forestry report

CANADIAN FORESTRY SERVICE • NORTHERN FOREST RESEARCH CENTRE

JULY 1972 EDMONTON, ALBERTA VOL. 2, NO. 1

IN THIS ISSUE ....

FIRE

SUPPRESSION COSTS

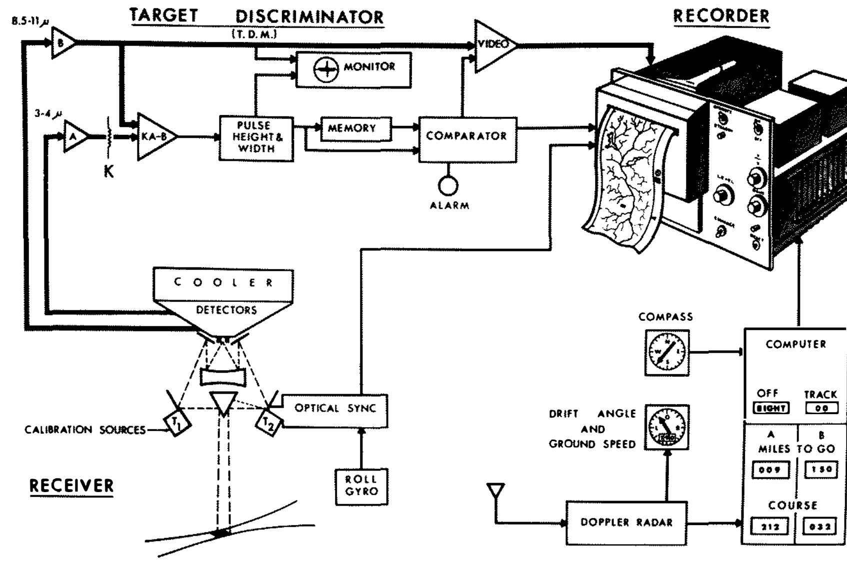
Catastrophic forest fires, though relatively few in number, generally absorb the bulk of the fire suppression funds expended annually across Canada. It would be naive to believe new knowledge will, in the near future, result in elimination of these catastrophic fire situations. Hopefully, of course, their numbers will be reduced. Nevertheless all managers recognize there are periods during the course of these fires when intensive suppression activities have little or no effect on the final outcome. These periods need to be recognized as opportunities to conserve funds and resources. This is a very difficult thing to act on however, as managers point out, due mainly to the momentum of resource build-up, inherent behaviour of people on the fire scene, and public expectation of how fire suppression operations should go. Nevertheless, the time may not be too far off when other agencies will interpose themselves more directly into the scene unless there is evidence such controls are being applied in a significant manner.

OPERATIONS & RESEARCH

Via the Sub-committee on Fire Research, an element of the Regional Program Advisory Committee, our fire research program has been greatly altered over the past several years. Most research effort is now directed into detection and and suppression which are operational. In most instances fire research objectives and results cannot be effectively reached nor kept relevant when undertaken away from the operational activity. Management agencies must be sympathetic to the need of research groups to have access to their operational methods and, when necessary expedite that access. The research teams on their part must respect the confidence of the management agencies, not presume special rights are included with the access, and must work in harmony and via staff designated by the management agencies.

Agreement in principal to this policy will go a long way towards ensuring that management agencies get their moneys worth from the research groups.

FOREST FIRE DETECTION IN THE PROCESS OF CHANGE



Newest Wildfire Detection Medium

Shown is a block diagram of the Bispectral 1/R Fire Detection System developed by the Northern Forest Fire Laboratory in Missoula, Montana.

Judging by the lingo of today's forest fire fighter the tenn "Forest Fire Protection" is synonymous with "airtanker, retardant, helicopter, helitack crews, dozers, fire line organization and all that's connected with the campaign fire. Many a holocaust that provides justification for these new and expensive fire suppression tools might have never occurred had there been a voice hollering "Fire!" a little sooner. We all know fires have to be detected before they can be fought. Nevertheless, fire detection is getting less attention than fire-fighting techniques and equipment. How else could it be that there are so many agencies who in the last few years have spent more money fighting a single blaze than they did on finding all fires in the same district throughout the entire fire season? One may ask: "What can I do about this? My detection system is doing its best. Besides, I can't get any money to look for fires that might never occur."

Well, there is something that can be done. One does not need to spend more money in total, but one must persuade the treasurer to spend more money sooner, and in the right place. Just look at the overall fire protection budget. How much of the pie went to prevention, pre-suppression, detection and suppression? Did not suppression end up with the lion's share?

The fire discovery size in western Canada, particularly in the northern areas, is so large that spending more money on detection can only result in a reduction in the actual fire suppression costs. Thus, the first necessary step is the attainment of a healthy balance between suppression and detection expenditures.

