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**PERSPECTIVE ANALYSIS OF THE  
PROPOSED ALPA APPROACH  
LIGHT SYSTEM**

A Supplement to Technical Development Report No. 96

**PERSPECTIVE ANALYSIS OF  
APPROACH LIGHT PATTERNS**

By  
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Technical Development Report No. 133



**CIVIL AERONAUTICS ADMINISTRATION  
TECHNICAL DEVELOPMENT AND  
EVALUATION CENTER  
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## PERSPECTIVE ANALYSIS OF THE PROPOSED ALPA APPROACH LIGHT SYSTEM

### SUMMARY

This report is a supplement to Technical Development Report No. 96, "Perspective Analysis of Approach Light Patterns," and covers the perspective analysis of the ALPA approach light system. It includes sketches of the perspective patterns as seen from several different viewing positions as well as a discussion of the effectiveness of guidance furnished by the system.

### INTRODUCTION

During the past several years many different patterns of approach lights have been developed, and much controversy has arisen regarding their relative merits. Many of these different systems were compared and tested at the Landing Aids Experiment Station at Arcata, Calif., and the slope line system was adopted as standard for the United States as a result of the recommendations of the Air Force-Navy-Civil Subcommittee on Visual Aids to Air Navigation, which resolved most of the controversy.

The Air Line Pilots Association, however, subsequently proposed and sponsored a configuration, designated in their report as the ALPA Approach Light System. This system essentially consists of an axial row of horizontal 14-foot bars of lights, mounted at the level of the threshold, and a condenser discharge lamp mounted with each unit. A 200-foot overrun area is outlined or boxed with red bars, and the threshold and first 200 feet of the runway are outlined with closely spaced green lights. One crossbar is provided at 1,000 feet from the threshold. A plan of this system is shown as Fig. 1.

The following study of the perspective patterns of this system was made under the same conditions and by the same method as those of other approach light systems described in a previously published report.<sup>1</sup> Here again the pattern of the perspective sketches, when viewed from a point ten inches above the left hand of the two small circles, occupies the same visual angles as the actual

light pattern when seen from the positions specified in Table I. The cockpit cutoff diagrams included in Technical Development Report No. 96 are applicable here. The flashing lights are not shown in the perspective diagrams because the pattern of these lights is constantly changing, and the flashing lights are included for identification purposes, not for guidance.

### DISCUSSION

With the ALPA system the only means by which a pilot can judge his altitude is the visual angle subtended at his eye by adjacent bars. As this angle varies with distance as well as with height, it is essential that the pilot know his distance from the threshold to be able to use this indication. A comparison between Figs. 2 and 3, 4 and 5, and 10 and 13 will illustrate the indications by which altitude can be judged.

Under conditions of restricted visibility, there is no distance indication given until the pilot comes within sight of the crossbar, which is 1,000 feet from the threshold. From this point on to the runway, the indication of distance is adequate.

The indication of attitude is given by reference to the appearance of the individual 14-foot horizontal bars, which are normal to the line of approach. There is serious doubt whether these bars are long enough to form satisfactory horizontal references when visibility is restricted and no other visual aids are available. Figs. 6, 7, 11 and 12 illustrate this guidance. When the pilot comes within sight of the 1,000-foot bar, he will get adequate attitude indication, which from this point is essentially the same as is given by the Calvert system.

As directional guidance is dependent on

<sup>1</sup>R. E. Warren, "Perspective Analysis of Approach Light Patterns," CAA Technical Development Report No. 96, August 1949.

reliable indication of attitude as well as position, the directional guidance given by the ALPA system is weak until the pilot comes within sight of the 1,000-foot bar.

The indication of lateral position with respect to the approach axis is adequate when the attitude is level. However, when the aircraft is banked the pattern becomes difficult to interpret. Figs. 6, 8 and 11 illustrate this point.

## CONCLUSIONS

The ALPA system, while being weak on nearly all points in the first part, improves considerably in all guidance factors except altitude after the first crossbar is sighted. There is no reliable indication of altitude, however. In comparison with other proposed systems, it is perhaps better than most except the Calvert and slope line systems.

