. Indian Service
U. S. Bureau of Land Management
U. S. Forest Service
Soil Conservation Service
National Park Service
Production and Marketing Administration
Farmers Home Administration
Montana Rural Electrification Assn.
Montana County Commissioner Assn.
Montana State Highway Patrol
Montana State Board of Forestry
Montana State Highway Department
Montana Fish and Game Department
Federal Bureau of Investigation
Private Timber Protective Agencies
Montana Extension Service
Montana Flying Farmers and Ranchers Association

Montana Rural Electrification Association and Montana Flying Farmers and Ranchers Association were added during the past year.

State coordinator is George W. Gustafson of the Montana Extension Service, reappointed to serve his fourth year in that capacity, devoting one-half of his time to the work of the Montana Rural Fire Fighters Service and one-half to the duties of the position of county agent supervisor with the Extension Service.

The State has been divided into twelve fire control districts. A district coordinator is appointed in each district to promote and coordinate all fire control efforts and to develop a program of fire control with the help and cooperation of all agencies concerned within his district.

Through the efforts of the Montana Rural Fire Fighters Service an act to provide protection and conservation of range and farm resources was passed by the 1945 Legislature. This act provides for rural fire protection

and control under authority of boards of county commissioners. Each board may appoint county and district rural fire chiefs, organize rural fire control crews, appropriate funds from the general fund of the county, levy a tax, or enter into cooperative agreements for fire control. The boards are authorized to fix closed season when burning is prohibited except through permits issued by the fire chiefs. This law is permissive rather than mandatory.

The board of county commissioners and the county organization form the basis on which the work of fire protection and control must be carried on. An effective organization and fire control program depends on the cooperation of all agencies interested in and capable of contributing to it.

The success of the Montana Rural Fire Fighters Service can best be measured on the county level, and much has been accomplished in fire prevention and control since the organization came into being, as indicated in the following summary of rural fire prevention and control activities in Montana, 1947-50:

		1947	1948	1949	1950
Counties organized under State law	number	53	53	53	54
Meetings held by county fire boards	do.	31	22	20	20
Members on county fire boards	do.	449	300	254	199
County and district fire chiefs appointed	do.	1,072	861	1,260	1,063
Public meetings held	do.	49	49	62	105
Attendance at public meetings	do.	2,045	1,158	1,913	2,319
County closed fire seasons declared	do.	17	13	23	20
State and Federal agencies giving local representative cooperation	do.	17	18	16	16
Amount of rural fire control budget set up by boards of county commissioners	dollars	16,544	16,411	17,585	21,600
Rural fires:					
Units burned	number	293	280	385	160
Estimate of loss	dollars	382,931	560,493	987,950	390,830
Volunteer fire fighters	number	2,025	2,144	4,190	1,248
Estimated saving	dollars	523,280	599,500	605,635	231,200

Every county, except two, has provided fire protection under the authority vested in the board of county commissioners by the Rural Fire Control Law. County fire chiefs and district fire chiefs within the county have been appointed. Large sums of money have been invested in fire fighting tools and equipment. Local fire fighting crews have been organized and trained in methods of fire fighting. Closed fire seasons have been established during seasons of dangerous fire hazards. In 1950, 453 volunteers attended 17 county training schools.

A system of reporting all rural fires has been in use for 4 years. District rural fire chiefs report to county fire chiefs or county extension agents. These in turn send the reports to the State coordinator, who makes monthly and annual summaries for the State. These reports give nature of fires, causes, losses, number of volunteer fire fighters, and estimated savings effected through work of fire fighting crews and use of tools and equipment. The summaries are published monthly in the "Rural Fire Flashes."

Voluntary fire control boards or committees are organized in most of the counties to plan fire control programs and advise with the boards of county commissioners on the needs of the counties on fire prevention and suppression. These committees usually consist of representatives of State and Federal agencies having range or forested areas within the counties, members of boards of county commissioners, county fire chiefs, district

"Missouri Wash" was developed primarily to remove preservative paint from Army equipment prior to repair work. The preservative paint (Army Specification AXS-673-P1), a black, tarlike substance, presented an uncommonly difficult problem of removal. Special commercial cleaners proved only partially effective, and were prohibitive in cost and a menace to health because of strong chemicals and toxic vapors. The degreasing preparation "Missouri Wash" proved satisfactory and also offered an economical and safe means of cleaning engines and other parts subject to collection of oily grime. Less cleaning material and labor are required to do the job. Health menace and fire hazard are reduced to safe limits, due to practically nonharmful ingredients and high flash (fire) point of the solvent.

The use of "Missouri Wash" requires the same precautions governing the use of plain solvents. It should not be sprayed unless ventilation is plentiful, and should never be applied to a hot engine.

"Missouri Wash" is composed of Stoddard Solvent and common corn starch. The solvent is a natural dissolvent agent for oil or asphaltic base substances, but is quite fluid and evaporates rapidly. The corn starch serves as a holding agent and evaporation retarder, thus increasing the inherent dissolvent action of the solvent. Corn starch may ordinarily be purchased from wholesale grocers in 100-pound containers for about 8 cents a pound.

Instructions for preparation and application of "Missouri Wash" are as follows: Add corn starch to Stoddard Solvent in a proportion of 3 to 6 pounds to 1 gallon, depending upon consistency desired. Stir to mix. A thick consistency is desirable for vertical or overhead surfaces, or when surfaces to be cleaned are heavily coated; a thinner consistency for spraying, or when substance to be removed is loose and dissolves readily. Apply with brush or spray as a saturating solution, not as a wash, and in the least quantity necessary. Let soak for 20 to 30 minutes, depending upon conditions encountered, then wash with hot or cold water, or steam. (Steam damages paint and should be resorted to only in extremely difficult cleaning operations.) In some instances, a repeat process will be necessary. If water or steam is not available, use straight solvent to wash off the dissolved material.

Mix only in sufficient quantity for daily use, and preferably, only in quantity for immediate use. The corn starch has a tendency to precipitate and solidify at the bottom of the container unless solution is frequently stirred. "Missouri Wash" will not harm permanent type paints.

"Missouri Wash" should be the answer to the common and difficult equipment cleaning problems which continually face the field. Application for patent is pending. However, "Missouri Wash" may be used by the Forest Service and other government agencies which may choose to do so.—Lester K. Gardner, *Administrative Assistant, Division of Engineering, Region 5, U. S. Forest Service.*

PORTABLE HEADLIGHT UNIT FOR TRACTORS

ORVILLE LIND

Assistant Ranger, Allegheny National Forest

A handy portable-headlight unit for tractors and bulldozers not equipped with regular headlights can be assembled from a discarded truck head lamp and a home-made universal mounting bracket (fig. 1). The headlight used is a pre-1940 type, the kind not built into the truck's fender. Its glass, reflector, rim, case, and wiring circuit must be in good condition. The positive lead wire should be long enough to reach the positive battery terminal or the live side of the ignition system; the negative side is grounded to the tractor frame by means of the universal bracket. This system will not work with tractors having magnetos.

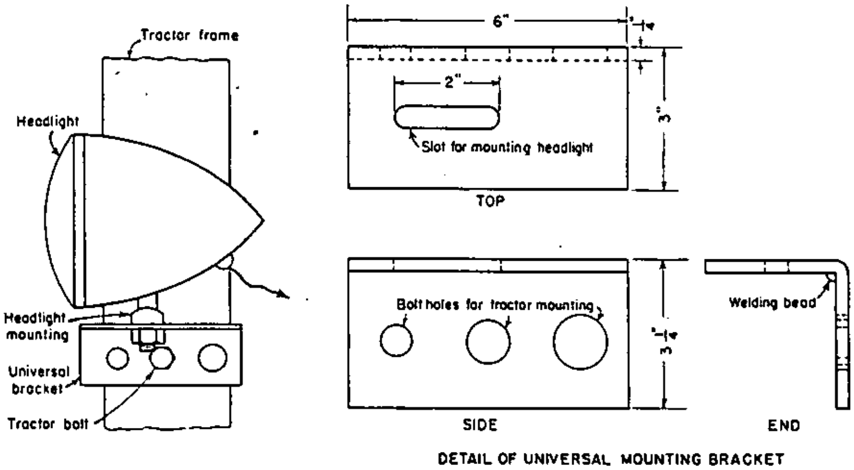


FIGURE 1.—Assembly of portable headlight unit for tractors.

