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UNITED STATES GOVERNMENT

FEDERAL AVIATION AGENCY

Memorandum

Memorandum Report on Project
320-101-01X, "100-Foot and 50-Foot
SUBJECT: Altitude Marker Beacons for ILS
Improvements"

DATE: UG 16 1966

IN REPLY
REFER TO NA-522

FROM : Chief, Test and Evaluation Division

TO : Chief, Navigation Development Division, RD-300

This Division has conducted flight tests on standard marker beacons
located to mark the 100- and 50-foot altitude points on an ILS approach.

The results are contained in the attached Memorandum Report.



Hans Giesecke, NA-500

Attachment

Distribution:

NA-1 (1)
NA-100 (2)
NA-510 (1)
NA-530 (1)
NA-540 (1)
NA-550 (1)
RD-54 (1)
RD-300 (5)

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MEMORANDUM REPORT

100-FOOT AND 50-FOOT ALTITUDE MARKER BEACONS
FOR
INSTRUMENT LANDING SYSTEM IMPROVEMENT

PROJECT NO. 320-101-01X

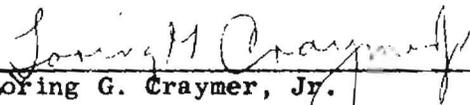
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July 1966

FEDERAL AVIATION AGENCY
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INTRODUCTION

- A. **PURPOSE:** The purpose of this experiment was to determine the usefulness of 75-megacycle marker beacons for indicating aircraft passage on the glide path at nominal altitudes of 100 and 50 feet for Category II and Category III ILS operations.
- B. **DESCRIPTION OF EQUIPMENT:** Conventional marker beacon equipment, consisting of TV-26 transmitters and CA-1671 antenna and harness assemblies, was used for these tests. The antennas were two half-wave collinear dipoles excited in phase and spaced one-quarter wave length above a 20-foot square counterpoise. ILS marker beacon installation instructions specify that the dipoles be mounted parallel to, and as near as possible, on the extended runway centerline. The 100-foot altitude marker was installed 960 feet from the runway threshold and on the extended runway centerline. The 50-foot altitude marker antenna was located at the threshold and displaced laterally, 50 feet left of the runway edge or 150 feet from the centerline. This offset was necessitated by the wing spread and engine location of several large high-performance aircraft which use the NAFEC runways. All marker locations (Figure 1) were predicated on the commissioned glide slope angle of 2.59° . The 100-foot altitude counterpoise was installed one-quarter wave length above the ground, and the 50-foot altitude counterpoise was at ground level in order to comply with obstruction criteria.

DISCUSSION

- A. **TEST ENVIRONMENT:** The test environment consisted of the marker beacon located on the approach to instrument runway 13, NAFEC range control, and theodolites with local VHF communications. Convair T-29 aircraft equipped with flight consoles were used for most of the tests. During the tests both the 100-foot and the 50-foot marker beacons were modulated at 3000 cycles so as to illuminate the white cockpit light. Six dots per second keying, originally used at the 100-foot marker, was removed to obtain accurate recordings. Aircraft position accuracy was ± 20 feet in range and ± 1.5 feet in altitude. Light-on and light-off time from the airborne recorder was manually read and correlated with time and position data. The marker beacon receiver used was a Bendix MN-53B set at low sensitivity (2500 microvolt input for light-on condition).

Flight paths were parallel to the runway and varied between 50- and 3000-foot altitudes with various offsets between 3000 feet right and 3000 feet left of the runway. ILS approaches were made to obtain light-on time for typical instrument approaches. Level flights were made at various altitudes and offsets to determine the beacon patterns.

Cross polarization due to aircraft crab had an effect on the measurements but was not corrected since the tolerance on the parameters measured was fairly broad.

