WEATHER MODIFICATION - A FIRE CONTROL TOOL

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In years to come, it would be known as the "Year of the Big Burn". But there was little time to consider phrasemaking now, for Alaska was aflame. Towering columns of white smoke climbed the northern sky in every direction. Each day brought reports of new outbreaks as flames engulfed stands of virgin timber and surged mile after mile in areas so widespread that organized efforts at control were out of the question for all but the most threatening.

It was, in fact, the worst fire siege in Alaska's history. By conservative estimate, more than 3-1/2 million acres - an area larger than Delaware and Rhode Island combined - had been blackened.

Foresters blamed this 1969 holocuast on dry lightning storms, erratic winds, and the combination of an unprecedented dry season extending through two summers and the previous winter. In massive understatement, they termed it an extreme emergency.

Grasping at every means of halting the major fires, the Department of the Interior surveyed the capabilities of its various agencies and considered with new interest the Bureau of Reclamation and its Project Skywater - a scientific research program of cloud seeding to augment precipitation in water-short areas of the Western United States.

Could cloud seeding, the Department asked, be used to "douse" the worst of the Alaskan fires?

In posing the question, there was born the start of a new technology that may become a revolutionary weapon in the battle against forest fires that cause an estimated $50 million in timber losses each year in the United States alone. Two years now have passed since the concept, based upon up-to-date seeding techniques, was first voiced and scientists from Government and the private sector reserve judgement about its worth. There have been, in those two years, too few opportunities to test its application.

But from those opportunities has come evidence that cloud seeding may in fact provide a valuable and effective tool with which to combat this destructive member of mankind's natural enemies.

The proposal raised a wide range of questions to Bureau of Reclamation officials in that searing summer for Alaska. The Bureau's Project Skywater is directed to goals other than the suppression of fires.

But given certain conditions, Reclamation's scientists said, the scheme might be possible. Most important, there must be clouds of the proper character, with moisture and temperature regimes that meet established criteria, and in the proper place and at the proper time. Success would hinge on the willingness of nature to exactly aline a formidable number of variables, and the ability of the scientists to capitalize on those opportunities.

The Bureau of Land Management, which is responsible for administering much of the Alaskan interior, quickly arranged for a coordinated but brief field program in response to the Alaskan emergency. The Bureau of Reclamation would make available its expertise in precipitation management. Other participating agencies included the Environmental Science Service Administration (presently the National Oceanic and Atmospheric Administration), the U.S. Forest Service, the U.S. Air Force, and the University of Alaska. The overall effort was dubbed "Project MOD" (for modification), with headquarters at Fairbanks, Alaska.

Reclamation's representative on this task force responsible for the Weather Advisory Group of Project MOD was William J. Douglas of Denver, Research Meteorologist for the Division of Atmospheric Water Resources Management. Recruited as a technical consultant was Dr. Richard A. Schleusener, Director of the Institute of Atmospheric Sciences at South Dakota School of Mines and Technology at Rapid City. The institute has been conducting research for several years under contract to the Bureau of Reclamation's Project Skywater.

To locate and identify cloud cells suitable for seeding, the U.S. Air Force made available a radar unit whose data would be used by the Project MOD staff. The Forest Service provided an aircraft equipped with the infrared photo equipment whose pictures detect fire area "hot spots" invisible to the naked eye. The Bureau of Land Management offered a small jet aircraft for high-altitude observation, a helicopter, and a short-runway light aircraft. The University of Alaska extended the use of its computer center facilities for data analysis.

The seeding operations would be conducted under contract to BLM by a Boulder, Colorado weather research firm, EG&G, Inc., which had a twin-engine aircraft for field operations.

Once assembled at Fairbanks in mid-July, the immensity of the problem became clear to the Weather Advisory Group. There were, at this moment, 56 fires raging in the Alaskan interior. They had ravaged more than 3 million acres. Nearly 1,000 men were then engaged in battling 19 of the worst fires. The remaining 37 blazes were burning unchecked and untended.