Next, examine your detection system. Chances are your system is pretty well the same as it was years ago. How does this compare with the changes on the fire line?

Fire detection techniques have evolved; changes are continuously taking place. Perhaps the most significant stride in detection has been the large-scale acceptance of intermittent detectors such as the air patrol. These allow an escalation or de-escalation of detection intensity geared to prevailing fire risk, burning conditions and efficiency of fire suppression effort. Savings realized during low fire risk conditions can be used to intensify detection when it is needed most during high fire risk conditions. The result is better detection for the same money.

A number of fire suppression agencies have made aerial patrols the mainstay of fire detection. Others are maintaining a skeleton net-work of lookouts paired with air patrols or various mixtures of lookouts and air patrols. Generally speaking, aerial patrols should be used where intermediate detection can be tolerated while lookouts are considered necessary in areas demanding continuous surveillance.

Aerial patrols, owing to their intermittent nature, do depend on precise scheduling for their success. There are a number of recent developments that are valuable tools in planning air patrol schedules:

1. The Canadian Forest Fire Behavior Rating System
2. Numerous fire behavior studies
3. Computer simulation models
4. Statistical data banks
5. Special forestry weather forecasts

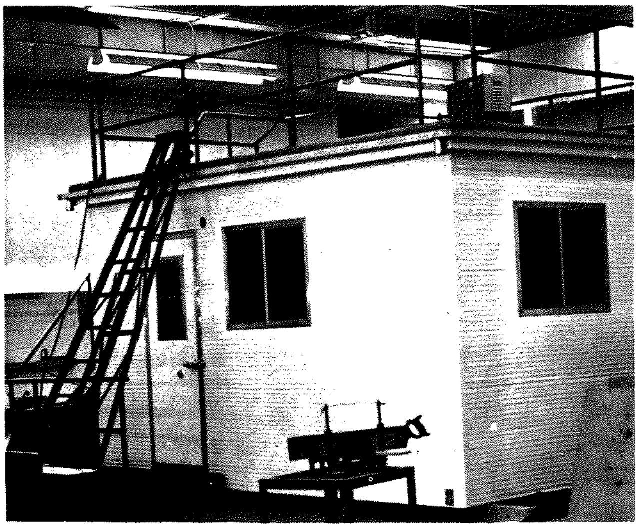
A number of electronic devices, designed to make aerial patrols more effective, have also become available. These devices range from an inexpensive airborne fire spotter to assist the aerial observer in locating hot spots to the sophisticated infra-red fire detection system capable of probing a 10-mile wide swath of terrain for incipient fires unimpeded by smoke or darkness. Other devices are doing some of the work that lookoutmen customarily do, such as:

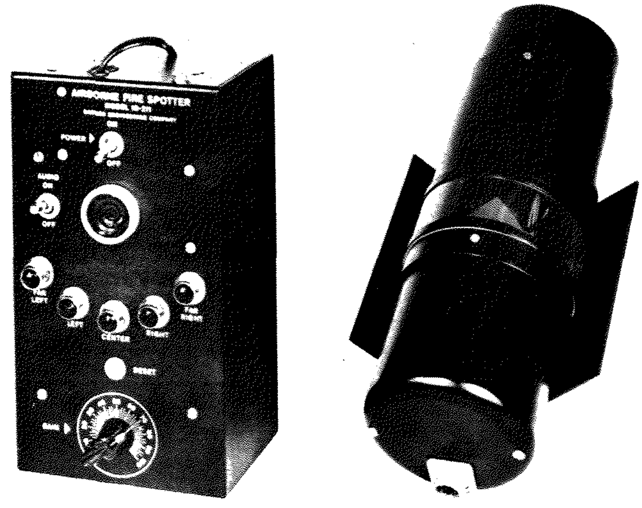
1. Weather recordings
2. Radio relays
3. Tracking storms and observing lightning strikes.

It is certain that there will be fewer but better lookouts in the future. Work is being done to increase the efficiency of lookout construction and operation. For instance:

1. Lookoutman training has been stepped up by almost all fire suppression agencies.
2. Ontario has developed a portable aluminum tower in 1970.
3. Alberta is in the process of building portable, pre-fabricated lookout cabins.
4. British Columbia and the Yukon Territory are looking into the possibility of adapting commercially-manufactured trailer units as lookout cabins.
5. Refined techniques of lookout site evaluation.
6. Quick-service radio installations.

To sum it up, regardless of the mode of detection and the system that you are using there is room for improvement. What about costs? Some detection systems can be and have been streamlined within the existing detection budget. However, if you are planning to get one good airborne infra-red detection system paired with some automated weather stations, prepare for a quarter of a million dollars in capital investments. A lot of money? Yes, it sure is – but didn't you have the same thought when you contracted the first large air-tanker?