The light can be quickly attached to the front of the tractor frame by means of a universal mounting bracket. This bracket is made of ¼-inch iron plate, 6 by 6¼ inches, or from ¼-inch angle iron, 3 by 3¼ by 6 inches. If ¼-inch iron plate is used, bend to the dimensions of the ¼-inch angle iron. On one end of the 3- by 6-inch face, make a 2-inch slot slightly larger than the diameter of the headlight mounting bolt. On the 3¼- by 6-inch face, drill two or three bolt holes of different diameters so that one will fit the bolt of any tractor on which the unit may be used. The angle of the bracket should be reinforced by a welding bead. Slight variations may be necessary in the mounting bracket so that it will fit the type tractor on which the light is to be used. The bracket can be made for a right- or left-hand unit.

Paint the light fire red and attach it to the mounting bracket slot by means of the headlight bolt. Bolt the bracket to the frame and attach the positive lead wire to the positive battery terminal for a check on wiring and lighting.

This portable tractor headlight was developed to meet a special need of the Allegheny National Forest. Here, lease tractors can usually be rented more quickly and cheaply than Forest Service tractors can be transported to a fire. Because the rented equipment often lacks adequate lights for night work, each district fire cache has a box of four portable headlights ready for use. In addition to the lights, the box contains wrenches, friction tape, and extra light wire.

Flammability of Chaparral Depends on How It Grows

Southern California chaparral has long been noted for its flammability, which is usually ascribed to the general character of the vegetation, steep slopes, and severe weather conditions. Probably not enough emphasis has been given to changes in the vegetation itself that affect its fuel qualities.

All evergreen California chaparral species normally grow new twigs and leaves in the spring and drop a portion of the older leaves in the summer and fall. For the canopy to reach full development, after this type of vegetation is first established, usually requires 8 to 12 years, during which time little dead wood or litter is produced and fire presents no particular problem.

When the site becomes fully occupied, annual production of new twigs and leaves is balanced by the death of older branches and leaves. In normal years there is a seasonal cycle in flammability caused by an increase in numbers of leaves with high moisture content in the spring, then a decrease in numbers and a decline in leaf moisture in summer and fall. Normally, this annual cycle of balanced growth and death causes a gradual build-up of dead fuels. But flammability is usually kept within reasonable, though seasonally variable, limits by the slow compacting and decay of accumulated litter, and by the overstory of green leaves which shields against sun, wind, and desiccation.

This normal state of affairs has been upset since 1945—the beginning of the present southern California drought. By 1948 the shortage of rainfall began showing its effects by the appearance of individual dead bushes scattered over the landscape.

By the beginning of the 1950 fire season the topsoil was powder dry. In some areas there was little if any growth of new leaves; more old leaves, too, had fallen. Instead of full-bodied dense crowns, thin, transparent, drab-colored foliage met the eye. By midsummer the chaparral looked and felt parched. That it could be so dry and still be alive was unbelievable. The canopy over large areas was punctured with stark, dead branches, and many more than the usual number of dead shrubs could be seen.

This marked change in growth—or lack of it—meant a much higher than normal ratio of dead to green fuel, extremely flammable foliage, higher fuel temperatures from increased exposure to the sun, more freedom of air movement—meaning more wind close to the ground.

Years of drought are often characterized by low humidities and high temperatures. These occurred often in the summer of 1950. The lack of moisture in soil and vegetation also held the pickup of humidity and fuel moisture at night to a minimum, resulting in extra long daily burning periods.

The combination of deteriorated cover and severe weather had by 1950 reached the point of near-maximum conflagration potential. By May this year the southern part of the State had received only half or less of its normal seasonal rainfall; very little more is expected. The outlook for the 1951 southern California fire season is thus for more thinning and dying out of shrubs with a consequent increase in flammability beyond anything yet experienced in our time.—CHARLES C. BUCK, *Division of Fire Research, California Forest and Range Experiment Station.*

COLLAPSIBLE FIRE CAMP TABLE SUITABLE FOR DROPPING FROM AN AIRPLANE

R. Boyd Leonard

Fire Control Officer, Salmon National Forest

The collapsible table plan shown in the January 1951 issue of Fire Control Notes inspired the personnel of the Salmon National Forest to study ways of breaking the table on down into a parcel small enough for dropping from a plane of the Ford Tri-motor type and one that could be packed easily on a pack horse. It was generally believed that these could be dropped with a supply order and would materially improve the facilities in the early stages of a fire camp. They could also be used at camps accessible by motor vehicle.

The table that was built is compact and light. It has no parts that are not fixed securely. Material used is ¾-inch plywood, strap hinges, door hinges with removable pin, a few feet of light chain, and some screws.

In figure 1 the braces can be seen mortised into keepers on the bottom side of the table. The chains are fixed at both ends and work automatically. The lower shelf board slides into place and the two parts of the door hinge are fastened securely together with the pin. Figure 2 shows door hinge with pin in place and the two braces removed from the keepers and in place to give rigidity to the table. The two lengths of chain are now tight and held that way by the braces.

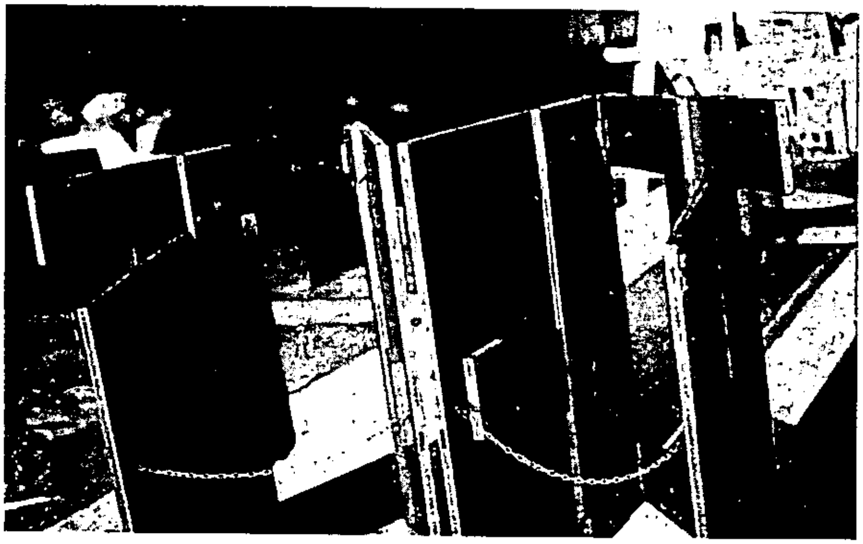


Figure 1.—Collapsible table partly opened. Note location of braces when table is folded.

When the table is in use the strap hinges are necessarily on top (fig. 3). These could be turned over and mortised into the top to lie flat with the surface. For a camp table, however, the hinges as shown will likely not prove objectionable and it is believed that they give more strength against twisting or sudden blows.

It is planned to give the table a thorough try before reporting on the success of this development.