The task force quickly set about establishing criteria for the program. Two scientific issues were paramount: Would seeding produce any rainfall that might reduce the intensity of the fires, and might there be any real potential for precipitation management in forest fire suppression?

The selection of fire areas to be treated would be governed in large part by the day-to-day availability of suitable clouds moving along the proper paths.

In the days that followed during the test period, the task force was destined to frustration. Only twice were there favorable days when clouds amenable to seeding appeared over fire areas, and even then, conditions were marginal. The first of these opportunities produced some dramatic results, however.

Near Fort Yukon, a series of fires was scrambling through heavy timber, two of them named "Fishhook" and "Rotten Fish Slough." The latter had blackened 15,000 acres and was moving on so broad a front that no effort had been made to put in ground crews.

On July 26, broken cumulus clouds with tops ranging to 15,500 feet blossomed upwind of Fort Yukon and seeding and observation aircraft went aloft. Because of the wind patterns that day, neither "Fishhook" nor "Rotten Fish Slough" was an intended target. The variables that alined themselves for the task force pointed to other fires instead.

Late in the afternoon, a test cloud was selected and seeded from above with pyrotechnic devices containing silver iodide. The cloud top grew, and a grey curtain of rain unfurled itself from the cloud base beginning some 30 minutes after seeding. From the air, it appeared the showers had some effect on scattered "hot spots" below.

The following day, however, there came a surprise. After the aircraft had left the seeding area, the test cloud had continued to intensify and had moved over a part of the Fishhook fire and directly over the Rotten Fish Slough fire. Bureau of Land Management fire control officials reported that: "The southern edge of the Fishhook fire had been 'knocked down' by rain and the Rotten Fish Slough fire had been hit by enough rain so that it was completely knocked out".

The Weather Advisory Group agreed: "The position of the (Rotten Fish Sough) fire with respect to the position of the seeded cloud upwind, and the timing of the observations with respect to the time of seeding indicate that the rain was probably initiated by the seeding. The effect of rain on this fire was very marked".

Even among those most enthusiastic over the prospects for Project MOD, the abbreviated 1969 effort suggested little more than that the scheme warranted further exploration. That recommendation of the Weather Advisory Group was made, and won prompt approval from the Department of the Interior. A second program was arranged accordingly for the 1970 summer, when fires continued to burn into the third year in the Alaskan interior.

The field site this time was Galena, a village some 225 miles west of Fairbanks, on the Yukon River. Accessible only by air and water, Galena offered housing, food, fuel facilities, and a paved runway.

The contractor to the Bureau of Land Management - Meteorology Research Inc., of Altadena, California, flew in a twin-engined seeding aircraft and a weather radar, and established a rawinsonde launch site to supplement meteorologic ascents from other Alaskan points. The radar was to be used for cloud targeting in a 50-mile radius and to assist in evaluating seeding results.

At Galena, too, the BLM stationed two helicopters, along with a twin-engine aircraft for low level observation. A high-level observation aircraft, pressurized and with turbo-prop engines, was based at Fairbanks. Ground crews comprised of BLM and Forest Service personnel were made available and equipped with portable gear that included rain gages, hand anemometers, sling psychrometers, time-lapse and still cameras.

As in the 1969 program, weather data were funneled to the headquarters facility at Fairbanks where the National Weather Service and the University of Alaska combined to provide teletype, facsimile, and computer support.

An important addition to the 1970 program, however, was the use of a computer model that projected minimum cloud parameters to indicate seeding potential. The cumulus model accepts radiosonde data and produces information to indicate cloud response to seeding - cloud top growth, expected increase in precipitation, and so on, as related to cloud diameter. The model was developed by Drs. Alan Weinstein and Larry Davis, then of Pennsylvania State University. It was based initially on theoretical equations, and later modified on the basis of field experience.

