Aerial Fire Protection in Forestry
by
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>Pilot Administration - Diagram &quot;A&quot;</td>
<td>3</td>
</tr>
<tr>
<td>Diagram &quot;B&quot;</td>
<td>4</td>
</tr>
<tr>
<td>II. LOCATION OF AERIAL FIRE PROTECTION UNITS</td>
<td>5</td>
</tr>
<tr>
<td>III. DEVELOPMENT OF AN AERIAL FIRE CONTROL SYSTEM</td>
<td>7</td>
</tr>
<tr>
<td>IV. UTILIZATION OF DIFFERENT TYPES OF AIRCRAFT</td>
<td>8</td>
</tr>
<tr>
<td>Forest Service C-64 and L-5 Fire Protection Planes Standing By for Action</td>
<td>9</td>
</tr>
<tr>
<td>Typical Terrain which Fire Protection Units Cover</td>
<td>9</td>
</tr>
<tr>
<td>United States Forest Service Fire Protection Aircraft: C-64, Noorduyn Smoke Jumping and Cargo Plane</td>
<td>12</td>
</tr>
<tr>
<td>L-5 Consolidated-Vultee Reconnaissance Plane</td>
<td>12</td>
</tr>
<tr>
<td>V. CARGO DROPPING</td>
<td>13</td>
</tr>
<tr>
<td>Dispatcher</td>
<td>14</td>
</tr>
<tr>
<td>Packers</td>
<td>14</td>
</tr>
<tr>
<td>Checker</td>
<td>14</td>
</tr>
<tr>
<td>Pilot</td>
<td>14</td>
</tr>
<tr>
<td>Dropper</td>
<td>15</td>
</tr>
<tr>
<td>Cargo Parachutes</td>
<td>15</td>
</tr>
<tr>
<td>Burlap Parachute</td>
<td>15</td>
</tr>
<tr>
<td>A Panel Signal which is used in signaling aircraft after the smokejumper reaches the fire. This &quot;T&quot; signal means 'Drop A Cross Cut Saw'</td>
<td>16</td>
</tr>
<tr>
<td>A message dropper and a test drift chute</td>
<td>16</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Converted Man-Parachute</td>
<td>17</td>
</tr>
<tr>
<td>Army Bomb Parachute</td>
<td>17</td>
</tr>
<tr>
<td>Cargo Containers</td>
<td>17</td>
</tr>
<tr>
<td>The Steps in Rolling A Burlap Cargo Dropping Chute</td>
<td>18</td>
</tr>
<tr>
<td>Cargo Containers and Methods of Packaging Cargo For Dropping</td>
<td>20</td>
</tr>
<tr>
<td>VI. THE SMOKEJUMPER</td>
<td>24</td>
</tr>
<tr>
<td>Smokejumper Training</td>
<td>24</td>
</tr>
<tr>
<td>Smokejumper Training Requirements, Facilities</td>
<td>24</td>
</tr>
<tr>
<td>A Smokejumper in full suit</td>
<td>25</td>
</tr>
<tr>
<td>Rolling the Burlap Cargo Dropping Chute</td>
<td>25</td>
</tr>
<tr>
<td>Equipment</td>
<td>26</td>
</tr>
<tr>
<td>Personnel</td>
<td>26</td>
</tr>
<tr>
<td>Planes and Pilots</td>
<td>26</td>
</tr>
<tr>
<td>Ground Training</td>
<td>26</td>
</tr>
<tr>
<td>&quot;Smoke Jumpers&quot; - Two Smoke Jumpers Ready to Board An Aircraft in Full Jump Suits</td>
<td>27</td>
</tr>
<tr>
<td>Help is Required to Get into A Jump Suit. Jump Foreman Makes Final Check-up on Equipment</td>
<td>27</td>
</tr>
<tr>
<td>A. Obstacle Course and Calisthenics</td>
<td>28</td>
</tr>
<tr>
<td>B. Tower Jump</td>
<td>28</td>
</tr>
<tr>
<td>C. Letdown</td>
<td>29</td>
</tr>
<tr>
<td>D. Mockup</td>
<td>29</td>
</tr>
<tr>
<td>Jump Training</td>
<td>29</td>
</tr>
<tr>
<td>Fire Training</td>
<td>30</td>
</tr>
<tr>
<td>Radio Training</td>
<td>30</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>First Aid Training</td>
<td>30</td>
</tr>
<tr>
<td>VII. THE FOREST SERVICE PILOT</td>
<td>31</td>
</tr>
<tr>
<td>Maintenance and Protection of Airplanes</td>
<td>31</td>
</tr>
<tr>
<td>Safety Precautions in Flying</td>
<td>32</td>
</tr>
<tr>
<td>Form Reports</td>
<td>33</td>
</tr>
<tr>
<td>Form R6-F17 - Flight Plan</td>
<td>35</td>
</tr>
<tr>
<td>Form R6-F22 - Daily Aircraft Flight Report</td>
<td>36</td>
</tr>
<tr>
<td>Form R6-F23 - Airplane Operation Report</td>
<td>37</td>
</tr>
<tr>
<td>Special Instructions for the Use of Airplanes</td>
<td>38</td>
</tr>
<tr>
<td>U. S. Forest Service Airplane Pilot Qualifications</td>
<td>45</td>
</tr>
<tr>
<td>General Experience</td>
<td>45</td>
</tr>
<tr>
<td>Total Flying Time (hours) Points per 100 Hours</td>
<td>45</td>
</tr>
<tr>
<td>Years of Experience</td>
<td>45</td>
</tr>
<tr>
<td>Experience by Type of Aircraft</td>
<td>45</td>
</tr>
<tr>
<td>Miscellaneous Experience</td>
<td>46</td>
</tr>
<tr>
<td>Specific Experience</td>
<td>46</td>
</tr>
<tr>
<td>Specific Requirements</td>
<td>46</td>
</tr>
<tr>
<td>Search Pilot, CAF-7</td>
<td>46</td>
</tr>
<tr>
<td>Pilot, CAF-9</td>
<td>47</td>
</tr>
<tr>
<td>First Pilot, CAF-11</td>
<td>47</td>
</tr>
<tr>
<td>Chief Pilot, CAF-12</td>
<td>47</td>
</tr>
<tr>
<td>Job Classification</td>
<td>48</td>
</tr>
<tr>
<td>Search Pilot, CAF-7</td>
<td>48</td>
</tr>
<tr>
<td>Pilot, CAF-9</td>
<td>48</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>First Pilot, CAF-11</td>
<td>48</td>
</tr>
<tr>
<td>Chief Pilot, CAF-12</td>
<td>48</td>
</tr>
<tr>
<td>VIII. COST ANALYSIS OF AN AERIAL UNIT</td>
<td>49</td>
</tr>
<tr>
<td>Administration Overhead</td>
<td>50</td>
</tr>
<tr>
<td>IX. THE FUTURE OF AERIAL FIRE PROTECTION</td>
<td>51</td>
</tr>
<tr>
<td>The Helicopter</td>
<td>51</td>
</tr>
<tr>
<td>Cargo and Liaison Planes in the Future</td>
<td>52</td>
</tr>
<tr>
<td>The Missoula, Montana Experiment</td>
<td>52</td>
</tr>
<tr>
<td>Conclusions</td>
<td>55</td>
</tr>
<tr>
<td>A U. S. Air Force F-47 Dropping a Water Bomb on a Forest Fire</td>
<td>56</td>
</tr>
<tr>
<td>A 165-Gallon Water Bomb</td>
<td>57</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>58</td>
</tr>
</tbody>
</table>
I. INTRODUCTION

Aerial fire protection is as revolutionary in the field of forestry as the atomic bomb is in the field of science. The old methods of fire control are being replaced by the newer, more modern, and more efficient methods.