TABLE I

Conditions Existing For Each Perspective Study

Situation Number	Lateral Position	Dist. from Threshold (ft.)	Altitude (ft.)	Visibility	Airplane Attitude
1	Axis	3500	200	Unlimited	Level
2	Axis	3500	300	Unlimited	Level
3	100 ft. Left of Axis	3500	200	Unlimited	Level
4	100 ft. Left of Axis	3500	350	Unlimited	Level
5	Axis	3000	180	Limited	Banked
6	Axis	3000	280	Limited	Banked
7	100 ft. Left of Axis	3000	180	Limited	20° Right
8	100 ft. Left of Axis	3000	270	Limited	20° Right
9	Axis	3000	180	Limited	Level
10	100 ft. Left of Axis	3000	180	Limited	20° Left
11	100 ft. Left of Axis	3000	245	Limited	20° Left
12	Axis	3000	100	Limited	Level

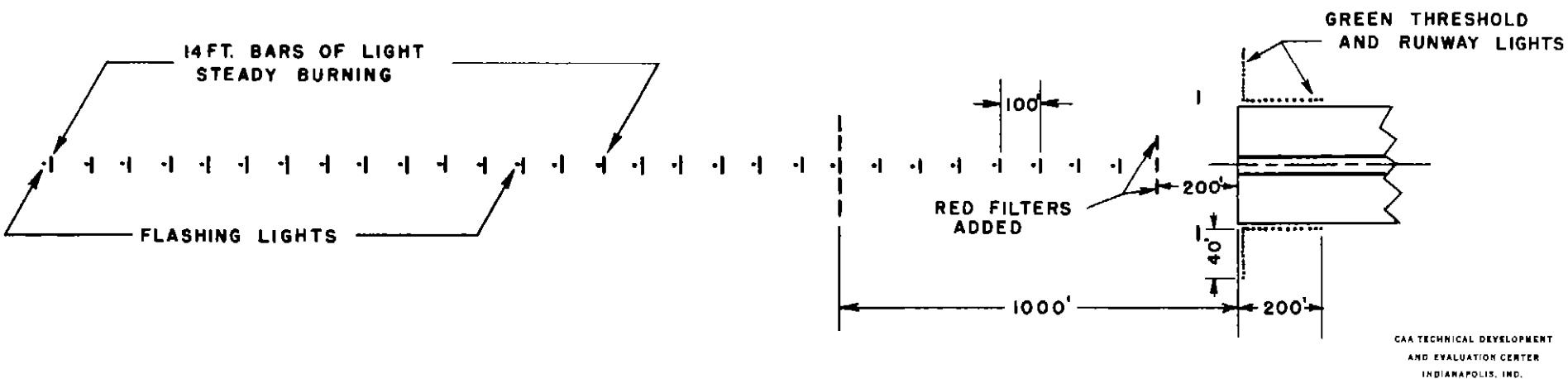
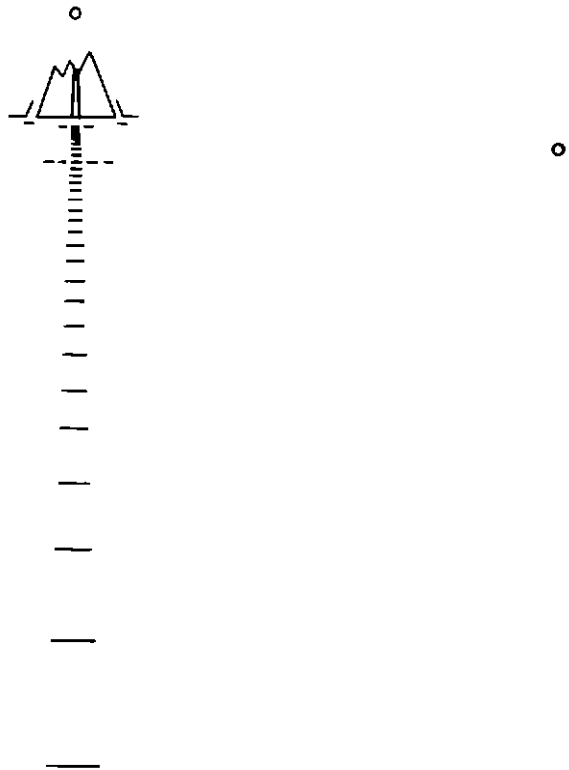