When the 1970 task force became operational on June 1, the fire situation in Alaska had greatly improved from the previous year. The winter had again been dry, but a number of fires had simply burned themselves out and others had been controlled by ground crews. In the vicinity of Galena, where fire incidence had been high in years previous, there were only occasional plumes of smoke on the mountainous horizon.

During June, there were 12 days with operational weather and cloud systems. But on 7 of those days, no fires burned anywhere in the area. Of the 5 days when operations were conducted, June 11 saw the most successful effort. A cloud about 8 miles upwind of the target fire was seeded with two vertical-fall silver iodide pyrotechnics, followed by one slow-burning flare.

The cloud top grew from 12,000 feet to 20,000 feet within 10 minutes, and observers both in the air and on the ground watched as generous showers developed. The raincloud passed directly over the fire, knocking it down and depositing - by official measurement - 0.25 inch of moisture.

July was the month of the "big bust," but again Nature conspired against the task force. A line of thunderstorms ripped through the area and, within 2 days, more than 100 new fire outbreaks were reported north and east of Galena. The largest of them destroyed some 60,000 acres. The others generally were controlled by ground crews before they reached such scale. Most were outside the radar's effective range, however, and too distant from the field site to permit use of the helicopters, whose 3-hour fuel supply gave them a safe, effective range of only 60-80 miles. The choppers were essential because only they could place crews on the ground to make the on-site observations and measurements required to scientifically document the results of seeding.

Only five operations were conducted during July, and the most successful was - appropriately - on July 4. Ninety-six fires were counted that day in the Galena area, not all of them within the operations area but nonetheless offering greater opportunities than at any previous time during the 1970 season.

Upwind of an active blaze near Daklia, the seeding aircraft treated three clouds and observed an 8,000-foot growth in the cloud tops. Precipitation followed, and tracked across the northern end of the fireline to suppress the blaze there. Returning to Galena from this mission, the seeding and observation aircraft spotted another blaze with suitable clouds immediately upwind. These, too, were seeded and responded dramatically. This fire, struck by rain, went from a fast-burning condition to smoke wisps within a few minutes.

During the 2-month operational period, the variables - the complex factors beyond scientific control that required alinement before any treatment could be considered - smiled on the task force on only three occasions.

These missions took place on 2 separate days and the resulting rains hit the target fires. Without exception, the results were impressive, the showers quenching active blazes that a few minutes before were roaring unchecked through stands of virgin timber.

By any scientific yardstick, however, the success ratio was unimpressive. A summary report on the 2 years' operations observed that: "Based on the low rate of success, it appears that cloud seeding to a preselected target is not a reliable fire suppression tool". (Emphasis added).

But to the two principal questions - that is, did seeding produce any rainfall that reduced the intensity of the fires, and is there real potential for weather modification in forest fire suppression - the task force members offered a qualified "yes".

The greatest prospect for this new scientific tool would appear to be in attacking what foresters call the "buildup index". This is a measure of cumulative dryness related to a regional fire hazard. At those times and in those places where a real forest fire hazard develops, selective cloud seeding might offer one means of reducing the potential for an outbreak of fires.

No decision has been made at this writing whether the fire suppression program will be extended, in Alaska or elsewhere. Should further testing and evaluation be recommended, however, members of the Weather Advisory Group concur that future programs should have greater flexibility than was possible in either the 1969 or 1970 Alaskan effort.

To permit as complete a test as possible, the aircraft-equipped seeding teams should have sufficient logistic support to attack fire situations anywhere they develop so long as suitable clouds are available. The experiences of Alaska indicate that too few opportunities are permitted when, even after the most careful consideration, a fixed base of operations is designated in a high fire incidence area; when limited-range radar support is provided; and when no more than a single seeding aircraft is available.

Under these conditions, far more suitable opportunities are destined to be lost than are identified and treated. Hence, a more widespread test on a broader front, over a longer time span, and with greater logistical support would appear to be desirable.

Whether in controlling the buildup index or in suppressing fires once they are in progress, the techniques of weather modification must be considered - at least at this point in their development - as a potential supplement to other fire control techniques already in use.