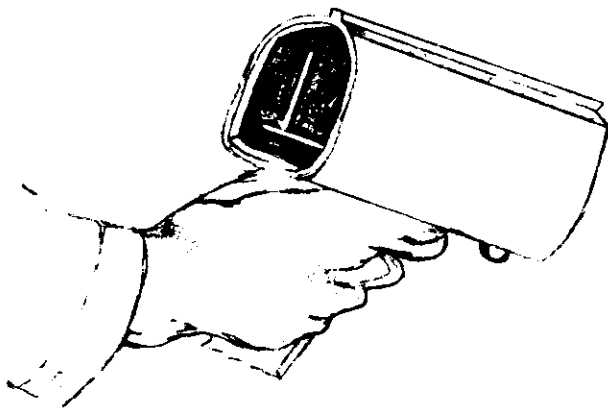


Roscommon Equipment Center

- INTERIM REPORT -

PROJECT NO. 28 - HAND-HELD IR SPOTTER



NORTHEAST FOREST FIRE SUPERVISORS

JUNE 1979

- INTERIM REPORT -

REC Project No. 28 -- Hand-Held IR Spotter
June 1979

At the June 1977 Roscommon Equipment Committee Meeting the decision was made to approve this project and purchase six 3-M brand hand-held IR spotters (Model 201MS). The scanners were purchased and received in September 1977.

As a condition of sale, the 3M Company would only release them after a "hands-on" training in their use and interpretation. This stipulation was made by 3M to protect their new product and insure that user evaluation was made with full knowledge of the capabilities and limitations of the equipment. Purchase price for these units is \$465.00 each (current market price).

The six units were assigned to the following States:

New York	Maine
Michigan	Massachusetts
Pennsylvania	Wisconsin

Both the States of Minnesota and Michigan own and use additional units outside the REC program. For evaluation purposes their data will be included in this report.

Report Summary

Use on Fires to Date

Wisconsin - 1
Minnesota - 24
Pennsylvania - 2
Michigan - 9

Total fires - 36

Repairs Needed

None

Types of Fuel in Which Units Were Used

- Peat
- Duff
- Jackpine slash
- Hardwood slash
- Understory fuels in typical eastern hardwood and pine stands

The units were evaluated to work successfully in all fuel types tested thus far.

Use of the Instrument

Most users rated the scanner as "simple" to use. However, one individual said "simple to use, but complex to interpret." The interpretation problem was highlighted by the 3M technical representatives as presenting the greatest potential for misuse.

Design Improvement

No suggestions to date.

Training

A number of other individuals have received training in the use of the scanner. Training has been in the range of 1-2 hours. There were no problems experienced by the trainers in instructing others in the "proper" use of the scanner.

Other Uses

Checking heat loss locations from buildings.

Since purchasing the 3M scanners, another company has been marketing a similar type device. Macer Industries of Fallon, Nevada produces a small hand-held scanner (Macer Model 485) at a cost of \$250.00 each. It was decided by the Roscommon Equipment Committee to purchase three of these units for comparative testing with the 3M units. We are presently waiting on delivery. The units will be placed in the States of New York, Michigan and Minnesota.

To supplement this brief report two narrative reports submitted by the State of Pennsylvania have been included in the Appendix. Appendix "A" is a report on actual fire use by a District Forester; Appendix "B" is a report comparing the 3M and Macer using charcoal briquettes as the heat source.

Conclusion

Since this is an interim report, there are no conclusions offered. Fire seasons for the past two years have been light and have not afforded scanner users with the opportunity to adequately test their units. The addition of the Macer units will lengthen the life of the study to enable a good comparative test.

APPENDIX

May 23, 1978

SUBJECT: Infrared Scanner

TO: Mr. Warren Ely, Staff Forester
Division of Forest Fire ProtectionFROM: 
Robert M. Coy, District Forester
Wyoming Forest District # 20

By: Don Wary

The infrared scanner gun from the Division of Protection was used on two fires in Luzerne County between April 28 and April 30th.

The fire on April 28th., was approximately 1 acre in size upon arrival and was burning moderately hard in heavy brush fuel. The helicopter was working the head and East flank. As soon as the crew had the fire knocked down, I started using the scanner gun to check the lines. The lines were still too hot to use the gun on the high gain setting. On the medium setting the gun was set off by areas that were still smoking. Only visably hot areas set off the scanner when it was set on the low gain level.

The only problem that occurred on this fire was when I cooled the scanner off by pointing it at the hand raked line the crew placed around the fire. After it was cooled down the gun would go off when it was pointed at normal leaf surface.