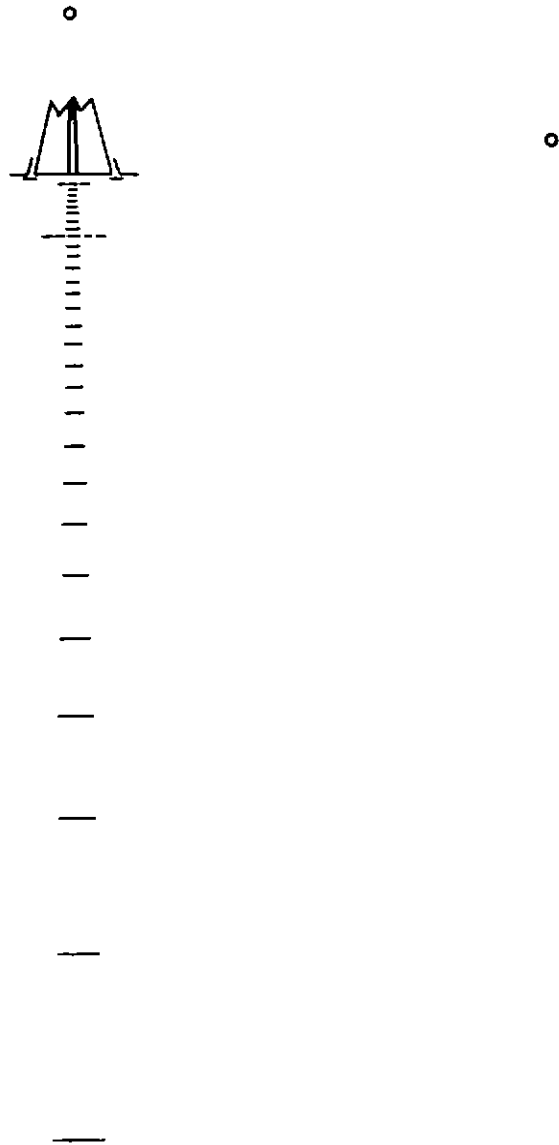
Fig. 1 Plan of ALPA Approach Light System