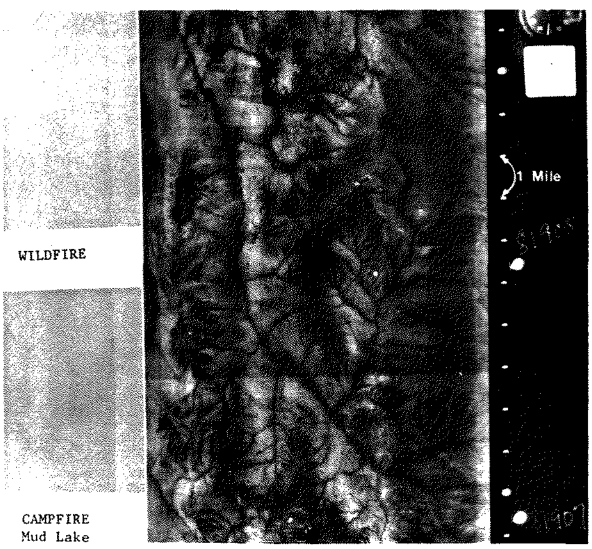




More New Developments in Wildfire Detection

A Helicopter Portable Lookout Cabin under construction at the Alberta Forest Service.

The Barnes Airborne Fire Spotter



Fire Watch Tomorrow – Which One?

Infra Red Imagery?

View from Lookout? (Sugarloaf Lookout - Alberta)

PORTABLE HELITANKER RETARDANT SYSTEMS FOR THE YUKON

In the Yukon Territory, highly flammable fuel types, extreme fire climate, inadequate fire detection, limited initial and support attack capabilities and poor access combine to make forest fire suppression a difficult task. As a result, many fires are relatively large at the time of initial action and fixed-wing airtankers have at times little or no success at suppressing these fires.

Preliminary testing by the Northern Forest Research Centre, Yukon Forest Service indicated that both medium and large helicopters, if supported by an efficient retardant mixing system established at or near the fire site, could greatly increase the efficiency of fire-fighting crews and decrease the time and money required to control the fire(s). Long-term retardant was especially effective in deep-duff fuels where repeated drops with water were usually required, and where limited accessibility and manpower prevented fast action on hotspots and potential blow-up locations, particularly on project fires. The use of retardant usually required less flying time than when water was used, thereby permitting the helicopter(s) to be utilized on other missions.

Two portable helitanker, retardant systems were developed for fire control operations in the Yukon. Phos-Chek 259 appeared well suited for helicopter use because of its low bulk and ease of mixing. Between 1.5 and 2.0 pounds Phos-Chek 259 per gallon of water are required to prepare an effective retardant mixture.

One system included two Wajax pumps, a 1,000-gallon port-a-tank, and several lengths of 1½-inch hose and siamese valves. Water pressure was sufficient to disperse and mix the retardant powder. About 75 gallons per minute could be mixed with one Wajax pump, while 150 plus gallons per minute could be mixed with the two pumps. The retardant solution was either transferred to a second port-a-tank or dipped directly from the mixing tank. The port-a-tank, which measures 8 feet by 8 feet by 2½ feet is large enough to handle dipping by a Bell 206 Jet Ranger. The Jet Ranger, which carries 90 gallons of retardant in its Sims bucket, was easily accommodated by this system with a 2½-minute turn-around. An effective drop pattern about 100 feet long and 15 feet wide is obtained with the helicopter dropping at 25 knots and 75 feet. This system, however, has limited capability in supplying large quantities of retardant.

The second system utilizes the Phos-Chek Hamp Mixer, which mixes 250 - 275 gallons retardant per minute. The svstem consists of: an eductor; a 3 x 3 Gorman Rupp wheel-mounted, electric-start pump fitted with wyes and throttle valve; and hoses, quick-connect couplings and port-a-tank(s). It is easily transported in a small truck or can be slung under a Bell 205A or Sikorsky S58T helicopter. The system has been modified to permit transport by the Jet Ranger helicopter.

Both the Bell 205A and Sikorsky S58T helicopters, which carry up to 350 gallons of retardant, proved to be very effective suppression tools. Constant availability for suppressing potential danger spots, pinpoint accuracy and the option to release part or all of the retardant load while operating at varying speeds and altitudes, make the large helicopter a versatile suppression tool. Observations showed an effective drop pattern at least 350 feet long and 25 feet wide could be obtained with a 350 gallon load of retardant.

Close co-ordination is required to maintain a supply of retardant powder at the mixing location. Experiences during the 1971 fire season showed that the increased efficiency of the helicopter/retardant combination permitted transport of the retardant powder supply by the same helicopter(s). In many instances, a fixed-winged float plane was used to supply both the retardant and fuel for the helicopter(s), thus allowing the latter to be used at maximum efficiency.