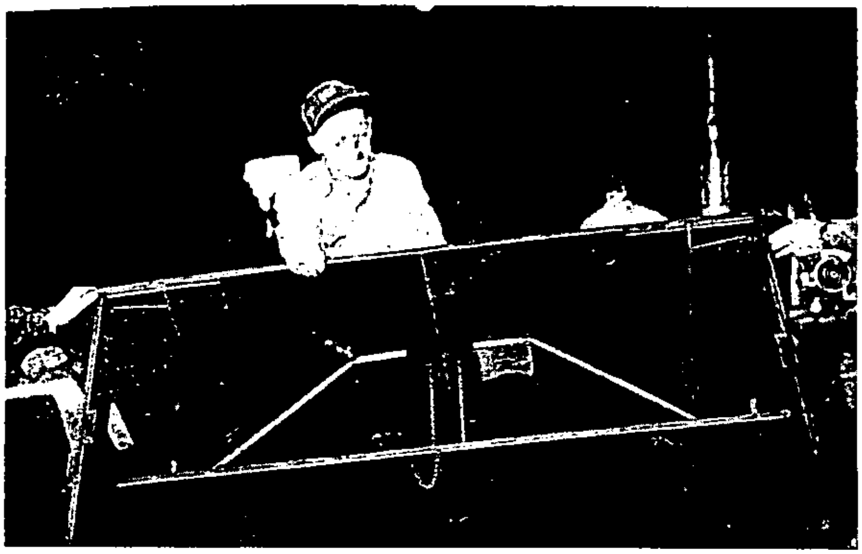


FIGURE 2.—Table assembled with door hinge pins and braces in place.

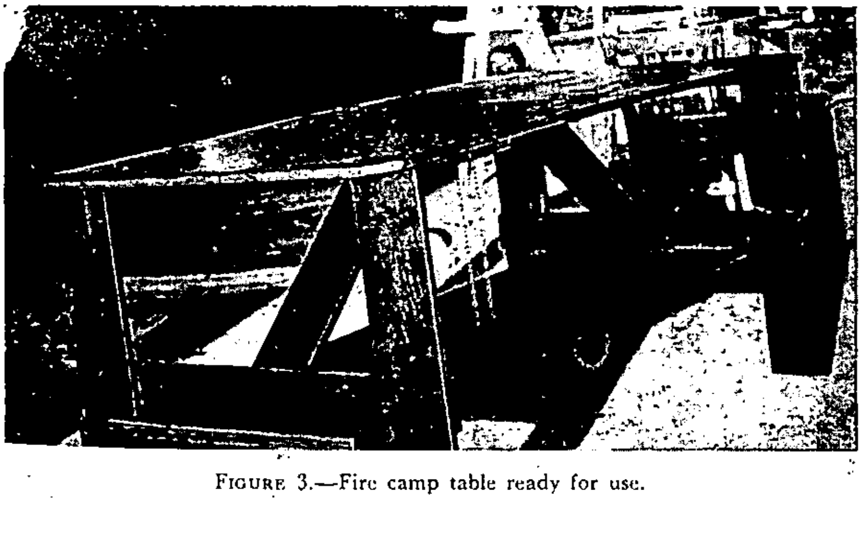


FIGURE 3.—Fire camp table ready for use.

BUTANE-DIESEL FLAME THROWER

ARCADIA EQUIPMENT DEVELOPMENT CENTER

California Region, U. S. Forest Service

An article, "A New Mobile Flame Thrower," by Henry Wertz, Jr., and C. Vernon May, of Los Angeles County Department of Foresters and Fire Wardens, appeared in the October 1946 issue of FIRE CONTROL NOTES. The unit described was a trailer-mounted power flame thrower, using butane and Diesel for fuel.

This unit has proved very successful in backfiring under adverse burning conditions. Such conditions have a tendency of developing rapidly in coastal areas, because of fog rolling in from the ocean.

To meet the increasing demand for these backfiring units, three trailer units were built in 1950 at the U. S. Forest Service Equipment Service Shops at Arcadia, from existing blueprints and information supplied by Los Angeles County Department of Foresters and Fire Wardens, and with recommended features for better performance and safety added. Most of the necessary information for designing the revised unit, which has been proved safe and efficient, was provided by the personnel of Los Angeles County who were responsible for the original development.

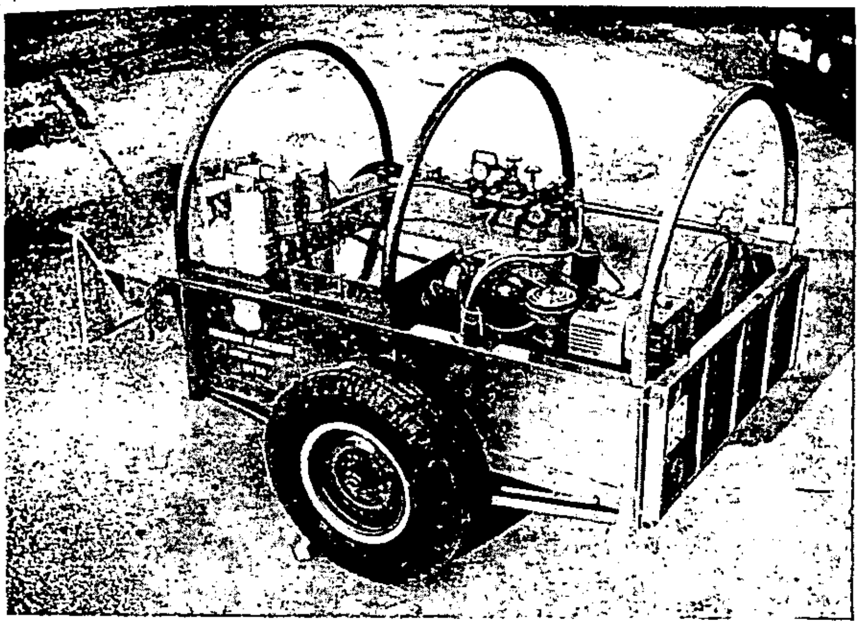
This flame thrower is designed to project a very hot flame for a considerable distance. This is accomplished by using a cheap but safe fuel, Diesel oil, which is ignited by passing through a butane flame. The ignited Diesel is projected 30 feet or more by means of compressed air (fig. 1); some Diesel fuel is deposited on the ground to maintain a flame. The primary purpose of the butane is to produce a sure-fire ignitor for the Diesel fuel.

F-465836

FIGURE 1.—Flame projected by the butane-Diesel flame thrower.

However, butane alone produces a flame which carries 3 or 4 feet, and is very effective for igniting light forest cover.

The unit is mounted in a sturdy trailer with a wide wheel base and a low center of gravity (fig. 2). The tongue of the trailer is equipped with two hitches, one for secure and safe trailing behind a truck on the highway, and the other for pulling behind a tractor.



F-465834

FIGURE 2.—Backfiring unit mounted in trailer.

Three "crash bars" are installed over the trailer to protect equipment in case of an upset. Experience in the past has revealed the necessity of such protection.

The revised unit has a 120-gallon tank in which approximately 100 gallons of Diesel is placed, to allow room for compressed air. Near the center and at the top of the Diesel tank are five holes to serve as inlets and outlets for fuel and air. One has an internal dip pipe extending down to within one-half inch of the bottom of the tank, serving as a discharge line for Diesel. At the top of this pipe is attached a hose for supplying Diesel for the firing gun.

A second hole takes a pipe, tapping the air space at the top of the tank, which is also connected to the Diesel line and equipped with a valve so that the hose and gun can be purged of fuel by an air stream. As a safety precaution, a pop-off valve that opens at 150 pounds pressure is installed in this line.

A third hole, near the fill spout, takes a valve which serves as an escape for the compressed air. The handle of this valve projects over the fill spout so that the cap cannot be removed until the valve is opened.