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Fig. 2 Situation 1





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Fig. 3 Situation 2

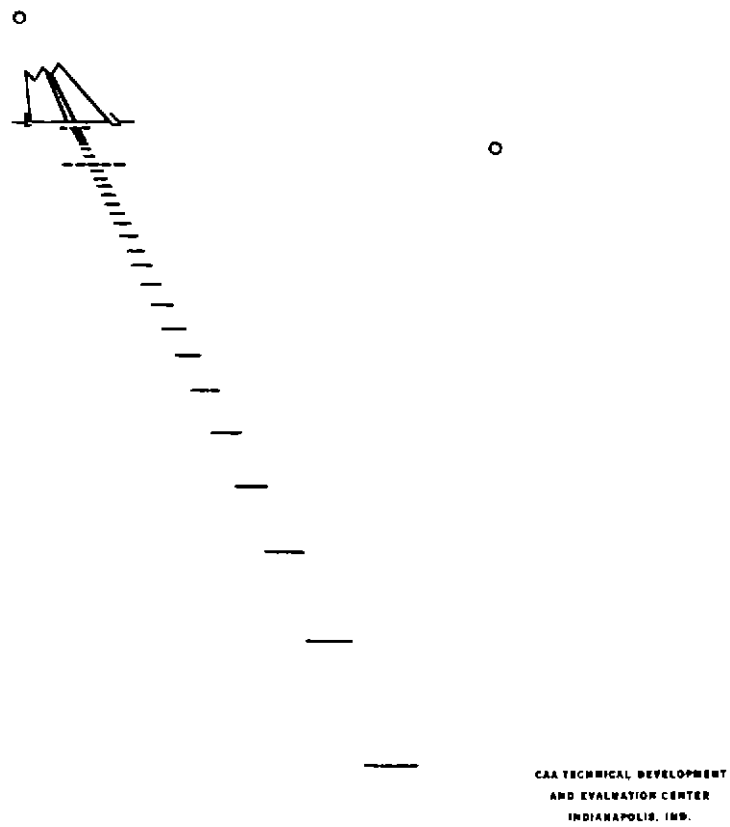