Use of the helicopter/retardant combination will greatly increase in the future. Operational fire control agencies considering the use of portable helitanker retardant systems should not automatically reject the concept because certain logistical problems appear evident and examples of where the system cannot be used are available. Rather, they should re-evaluate their fire suppression operations, particularly where airtankers, bulldozers or large numbers of fire-fighters are involved, and objectively determine where the portable helitanker retardant system can be used as an effective suppression tool.

Eductor unit can mix 250 to 275 gallons of Phos-Chek per minute.

Two Bell 206 Jet Rangers dip a 90-gallon retardant load every 90 seconds.

B-26 AIRTANKER AIR DROP TESTS WITH LIQUID CONCENTRATE

Fire-Trol 931, a liquid concentrate (LC) fire retardant, was operationally tested by the Northern Forest Research Centre in co-operation with the Alberta Forest Service during 1971. The syrup-like liquid retardant, which consists primarily of 10 - 34 - 0 diammonium polyphosphate fertilizer (fire-inhibiting salt) and attapulgite clay (color carrier), iron oxide (coloring agent) and sodium dichromate (corrosion inhibitor) is mixed with water at a 1 to 4 ratio to obtain 8.3% P_2O_5 equivalent. The ease with which the product is mixed and handled enhances its potential. However, in the mixed state it is similar to water in consistency and speculation concerning its air drop characteristics prevails.

A series of air drop tests were made with Fire-Trol 931 and the B-26 airtanker during 1971. Drop speed was 140 m.p.h. and drop height 80 - 100 feet above the open field and 75 feet above the tree canopy in a stand of lodgepole pine (65 feet tall). The table shows the length and width (to a minimum 10 feet) for Fire-Trol 931 (LC) at the .04-inch application rate (2.1 gal/100 sq. ft.). Values in parentheses represent Fire-Trol 100 slurry data reported in Volume 1, No. 1 of Forestry Report.

Drop type	Ave. Length (feet)	Ave. Width (feet)
450 gal.	170 (180)	20 (30)
225 gal.	10 (90)	10 (20)
450 gal. (2-225)	30 (220)	10 (20)
450 gal. (lodgepole pine)	60 (no data)	15 (no data)

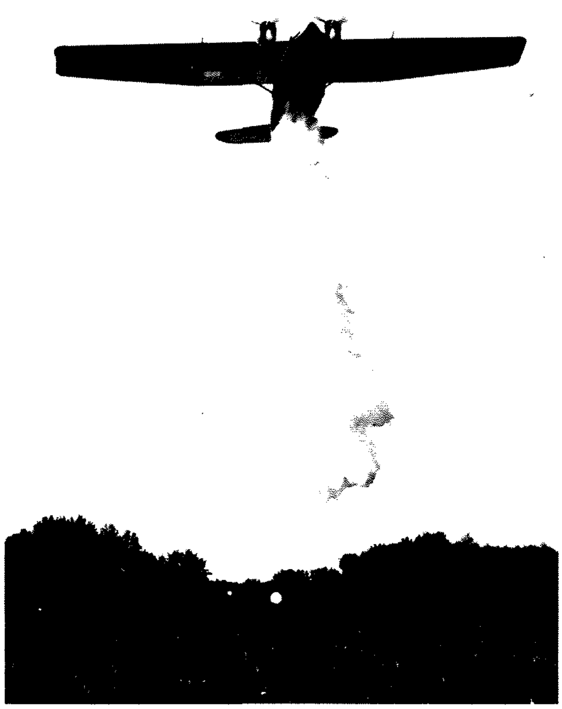
In the open field, between 60 - 65% of the Fire-Trol 931 (LC) loads reached the ground compared to 75 - 80% of the Fire-Trol 100 slurry. Greater areas of Fire-Trol 100 slurry were present in the higher concentration levels within the drop patterns, indicating that the unthickened LC dispersed more than did the slurry during the fall to the ground. Although the tests were conducted under ideal weather conditions, with winds in the 0 - 5 m.p.h. range, a significant amount of drift was noticeable with the Fire-Trol 931 (LC). This indicates that a thickening agent would be a definite asset, particularly where drops are made during windy conditions and from higher altitudes. Additional drop tests from 100 feet with a TBM airtanker during a 15 m.p.h. headwind showed Fire-Trol 931 (LC) retardant spread out twice as much laterally and had only two-thirds the length of Fire-Trol 100 slurry.