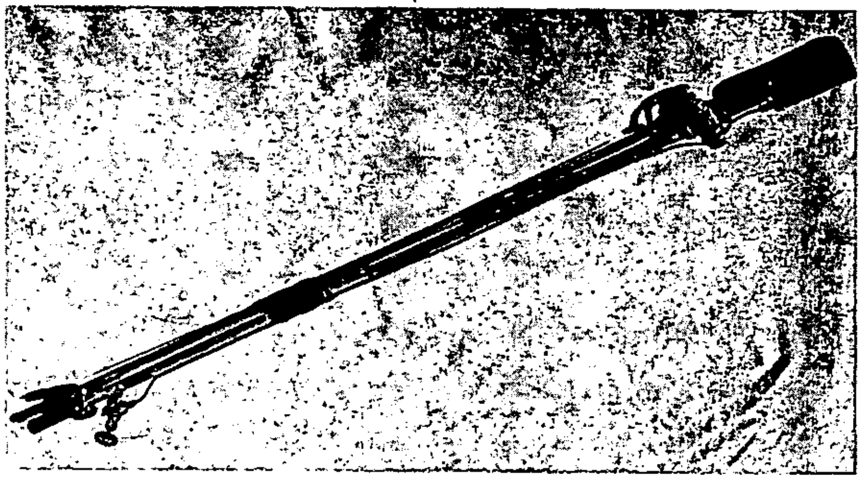
The fourth hole serves as a fill spout, and the fifth as an intake for air from the compressor

The six small butane tanks fit into a rack and are securely fastened in place. They can be replaced when empty without interrupting operation, as only two are in use at a time. Six copper tube lines connect them into a manifold, with six valves located adjacent to the manifold. These valves permit closing of any number of the six lines for replacement of the butane tanks, or isolation of any leak or break. A regulator and gage are installed on the manifold outlet to control butane pressure to the firing gun.

A compressor, run by a 5.1 horsepower engine, supplies the compressed air to the space in the top of the Diesel tank. An adjustable pressure relief valve installed in the bypass line allows setting to any pressure desired. (For Diesel fuel the best operating pressure for ignition and projection was found to be 80 to 110 pounds.)

Two 50-foot lengths of three-ply oil-resistant hose connect the fuel tanks with the firing gun. This heavy hose is deemed advisable as a factor of safety.

The gun is 5½ feet long, made of ¾-inch pipe, with a special built brass firing nozzle (fig. 3). Flow of butane is regulated by a globe valve installed near the handle. From this valve, copper tubing extends to the tip, fastened along the pipe, for delivering butane to the firing nozzle. Guns designed for the first units had a quick-throw valve mounted near the tip and regulated by a remote control wire to a trigger on the handle. This caused the gun to be front heavy, so in the later design the quick-throw valve is mounted on the handle.



F-465835

Figure 3.—Firing gun of the butane-Diesel flame thrower.

A check valve installed at the tip traps the Diesel in the barrel when pressure is shut off. Even after making this change the gun is heavy for continued use by one operator, but, because of excessive heat, operators will of necessity change off frequently.

The ⅜-inch hose and 5/32-inch tip use 4.8 gallons of Diesel per minute, and 21 minutes of continuous firing is obtained from one tank of Diesel

(100 gallons). With the very hot flame and long projection of the flame, continuous firing would be rare. However, this might occur when backfiring along a road, in which case additional fuel could easily be supplied. It is feasible to use a ⅛-inch tip and ¼-inch hose, which would increase operation time without refueling, and still maintain good flame projection.

Since this trailer unit is designed primarily for towing behind a tractor, its capacity and weight have been increased considerably over those of the original models built in 1946. The additional capacity of the fuel tank provides longer operation without refueling. Weight is so distributed in the trailer that the front end is heavy, but is still sufficiently light for one man to attach the trailer hitch. Cost of the unit complete with trailer in March 1951 was $1,400.

Further details and specifications are available in drawings F-26-01 to 04, at the Arcadia Equipment Development Center, U. S. Forest Service, 701 N. Santa Anita Ave., Arcadia, Calif.

World-Wide Distribution

FIRE CONTROL NOTES, with less than 5,000 copies of each issue, probably sets some kind of a record for wide distribution. About half of each issue goes to Forest Service personnel. Other Federal and State agencies having fire control responsibilities also receive it regularly, as do many privately financed fire control organizations.

The larger libraries maintain complete files of the NOTES. Forestry schools, corporations, timberland owners, consulting foresters, and other interested companies and individuals receive it.

Canada leads all other countries in the number of copies distributed outside of the United States. Copies are sent to individuals or agencies in 70 different foreign countries—from South Africa to West Australia, from Burma to Iceland.—E. ARNOLD HANSON, *Information Specialist, Division of Information and Education, U. S. Forest Service.*

A SLIP-ON ATTACK UNIT

Einar E. Aamodt

Engineer, Region 9, U. S. Forest Service

A 1-ton, 4-wheel-drive pickup has been equipped at Michigan's Roscommon Shop for fire fighting with a slip-on tanker, slip-on pump, and slip-on hydraulically controlled plow. Special 9:00x13:00 tires provide flotation and good traction. Road clearance is 8½ inches. A special heavy-duty 15-gallon gasoline tank is installed on the right running board. Two overload long spring leaves are added on each side in front. Heavy, 2x½-inch angle iron armor is used on the sides, running boards, and fenders; heavy 5-inch channel bumpers are provided front and rear. Two back-pack pumps are mounted in the rear of the fenders, and a flame torch on the heavy-duty gas tank (fig. 1). These can easily and quickly be replaced or removed, and are well protected from damage by brush and trees. Hand tools are carried in the large tool box under the front seat cushion. Two tow hooks on the front frame, and a ball hitch on the rear are provided. There is room for two single seats in the rear of the truck. The wide cab seat can accommodate three persons.

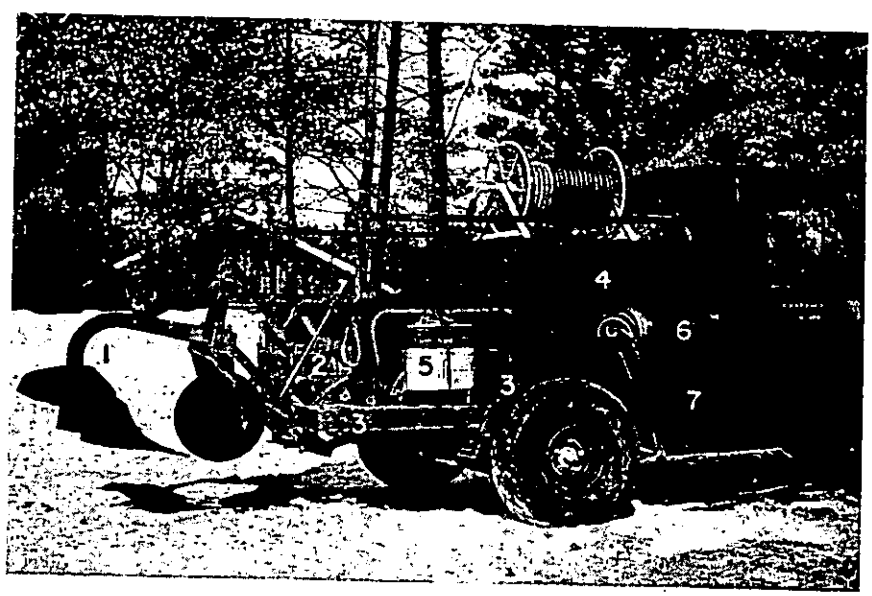


Figure 1.—Pickup equipped as a fire fighting unit: (1) Plow; (2) hydraulic lift (pump not shown); (3) bumper and fender armor; (4) water tank (245 gallons) with live hose reel; (5) back-pack pump (one each side); (6) backfiring torch (under body flange); (7) special heavy-duty gas tank.

The 245-gallon water tank used is 48 by 48 by 26 inches high. The tank is equipped with 6-inch rollers and can be easily rolled onto a platform when filled with water. It is held securely in place by two ¾-inch slide pins in the front of the body, and an easily removed ½-inch bar across rear of tank, fastened through each side of the pickup body. A live hose reel, with Chickson joint and 300 feet of ¾-inch hose is mounted on the tank. Hose connection from the pump to the reel and the 1½-inch hose connection to the tank are the quick pull type and can be easily and quickly engaged or disengaged.

The slip-on plow is a modified Monroe hydraulic plow. It is easily removed from the three-point carrier by pulling three pins. The plow lever and level float arms are also removed by pulling pins. The hydraulic cylinder unit is mounted on a single steel plate, along with the pump, and this entire assembly can be removed by pulling two hand pins. A double hose break-away no-leak coupling is installed in the hydraulic hose line and can be coupled or uncoupled without tools and without loss of any oil, and this can be done with or without pressure on the oil line.