Fig. 4 Situation 3

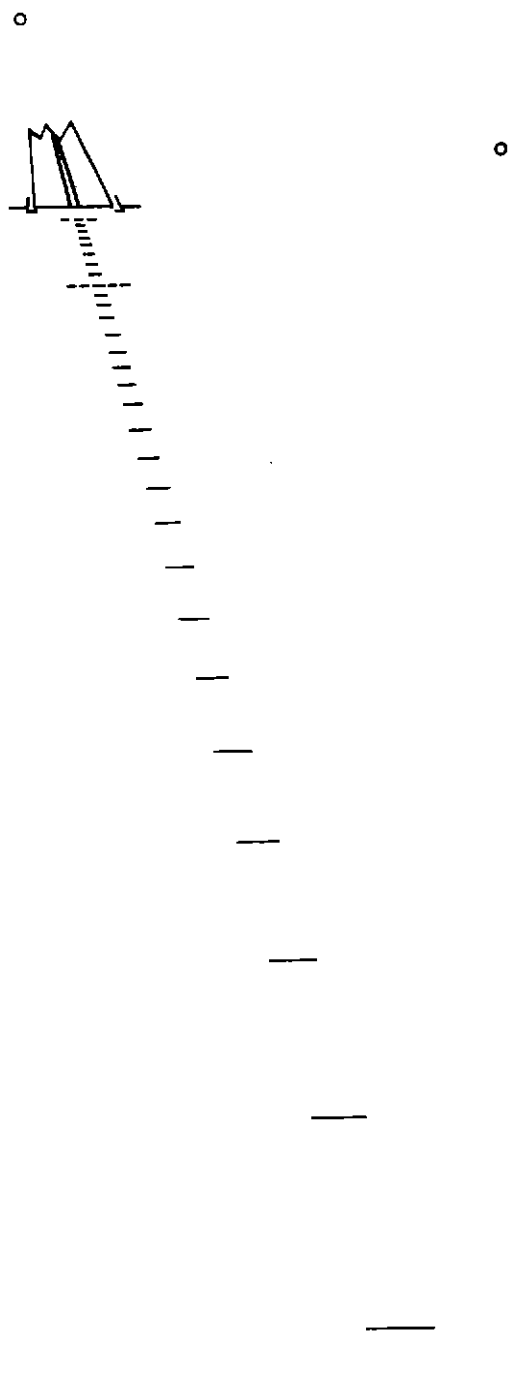


Fig. 5 Situation 4

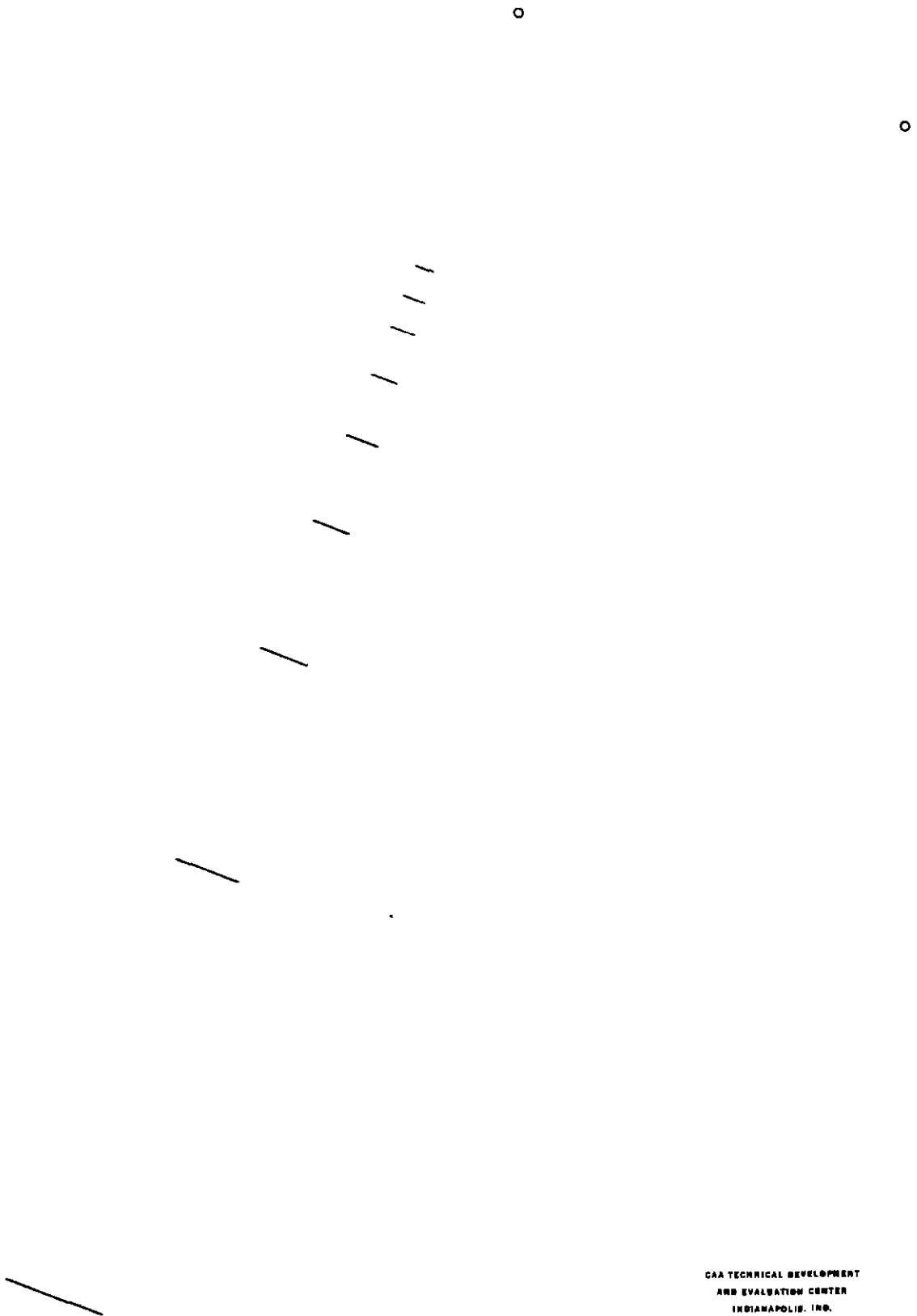
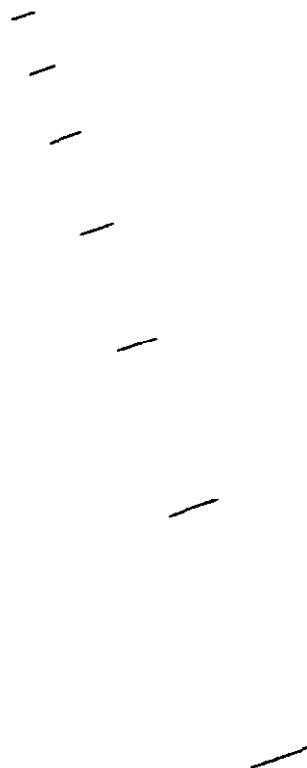