In the lodgepole pine stand, 33% of the Fire-Trol 931 (LC) reached the ground compared to 25% of the Fire-Trol 100 slurry. Results are limited, however, and composition of the natural stand may account for some of the difference in the recovery rate. The drop cloud of Fire-Trol 931 (LC), in descending into the lodgepole pine stand, resembled a swirling rain and coated the entire tree crown, but with a much thinner layer than did Fire-Trol 100 slurry. Greater amounts of Fire-Trol 931 than Fire-Trol 100 reached the ground in the lower concentration levels, decreasing the effective area of coverage within the .04-inch application range. However, in a lighter fuel, a sparse forest cover or a deep duff layer, Fire-Trol 931 (LC) would likely be more effective than Fire-Trol 100 slurry providing of course the same amounts of both retardants reached the fuel surface.

PBY-CANSO AIR DROP TESTS WITH GELGARD RETARDANT

The PBY Canso, a twin-engine, high-winged amphibious aircraft receives wide use as an airtanker in the parts of Canada where lakes are abundant. It has a load capacity of 800 Imperial gallons (two 400-gallon internal tanks) and obtains its load through a 6-inch probe while skimming the water surface at 85 - 90 knots. Loading time varies between 12 and 17 seconds, and depends upon speed and weight of aircraft and wind conditions. Loading distance is about 1600 feet. Use of GELGARD, a water thickener, which is injected into the tanks during the loading process, is a common practice.

Air drop tests were made to determine the ground distribution patterns obtained with the PBY Canso dropping a thick mixture of GELGARD retardant. Drop speed was 100 m.p.h. and drop height 80 - 100 feet above the open field and 50 feet above the tree canopy of a stand of medium-stocked white spruce and white spruce-aspen. Both stands were 85 feet high. All tests were made under ideal drop conditions; drop patterns are presented in the table. An application rate of .04-inch was previously the minimum considered to be effective for wildfire operations, although .07-inch is now considered to be a more realistic rate for short-term retardants like GELGARD applied onto low-intensity fires.



A PBY Canso dropping a load of Gelgard on to an open field test site.

Drop Type	Depth* (inches)	Ave. Length (feet)	Ave. Width (feet)
800-gallon salvo (open)	.02	275	55
	.04	230	45
	.07	170	25
400 gallon (single tank open)	.02	250	40
	.04	165	30
	.07	95	15
800 gallon salvo (white spruce)	.02	205	50
	.04	65	20
	.07	15	10
800 gallon salvo (white spruce-aspen)	.02	185	50
	.04	105	30
	.07	30	10

* .02" = 1.0 imp. gal/100 sq. ft.
.04" = 2.1 imp. gal/100 sq. ft.
.07" = 3.6 imp. gal/100 sq. ft.

SIKORSKY S58T DROP TESTS WITH PHOS-CHEK RETARDANT

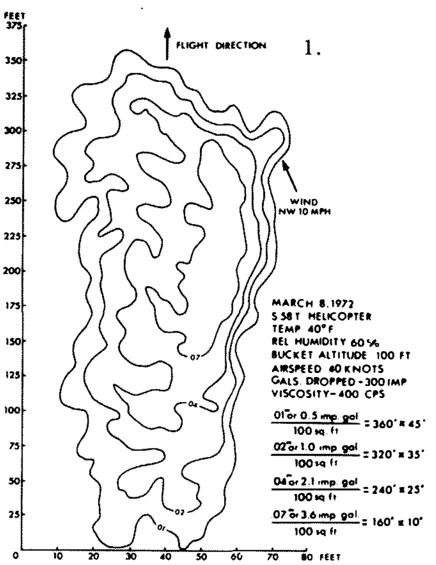
In 1971, Canadian Forestry Service fire researchers worked with Yukon Forest Service personnel to develop a portable helitanker retardant system for the Yukon Territory (see article on p. 4). Experience gained with this operation pointed to the great potential for use of large helicopters in transporting men and equipment as well as for retardant and water-dropping on wildfires. To further evaluate this potential, the Canadian Forestry Service initiated and conducted a drop test program with the Sikorsky S58T helicopter with a 350-gallon Chadwick bucket, Phos-Chek fire retardant and water.

A total of 20 300-gallon drops – 16 retardant, 4 water – were made at speeds of 20, 40 and 60 knots, bucket drop heights of 50, 100 and 200 feet and retardant viscosities of 100 and 400 cps. These drop tests, conducted at Vancouver International Airport in March owing to unsuitable weather in Edmonton, were made onto a cup-grid measuring 600 ft. by 100 ft. with cups spaced 5 and 10 feet apart laterally and lengthwise, respectively.

Assuming an application rate of 0.04-inch of retardant to stop or slow low-intensity fires, the following preliminary results are indicative of length and width of fireline established by a Sikorsky S58T helicopter.