We were successful in finding about 6 hot spots with no visible smoke with the scanner.

The second fire occurred about 2:00 AM on April 30th. Because of the presence of a number of mine shafts and dangerous cliffs in the area of the fire, the crew waited until dawn to suppress the fire. I went to the fire with Dick Gearhart's crew at about 10:00 AM to mop up and patrol it. The only areas with visible smoke were along the North flank. We split the crew and I went with half of them to the south flank to begin scanning the perimeter. Before we got to the top of the ridge, our recon plane spotted a small breakout within the fire perimeter in a rock ledge. We proceeded to the area of the breakout and used the scanner to locate several hot spots in the rock outcroppings.

The scanner was sensitive enough to pick up burning leaves 3 to 4 feet down in the rock layers. It was also able to pick up areas where dry moss was burning in cracks in the rocks.

Altogether we found about 15 hot spots with no visible smoke along the fire's edge that we felt could have started breakovers with the existing low humidity and high winds. We also found several trees near the perimeter that were smoldering under loose bark layers.

Although we were not able to test the device on many fires, we were quite impressed with the results. I feel if it was used properly, it would be an excellent tool for cold trailing the perimeters of fires when weather conditions exist that could cause breakover problems.

DKW/jl

Testing Hand Held Infra Red Devices
For Determining Heat Sources On Wildfires

The tests were completed by Warren Ely, Chief of Operations Section-Division of Forest Fire Protection, Robert Davey, Staff Forester West-Division of Forest Fire Protection, John McCarty Forest Technician East-Division of Forest Fire Protection, Stanley Hess Forest Technician West-Division of Forest Fire Protection, and Barry Killian, Student Intern Elizabethtown College.

Test Date: October 3, 1978 and October 4, 1978

Place: Elizabethville Warehouse Division of Forest Fire Protection

Items Tested: 3M Brand Heat Scanner Model 201 MS,
Macer Industries Inc. Heat Sensor Model 485

Phase I Test - 3M Heat Scanner Model 201 MS, Macer Industries Model 485
Date October 3, 1978 Time 9:00 a.m. to 1:30 p.m.

Temperature - 47°F

Weather - Mostly Sunny

Test Site - Elizabethville Warehouse, PA. Bureau of Forestry
Division of Forest Fire Protection
Dauphin County, Pennsylvania

Materials Used - 3M Heat Scanner Model 201 MS, Macer Industries Heat Sensor Model 485, 50 foot rewind tape, Kingsford charcoal briquettes, aluminum foil, fresh Mallory, alkaline batteries for both Infra Red Devices.

Test Procedure - Using two hot charcoal briquettes placed on aluminum foil, measure the maximum distance in feet and inches from the heat source (hot briquettes) to the Infra Red device where the Infra Red device indicates the heat source. This process was repeated by adding one hot briquette at a time, and measuring the distance. The results were tabulated in the following table.

Number of Briquettes	3M Scanner Model 201 MS Sensitivity Meter			Macer Industries
	High	Medium	Low	Model 485
2	13'0"	6'6"	3'10"	36' 4"
3	15'8"	8'1"	3'10"	45' 0"
4	12'0"	7'11"	4'12"	59' 7"
5	15'0"	9'0"	6'9"	75' 9"
6	-	-	-	107' 1"
xxx				
10	17'2"	9'5"	6'9"	118' 9"

xxx Skipped briquettes 7, 8, & 9 then moved to a shade location for the ten briquette test. We could not test the 3M scanner model 201 MS at the original site because of partial sunlight.

Discussion - The 3M scanner Model 201MS appears to be a very sensitive heat scanner. We had to move from our first test site where patches of sun light filtered through the tree canopy to a second test site which was completely shaded. The reason for the move was the temperature differences picked up by the 3M heat scanner in the sunlit portions of the Forest Floor. The indicator needle makes no distinction between sunlight shadow temperature differentiation and the hot briquette location. An alternative solution to the sunlight-shadow problem is to switch the sensitivity switch to low. This decreases the sensitivity of the 3M scanner for picking up the hot briquette heat source.

As long as the Macer Model 485 was pointed accurately at the briquettes, heat sensing occurred. The tabulation shows that 10 hot briquettes were picked up at 118' 9" using the Macer Model 485. Of course the briquettes were in plain view and pinpoint sighting was used. Still, this was an impressive distance for the machine to sense a heat source.

The testers also noted that it was possible to determine if a heat source was cooling using the 3M Model 201 MS. This would be an advantage in cold trailing on wildfires. This was accomplished using the directions found on pages 5 & 6 of the training manual.