In the last ten years, aerial fire protection has been steadily advancing and each year adds to its proficiency. Its importance has been recognized by both the U. S. Forest Service and the State Forest Service. Although aerial fire protection is still in an experimental stage, past progress has proven that thousands of dollars can be saved annually with the perfection of aerial fire control. At the present, no course is offered in this field at this school. However, it is the writer's belief that such a course should be added, and no doubt it will be, since it is imperative that future foresters acquaint themselves with the newest and most efficient modern methods of fire fighting and protection, and not become stalemated with old ideas and customs.

This paper will give a brief resume of the aerial fire protection system now in operation in Region 6. The information for this thesis was compiled from actual experience during the three months fire season, 1947, as aerial pilot for the U. S. Forest Service in the Wallowa National Forest, Region 6, Oregon, and from specific data from the U. S. Forest Service documents.

The administration of an aerial fire protection system is similar to any other forest service branch. The Regional Forester is the head, and the direct administration is done by the forest service
officer in charge of fire control. Directly under him is the chief pilot
and the supervisor of the regional parachute unit. During the fire
season when the crews are in the field, they are under direct control of
the forest supervisor, unless the unit is detailed to one district, in
which case, the ranger is in charge.

The whole aerial system is divided into three principal subdivi-
sions; namely, the smokejumpers, pilots and aircraft. A schematic
diagram (diagram "A"), the pilot administration, is shown on the following
page. These organizational outlines are variable and no two are exactly
the same. Diagram "B" shows the administration of the smokejumpers. (2)

The Forest Service aerial fire protection system is expanding
yearly with new methods of combating fires. Many hours of office com-
putations and fire control study have gone into the development of the
aerial system. Fire detection is a phase of protection that must be
developed in the office and regulated by appropriations.

The cargo dropping and smokejumping system are closely co-
ordinated, and both are suppression measures that cannot by predetermined,
but must be regulated in the field whenever an emergency arises. A
study of the summer fire records are the basis for wintertime development
of the next summer's aerial system.
PILOT ADMINISTRATION

Regional Forester

Regional Fire Control Officer

Chief Pilot

Pilots

Mechanics

Forest Supervisor

Administrative Assistant

District Ranger

Pilots

DIAGRAM "A"
Diagram "B"
II. LOCATION OF AERIAL FIRE PROTECTION UNITS

The location of aerial units vary, depending upon such factors as allotted funds, accessibility to areas, how controlled, etc. But the main and most influential factor in most cases is travel time; whether or not time can be saved by using an aerial unit. This is determined by comparing how much time is required to get men to a fire area by truck, horseback or on foot, whichever the case may be, depending on the terrain of the area. Aerial protection is most advantageous in remote, inaccessible areas. At present there are three such areas in the northwest that have an aerial fire protection unit at each during the fire season. They are the Chelan, Wallowa and Siskiyou units.

The Chelan unit is located in the Chelan National Forest near Okinogan, Washington. The unit consists of the following aerial personnel and aircraft:

- 2 pilots
- 30 smokejumpers and trainers
- 1 liaison plane
- 1 transport plane

The Wallowa unit is located at Joseph, Oregon, during the first part of the fire season, then is later transferred to the main operational base at Memaloose, Oregon, a field situated overlooking Hell's Canyon on the Snake River, at a field elevation of seven thousand (7,000) feet. Last fire season this unit consisted of the following:
2 pilots
7 smokejumpers
1 liaison plane
1 transport plane

The Siskiyou unit is located at Cave Junction, Oregon, and is under the control of the Siskiyou Regional Forest. During the last fire season it had the following aerial personnel and aircraft:

3 pilots
29 smokejumpers
1 liaison plane
2 transport planes

The headquarters unit operates the year round. It is located at the Portland municipal airport, Portland, Oregon. This unit employs a chief pilot and two mechanics. Their duty is the maintenance of all the aircraft. The forest service hanger is a disbanded army hanger of eight-plane capacity with planes being stored there in the winter and readied for the subsequent fire season. The Portland headquarters unit compiles all records and flying data of all the aerial units during the fire season. (3)
III. DEVELOPMENT OF AN AERIAL
FIRE CONTROL SYSTEM

The distance to the fire, the accessibility of the area by various methods and the time element must be taken into consideration to develop a fire control unit.

The distance to the fire is directly related to the time involved in getting men to a fire area in the initial attack. Experience has proven that the initial attack is the most important element of fire control, as the longer a fire burns, the harder it is to control. Time is wasted with the hours spent in getting men to the fire area in a rugged mountainous area by transporting them on horseback and often on foot; whereas, if men and equipment are dropped into the fire zone by plane, acres of valuable timber, etc., can be saved.

In setting up an aerial fire control plan, the area is layed out in such a manner that it will give ground suppression crews the sectors that can be quickly reached by trucks, and to give the inaccessible parts to the smokejumper outfit. In some cases, such as the Chelan National Forest smokejumpers, the air crew is dispatched to a fire within a short distance from headquarters. Thus, when the ground crew arrives, the fire is easily suppressed and the smokejumpers are soon transported back to their field headquarters.
IV. UTILIZATION OF DIFFERENT TYPES OF AIRCRAFT

The C-61+, Noordyne transport plane is used principally for transporting cargo and the smokejumpers. It is a seven passenger, high-winged monoplane with a six hundred and fifty (650) horsepower Pratt & Whitney radial engine. This ship has flight characteristics that are highly favorable for forest service aerial protection. Its cargo capacity on a two hour flight is one thousand (1,000) to one thousand, five hundred (1,500) pounds, depending upon the field elevation. It has space enough for three smokejumpers, jump foreman and full equipment necessary for the initial attack. A special door has been built in on the right hand side of the fuselage to facilitate a better and safer jumping exit.

This plane has been very successful for cargo dropping. A special trap door has been built in the bottom of the fuselage to expedite dropping. (This phase of the aptitude of the Noordyne is covered more fully further in the report.)

Due to its high operating cost, forty dollars ($40.00) per hour, and the necessity of having it ready in case of fire, this plane is rarely used for patrolling for fires except in extreme emergencies.

A second type of aircraft is the L-5, a small, two passenger, Vultee liaison plane. (The type used for artillery observation during World War II.) These planes have been very successful for patrol flying.
Forest Service C-61 and L-5
Fire Protection Planes Standing By for Action

Typical Terrain which Fire Protection Units Cover
This ship, in patrol duty, is used for a daily reconnaissance, the flight being over a route predetermined by the pilot, to cover the entire area in search of fire that might have been started by lightning strikes. After a lightning storm, the L-5 pilot is given information on the path of the storm. In the event that a fire is located from a patrol plane, its exact location is transmitted by radio to the field base and the transport plane and full crew are immediately dispatched to the scene of the fire.

The finding of a fire by a liaison plane, the dispatching of the smokejumpers by the transport plane, getting them on the fire without waste of valuable time are the most important aspects of aerial fire protection.

The L-5 is sometimes used for dropping small items such as messages or emergency rations. These are dropped by the observer who accompanies the pilot on all patrol flights. Since the duty of the observer is to plot all fires found, it is a great advantage to have an observer who is familiar with that particular locality. The location, usually given to the transport pilot, will be a more accurate mapping of the fire.

In areas not provided with forest service aircraft, private planes (contract planes) are hired. All charted ships must be covered by a Memorandum of Verbal Agreement for Airplane Rental. All rental agreements for aircraft of over two hundred (200) horsepower, or for more than three passengers, must be submitted to the Regional Forester for review by a technician and for advanced approval of the Division of Fire Control. No aircraft is allowed use until such approval is obtained. For aircraft less than two hundred (200) horse-
power, the charter plane application forms can be approved by the Forest Supervisor. (Only pilots who are listed and approved for that particular aircraft will be accepted as pilot by the forest service officer requisitioning a charted flight).

A contract plane must have a current Civil Aeronautics Authority certificate of air worthiness, and must have access to shop equipment for maintenance work.