Generally, the helicopter drop pattern is longer and narrower than that from fixed wing airtankers, a desirable quality for increased pattern effectiveness on the fire-line. While even a large helicopter cannot match a fixed-wing airtanker in total capacity, it makes up for this deficiency by greater versatility and pin-point accuracy on the fire-line. Its versatility for a portable operation adjacent to a fire, its capacity for transporting men and materials and its apparently effective drop pattern characteristics suggest a more important role for helicopters in wildfire control.

1.



2.

1) Drop pattern with Phos-chek retardant from Sikorsky S58T helicopter.

2) Evaluation of a helicopter for wildfire control.

Drop Type	Depth (inches)	Avg. Length (feet)	Avg. Width (feet)
Phos-chek			
	0.02	450	23
60 knots, 50 ft.	0.04	370	17
350 cps.	0.07	22*	15*
	0.02	160	25
20 knots, 100 ft.	0.04	150	22
400 cps.	0.07	130	17
	0.02	320	35
40 knots, 100 ft.	0.04	240	25
400 cps.	0.07	160	10
20 knots, 200 ft.	0.02	170	42
400 cps.	0.04	147	35
	0.07	135	25
	0.02	260	37
40 knots, 200 ft.	0.04	190	35
400 cps.	0.07	50*	20*
Water			
	0.02	360	35
40 knots, 100 ft.	0.04	230	26
	0.07	210	10

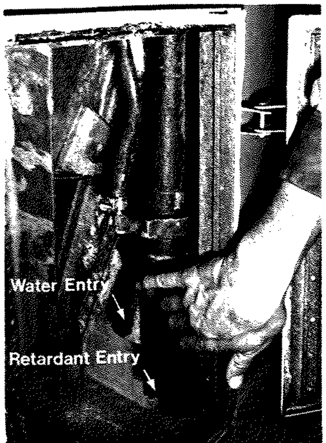
*Longest continuous retardant line of this concentration.

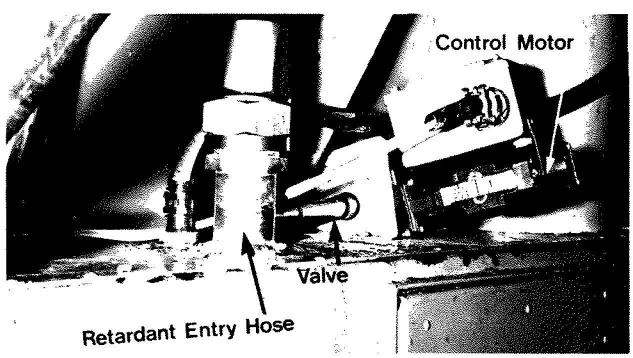
MODIFICATION OF CHEMICAL INJECTION SYSTEM IN THE PBY CANSO AIRTANKER

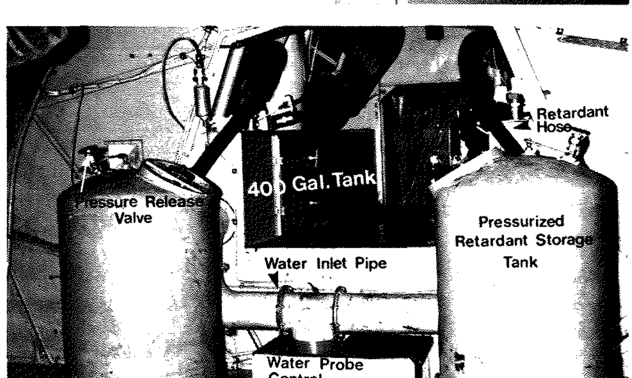
A system for injecting retardant powder into water tanks of the PBY Canso during the loading process has been widely used in Canada. To date, only GELGARD and TENOGUM short-term retardants are suitable for use with the system because of their characteristics. When added to water in small quantities, they form a viscous mixture in a very short period. These water thickeners increase the amount of material reaching the ground and permit a thicker layer of water to be retained on fuel surfaces.

The original system has been modified following numerous problems encountered during operational use. Modifications include:

1. Change of injection orifice from mid-rear to top of water tanks. (continued)







(continued)

2. Replacement of original low voltage injection timer with high voltage timer.
3. Elimination of water pressure switch used to activate system.
4. Replacement of nitrogen pressure system by air compression system.

The system must be calibrated for each retardant, i.e., GELGARD and TENOGUM.

The key to the efficient operation of the chemical injection system is proper maintenance. Details on the modification procedure can be obtained by contacting the CFS.

PORTABLE VIDEO SYSTEM - A NEW RESEARCH AID

Many fire research studies, such as a B-26 airdrop or a high-hazard prescribed burn entail considerable expense and effort to prepare for an event which lasts only a few minutes. In these situations, it is often convenient and rewarding to obtain a continuous record of the operation. A portable video system has this capability and has already proven a most valuable aid in research development and training at the Northern Forest Research Centre.

