

M1649

Evaluation of an Electronic Guidance System for Aircraft Used to Apply the Bait in the Imported Fire Ant Programme¹

Abstract

An evaluation of an electronic guidance system (Lorac) for aircraft was made during a series of bait treatments for the imported fire ants, *Solenopsis richteri* Forel and *Solenopsis invicta* Buren, in northeastern Mississippi. We found that the system was highly sensitive, and inspection of the continuously-recorded flight charts provided a good method of detecting probable skips in the bait dispersal patterns. The data indicated that the ability of pilots to utilise the system varied but increased as they gained experience.

Evaluation

W. A. Banks et al. (Florida Area Southern Region, Agr. Res. Serv., USDA, Gainesville, Fla., unpublished data) concluded from a series of eradication trials that isolated infestations of imported fire ants, *Solenopsis richteri* Forel and *Solenopsis invicta* Buren, can be eradicated from several million acres with mirex bait if the bait is applied uniformly over the entire area. However, collections of bait after aerial application have shown widely varying rates of deposition, and strips of land a few feet to several hundred feet wide and of different lengths occasionally receive no bait at all.

The principal sources of the errors in distribution are the guidance system of the aircraft and the variable drift of released bait due to the winds. Thus, the recent development of electronic guidance systems has produced great improvement. Henderson (1966) demonstrated vividly the advantages compared with the use of manually operated guidelines

(helium-filled kytoons). Still, even with electronic guidance systems, aircraft can deviate from the desired flight path, perhaps as a result of interference with the electronic signal (e.g., lightning and radio or television transmissions) or because of inexperience or inefficiency of the pilot. (However, a permanent record of the flight path is made so deviations can be detected, and large skips can be reflown.)

We were therefore interested that during the third application of bait to an eradication trial area in northeast Mississippi we had the opportunity to make a detailed inspection of the flight records of an electronic guidance system developed by the Lorac Company.² Lorac uses a strip recorder to make a continuous permanent record of the flight path of the aircraft. On the resulting charts, one mile shows as 98 mm along the longitudinal axis and 150 ft by 20 mm along the lateral axis. The system has a maximum transmitter and receiver sensitivity of ± 6 ft, and the maximum lateral deviation allowable by specification is 12 ft. As a result, a clear record of the flight path of the aircraft is obtained, and deviations of only a few feet can be measured (Fig. 1). Major skips noted on the chart corresponded exactly to skips noted on the ground.

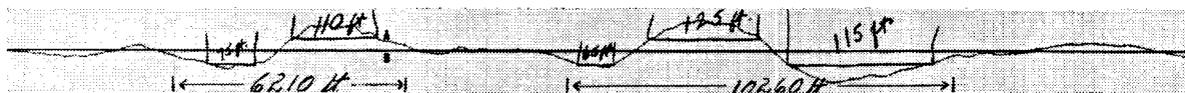
In our study, we listed as potential skips all deviations of more than 50 ft from the desired flight path that were longer than 1000ft (Table 1). (The shorter deviations that occurred were

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¹ This paper reflects the results of research only. Mention of a pesticide, commercial or proprietary product in this paper does not constitute a recommendation or an endorsement of this product by the U.S. Department of Agriculture.

² Lorac Service Corporation, 6200 East 41st Street, P.O. Box 1590, Tulsa, Oklahoma 74102.

Figure 1. Performance of pilots recorded by Lorac recorder. In this 6-mile example, the pilot moved back and forth over the theoretical flight line in a lateral displacement ranging from 65 to 125 ft for approximately 16,000 ft. A - actual line recorded, B - theoretical flight line.



not studied.) Totals of 3 aircraft and 4 pilots were involved; swath lengths of 20 miles and intervals of 140 ft were flown (a theoretical 25-ft overlap); and a total of 365,489 acres was treated. From our readings of the Lorac charts, 16,221 acres (about 4.5% of the area) were theoretically missed, that is, received no bait. This area may not seem large, but it becomes significant because at a rate of one ant colony per acre, 16,221 colonies could have survived. (If the density was 10 colonies per acre, 162,210 colonies could have survived.) Obviously, in any eradication program, survival of this many colonies would mean failure. Another factor that became evident from the data is the increased efficiency of the pilots with time on the job. Wherever sufficient information was available to judge an individual pilot, the number of skips decreased more than 90% with time. Thus, skips due to inability to follow the Lorac signal can be reduced by using well-trained pilots (Figs. 1 and 2 and Table 1).