The new style large-size modified Jeep plow with high lift, has the hydraulic control levers on the steering column. The plow operates on a level float arrangement and does not require adjustment when the water load is decreased. When the plow has been raised as far as it will go the pressure valve whistles indicating that the lever should then be moved to the neutral position. When the plow is down in plowing position the control lever can be put in neutral position and left there, allowing the plow to float without any down pressure. Pressure, if needed, can be applied to the plow by leaving the control lever in the down position. A button screw arrangement on the oil reservoir valve provides adjustment to increase or decrease the pressure to the plow. Full maximum pressure of 500 pounds per square inch in the hydraulic system is obtained when the button is all the way in. Each half turn clockwise reduces the pressure about 85 pounds per square inch. Once the desirable pressure point is found, the adjustment is left there until soil conditions change.

The hydraulic pump is mounted on top of the engine head and is powered by a V-belt drive. A slip pin makes it easy to disconnect the pulley drive and disengage the pump. The pump should be disengaged on long trips and when the plow is removed.

When the plow is raised upright (in carrying position) it cannot be operated. The trailer hitch may be used when the plow is upright.

The modified Willys plow, which is the same as the modified Jeep plow except for the greater width of the turf knives, makes a fire line approximately 60 inches wide, with furrow bottom width of 20 to 21 inches and depth of 3½ to 4 inches. Most plowing is done with the plow in floating position, without pressure from the hydraulic pump.

The pump slip-on unit is mounted with a hydraulic cylinder (plow) unit, on a ½-inch mild steel plate (fig. 2). This entire assembly can be easily removed by pulling two hand pins which extend through the reinforced floor of the truck. The pump is chain drive, 3 speeds, from the rear power take-off. A ⅝-inch pitch roller chain drive is used. A short shaft with a universal joint and sprocket drive is mounted along-

side of and parallel to the hydraulic cylinder unit. A short channel bumper bar is bolted in place in the center of the rear bumper, giving full protection to the power take-off when the truck is put to other use.

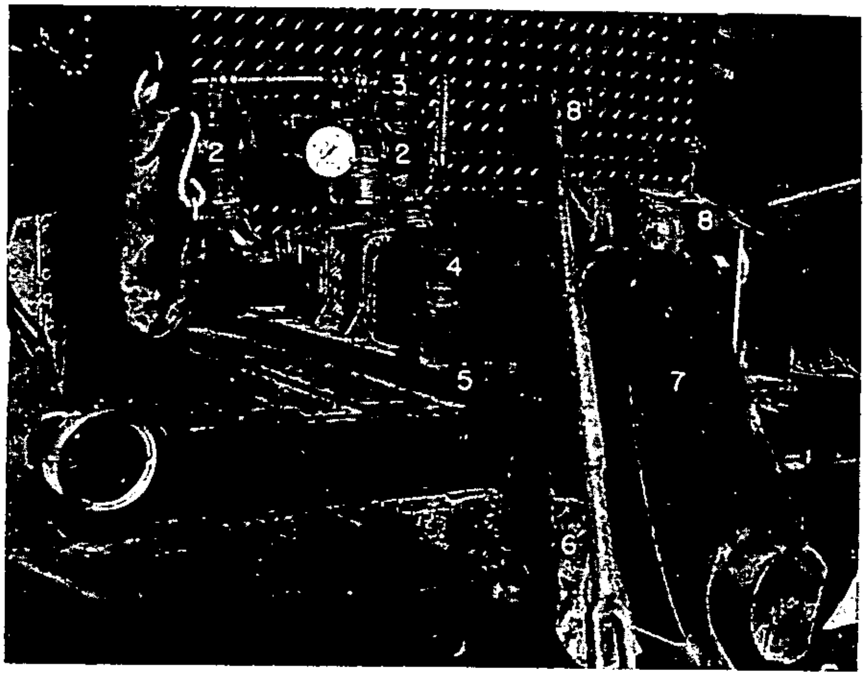


FIGURE 2.—Pump slip-on unit: (1) pump; (2) siamese valve; (3) automatic pressure valve; (4) drive shaft cover; (5) plate on which pump and hydraulic lift mechanism is mounted (fastened to bed of truck by 2 pins); (6) power take-off for lift mechanism; (7) roller chain drive cover; (8) lift mechanism.

Two valves, with handles pointing in the direction of the flow of water, and a pressure release valve that feeds the excess water back into the pump, are used in the pump unit. A cap is provided so that the unit can be operated as a stationary pumper using 1½-inch hose, and a second cap allows attachment of a suction hose. A slotted forestry type hose connection is provided between the tank and pump, and a 14-inch length of rubber suction hose is used to absorb vibration between the pump and tank. The tank outlet is equipped with a 1½-inch gate valve so the water can be contained when the pump unit is removed.

Adequate pump speed was determined for the lowest forward speed (low-low), and more than enough water is provided. When used as a stationary pumper the pump can be run at three different gear shift speeds (low-low, intermediate-low, and high-low), so the engine can be run at a relatively low speed while the pump operates at a high speed. The pump will deliver 50 gallons per minute free flow and 23.7 gallons per minute at 150 pounds per square inch pressure. Flow can be reduced with small nozzle to 3 gallons per minute at 200 pounds pressure, with the excess water bypassed back to the pump. The pistol grip type gun used

with this unit has an easily operated single trigger control with locking device that gives complete quick shutoff to fog, spray cone, or straight stream. Five sizes of nozzles are provided to give a choice for light or heavy (slash) fuels, the largest size being ¼ inch or 20 gallons per minute and the smallest 3/32 inch or 5 gallons per minute. Control of fog, any width of cone spray, or straight stream of water is excellent, regardless of size tip used. No wrenches are required to change tips, and extra tips can be carried in a clip on the gun.

The slip-on unit can be removed or replaced without the use of any special tools or equipment and a complete change-over would ordinarily take less than 10 minutes.

The hydraulic plow lift and power take-off pump controls in the cab do not interfere with the normal operation of the truck when the plow and pump units are removed. The manipulation of the controls with the plow or pump removed causes no damage. The heavy armor of the fenders and sides and the front and rear bumpers does not interfere in any way with the normal use of the truck. It gives added protection for year-round use. A post-hole digger or other power belt attachments can be used with the hydraulic unit with or without the water tank or pump in place. The plow can be easily removed and a tree scalper or other attachment installed quickly.

Net weight of all equipment and full water load is 3,005 pounds; net weight of truck is 3,235 pounds; drawbar draft power for S-low gear (1 to 6 m.p.h.) is 3,240 pounds; drawbar required for plow is 800 to 1,200 pounds on the average. Five horsepower is required for pump at 150 pounds pressure.

The 1-ton unit handles the larger plow easily and most times without effort. Passengers riding in the cab usually cannot tell whether the plow is up or down. Tests indicate safe speeds, fully loaded, of 50 m.p.h. on highways, 40 m.p.h., on gravel roads, 25 m.p.h. on side roads and ways, and 6 to 15 m.p.h. in open field travel. Climb ability in grass sod and brush extends to 50-percent slope, and plowing to 32-percent slope. These tests were made with the 9:00x13:00 tires at 26 pounds pressure.

This truck with the new "F" head engine and flotation tires, and its all-steel cab, wide comfortable seat, good visibility, inside and outside rear-view mirrors, and heater and defroster, has a utility value for off-the-road and cross-country use in winter as well as in summer that is not equalled in any other unit. The truck rides comfortably, handles easily, and is reasonably economical to operate.

The rear channel bumper extends to the lower end of the rear fender, and has a piece of floor plate flush with the top of the bumper extending in to the body of the truck. This serves as a step plate and also as a mounting for the back-pack pump as well as affording protection and extra strength. The center portion of the bumper is removable to accommodate the plow unit. The bumper extends about 8 inches in the rear of the truck body to give protection while backing up. A brush guard is provided on the front end and 1-inch pipes extend from the outer ends of the front bumper to the ends of the front fender armor.