During the fire season, the forest service planes are maintained by the pilots. However, in case of major repairs, one of the mechanics from the Portland headquarters unit is transported to the field to make such repairs.
C-64 Noorduyn Smoke Jumping and Cargo Plane

L-5 Consolidated-Vultee Reconnaissance Plane
V. CARGO DROPPING

Emergency transportation of supplies is one of the outstanding and most important uses of the aircraft in fire control. It should be recognized at the outset in organizing an aerial unit that the method of aerial delivery has its limitations, and that it cannot be depended upon to function at all times without failure. When flying conditions such as haze or smoke are bad, flying becomes too hazardous, and the airplane becomes useless in forwarding supplies. Whenever a fire camp setup is to be supplied by air, a surplus for such emergencies should be provided.

The use of aircraft has developed into a vital importance, especially in remote areas. Not only is it important, but is sometimes cheaper than overland transportation costs. In the past, supplies were delivered close as possible to the point of need by pack mules, but now they can be dropped from the airplane in the exact area where they are most needed, thus the time of delivery is greatly reduced. Whenever a fire is within fifteen or twenty miles of both aircraft and pack stock bases, provided that at least 50 per cent of the cargo chutes are returned, the cost of delivery is about the same for both methods. (5) The round trip for this distance, however, would take two days by pack stock, and forty-five minutes, or possibly less, by aircraft. Over a period of time it would be possible for an airplane carrying a load of one thousand (1,000) pounds to keep up with the work of seventy-five (75) pack animals. By plane, under the previously stated conditions, four tons could be delivered the first day. It would take forty horses to deliver the same amount the first day. In cases where the air
distance is much greater than the distance to be covered by the pack stock, or whenever the round trip can be made in one day with the pack animals, the comparative cost of aerial delivery increases often to twice as much, or even more, than the cost of packing over the trails. However, when there are no trails, the cost of packing is increased proportionally. (6)

The servicing of fire crews by airplane requires a highly developed, well trained, and efficient organization. On large fires a complete organization would consist of dispatcher, packers, chute men, checkers, drivers, pilots and droppers.

**Dispatcher**

The dispatcher should be a man who has had some experience in flying over mountains and who is a good judge of weather conditions, flying hazards, camp locations, and who is familiar with the technique of packing and dropping fire fighting equipment and supplies. He should check on the packing in general, see that flight records and load records are properly kept, and to carefully and efficiently dispatch the airplanes to eliminate unnecessary flights. (5)

**Packers**

There should be a foreman in immediate charge of the packing and chute making. Each bundle should be tagged and weighed and contents noted on each tag. (5)

**Checker**

The checker should add to each tag the number of the trip, the number of each bundle, and the number of bundles in the load. (5)

**Pilot**

The pilot is under no obligation to carry the quoted figures of load. He will determine the maximum safe load under prevailing
take-off and flying conditions. (5)

**Dropper**

The dropper should be a man who has been instructed how to pack and discharge bundles. When loading he should check up on the tying of each bundle. (5)

**Cargo Parachutes**

Several types of cargo parachutes have proved satisfactory for forest service use. They are:

(a) Burlap parachutes

(b) Converted man-parachutes

(c) Army bomb parachutes

These three types of parachutes will adequately serve the specific dropping needs of the forest service at very low costs. Other army parachutes will meet the requirements of the job but generally are more expensive. (7)

**Burlap Parachute**

Consider using burlap parachutes (fifty (50) and one hundred (100) foot square canopy) when: (7)

(1) Packages weigh less than seventy-five (75) pounds.

(2) Using small airplanes where pilot does dropping.

(3) Little or no recovery of parachutes is expected.

(4) In tall timber where target area is small.

(5) The need for reducing parachute drift is an important factor.
A Panel Signal which is used in signaling aircraft after the smoke jumper reaches the fire. This "T" signal means 'Drop A Cross Cut Saw'

A message dropper and a test drift chute
Converted Man-Parachute

Cargo parachutes made from condemned man-parachutes should receive consideration when: (7)

(1) A large size cargo dropping airplane is available.
(2) A dropper is employed to discharge the packages.
(3) Transportation of large quantities of supplies is involved.
(4) Salvage of parachutes is possible.

Army Bomb Parachute

The army bomb dropping parachute has a spread of thirty-eight (38) square feet and will lower loads weighing up to forty (40) pounds. It is constructed of nylon or silk and comes equipped with shroud lines. It opens fast and its performance is reliable. The bomb chute will serve the same purposes as the small burlap chutes. (7)

Cargo Containers

Cargo containers are invaluable to speed up preparation of cargo loads and to reduce loss resulting from faulty roping. Cargo containers most commonly used include: (7)

(a) Gunny sacks
(b) Burlap wool sacks
(c) Canvas bags
(d) Canvas cargo nets
(e) Cargo slings
(f) Mantas and burlap
(g) Cans and cardboard cartons
(h) Wooden boxes
The lines are tied to the chute corners by a tight square knot, the chute being considered as another line. Then lay the chute flat on the ground with lines clear.

1. Make a half hitch with knotted end of shroud line to lock the tie.
2. Two of the corners are brought together.
3. The folds are straightened and formed into a pocket to facilitate the opening of the chute.
4. The two sides are folded to the center and then folded again to the center to a width of 18 inches. If roll is less than 18" long, the chute will be too stubby, will fall too fast, and may not open.

The Steps in Rolling A Burlap Cargo Dropping Chute
The streamer is rolled up and tied to a line at one corner of the chute.

The chute is rolled up reasonably tight to form a cylinder approximately 22 inches in circumference or 7 inches in diameter. If the roll is made too long and loose, the ends will bend upward and prevent the roll from unwinding.

Before the lines are rolled up on the chute, they are straightened to lie without crossing. The lines should be rolled up snugly on the middle third of the roll in order to prevent any loop slipping off the end. A rubber band made from discarded inner tube and snapped across the lines will prevent loosening of loops until ready to drop.

When the lines are rolled up, a knot is tied in the four strands two feet from the ends.

The ends beyond the knot are tied to the bundle.

If the chute is flattened by the weight of other loads in the plane, it should be shaped before discharging.

When the bundle is discharged from the plane, a few feet of slack should be left between the load and chute if the load is bulky.
Cargo Containers And Methods of Packaging Cargo For Dropping
Cargo Containers And Methods of Packaging Cargo For Dropping
VI. THE SMOKEJUMPER

The Forest Service Smokejumper is an integral part of an aerial fire suppression team. It is his job to attack the fire at the earliest time possible after reaching the ground. The smokejumper must be well trained and versified in the field of smokejumping and fire suppression. When the smokejumper is not actually fighting fire, he is occupied by various work projects at an aerial fire suppression camp.

Smokejumper Training

Smokejumper training in its broadest sense, involves the integration of a number of courses into one intensive training session. The present scheme, which allows for three weeks or more at the training camp, includes all other necessary phases of training, together with the actual smokejumping training. This is done on a carefully scheduled basis which is designed to take advantage of all breaks in the weather, but provides a backlog of project work in the event of more than the anticipated delays. (2)

Smokejumper Training Requirements, Facilities

Training camps are equipped with adequate housing, mess facilities, classroom space, landing field with communications and equipment shelter, timber and open field jumping areas (preferably adjacent to the camp), parachute loft complete with packing tables and tools, inspection and drying well, storage space for all equipment, and machines and material for repair work. The parachute loft should have a minimum of three tables for forty men jumping each day, or four tables with eighty men alternating. (2)
A Smoke Jumper
In Full Suit

Rolling the Burlap
Cargo Dropping Chute
Equipment

Ground training areas include obstacle courses, jump towers, let down high-line, mockup cabins equipped with static line cables, benches and doorslip, jumping suit and accessories, back and chest pack parachutes, directional voice amplifier, climbing outfits, fire packs, loose fire tools, special fire equipment, lookout tower with fire-finder, communications equipment, trucks and pick-ups. (2)

Personnel

The personnel staff includes sufficient administrative officers to properly supervise and correlate jumps, for ground and fire suppression training, one trainer-squad-leader for each ten trainees, loft crew sufficient to handle packing and maintenance, special instructors, cooks, flunkies and truck drivers, according to the size of the job. (2)

Planes and Pilots

Usually one pilot flies each day of jump training. Two can be used simultaneously on the same field when necessary to make up for lost time, by carefully scheduled flights.