Phase 2 Test - Macer Industries Inc. Heat Sensor Model 485 and 3M Brand Heat Scanner Model 201 MS

Date - October 4, 1978

Temperature - 54°F

Weather - Overcast with intermittent showers

Test Site - Elizabethville Warehouse PA Bureau of Forestry Division of Forest Fire Protection, Dauphin County Pennsylvania

Materials Used - 3M Heat scanner model 201 MS, Macer Industries Heat sensor Model 485.

Test Procedure - Individual hot charcoal briquettes were placed at random along a trail. A total of ten heated briquettes were used. The persons using the two test Infra Red devices walked the trail scanning for the heated briquettes. The recorders noted the distance at which the Infra Red devices picked up the heated briquettes. The persons using the Infra Red devices started at opposite ends of the trail. It took both testers about 2½ minutes to complete this task. The results of this test are tabulated as follows:

Trial #1

3M Scanner Model 201MS

Macer Industries Model 485

Distance in feet	Time Seconds	Briquette No.	Distance in feet	Time in Seconds
2	11	1	6	
3	35	2	8	
7	60	3	9	
3	67	4	6	
5	72	5	missed	
5	90	6	10	
3	110	7	9	
4	120	8	8	
5	130	9	missed	
4	150	10	10	
				Total Time (2 min. 15 sec.)

Trial #2

It was decided to hide 10 briquettes on another trial to simulate fire line hot spot conditions. Some examples include: Placing a briquette between two stones, under and along fallen tree branches, and near the base of standing trees at the root collar.

These briquettes were placed so that heat was radiating from the briquettes. During this trial run, each tester found 4 briquettes out of ten. The remaining six briquettes were missed.

We found the six briquettes on a subsequent scan along the trail.

Discussion - All of us involved in testing these passive Infra Red devices gained experience in the use of these devices. Our observations were reached by consensus of the group.

First, we found that the 3M Model 201 MS is sensitive to sunlight. This sensitivity is described in the training manual for the 3M scanner under "hints to assist in more effective heat scanner operation" page 6. This sensitivity causes frustration for the person using the 3M scanner. Our past experience in coldtrailing on wildfires, gives us the feeling that confusion and frustration caused by sensitivity to sunlight using the 3M scanner would discourage the use of the 3M scanner on wildfires.

On the second day of testing (total overcast) the 3M scanner was easier to use. The 3M scanner was picking up only the radiant heat from the briquettes. We think using the 3M scanner Model 201S is satisfactory on cloudy and overcast days or at night. Partly sunny to sunny days will increase the difficulty of using the 3M scanner to the point of user frustration. If the problems associated with using the 3M scanner on sunny days can be resolved; the practical use of the 3M scanner will be increased. The Macer industries Heat sensor Model 485 was easier to use than the 3M scanner Model 201 MS. The problem of using the Macer 485 in full sunlight didn't exist. We did find that after using the Macer Model 485 for approximately 30 minutes, the machine malfunctioned. This was characterized by a constant buzzing and light indication when the activator bar was depressed. The maladay occurred during both days of testing. The limited literature available on the Macer Heat

Sensor doesn't refer to any environmental condition which would create this malfunction. On both days after a period of time the sensor again reacted correctly.

This malfunction could cause serious problems when used in "cold-trailing" on wildfires. Additionally, we observed that heat sources could be missed using the Macer Model 485. We think this is caused by the 10° field of view. This makes scanning for heat sources more time consuming and increases the chances for missing heat sources.

Both Infra Red devices tested exhibited drawbacks. The 3M scanner Model 201 MS when used in partial or full sunlight, reacts readily to the differences in temperatures between the shaded and sunlit surfaces. This creates a serious problem when using the device to detect heat sources on sunny days. This could easily lead to the observer discontinuing the use of the heat scanner because of the sensitivity of the device. With the Macer Industries Inc. Model 485, the 10° field of view created a situation where meticulous scanning with pinpoint accuracy was necessary. During both days of testing the Macer Model 485 malfunctioned after using the device for a period of time. Perhaps the best heat scanner would incorporate the best features of these tested devices. We like the Macer Model 485 because it is an easy device to use. There is no problem with solar radiation causing the device to indicate a heat source. The 3M scanner Model 201 MS works well on cloudy days, and the field of view is 28°. For our use, in testing these two devices we conclude that the ease of operating the Macer Model 485 on sunny days is the important factor that makes us prefer this heat sensor. We will continue Phase 2 testing after leaves have fallen from the trees.

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