The tank is constructed of 16-gauge mild steel four-way floor plate and has angle-iron reinforcements in all corners and one set of baffle plates

run each way. Inside of tank is treated to prevent rust. Top cover is fastened with brass screws and can be removed to recoat or clean tank. The factory mounted gasoline tank was so low that debris and stumps damaged it, and there was also danger of puncture while on fire line. It was replaced by a special heavy-duty tank.

The larger tires and wheels appear to be a good investment if the truck is to be used for plowing and for extensive cross-country travel.

Rain That Does Not Affect Fires

Rain during the fire season is a blessing, but a blessing whose magnitude can easily be overestimated. Many a smokechaser has become soaked while traveling through open country and thereby lulled into a false sense of security, only to be rudely awakened by the enthusiastic behavior of a fire which apparently hadn't heard about the rain. The reason is that quite a lot of our precipitation never reaches the ground.

Data presented by Joseph Kittredge in his book "Forest Influences" show that the forest types of the northern Rocky Mountains intercept 8 to 43 percent of the total precipitation during the growing season. Interception varies inversely as the amount of precipitation in each storm. Showers of up to 0.04 inch may be completely intercepted by an unbroken forest canopy, while 55 to 75 percent of a 0.20-inch rain will probably reach the ground.

The importance of interception to fire control in Region 1 becomes apparent from analysis of precipitation per shower during July and August 1950. During this exceptionally wet summer, 26 percent of all showers brought 0.01 inch of rain or less, 47 percent 0.05 inch or less, 60 percent 0.10 or less. Thus it appears that about one shower in every three produces too little rain to reach the fuels beneath a heavy canopy. Indications are that perhaps another third of the summer storms do not get enough rain through the canopy to moisten fuels significantly.

Thus after a summer rain the normal order of fire behavior will usually be reversed for a time, with fires in green timber more active than those in burns and logged-off areas. And at such times the behavior of fires in the timber has a good chance of surprising firegoers, dispatchers, and unwary overhead.—DIVISION OF FIRE RESEARCH, *Northern Rocky Mountain Forest and Range Experiment Station.*

BLANKET BAGGER

Leon R. Thomas

Supervisor, Mendocino National Forest

A simply, efficient labor- and time-saving device for placing blankets in standard 10-blanket paper bags has been developed by Warehouseman Russell Burton of the Sequoia National Forest.

The device consists of a table 30 inches high with a top 26 by 24 inches and an angled bag holder 24 by 48 inches with a foot board (fig. 1). An old tatum is attached to the angle board so that the top lifts up and permits the paper sack to be clamped in the tatum jaws. The top is then turned down inside the bag and the blankets slide over it without pulling out the bag.

A piece of strip metal is attached to the table and part of an old clamp board is fastened to the top of the strip. This holds the upper part of the paper bag. The clamp on the metal strip is 1 foot from the table.

One man with the bagger can operate faster and more efficiently than two men without it.

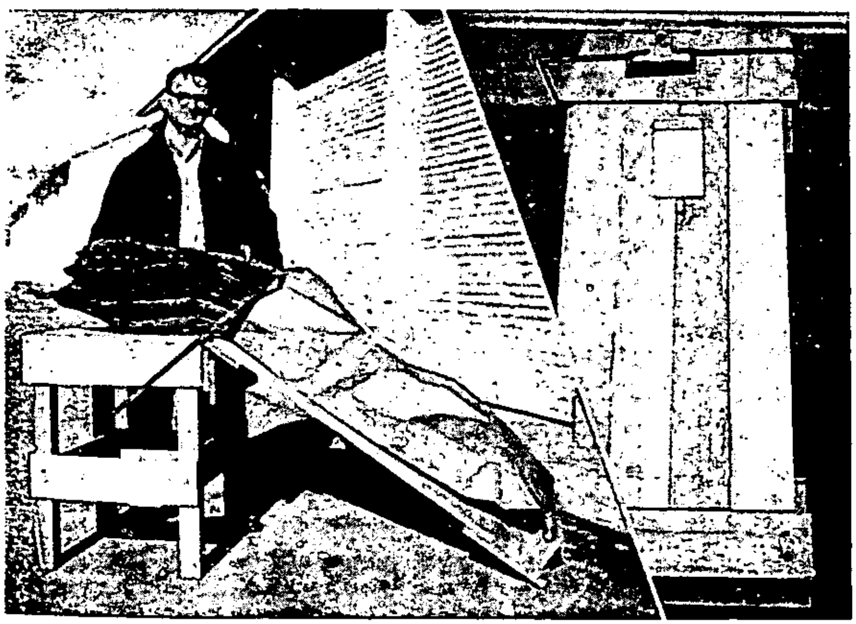


Figure 1.—Blanket bagger: *Left,* Warehouseman Burton operating bagger; *Right,* arrangement of tatum and metal strip with clamp.

FROZEN PREPARED MEALS

LEON R. THOMAS

Supervisor, Mendocino National Forest

Complete prepared frozen meals, as now extensively used by the commercial continental and intercontinental airlines and branches of the armed forces, are well adapted to many Forest Service activities.

The basic meals consist of meat or fish, potatoes or rice, and a vegetable, placed in an aluminum or tinfoil plate and covered with a sheet of foil then quick frozen. Some companies pack the basic meal with bread, butter, a drink, salad and dessert, and disposable eating utensils to make a complete one meal unit. Other companies just pack the basic meal and the latter items must be added to round out the meal. Breakfast units are similarly prepared and packaged. They consist of eggs with bacon or ham, fruit and variable items.

The Sequoia National Forest experimented in the use of sixteen different individual types of meals during the summer of 1950. They were used in such activities as feeding men in fire camps and on the fire line to week long pack trips in the "back country." The results were very good in all cases. The types found most suitable to our needs were the basic plates of chopped beef, beef stew, pot roasts, swiss steak, roast turkey, chicken, and the egg and bacon breakfasts.

The meals must be handled and cared for in the same manner as all quick frozen products now carried in nearly all grocery stores. Dri-ice refrigeration can be used for transporting the meals and for packaging in sealed cartons for later use under field storage conditions.

Methods of heating the meals offer no complications. Almost any type heat can be used such as kitchen stoves (ovens or on top), gas field range or oven, open fire, covered campground stove or ice can stove, on top of and buried in a bed of coals, or special stoves distributed by the frozen food companies.

A few important advantages of the meals are:

1. Sanitary. They are packed under strict supervision and the bacteria count is very low. They do not spoil quickly after thawing. There is no chance for contamination until the cover is removed for actual eating.

2. Excellent quality and good quantity. The meals are of excellent quality and taste. Only the best of raw products are used. There are 11 ounces or more of eatable food in each basic meal. This, supplemented with bread, drink, salad, and dessert, is sufficient for the average man. For those who may want more, a few extra meals can be put in and divided up.

3. No waste. All of the food is eatable. There is no waste in preparation and little of the prepared food will be wasted.

4. No cooks needed. Professional cooks are not needed. Most anyone can heat the meals after a little experience.

5. Ease of handling. The units are light in weight, compact, and very easy to handle and store.

6. Nothing to retrieve. Everything is disposable—nothing to wash, nothing to retrieve. This is a most important factor in on-the-line use and in back country fires.

7. Stored for immediate needs. The meals are always ready—no cooking preparation needed. They can be transported where desired and made ready to eat in a minimum of time.

8. Less cost. Frozen meals can be purchased, stored, and made ready for use cheaper than meals prepared in present conventional fire camp methods.

9. Saving of manpower behind the line. Fewer men needed in service and camp jobs.

10. Delivered hot if desirable. The meals can be heated in a base camp and delivered to the line preheated, where transportation methods permit.

11. Keeps men on the line. The convenience and ease of handling makes it much more possible to keep men on the line, *where they are needed,* by serving them with frozen prepared meals by helicopter, cargo plane, truck, or mule train.

The meals are recommended for use in all types of administrative operations requiring road crews, construction crews, established camps, and the like. They are particularly recommended for use on the fire lines and in small fire camps where it is desirable that men *stay on the line.* They are excellently adapted for delivery by parachute and by helicopter.