Ground Training

Ground training is usually one week to ten days. Trainees are first assembled for a general lecture by the chief instructor, on parachutes and their operations. Men are familiarized with terms and methods used and are given a brief history of the parachute. Trainees are then divided into ten-men squads with each squad under the supervision of an experienced jump trainer. Each man is assigned his individual equipment, consisting of helmet, mask, two-piece suit, back brace, harness, rope, streamers, and seamless sack in which to keep his equipment. Each man is assigned a number which he stencils on his
equipment and bag. Each squad is then put through the below named phases, putting in one hour on each phase during each day of ground training. The other four hours are spent in some type of toughening project work or in long conditioning hikes. Such work as tree planting, trail or telephone maintenance, involving considerable hiking, is ideal. Other types of work may require that regular hikes be made on alternate days. (2)

A. Obstacle Course and Calisthenics

These courses are designed to limber and toughen muscles, develop coordination, and teach the technique of going into a roll to avoid leg injuries upon landing. (2)

B. Tower Jump

During the ground training the men are jumped thirty to fifty times from the training towers. The man, wearing a complete outfit, minus chutes, jumps from a door frame at the top of a twenty-two (22) foot tower, his harness is fastened to a set of dummy risers, which are attached to a short single-tree. The single-tree is connected to a one inch rope which runs to pulleys on an overhead boom and is anchored on the ground with sufficient slack to permit the trainee to jump from the tower and fall free to a point just above the safety net. When thus snubbed up sharply after an eighteen (18) foot fall, the jumper experiences a shock similar to the opening of a parachute. This training teaches the correct method of takeoff from the door of an airplane, gives the man confidence in his equipment, and helps him overcome the fear of jumping from a high place. The jumper is taught to leave the tower door with a slight hop to clear the step, to straighten up and drop erect as possible in order to lessen the shock of the opening
chute, and to cross his arms to prevent them from fouling in the shroud lines if he should be out of position when the chute breaks out of the back pack. (2)  

C. Letdown  

This training is necessary to teach the men how to free their harnesses from the risers of a parachute after landing in tall trees, and to lower themselves to the ground safely with the seventy-five (75) foot rope which is carried in the right-leg rope pocket of their jumping suits. (2)  

D. Mockup  

Replicas of Ford trimotor and Travelair plane cabins are used to teach the men the proper routine followed in loading planes with equipment and men, signaling done by spotter to plane pilot, jumping signals, fastening static lines to plane cable, and to teach the men to dress in limited space of a loaded plane as a means of lessening the discomfort of long rides in the hot, cumbersome jumping suits. (2)  

Jump Training  

Ten to fourteen days is usually required for this training. If possible each trainee is given at least one plane ride prior to making an actual jump, and whenever practicable, small groups of trainees are taken up before their jump to watch another group go through the jump procedures. Demonstration jumps by experienced jumpers are first made before assembled trainees, and a total of seven training jumps is given each trainee. The first four jumps are on an open field or airport, and a loudspeaker system with directional horn is used by the instructor on the ground in coaching the jumpers after they leave the plane. The fifth jump is made into green timber for practice in timber
landings and letdown technique. The sixth jump is a slip jump into an open field for practice in collapsing the canopy for a count of ten to increase rate of descent to escape from the high wind area. The seventh jump is made in an area closely simulating the type of conditions men usually encounter when making back country fire jumps. This jump is also combined with fire camp organization and fire suppression training. (2)

Fire Training

Bad weather and non-flying days are utilized fully, and much of the training fits in with jump training on a part-time basis. Effort is made to get men on at least one early training fire before the active season begins. (2)

Radio Training

Each jumper is taught the essential knowledge of radios, in setting up, making minor adjustments, and operating radios under all conditions in which the use of sets is anticipated. (2)

First Aid Training

In accord with service-wide efforts to increase the number of qualified first aid men, Red Cross first aid instruction is included in the jumper training schedule, usually as a fill-in class on bad weather days when outside training is impractical. Qualified instructors have thus far been obtained from within the jumper organization and the objective has been to qualify each man in the standard Red Cross first aid course. (2)
Pilots who fly airplanes for the U. S. Forest Service have other duties and responsibilities besides piloting their planes from one airport to another. In addition to piloting, they must protect the equipment, do maintenance and servicing, as directed, and make needed reports. The airplanes are used for dropping smokejumpers and supplies, for patrol, and for reconnaissance of fires. Dropping operations and patrolling over the mountains, with the duty to locate and map fires accurately, involves special types of flying, which require more than average ability and skill if they are to be done in an efficient and safe manner.

When smokejumpers are being dropped or cargo discharged, flying speeds are reduced to slightly above stalling speed. It is sometimes necessary to execute turns in narrow canyons, which requires good judgment concerning performance of the particular airplane being flown.

Turbulent air conditions and down currents are often encountered, due both to air mass movements and to thermal conditions. Severe turbulence accompanies most cold front movements during July and August. (3)

Pilots are expected to carry maximum loads and yet leave a large margin of safety in operating from small airports or airports where special judgment in landing and taking off is required because of location and obstructions.

Maintenance and Protection of Airplanes

Although the pilot may not be an experienced mechanic, he is
held responsible for maintaining his airplane in proper condition. He must also protect it from damage. Pilots are given instructions concerning the amount and kind of inspecting and servicing they are expected to do. L-5 pilots are supplied with the U. S. Army Air Force Aircraft Inspection and Maintenance Guide, 00-20a-2-L-5. (3) C-64 pilots are supplied with Guide, 00-20a-C-64a. (3) Only that work which each pilot is deemed competent to do, is to be done by him, according to instructions when he takes delivery of the airplane he is to fly. Pilots are cautioned not to attempt adjustments or repairs on unfamiliar plane parts. Serious damage can be done and dangerous conditions can be created by over-ambitious, inexperienced repairing or adjusting, by unauthorized personnel.

Safety Precautions in Flying

All pilots are expected to take off, climb, glide and land "Airline Style". (3) The safety of the pilot and the safety of the passengers and equipment depends on the motor when flying over mountainous and timbered country. Pilots are cautioned to respect the motors. "Warm it up slowly and give it time to cool to a reasonable temperature before stopping it after a flight. Climb at a reasonable angle and glide with sufficient throttle to keep all spark plugs firing." (3)

Pilots determine whether or not field conditions and weather conditions permit safe operations. Those not familiar with conditions which may be encountered in mountain flying during and immediately following the passage of a cold front should stay on the ground for a few hours, until conditions improve.

The pilot should not deviate from the flight plan he flies
unless he is over open country. If he encounters weather conditions that will not permit him to fly the course described in the flight plan, he must either contact by radio someone who can and will get word to the standby officer named in the flight plan to alter it, or he must return and file another flight plan for a different route. (3) Any other procedure would defeat the purpose of the flight plan.

Conditions which might require cancellation of a proposed flight by the pilot are: take-off wind conditions, take-off field conditions, excessive load, too late to arrive before sunset, severe turbulence, low clouds, fog, smoke, or haze.

Flying below mountain ridges during hazy weather after one-half hour before sunset and before one-half hour after sunrise is hazardous. It should be done only when the flight is very urgent, and then with caution.