Fig. 6 Situation 5



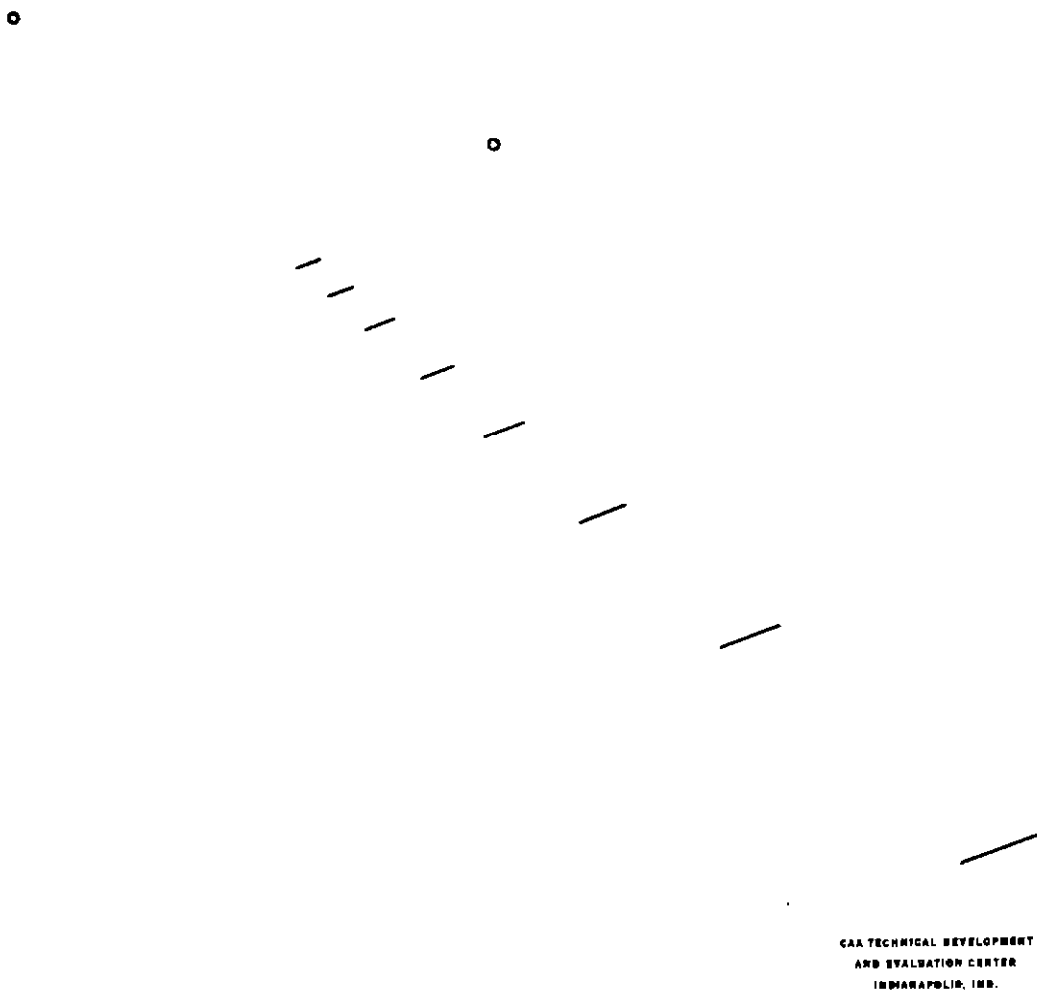
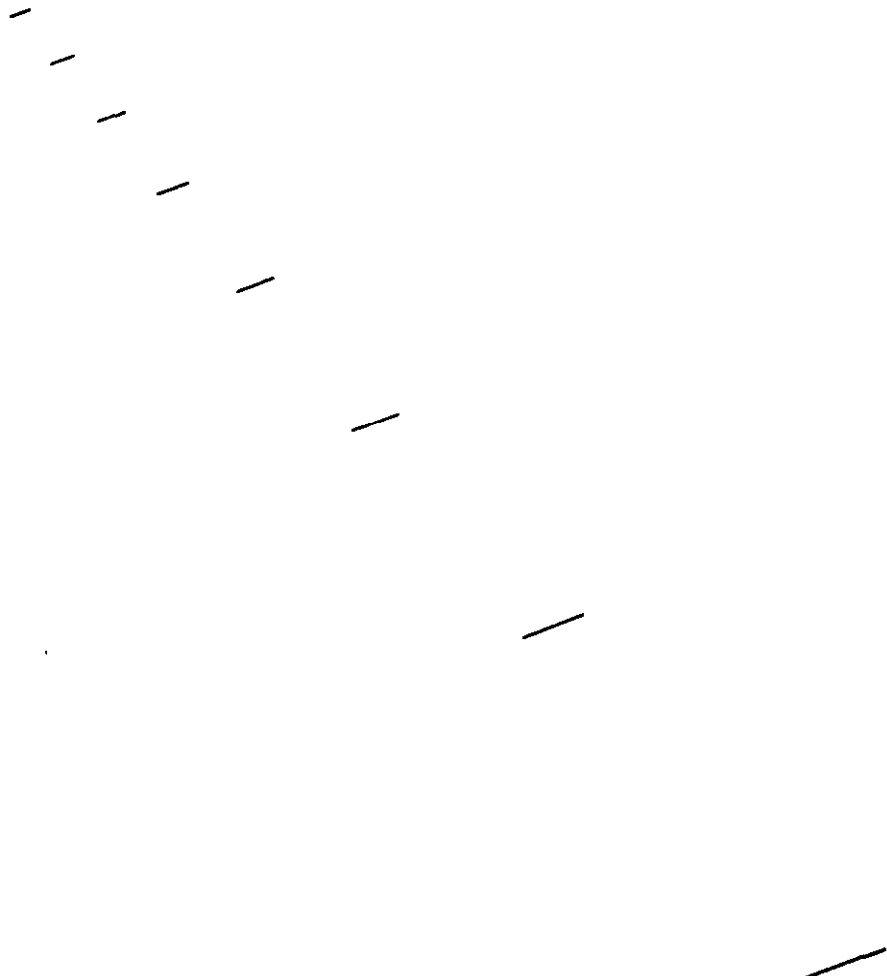