Several forests in Region 5 are planning to use frozen prepared meals this year. Caution is urged in undertaking their use for the first time. New techniques and procedures are required. It is suggested you learn these before undertaking a large scale project.

Reference to companies supplying the frozen meals can be found in various frozen food journals, or secured from the Operation Division, U. S. Forest Service, 630 Sansome Street, San Francisco 11, Calif.

USE OF AIRCRAFT FOR FOREST FIRE DETECTION IN WEST VIRGINIA

A. E. FRANCE

Pilot, West Virginia Conservation Commission

The Conservation Commission of West Virginia has used an airplane in forest fire detection for the past 3 years. During this period the airplane has been flown more than one thousand hours. Six hundred and fifty hours was flown on fire patrol; the remainder was used for executive transportation, beaver dam survey, deer census, aerial photography, patrolling closed streams, and in fire control demonstrations for school children, 4-H Clubs, and Boy Scouts. In this 3-year period West Virginia had 3,498 forest fires reported. Of this number about 700 fires were reported by the pilot, making an average of more than one fire per hour flown.

On days of low visibility observation from towers is restricted to a few miles. Under such conditions the airplane patrols the area between the towers to give complete coverage. Visibility on many of our areas is poor because of smoke from many industrial plants and burning slag piles. When no wind is blowing a haze develops in the valleys and extends upward above the fire towers. The airplane can fly above this haze and spot fires that tower observers cannot possibly see.

A good example of this occurred one day in November 1948. There had been no wind for 24 hours and it was very hazy in the southern counties, making detection of fires by the towers difficult. While on patrol that afternoon the pilot spotted nine fires which would normally have been observed by the towermen.

There are times when a tower has a reading on a fire but is unable to get a cross-check from another tower. In some cases a smoke will drift a few miles in the hollow before rising. This makes it difficult for the towerman to give the exact location of the fire. The airplane is then used to locate the fire and help the suppression crew or smokechaser get to it without too much delay. Sometimes the smoke is from a legal burning, a condition which often cannot be determined from a tower. If this is the case, a determination from the air can save the forest protector a needless trip. Also, if the smoke happens to be from another source, such as brush burning or right-of-way burning, the forest protector can be notified and he can change his plan of action to suit the situation.

The airplane is very helpful in determining the size of a fire. While over the fire the pilot can relay information to the station or suppression crew concerning the terrain and whether the fire is burning slow or fast. He can also advise if it is possible to get to the fire by truck, car, or jeep, and if there are any barriers, such as pipe-line rights-of-way, strip mines, or streams, which may help in suppression of the fire.

A system of triangulation similar to that used by the fire towers has

proved effective in giving a more exact location of fires. Briefly, this is done by flying a compass heading from two known towns or locations, and at the point where the two lines intersect is the location of the fire. Best results come from a fix from two points that will give a 90° angle.

These uses indicate the value of the airplane in fire detection, but there are some disadvantages. It is difficult to locate fires accurately after dark, and flying single engine airplanes at night in mountainous terrain is not safe practice. A second disadvantage is that the airplane cannot safely be flown on days when the wind velocity is high. Both of these disadvantages could be partially eliminated with a small twin engine airplane but as yet there has not been an airplane built to meet this need.

Periods of high wind velocity are not frequent. We experienced extremely high winds for one 9-hour period on March 27, 1950. That day, we had 191 fires reported. These fires burned over twenty thousand acres in the 9-hour period. At 11:00 o'clock the pilot took off on fire patrol with a wind blowing from the south at about 20 miles per hour. By 12:10 the pilot had reported 14 fires in 2 counties and the air had become so turbulent that he could hardly hold his map, much less run an accurate fix on the fire. When he landed, the wind was gusting to 55 miles per hour. Later, weather stations recorded wind velocities as high as 72 m.p.h.

The West Virginia Commission's Stinson airplane is equipped with a radio and public address loud-speaker that is very effective from an altitude of 2,000 feet. This speaker is mounted in the right rear seat where a 12-inch diameter hole has been cut to emit the signal. The hole can also be used for aerial photography and for dropping of small parcels by parachute. It takes about 10 minutes to install or remove this speaker. With the speaker, the plane can carry three passengers. When the speaker is removed a plywood board is fixed over the hole and a metal plate is installed under the fuselage to smooth up the airflow.

Power output of the public address speaker is 50 watts, which is plenty without too much drain on the battery (fig. 1). Speeches should be short and well planned to cut down the drain on the battery and because time is limited over the area due to the speaker being mounted vertically in the airplane. Some speakers are mounted at an angle so that the address can be centered over one spot while the airplane circles the area. Both systems are good. With the vertical type best results can be obtained by flying upwind at reduced power and speed with flaps down. This gives a longer period over the area and the signal is forced downward by the flaps.

The speaker has been very effective in the control of brush burning. When a farmer is burning his brush too near the forest the pilot can warn him of the danger, and he usually puts the fire out. On many occasions the pilot gives locations of fires to local protectors when the county forest protector is engaged with other fires in his county. Another use of the loud-speaker is to give directions on going fires, especially when they are larger than usual and in rugged terrain.

The airplane also has a two-way radio operating on a frequency of 31.98 megacycles (figs. 2 and 3). This radio, designed for the Greyhound Bus Company, was purchased because it worked on a 12-volt system as does the airplane. The heavy base plates were removed and replaced by aluminum to lighten its weight considerably.

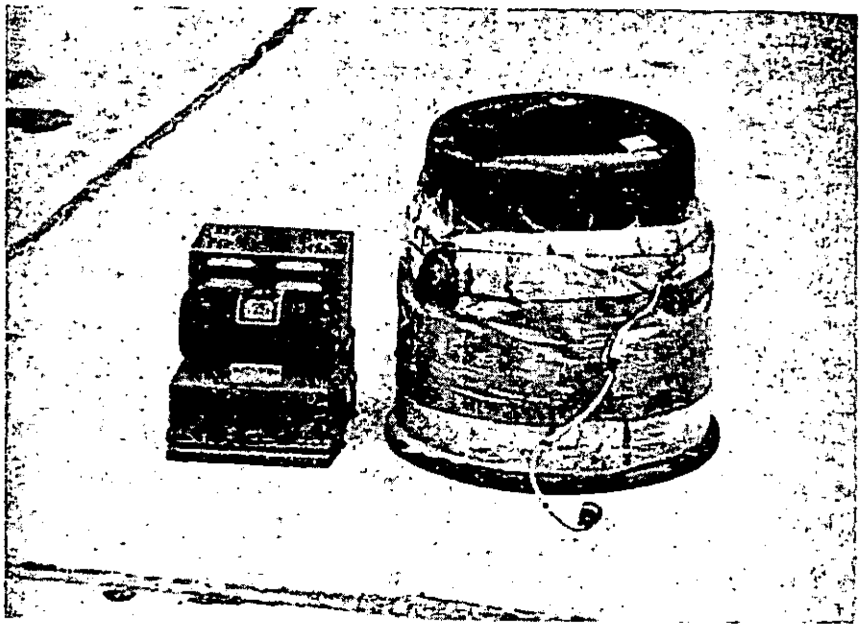


Figure 1.—Loud-speaker and 50-watt power supply.