Form Reports

Pilots are required to complete the following aircraft report forms prior to taking off:

A. Form R6-F17, Flight Plan, is provided to make certain some responsible party will check in all flights made with airplanes owned or chartered by the Forest Service. It is to be used for every flight, except (1) when a CAA flight plan is filed, or (2) on days when the weather is clear several scheduled flights of short duration are to be made over an established route to a fire camp to deliver supplies, the Airplane Load List carries a description of the airplane, and the airport attendant is to remain at the airport until all planes have been accounted for. (3)

B. Form R6-F22, Daily Aircraft Flight Report, is needed to
furnish necessary information to the Engineering Shop at Sellwook, Oregon, for billing purposes and information needed by the Division of Fire Control for seasonal statistical records. (3) This form requires only a few words. Most of the information consists of figures, entered in the spaces provided.

C. Form R6-F23, Airplane Operation Report, is needed to keep the Portland Air Base Shop properly informed of the condition of all Region 6 airplanes at all times. (3) The pilot makes reports on this form in accordance with the instructions thereon. The more complete the information, the more value the form will have for the purpose intended. All gasoline and oil put into the airplane must be accurately entered. The entries are used for accounting purposes and indicate the condition of the motor.
Flight Plan - For use in getting immediate action to locate and get aid to pilot forced down while on dropping mission

Form R6-F17
(Revised 5/30/46)

FLIGHT PLAN

U. S. Forest Service-Owned or Chartered Aircraft

Region 6

<table>
<thead>
<tr>
<th>Flight Plan filed at</th>
<th>with</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Place)</td>
<td>(Date) (Time) (Standby Officer)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAA Airplane No.</th>
<th>Type plane</th>
<th>Color</th>
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<tr>
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<table>
<thead>
<tr>
<th>Pilot</th>
<th>Passengers</th>
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<tbody>
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<table>
<thead>
<tr>
<th>Point of Departure</th>
<th>Time</th>
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<table>
<thead>
<tr>
<th>Point of Intended Landing</th>
<th>Time</th>
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<table>
<thead>
<tr>
<th>Hours of Fuel Supply</th>
<th>Route of Travel</th>
</tr>
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<td></td>
<td></td>
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Radio frequencies to be used on this flight, stations to be contacted, and time of contact:

<table>
<thead>
<tr>
<th>Station Name</th>
<th>Radio Frequency</th>
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<tbody>
<tr>
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<table>
<thead>
<tr>
<th>Purpose of Flight</th>
<th>Authorized by</th>
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Flight Closed By | Received By | Time | Time |
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</table>

In the event no arrival report is received by ______ (time), the standby officer will immediately notify ______ of the U. S. Forest Service or if the standby officer is a Forest officer he will take action to determine the location of the airplane described above.
# Daily Aircraft Flight Report

**Region 6**

**Date**: 19  

**Flight Report No.**:  

**Pilot**:  

**Description of Flight Mission**

<table>
<thead>
<tr>
<th>Flight No.</th>
<th>From</th>
<th>To</th>
<th>Charge Flight To</th>
<th>Flight Time</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Forest</td>
<td>Take Off</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Project</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td></td>
</tr>
</tbody>
</table>

**Flight Record**

<table>
<thead>
<tr>
<th>Flt Cargo</th>
<th>Jumpers</th>
<th>Psgrs</th>
<th>Fires</th>
<th>Lookouts</th>
<th>Radio Contacts</th>
<th>Visibility</th>
<th>Mi. Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cr'd</td>
<td>Cr'd</td>
<td>Sc't'd</td>
<td>Serviced</td>
<td>Made</td>
<td></td>
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<td>Drp'd</td>
<td></td>
<td>Disc.</td>
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</table>

**Base of Operations**  

**Submitted By**

**NOTE**: Pilot to prepare report in duplicate (pen-pencil), retain copy and submit original to base of operations office. Base office will prepare typed copies as follows: (1) Original typed copy to REP; (2) Copy to R.O. Fire Control; (3) one copy to each Forest or unit for which flight was made; (4) Retain one copy for base office files. REP will prepare billings for Forests and units involved with reference to flight report numbers.
Form R6-P23

AIRPLANE OPERATION REPORT
Region 6

Date: __________ 19________  Operation Report No. _______
CAA Airplane No. _______ DESCRIPTION Pilot ________________

<table>
<thead>
<tr>
<th>Inspection Status</th>
<th>Servicing Obtained</th>
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<tbody>
<tr>
<td>Date of or hours due.</td>
<td></td>
</tr>
<tr>
<td>Preflight &amp; Daily</td>
<td>1st</td>
</tr>
<tr>
<td>25 Hour</td>
<td>2nd</td>
</tr>
<tr>
<td>50 Hour</td>
<td>3rd</td>
</tr>
<tr>
<td>100 Hour</td>
<td>4th</td>
</tr>
<tr>
<td>Engine Hours to date</td>
<td>5th</td>
</tr>
<tr>
<td>Hours Flown today</td>
<td>6th</td>
</tr>
<tr>
<td>Total Engine Hours</td>
<td>7th</td>
</tr>
</tbody>
</table>

Remarks as to condition of aircraft and engine and detailed description of service or minor repair work performed:

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

NOTE: Pilot will prepare one copy each day the airplane is flown, and transmit it to Portland Air Base Dept. Shop, Box 911, Route 4, Portland 11, Oregon.
Special Instructions for the Use of Airplanes

1. Safe business-like flying and operation of airplanes is the guiding rule at all times.

2. Any stunting or flying that even approaches unsafe practices is prohibited. All operations, at all times, will be conducted in a business-like manner.

3. Flying must not be "stretched", i.e., flying in smoky or foggy weather, when visibility conditions are poor for any reason late in the evening, below minimum altitudes, with overloads, with a doubtful gas supply, operating from poorly maintained or too short landing fields, or when the airplane is not operating satisfactorily. Flying for smokejumping or cargo dropping should preferably be done in the early morning or late in the day. At times the afternoon air is so turbulent over mountainous terrain that it will be unsafe to drop cargo or smokejumpers, or to transport freight or personnel. Smokejumpers should not jump when the air is very turbulent or a strong wind is blowing. If safety conditions are marginal, the airplane should stay grounded until conditions have improved.

4. The pilot and passengers in a Forest Service-owned aircraft will refrain from smoking during all flights. Forest officers will refrain from smoking in all chartered aircraft (except those chartered from a commercial airline) and the pilot of such aircraft will be requested also to refrain from smoking. Forest officers will always wear stout shoes or regular mountain work shoes when flying over mountains. They will also carry a knife and matches.

5. The pilot is the Captain of the airplane and is responsible for its operation. He will always make the final decision deciding the safeness of flying, the type and amount of
cargo to be carried, and the number and conduct of passengers transported. However, no forest officer will either be required or need to make a flight if he considers flying conditions or the aircraft unsafe.

6. C.A.A. rules for the operation or flying of airplanes must be adhered to at all times except as provided for by a certified waiver of air traffic rules or as modified by these instructions. Pilots are expected to know and follow the C.A.A. rules.

7. Airplane log books must be currently and fully maintained. U. S. Forest Service-owned aircraft must be given the one hundred (100) hour check and other checks and major overhauls as prescribed by the C.A.A. or the Regional Forester.

8. Every flight must be authorized by a designated Forest officer. Each Forest Supervisor will designate in writing those authorized to request flights. When Forest Service pilots are to be used, a copy of the authorization will be furnished the pilot or pilots involved. No Forest Service pilot will make an unauthorized flight unless an emergency involving life or property is involved.

9. Persons other than forest officers and other authorized government or protection agency personnel will not be carried as passengers or be taken on flights unless permission in writing is furnished by the Forest Supervisor. A copy of the written permit will be furnished a Forest Service pilot; otherwise the pilot will refuse to carry an unauthorized passenger. All persons other than forest officers or other Federal officials on official business must sign an "Airplane Passenger Release", Form R6-F16, before they are taken on a flight. The practice of taking non-Forest Service persons on flights is discouraged.
10. The pilot will always make a test flight alone if the plane has not been used for a week or after any repair work has been done on the aircraft or its motor.