We have also reviewed the 440 miles of flight

to determine the number of potential skips that would have been eliminated if the swath width had been decreased to produce 37½ or 50 ft of overlap on either side of the swath (Table 2). The aircraft deviated from the desired flight path by more than 25 ft on 1014 occasions; about 36% of the deviations would have been eliminated with a 37½-ft overlap and about 77% with a 50-ft overlap. However, even with a 50-ft overlap, 233 deviations would not have been covered. Thus, with the present swath width, an increase in overlap to cover all skips due to flight error would soon become uneconomical.

Table 1 shows the number of acres that were reflight because of large skips detected by evaluating the Lorac flight charts. Because this evaluation was made after the third in a series of three treatments to the test area, the number of ant colonies present was certainly low. Thus, we cannot say with certainty that our choice of areas for retreatment was entirely adequate; however, we did not find any colonies during the posttreatment surveys.

Table 1. Data collected by Lorac from a Lockheed PV-1 aircraft used in a northeast Mississippi eradication block, 1969.

Aircraft no.	Dates of treatment	No. of swaths	Strip no.	Acres	Percent acres missed	Acres reflight ¹
45CK	9/29-10/17	102	4	37,944	8.56	1,829
	10/9 -10/24	102	5	37,944	2.29	602
	10/18-10/19	40	11	14,880	5.49	284
	10/22-10/25	55	1	22,505	.70	78
159U	9/26-10/8	102	2	37,944	6.31	1,605
	10/2 -10/24	102	6	37,944	2.08	213
	10/4 -10/18	56	12	20,832	1.76	0 ²
	10/9 -10/23	104	7	38,688	.56	78
4680-Pilot 1	10/21-10/24	73	9	27,156	.43	0
	9/26-10/24	101	3	37,572	14.32	4,339
	10/9 -10/17	100	8	37,200	2.83	728
Pilot 2	10/9 -10/17	40	10	14,880	5.40	0 ²

¹ Only those skips deemed extremely hazardous were retreated.

² Skips in these strips not reflight so mound survival due to deviations could be determined.

Figure 2. Performance of pilots after a period of training with the Lorac system. In this 6-mile example, the maximum lateral deviation from the theoretical flight line was 50 ft. A – actual line recorded, B – theoretical flight line.



Table 2. Deviations of 25 ft or more noted on the Lorac recorder strips from the last treatment of the northeast Mississippi eradication block and the number that might have been eliminated with an increase in swath overlap from 25 to 37½, 50 ft, or > 50 ft.

Aircraft	Number of deviations of more than 25 ft	Deviations that would have been covered by an overlap on each side of swath of					
		37½ ft		50 ft		More than 50 ft	
		Number	Percentage	Number	Percentage	Number	Percentage
4680	358	93	25.98	160	44.69	105	29.33
159U	316	120	37.98	118	37.34	78	24.68
45CK	340	157	45.38	139	40.17	50	14.45
Average	340	123	36.45	139	40.73	78	22.82

From our evaluation, Lorac electronic guidance system is a highly sensitive method of guiding and charting the flight path of aircraft applying mirex bait, and detailed inspections of the flight charts will permit detection of skips caused by inaccurate flying. The data also show that the ability of the pilots to

follow the electronic guidance signal varies and increases greatly with experience.

REFERENCE

Henderson, D. K. 1966. Decca system looks good for large scale ag operations. American Aviation. Aug. 1966.