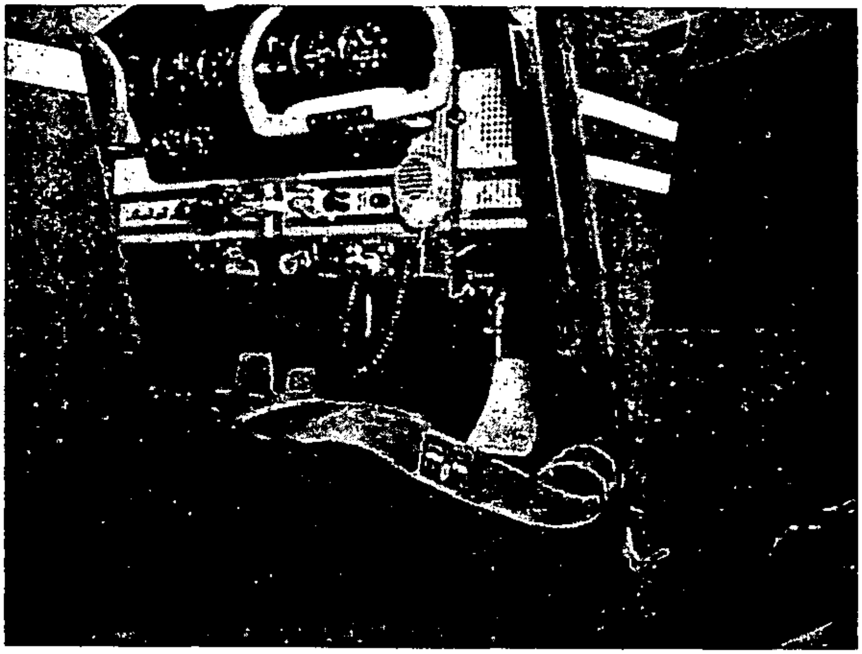


Figure 2.—Control head and microphone for FM radio mounted on instrument panel.

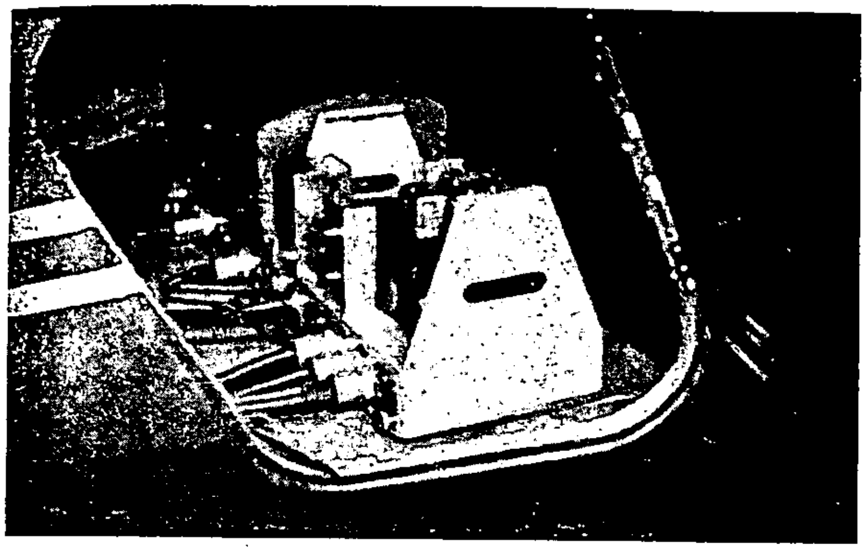


FIGURE 3.—FM radio installed in baggage compartment of airplane.

This radio provides the pilot communication with 154 other radio units. Of these units 110 are mobile, 5 are at district headquarters, and the rest are in fire towers.

It is not intended that airplanes will replace fire towers, but they will be used as aids to the towers and for patrolling our Ohio River drainage which is not covered by fire towers. Airplanes will also be used to detect fires during the winter months when the fire towers are not manned and the weather becomes mild enough for forest fires. The past two winters were very mild in West Virginia, and we had a number of fires in the southern counties. Covering this large area was quite a task for our one airplane.

It has been very difficult to determine the cost per fire for aerial detection. The Commission's airplane has cost about 5 dollars per hour to operate. This includes gas, oil, and maintenance. Hangar rent is not included because this is given to the State by the Kanawha County Court, which owns and operates the airport. The pilot does most of the maintenance, except major overhauls and relicensing of plane each year. The only way we have determined the cost per fire spotted is by adding the number of fires and illegal brush burnings reported and dividing this total into the cost of operation of the airplane.

The area covered by the airplane is also hard to determine for a number of reasons. If the pilot flies at an altitude of 6,000 or 7,000 feet above the terrain and the visibility is fair to good, he can spot a fire in a radius of 20 to 25 miles. Under these conditions and at a speed of 110 m.p.h., the airplane can cover a large area in an hour's time. Flying at higher altitudes is impractical because much of the time is spent climbing and descending to run fixes on the fires and to use the loud-speaker. Also the pilot has to be at a low altitude to help the radio car or truck find the fire, and to

report road conditions and any other information which may help in suppressing the fire.

The number of fires in a day's patrol also has a great deal to do with the amount of coverage. On days when many smokes are being seen the area covered is materially reduced because some time has to be devoted to each fire. For example, on one day of patrolling with a large number of smokes to investigate, the pilot covered 10 counties in 6 hours as compared to 25 counties in 6 hours on another day when only three fires were seen. The amount of coverage per hour can be increased by using a faster plane, which can still fly slow enough to use a loud-speaker efficiently, and also by the pilot becoming better acquainted with the area patrolled, thereby cutting down the time for running fixes.

Determining the coverage is still a problem for which we would appreciate any information or suggestions. The pilot has tried using a planned patrol. This works all right on days of few or no fires, but does not when a large number of smokes are being seen. More airplanes each covering a smaller area would probably be the answer.

We have only had an airplane on forest fire detection for the past 3 years, but are utilizing it more all the time. Any suggestions as to better or more efficient use of airplanes in this phase of forestry will be welcomed by the Conservation Commission of West Virginia, Division of Forestry, Charleston 5, W. Va.

Vibration of Plane Struts Dangerous

Fastening loud speakers to airplane wing struts may set up vibration of sufficient intensity to prove dangerous. The tendency of prolonged vibration to cause crystalization of metal is well known and since wing struts are designed in accordance with the capacity of specific metals to withstand tension, any change in a metal which would change its strength might result in failure.

The installation shown in the photograph was test flown by engineers of the C.A.A. and found to vibrate dangerously at all flying speeds, power on and power off.

As an alternative, the speaker was installed inside the fuselage immediately aft of the rear seat. The rim of the speaker is flush with the bottom of the fuselage and set at an angle which points the instrument at a spot on the ground around which the plane is flown while a message is being transmitted. This installation was approved by C.A.A.—O. A. ALDERMAN, *State Forester, Ohio Department of Natural Resources.*

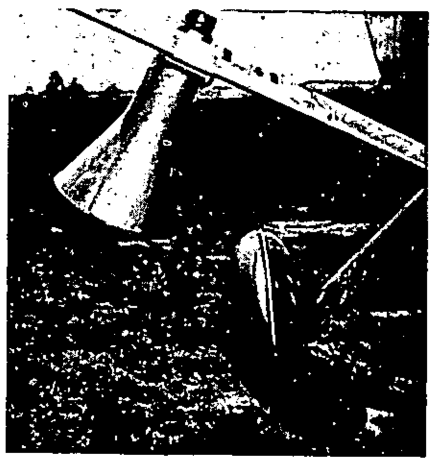


FIGURE 1.—Loud speaker fastened to wing strut of Stinson 150 Voyager.

INFORMATION FOR CONTRIBUTORS

It is requested that all contributions be submitted in duplicate, typed double space, and with no paragraphs breaking over to the next page.

The title of the article should be typed in capitals at the top of the first page, and immediately underneath it should appear the author's name, position, and unit.

Any introductory or explanatory information should not be included in the body of the article, but should be stated in the letter of transmittal.

Illustrations, whether drawings or photographs, should have clear detail and tell a story. Only glossy prints are acceptable. Legends for illustrations should be typed in the manuscript immediately following the paragraph in which the illustration is first mentioned, the legend being separated from the text by lines both above and below. Illustrations should be labeled "figures" and numbered consecutively. All diagrams should be drawn with the type page proportions in mind, and lettered so as to permit reduction. In mailing, illustrations should be placed between cardboards held together with rubber bands. *Paper clips should never be used.*

When Forest Service photographs are submitted, the negative number should be indicated with the legend to aid in later identification of the illustrations. When pictures do not carry Forest Service numbers, the source of the picture should be given, so that the negative may be located if it is desired.

India ink line drawings will reproduce properly, but no prints (black-line prints or blueprints) will give clear reproduction. Please therefore submit well-drawn tracings instead of prints.