11. No passengers will be taken on any cargo dropping or smoke-jumper trip except the cargo dropper for cargo trips, and the smoke-jumpers and spotter for smoke jumper trips. The only exception to this rule will be that one forest officer can be taken if the plane is not loaded to capacity and that he rides and stays in the co-pilot seat.

12. The cargo dropper will wear a back-pack parachute. He will also wear a safety belt and, while dropping cargo, secure it by a strap or rope to a fuselage member or the static line on the plane with a strong snap. In cargo dropping the floor of the airplane must be smoothly finished. A specially constructed dump board will be employed with use of burlap chutes, and a dump board with converted man-chutes is optional. The cargo dropper will attach a hunting-style knife with sheath to his belt if such knife is not fastened to the aircraft sufficiently close to the cargo opening to be readily available to the dropper. A bar, stout rope or strap will be placed across the open dropping door with the exception that it may be removed during actual dropping operations if it interferes with dropping.

13. A plane will not be flown lower than five hundred (500) feet from the ground when dropping cargo by parachutes. When dropping in valley bottoms, an elevation of around one thousand (1,000) feet will be maintained. Down drafts must be avoided, and the target should be approached so the elevation is lower beyond it. When severe turbulent air conditions prevail, cargo dropping should be limited to urgent needs and to the time of day when air conditions are best.
consistent with item 3 above.

14. A plane on patrol, reconnaissance, scouting, or similar operations will not be flown lower than five hundred (500) feet from the ground, except on take-off or landing. Plenty of elevation should be maintained at heads of canyons so ridges can be easily crossed. Down-stream flights are preferred to upstream flights. Down drafts must be avoided when flying at a low elevation.

15. When smokejumpers are jumping, the plane must be flown from fifteen hundred (1,500) to two thousand (2,000) feet above the selected jumping spot. If specified by a trained and competent spotter, the plane may be flown to within one thousand (1,000) feet of the ground when the size of the jumping spot is limited. It is better to look for a more favorable jumping spot, even if it is further from the fire, than to jump under fifteen hundred (1,500) foot elevation.

16. The smokejumper bench in the airplane will always be securely fastened to the plane.

17. When the plane is used to transport passengers from one airport to another, the regular plane seats with seat belts will be placed in the plane. The passengers will fasten seat belts when taking off or landing, or when the air is turbulent.

18. When equipment or supplies and passengers are being transported together, such as from one landing field to another, the equipment and supplies will be firmly secured to the airplane. If several loose or small packages are involved, they can best be wrapped in canvas and the whole bundle secured to the plane. Under no circumstances will passengers be permitted to ride in an aircraft when inflammables, such as gasoline or explosives, are being transported.
19. Safety parachutes, either approved back-pack or seat-pack, must be worn by all Forest Service personnel engaged in observing, scouting, dropping supplies or other similar hazardous flying. The pilot will be responsible for fitting the parachute, the best he can, to the wearer, and for showing him how to use it. Whenever possible, escape training should be taken in advance of flying from a qualified instructor. The Forest Service will have two safety parachutes with each of its planes and a few others at selected central locations; they must be properly inspected and repacked at C.A.A. required intervals every sixty (60) days by a licensed rigger. If Forest Service parachutes are not available, the airplane owner or contractor should be required to furnish parachutes, by rental if necessary. The wearing of parachutes for point-to-point flying; i.e., directly from one airfield to another, without unusual maneuvering, is not required. Otherwise parachutes must be worn. If not available, the flight will not be made.

20. No forest officer is permitted to pilot or fly a Forest Service-owned aircraft unless he has a C.A.A. commercial license, is classified as a Forest Service pilot, and has been previously approved by the Regional Forester.

21. No forest officer is permitted to fly or pilot his personally-owned or personally-rented private aircraft during official (on duty) hours or on official business without prior approval in writing from the Regional Forester for specific aircraft and for specific trips.

22. No Forest Service pilot or other forest officer will make a flight in a Forest Service-owned or chartered aircraft unless a flight plan is filed in advance with a responsible party (a forest
officer, C.A.A. representative, an airport manager, etc.) who will take the responsibility of checking the flight out and closing it and notifying a responsible forest officer if the flight is not closed on time. In the case of Forest Service-owned aircraft, the pilot is responsible for filing the flight plan; in the case of chartered planes, the forest officer in charge will be responsible for filing and closing the flight plan. Form R6-F17 will be used whenever practicable.

23. Use of chartered or rented private aircraft as covered by Memorandum of Verbal Agreement for Airplane Rental, the following rules apply:

(a) No chartered aircraft will be used unless it is covered by Memorandum of Verbal Agreement for Airplane Rental, Form R6-F30. All Forms R6-F30 for aircraft of over two hundred (200) horsepower or for more than three passengers (including the pilot) must be submitted to the Regional Forester for review by a technician and for advance approval in the Division of Fire Control; no aircraft will be used until such approval is obtained. For aircraft of less than two hundred (200) horsepower, the Forms R6-F30 will be approved by the Forest Supervisor or acting, in advance of use; if the Forest Supervisor wishes to obtain technical advice, the Forms will be submitted to the Division of Fire Control for review and recommendations. Lists of approved aircraft will be currently maintained in Forest and Ranger District suppression plans.

(b) Only such forest officers as are designated in writing by the Forest Supervisor will be authorized to charter aircraft. Such lists will be maintained in suppression plans.

(c) Only those pilots who are listed and approved on
Form R6-F3O for the particular aircraft will be accepted as pilots by the forest officer requisitioning a chartered flight. No pilot should be listed and approved on Form R6-F3O unless he has flown the particular type of aircraft for at least fifty (50) hours, at least twenty (20) hours which have been over terrain on missions similar to those to be flown under charter, has flown aircraft for a total of at least five hundred (500) hours, and has a current C.A.A. commercial pilot license for the type of aircraft to be chartered.

(d) No Form R6-F3O will be accepted and submitted by any forest officer for any aircraft unless the owner can show or demonstrate that:

1. The aircraft has a current C.A.A. Certificate of Air Worthiness.
2. He has at least one certified C.A.A. mechanic for each five aircraft or less in his ownership.
3. He has a shop or regularly makes use of a shop completely equipped to perform all airplane maintenance work except major motor overhauls; the shop to have a concrete floor, a well lighted work bench, and necessary tools and equipment.
4. He maintains planes in good shape, has conducted a successful operation for at least a year, and has a reputation for conducting a safe and dependable operation.

(e) If a chartered aircraft is used for cargo dropping, the owner will usually be required to furnish the cargo dropper. A Forest Service dropper will not be used on a chartered aircraft unless such use has been approved in advance by the Forest Supervisor. If a Forest Service dropper is not used, an advance flight, without load, will be made to the dropping area if necessary for a forest officer to show the pilot the dropping target.
U. S. Forest Service Airplane Pilot Qualifications

As a basis for hiring and securing the most capable pilots for U. S. Forest Service flying, the following selection system and requirements have been set up:

1. Airplane pilots employed by the Forest Service will be required to meet general experience and specific experience requirements, as follows:

(A) General Experience. All applicants will be given a numerical rating in accordance with the following system:

(1) Total Flying Time (hours) Points per 100 Hours

<table>
<thead>
<tr>
<th>Hours</th>
<th>Points per 100 Hours</th>
</tr>
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<tbody>
<tr>
<td>0 to 500</td>
<td>1.0</td>
</tr>
<tr>
<td>500 to 1000</td>
<td>.5 (additional)</td>
</tr>
<tr>
<td>1000 to 2000</td>
<td>.2</td>
</tr>
<tr>
<td>2000 and up</td>
<td>.1</td>
</tr>
</tbody>
</table>

(2) Years of Experience. One point will be awarded for every full year in which the applicant has been licensed as a private pilot or higher by the C.A.A., or has been on active flying status as pilot in the armed forces. However, two points will be deducted from this score for every year or major portion thereof the applicant has not been licensed or on flying status during the period for which credit is claimed, up to and including the year in which application for employment is made.