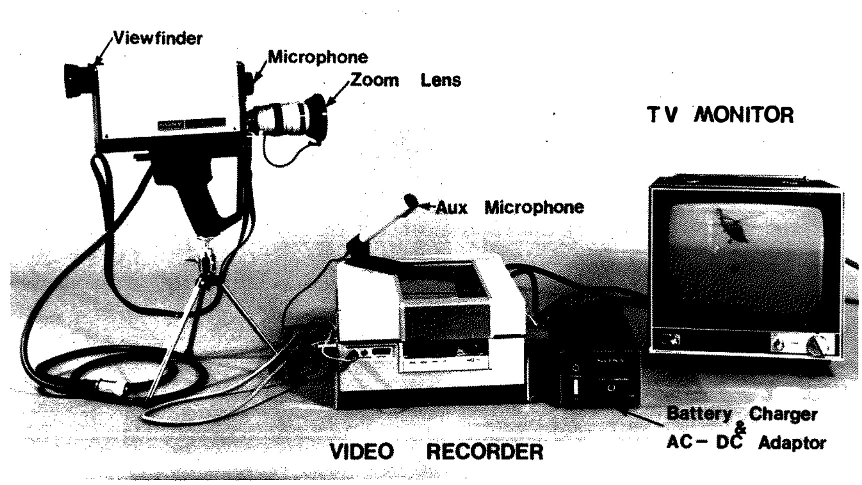
We use a Sony Videorover II (AV-3400/AVC-3400); a one man portable system which can be operated using a 12V DC or a 110V AC power source. The major components, a camera, a video recorder and a TV monitor – represent a total investment of $2,200.

The video camera, with a F1.8, 12.5-50 mm zoom lens, is automatically sensitive to light changes and has a built-in non-directional microphone. Recorded material can be immediately played back on a one-inch viewscreen housed in the back of the camera. The video-recorder stores the "live action" on a ½" magnetic tape, available in 10, 20 or 30-minute lengths.

The system has become an integral part of the fire research program at the Northern Forest Research Centre. Following a one-year assessment of its performance and application it is hoped that other regions and perhaps interested fire control agencies will purchase a video system since the exchange of edited tapes could serve as a most efficient means of immediately disseminating information.

Specific uses to date include monitoring rate of spread, flame height and flame angle during laboratory and field experiments; assessment of retardant drops from the Twin Otter, Tracker, B-26 airtankers and the S58T helicopter; supplementing training lectures in fire behavior and suppression.

Related applications include workshop taping, photographic inventory and as an aid in demonstrating research and development activities.



Major components of a portable video system used in aid of fire research.

COMPUTERIZED CANADIAN FOREST FIRE WEATHER INDEX

Recently, a Forest Fire Weather Committee (FFWC) was formed to co-ordinate forest fire weather services by the Atmospheric Environment Service (AES) and Canadian Forestry Service (CFS) of the Department of the Environment and to establish their respective roles relative to fire control agencies in Alberta, Saskatchewan, Manitoba, Yukon, Mackenzie District of the Northwest Territories and western National Parks. Based on requests by fire control agencies, the Committee developed an implementation plan to meet the immediate needs of these agencies for computer computation of Canadian Fire Weather Indices (CFWI). CFS responsibility lies primarily in the development and use of the CFWI as an operational tool in fire control programs whereas AES is responsible for forecasting of meteorological factors to produce predicted indices.

For 1972, the Committee has recommended that CFS should issue the current indices from the Forest Fire Research Institute in Ottawa to participating fire control agencies via AES communication facilities. Forecast indices are to be issued by AES directly to the fire control agency. Thus the user agency will receive the current and forecast indices for each forestry and synoptic weather station and also forecast values for selected stations in its area of responsibility. The weather factors and computed indices will be transmitted by telex or telecopier. Forecasts of temperature, relative humidity, wind and precipitation to facilitate computer computation of predictive indices will be provided by Edmonton, Regina and Winnipeg weather offices of the AES. The forecasts will be for individual stations rather than for areas.

It is expected that the 1972 actual and forecast indices program will be operational in Manitoba, Saskatchewan, Yukon, Mackenzie District of the Northwest Territories and Wood Buffalo National Park. The next major activity of the Committee will be to develop fire weather training programs to meet the needs of each fire control agency.