Fig. 8 Situation 7

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Fig. 9 Situation 8

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Fig. 10 Situation 9



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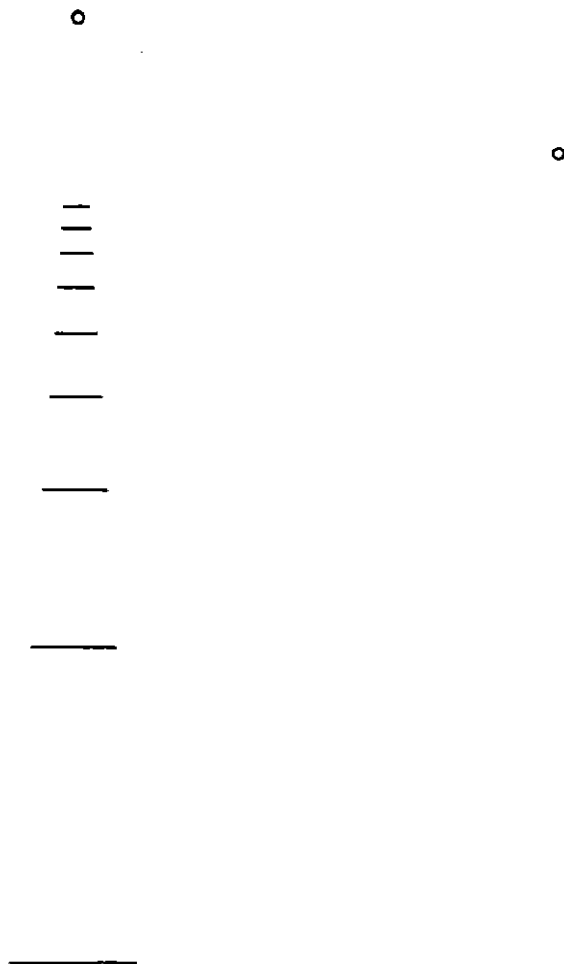


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Fig. 11 Situation 10



Fig. 12 Situation 11



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Fig. 13 Situation 12