(3) Experience by Type of Aircraft. For each of the general classifications of aircraft listed below, in which the applicant has flown not less than fifty (50) hours as first pilot, one point will be awarded.
Light, single engine (Cub, Aeronca, etc.)
Medium, single engine (Stinson Reliant, Waco, Primary or Basic Trainers)
Heavy, single engine (Advanced S.E. Trainers or Fighters)
Light, twin engine (Cessna, Beech, etc.)
Medium, twin engine (D.C.-3, PBY-5a, etc.)
Heavy, twin engine (B-25, B-26, A-20, A-26, etc.)
Four engine
Seaplane or floats
Helicopters
Gliders

Miscellaneous Experience. One point will be awarded for each of the following:

(a) Possesses a currently valid C.A.A. or Military or Naval instrument card.
(b) Possesses a currently valid Aeroplane and Engine mechanic's license issued by C.A.A.
(c) Has had separately, not less than three years' experience as both a civilian pilot or as a pilot in the Armed Forces.
(d) Has flown not less than five hundred (500) hours as a flight instructor.

Specific Experience. Such detailed experience and education as specified for the position to be filled will be required.

2. Specific Requirements

(a) Search Pilot, CAF-7. Applicant must possess a currently valid C.A.A. Commercial Pilot Certificate and have a General Experience Rating in accordance with (1-A) above of not less than 15. At least four hundred (400) hours first pilot time is required, of which at least fifty (50) hours shall have been in the class (sea or land, and approximate h.p. rating) to be operated. In addition, not less than ten (10) hours must have been flown at night.
(b) Pilot, CAF-9. Applicant must possess a currently valid C.A.A. Commercial Pilot Certificate and have a General Experience Rating in accordance with (1-A) above of not less than 20. At least one thousand (1,000) hours first pilot time is required, of which at least fifty (50) hours shall have been in the class (sea or land, and approximate h.p. rating) to be operated. In addition, not less than fifty (50) hours must have been flown at night, and at least one hundred (100) hours must have been flown on extended cross-country flights.

(c) First Pilot, CAF-11. Applicant must possess a currently valid C.A.A. Commercial Pilot Certificate and have a General Experience Rating in accordance with (1-A) above of not less than 25. At least one thousand, two hundred (1,200) hours first pilot time is required, of which at least two hundred (200) hours must have been in multi-engine aircraft, and not less than fifty (50) hours in the class (sea or land, and approximate h.p. rating) to be operated. In addition, not less than one hundred (100) hours must have been flown on extended cross-country flights. Furthermore, the applicant must hold or have held a valid C.A.A. or military or Naval instrument rating, and must agree, if employed to obtain a current C.A.A. instrument rating with the least practicable delay.

(d) Chief Pilot, CAF-12. For supervision of all flying activities within a regional area, in addition to piloting, the applicant must have not less than one thousand five hundred (1,500) hours of first pilot time, a General Experience Rating in accordance with (1-A) above of not less than 30, and must meet all other requirements for First Pilot, CAF-11.
3. **Job Classification**

(a) **Search Pilot, CAF-7.** To fly light single engine, liaison type aircraft on reconnaissance missions over forested areas. An observer will be carried in most cases, and radio contact will be maintained with the Forest Service radio network. Smokejumpers will not operate from this aircraft.

(b) **Pilot, CAF-9.** To fly a single engine aircraft over forested areas on reconnaissance missions, cargo dropping, smokejumper operations, rescue work, and to transport personnel on long cross-country flights.

(c) **First Pilot, CAF-11.** To fly all types of Forest Service aircraft, including multi-engine, over forested areas on reconnaissance, cargo dropping, smokejumper operations, rescue missions, and in addition, transport personnel on long cross-country flights.

(d) **Chief Pilot, CAF-12.** In addition to operating all types of Forest Service aircraft, as required of the First Pilot, to supervise all pilots and flight operations within an entire Forest Service Region.

4. Applications will be graded as follows:

(a) For meeting requirements of paragraph 2 

(b) All points above the minimum requirements applicable to General Experience, paragraph 1-A

(c) For every completed year of College Training in Forestry or Engineering above the minimum requirement, as called for in paragraph 1-b; one point for each year. (3)
VIII. COST ANALYSIS OF AN AERIAL UNIT

The costs of operating an aerial fire protection unit is based entirely upon the number of personnel and the number of airplanes in operation. The wages of the personnel are determined by Civil Service regulations and the costs for operating each type of aircraft varies with the flying conditions, amount flown and the age of the aircraft. The annual appropriations for the aerial unit is predetermined by the Fiscal Agent prior to the fire season. The aircraft have an allowance of a given amount per hour flown for presuppression operation expenses. The salaries appropriation of the smokejumpers, pilots, and ground personnel is set up as a presuppression expense. The actual expenses of fire suppression are charged to the unlimited "Fire Fighting Fund". The aircraft cost for overhead and maintenance is determined by the Forest Service "Equipment Use" method. (i.e. depreciation, cost per hour or mile).

The following is datum of costs for operating three types of aircraft used during the fire season of 1947:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>ESTIMATED LIFE (in hours)</th>
<th>INITIAL COST</th>
<th>RATE ($/PER HOUR)</th>
<th>TOTAL COST</th>
<th>(Per Hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noordyne (C-61)</td>
<td>920</td>
<td>$10,000</td>
<td>9.00</td>
<td>18.00</td>
<td>13.00</td>
</tr>
<tr>
<td>Vultee (L-5)</td>
<td>1,250</td>
<td>2,500</td>
<td>2.50</td>
<td>5.50</td>
<td>2.00</td>
</tr>
<tr>
<td>Stinson Voyager</td>
<td>1,500</td>
<td>5,000</td>
<td>2.50</td>
<td>4.00</td>
<td>3.50</td>
</tr>
</tbody>
</table>
The average cost for aircraft fuel during the fire season of 1947, was $0.235 per gallon of ninety-one (91) octane aviation gasoline and $0.215 per gallon of eighty (80) octane aviation gasoline. Oil costs were $2.00 per gallon in barrel lots.

Personnel expense in wages are based on Civil Service Standards. The salaries of the individuals vary, depending upon the job done within the organization and their CAF rating. Forest Service employees come under the overtime pay law for Civil Service personnel. Every hour over forty (40) hours a week employed, the wage earner receives time and one-half pay per hour.

A brief summary of approximate earnings per month is as follows:

<table>
<thead>
<tr>
<th>Type of Job</th>
<th>Wages Per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-64 Transport Pilot</td>
<td>$400.00</td>
</tr>
<tr>
<td>L-5 Pilot</td>
<td>350.00</td>
</tr>
<tr>
<td>Observer</td>
<td>275.00</td>
</tr>
<tr>
<td>Smokejump Foreman</td>
<td>210.00</td>
</tr>
<tr>
<td>Smokejumper</td>
<td>215.00</td>
</tr>
<tr>
<td>Cook</td>
<td>160.00</td>
</tr>
<tr>
<td>Basic Help</td>
<td>150.00</td>
</tr>
</tbody>
</table>

Administration Overhead

All other salaries of government employees who work with the aerial fire protection unit are persons who are regular annual employees of the Forest Service, and not seasonal help obtained for the express purpose of aiding the aerial fire protection project. The salaries of these regular employees are paid from an appropriation for the special project expenses, and the amount is determined from the number specified and the amount deemed necessary by the forest supervisor. (6)
IX. THE FUTURE OF AERIAL FIRE PROTECTION

Ten years ago people would have ridiculed a "Flying Forester", but today as the world progresses and improves, so does fire protection. Fire protection of the aerial type is still in its infancy. It has great possibilities. Already it has proven itself to be efficient, dependable and economically feasible. It is gradually replacing slower type methods of fire suppression. The type of planes and methods to be used in the future is hard to determine, but if aerial fire protection progresses as much in the next ten years as it has in the past decade, we can generally expect to see every National Forest have its own plane, pilots, and smokejumpers.