AERIAL IGNITION: A NEW TOOL IN WILDFIRE CONTROL

Fire suppression in remote northern areas of the Yukon Territory is complicated by inadequate detection, fire-fighting resources and access. Recognizing the limitations of conventional fire-fighting tactics and resources in such areas, the Yukon Forest Service requested the Northern Forest Research Centre of the Canadian Forestry Service to evaluate the potential of aerial back-burning and burn-out of large areas of fuel in front of fast moving forest fires (a system developed in Australia). To date incendiary capsules activated with a two component chemical reaction were field tested in the Yukon near Whitehorse by dropping them from a B206 Jet Ranger Helicopter. Work is underway to design and build a hand operated machine for dropping the capsules in front of going wildfires.

An operational field-test of the aerial ignition technique is planned during the 1972 field season on actual wildfire suppression. Yukon Fire Control Officials feel the technique has potential application in aid of fire control operations in other areas where conventional fire control methods prove ineffective.

AIRTANKER SIMULATION MODEL

A simulation model for comparing the effectiveness of different airtankers has been developed at the Northern Forest Research Centre. Utilizing fire growth models, fire occurrence and detection data, probability distributions and aircraft performance – including retardant line-building capability – the effectiveness of the Thrush Commander, TBM Avenger and B-26 airtankers was determined within a 25, 50, 75 and 100 mile operating radius.

Preliminary analysis of results indicates that for the data utilized:

1. the Thrush Commander airtanker has limited effectiveness, even within the 25-mile operating radius relative to larger aircraft.
2. two TBM Avengers and one B-26 airtankers are equally effective within a 50-mile operating radius; beyond this distance the B-26 quickly becomes the superior airtanker.
3. the ideal working unit for the B-26 airtanker is a group of three aircraft.

Additional results will be available in a forthcoming report.

REGIONAL SUB-COMMITTEE ON FIRE PROTECTION MEETS

The Fire Protection Sub-Committee was set up to periodically review the existing fire research program at the Northern Forest Research Centre and to delineate and recommend priorities for future work. Sub-Committee membership is made up of senior fire control planners from the six forest fire control agencies in Alberta, Saskatchewan, Manitoba, Yukon Territory, Mackenzie District of the Northwest Territories and western National Parks.

At its most recent meeting in December, 1971 the Sub-Committee reviewed the existing fire research program in the Region. In excess of 20 new project proposals were submitted and each proposal was subsequently assigned a priority point rating by member agencies. The results of this exercise clearly indicate that fire control agencies place much importance in increased emphasis on research and development work in detection systems and fire suppression methods. Development of guidelines for effective allocation of fire control resources, evaluation of resource values, effects of fire and fire control on the environment and refinement of fire behavior rating systems were also considered important. Also, the Sub-Committee strongly recommends that most investigations should be of a short-term (2 - 3 yrs.) nature with results immediately useful for implementation at the operational level. Client agencies are encouraged to assign a representative to such projects to ensure that the results are adequate to meet their requirements. Future meetings of the Sub-Committee will scrutinize the broad area of fire control planning and operational systems to develop in-depth proposals on the types and detail of research and development effort required. All new project proposals should be forwarded to the attention of the Chairman, Sub-Committee on Fire Protection, Northern Forest Research Centre.

CONTRIBUTORS

R. W. Reid
(Suppression Costs)
(Operations and Research)
Dr. Reid is Program Manager for protection research at Northern Forest Research Centre.

A. D. Kiil
(Regional Sub-Committee on fire protection meets; Sikorsky S58T helicopter drop tests with Phos-Chek retardant; computerized CFWI)
Mr. Kiil is Projects Co-ordinator for Fire Research at the Northern Forest Research Centre.

J. E. Grigel
(Portable helicopter retardant systems for the Yukon; modification of chemical injection system in the PBY Canso airtanker; airtanker simulation model)
Mr. Grigel was responsible for the regional research and development program on fire suppression methods until his resignation in March, 1972. He is now with the Wildfire Group, Monsanto Canada Ltd.

J. Niederleitner
(Forest fire detection in the process of change)
Mr. Niederleitner joined the C.F.S. in 1971 to conduct a research and development program in detection and communications systems.

R. J. Lieskovsky
(PBY - Canso air drop tests with Gelgard retardant; liquid concentrate air drop tests with the B-26 airtanker; Sikorsky S58T helicopter drop tests with Phos-Chek retardant)
Mr. Lieskovsky is involved in evaluation of air drop characteristics and fire retardants.

D. Quintilio
(Portable video system – a new research aid)
Mr. Quintilio has studied fire behavior in major fuels and is presently initiating a new program on fire-line construction rates.

G. Lait
(Portable video system – a new research aid; Aerial Ignition: a new tool in wildfire control)
Mr. Lait is involved in developing and testing of aerial ignition methods and equipment.

FORESTRY REPORT published by the Northern Forest Research Centre, Canadian Forestry Service, Environment Canada, 5320 - 122nd Street, Edmonton, Alberta. T6H 3S5
For further details concerning articles in this issue address the Director or Information Officer.