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USE OF AIR TANKERS PAYS OFF... a case study

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Air tankers are effective in helping control wild-fires, but they have also proved to be an expensive tool. The cost of aircraft operations is high. And the cost of chemical fire retardants is not insignificant. Most wildfires break out in rough terrain, where air tankers cannot drop retardants with pinpoint accuracy. Consequently, sizable amounts of chemicals are wasted because of missed targets and overlap of successive drops. If air tankers are used extensively, aerial operations become a major item in the cost of controlling a fire. Because of the ever-rising cost of putting out forest fires, fire control organizations are beginning to ask: Can the use of air tankers be justified?

Justification depends on the answer to the question: Did the use of air tankers reduce suppression costs and fire damages enough to offset the cost of their use? Although the question is simple to pose, finding the answer has many obstacles. Probably the most troublesome is the difficulty in ascertaining where the fire would have been stopped had the tankers not been used. In most fires, air tankers are used on many sectors, and for various objectives. Under these conditions, accurate cost data for any single area are difficult to obtain. Therefore, reliable evaluation of the effectiveness of tanker use for that area is seldom available.

In the 1967 Timber Canyon Fire on Los Padres National Forest, in southern California, the obstacles were not so formidable. Almost all of the air tanker use was confined to one area of the fire and to one fire control problem. Reliable data were available on direct and potential damages, air tanker use and cost, and other suppression activity costs. Data obtained in the fire area on weather, fuel moisture, and topographic configuration made it possible to estimate with a fair degree of confidence, the probable extent of the fire had tankers

ABSTRACT: Fire suppression costs in the 1967 Timber Canyon Fire, in Southern California, were increased by about \$39,000 over what they would have been had air tankers not been used. But because aircraft were called into help put out the fire, fire damages were reduced by \$501,375—yielding a “profit” of \$461,574. Data on weather, fuels, and topography made it possible to project with a fair degree of confidence what the probable fire area would have been had air tankers not been used.

RETRIEVAL TERMS: aerial fire suppression; benefit cost analysis; fire suppression costs.

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Figure 1.—The Timber Canyon Fire, after breaking out on October 16, 1967, spread well beyond its point of origin on successive days. Had air tankers not been used to control the fire, it probably would have spread to and covered Areas A and B.

not been used. Therefore, this fire provided a good opportunity to appraise the economic value of the air tanker use.

THE TIMBER CANYON FIRE

The Timber Canyon Fire started near the mouth of Timber Canyon late in the afternoon of October 16, 1967. Under the influence of Santa Ana winds the fire spread rapidly to the north and west along Santa Paula Ridge. The Santa Ana winds slackened during the night, but by the morning of October 17, fire had covered nearly 7,100 acres (*fig. 1*). To the west the fire was being held successfully above the developed area along Santa Paula Creek. In the northwest corner, the fire had reached the sparse fuel of an old burn and posed little threat for much further spread. The fire was also checked on its southern flank, mostly along the agricultural areas in this sector. In Timber Canyon the fire was being held on the relatively gentle slopes of the canyon bottom up as far as the steep topography at the head of the canyon. Thus, on the morning of October 17, the fire boss was faced with the problem of preventing the fire from crossing Santa Paula Ridge into Santa Paula Canyon, and of stopping the eastward and southerly spread of the fire in the upper reaches of Timber Canyon.

Under the weakening Santa Ana conditions the behavior of the fire on October 17 was dominated by up-slope thermal winds and by topography. The fire spread slowly until it reached a favorable position in fuel and topography. It then made a hot fast run to the top of the ridge. Some of the runs increased the amount of fire on the north side of Santa Paula Ridge. Spotting was frequent in the dry fuels, and even when moving slowly, the fire burned hot and aggressively. On the north slope of Santa Paula Ridge, fire spread was chiefly from rolling material.

To slow the fire spread and to provide a reasonable margin of safety for the crews in the steep topography, air tankers operated extensively over the head of Timber Canyon and the slopovers on Santa Paula Ridge. This action met with some success, and the fire crews were able to hold the southern edge of the fire in Timber Canyon and to slow down fire spread to the east and north. But ground crews could not complete a control line on the east flank before dark. By then the tankers could no longer operate. Without the holding action of the tankers, the fire gradually built up. Under the influence of a northwest wind it made a rapid run down Timber Canyon and over the dividing ridge into Boulder Canyon (*fig. 1*). The southern

edge of this run was controlled during the night, as was the eastern edge that lay in the more gentle terrain of the lower part of Boulder Creek.