The Helicopter

The helicopter should be watched with great interest. It is the writer's belief that within the next five years the Forest Service will have these operating with fire protection units. It can be visualized how important that the helicopter could be in taking men to a fire and letting them out within a few hundred feet of it. At the present time the helicopter is in its experimental stage. The most prominent makes are the Bell and the Sikorsky. The craft carries two people including the pilot. The initial cost is approximately fifty thousand dollars ($50,000). It is not efficient at high altitudes. The Forest Service needs a plane of this type that can carry several men at a small operating cost per hour. It is possible that the present helicopter model may be improved to such an extent that they would be practicable for Forest Service work. The United States Air Force is using them
for rescue work now, and they are very capable for such type of work, but in this case operating expenses are not considered.

Cargo and Liaison Planes in the Future

Cargo and Liaison Planes are being used more each year. Plans at the present are to have several main bases for operating in the forest and several small auxiliary fields. If these secondary fields are constructed, the smokejumpers can walk to an auxiliary field and there await transportation to a main operating base by a liaison type plane. Large transport planes could haul them to headquarters. The transport plane is being used more each year for food and supply dropping since it is quicker and cheaper for trail crews and lookouts.

The Missoula, Montana Experiment

The data that follow have been restricted by the War Department until recently. In order that the foresters can cooperate with the Air Forces in their part of aerial fire protection, they should know what has been done up to the present.

On July 23, 1947, the first fire bombing test (an experimental cooperative project between the Army Air Forces, Bureau of Standards and the U. S. Forest Service), was conducted near the Lolo Lookout, Montana, approximately fifty (50) miles southwest of Missoula, Montana.

The project was strictly of a research character. Its purpose was to test the feasibility of knocking down small fires and keeping them in check until ground crews arrive, through aerial delivery of water and other fire extinguishers, and to give air crew member bombing practice in the event that it might be necessary in the event of another national emergency. The aircraft operational phases were in charge of Army personnel on detail from Eglin Field, Florida.
The fire control aspects were being handled by the Forest Service, the research aspects by the Northern Rocky Mountain Forest and Range Experiment Station, and the operational phases by the Regional Office, Division of Fire Control.

The plan called for dropping some two hundred (200) modified gas tank bombs during the summer of 1947, and an undetermined number of four thousand (4,000) pound bombs and one hundred (100) pound chemical bomb. Both contact and proximity fused bombs were dropped. (9)

Accurate records were kept on the following:

1. The number of direct hits.
2. The range and deflection errors on all bombs that missed the target.
3. Factors affecting accuracy.
4. The pattern of dispersion of water or chemicals from individual bombs.
5. The quantity of water laid down.
6. Its effectiveness in controlling fires in different fuels under different burning conditions. (9)

The July 23rd demonstration was staged principally for high officials of the cooperating agencies.

"A loud speaker system was installed in the center of the area designated for observation purposes. Jack Barrows of the Northern Rocky Mountain Experiment Station (formerly Captain in the Army and who was active on the coast during the war, dispersing information on bomb disposal work) did the announcing in a masterful manner.

"One B-29 and two 47 airplanes took part in the demonstration. The B-29 bomber that was christened "The Rocky Mountain Ranger", and regularly assigned to this project, developed engine trouble the previous evening and a second B-29 was flown from Eglin Field, Florida during the night, which was considered quite an accomplishment in transcontinental travel. The demonstration was delayed only two hours because of this mishap.

"Two fires were started about 7:00 A.M. which was an M/L fuel type. They were set about one hundred and fifty (150) feet apart. One was set near the top of a small lateral ridge and the second approximately one hundred feet below the top. The fires failed to spread as anticipated and probably did not exceed 1/10 acre each four hours later when bombed.
"The big B-29 with a P-47 flying directly below each wing, approached the target area. After passing over the fires, the P-47's 'peeled off' in aerial bombing style. Each in turn approached the lower fire on a long even glide. The speed of the P-47's when they passed over the target was four hundred (400) miles per hour and the elevation approximately one hundred (100) feet. They carried a 162-gallon water-filled contact bomb on each wing. Two 'dry runs' were made by each plane before the bombs were released. The first pair of bombs dropped hit approximately thirty-six (36) feet short of the lower edge of the fire area. The second pair of bombs dropped hit about 20 feet short and scattered dust and mud fairly uniformly over the entire area. The second pair of bombs dropped were 'bull's' eyes' since the object of this type of bombing is to spatter dirt and mud over the fire areas.

"The B-29 approached the second fire, flying level at an elevation of three thousand (3,000) feet. A couple of 'dry runs' were made over the target followed by three 'wet runs'. The first bomb dropped was an M-56 four thousand (4,000) pound water-filled thin-jacketed unfused bomb. The second and third bombs dropped were the same type but contained proximity fuses designed to burst the bomb above the fire. The first bomb hit approximately four hundred (400) feet short and a couple of hundred feet to the right of the fire. The second bomb went approximately six hundred (600) feet over and to the left of the fire. The third bomb dropped went four hundred (400) to five hundred (500) feet over and to the right of the fire. The two fused bombs exploded but not until after they hit the ground. There was no evidence of water where the bombs hit. The announcer stated the bombs originally intended for this demonstration would not fit the racks of the substitute plane. This was the first time use was made of an M-56 bomb for this purpose. He further explained the bombs could not be filled to capacity with the equipment available, which accounted in part for the inaccurate results.

"A Ford Tri-Motor airplane followed the bombing planes and dropped two smokejumpers and their equipment. The smokejumpers made satisfactory landings (one practically at the edge of the fire) despite adverse wind conditions. The Tri-Motor then circled several minutes, taking pictures of the crowd and bombing area. These pictures were developed in the air and prints dropped. This part of the program consumed about twenty or thirty minutes and drew expressions of amazement from the crowd. A hot dinner consisting of roast beef, mashed potatoes, peas, bread, coffee, and ice water, canned fruit and cake, was then dropped from the plane. The hot meal was dropped in a nearby saddle and from the altitude of approximately one hundred (100) feet. The farthest package dropped was not over one hundred (100) feet from the target and several
were on the target. The low altitude dropping was very impressive. In one instance the chute was not fully inflated when the package hit the ground. Several of the containers were badly bent but there was little or no loss of food." (9)

Conclusions

For those in the field of fire protection, the experiment proved several factors. The Forest Service officials now realize the importance of aerial fire suppression of some type or other. The operation is indeed of high value to the Air Forces to train its pilots and bombardiers in bombing. In the future, if this country should ever be faced with combating guided missiles of sub-sonic or super-sonic types that could be directed to start forest fires, coordination between the Air Force and Forest Service is highly essential.

The seasonal aerial fire program as now operating has saved the American people millions of dollars in natural resources. The day when large fires get out of control due to the slowness of getting to the fire with the initial attack will soon be over. Aerial protection can and has proved itself economically feasible, and a highly efficient method for fire fighting. We can all look forward to the day of highly maneuverable and flexible aerial fire protection of our forest lands.
A U. S. Air Force P 47
Dropping a Water Bomb on a Forest Fire
A 165-Gallon Water Bomb
REFERENCES

1. Newton, Torrey A. -- Aviation in Forestry.


3. Region 6 -- Instructions and other Pertinent Data in Connection with the Use of Airplanes.


5. U. S. Forest Service -- Instructions for Dropping Supplies, Region 6.

6. Personal Interview with Assistant Region 6 Fire Control Officer.