Weather and fire behavior changed little on October 18. Air tankers flew in again to slow the fire while crews constructed a control line close to the fire edge. This operation was carried on successfully during most of the day. By late afternoon, however, the Santa Ana conditions had weakened to the extent that a strong flow of marine air penetrated the lower levels of the Santa Clara River Canyon. The strong westerly wind started a fire run in the lower part of Timber Canyon that carried into the bottom of Boulder Creek, where it was finally stopped (*fig. 1*). This run nullified much of the control work of the day, however.

On October 19, the use of the air tankers in a holding action was intensified. The control line in Boulder Creek was successfully completed and burned out. A control line on the north side of Santa Paula Ridge was nearly completed. With the help of the tankers this line was completed on October 20, and the Timber Canyon Fire was over.

ECONOMIC ANALYSIS

During its brief life the Timber Canyon Fire burned over 11,448 acres of watershed land. Its final perimeter was 23.3 miles. Cost of suppression was \$628,406, of which \$122,336, or about 19 percent, were spent for the 223,100 gallons of retardant dropped on the fire. Direct and watershed damages were estimated at \$95.50 per acre,¹ for a total damage of \$1,093,929. Without the retardant cost, the suppression cost was \$506,070, or \$21,719.74 per mile of perimeter.

Where would the fire have been stopped had air tankers not been used? The answer to this question must always be somewhat speculative. Because of the dry fuels, rugged terrain, and the existing weather pattern, it is highly probable that the entire Boulder Creek drainage would have burned. The most likely place to stop the fire spread to the east was in the sparse fuels on the east edge of Snow Canyon. To the south, the agricultural lands provided a natural fuel-break. The main divide to the north also provided a likely place for a final control

¹Watershed damages were derived from *Fire Damage from Increased Run-Off and Erosion—Los Padres National Forest* by C. C. Buck, W. L. Fons, and C. M. Countryman, U.S. Forest Serv. Calif. Forest & Range Exp. Sta., Berkeley, Calif. 107 pp., illus. 1948. Direct damages were determined by contact with property owners in the fire area.

line. This area (*Area A, fig. 1*) would have increased the burned area by 2,816 acres. In the Santa Paula Ridge area, the probable extent of the fire is more uncertain. Without the air tankers the fire probably would have reached the bottom of the East Fork of Santa Paula Creek in several places. The fire would have been in a position for extensive runs in the heavy fuels on the south-facing slope of this drainage. Because of the steep inaccessible terrain, the entire East Fork drainage and quite possibly much more probably would have burned. The East Fork drainage (*Area B, fig. 1*) would have added another 2,434 acres to the burned area. Thus, without the air tankers the extent of the Canyon Fire quite likely would have been about 5,250 acres more than it actually was.

Did the use of air tankers pay off economically? In suppression costs alone, it did not. The difference in the actual burn perimeter and that of the projected fire was about 3.8 miles. From the suppression cost figure of \$21,719.74 per mile calculated for the actual fire, the cost of suppression of the added area would be \$82,535. With a tanker-use cost of \$122,336 the suppression cost would be \$39,801 more with the tankers than without. The damage figures, however, tell a different story. At \$95.50 per acre, the damages for the additional 5,250 acres in the projected fire would amount to \$501,375. After deducting the loss for suppression costs, the "profit" from the use of the tankers would be \$461,574—an excellent payoff for an investment of \$122,336.

CONCLUSIONS

The use of air tankers on the Timber Canyon Fire was economically worthwhile and tactically successful. It does not follow, however, that this will always be true, for each fire presents a unique situation as to possible fire spread, potential fire damage, and probable fire suppression costs. The cost of an air tanker operation can also vary greatly, as can the possibility of the operation meeting its objective. Air tanker use is most likely to be profitable if potential fire damages are high and relatively few acres "saved" can offset tanker costs. Use of tankers is least likely to be profitable if there is low damage potential or if the fire spread is likely to be limited by weather or existing barriers. High fire danger can increase the likelihood of extensive spread, but can also increase the probability that an air tanker operation will not be successful. Unfortunately, the quantitative data needed in deciding when to use air tankers are seldom available. Until more is known about fire behavior under various conditions, fire damage potential, suppression costs, and effectiveness of air tankers, this decision must be subjectively made.

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The Author

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