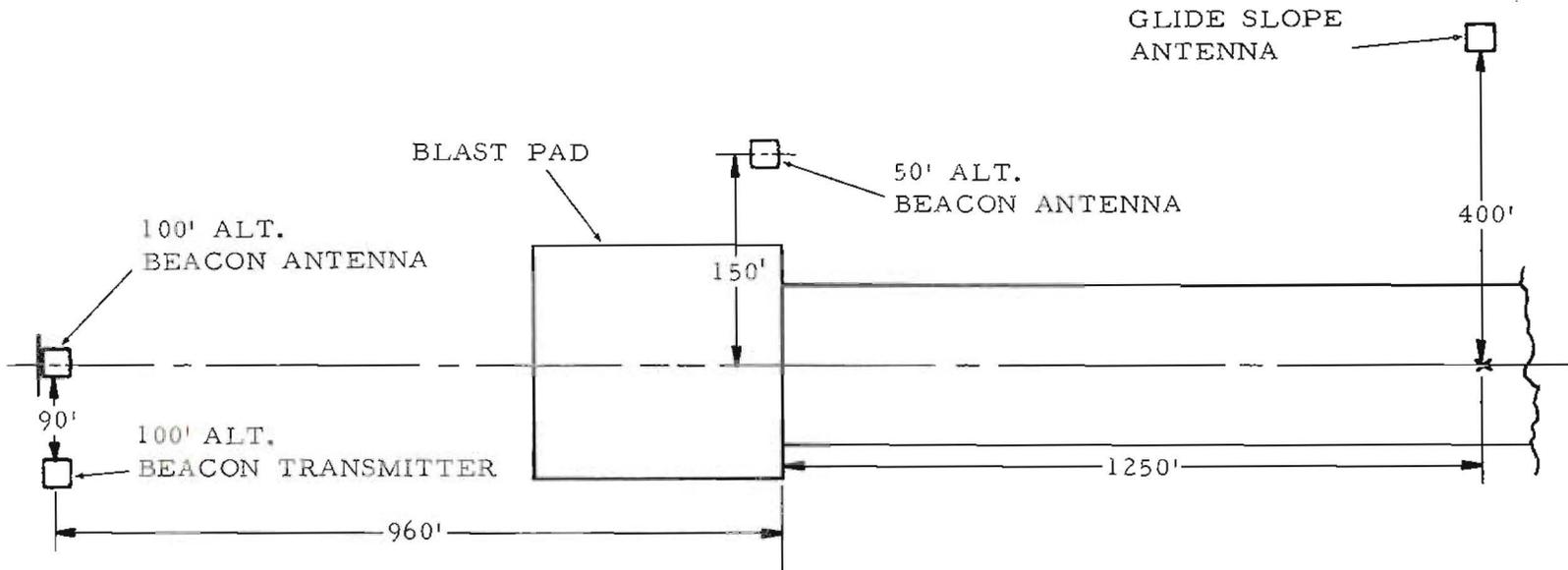
CONCLUSIONS

The test results obtained indicate:

1. Standard marker beacon transmitters and antennas, located at the 100- and 50-foot altitude points, can provide satisfactory indication of aircraft passage or imminence of runway threshold.
2. Offset marker operation at the 50-foot point with the CA-1671 antenna is not considered satisfactory due to pattern deterioration and possible critical performance for flights to the right of the runway centerline.
3. The beacon pattern can be satisfactorily adjusted with the counterpoise mounted at ground or runway elevation to conform with Flight Standards requirements.

RECOMMENDATIONS

It is recommended that flight checking and commissioning of inner marker beacons be accomplished at or near the particular decision height implemented.



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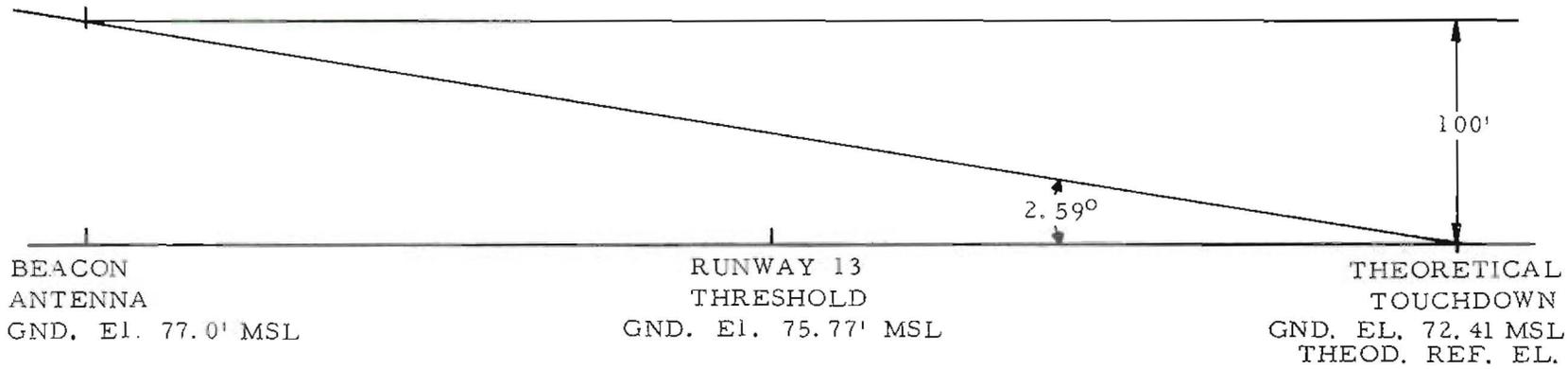


FIG. 1 LOCATION OF INNER MARKERS

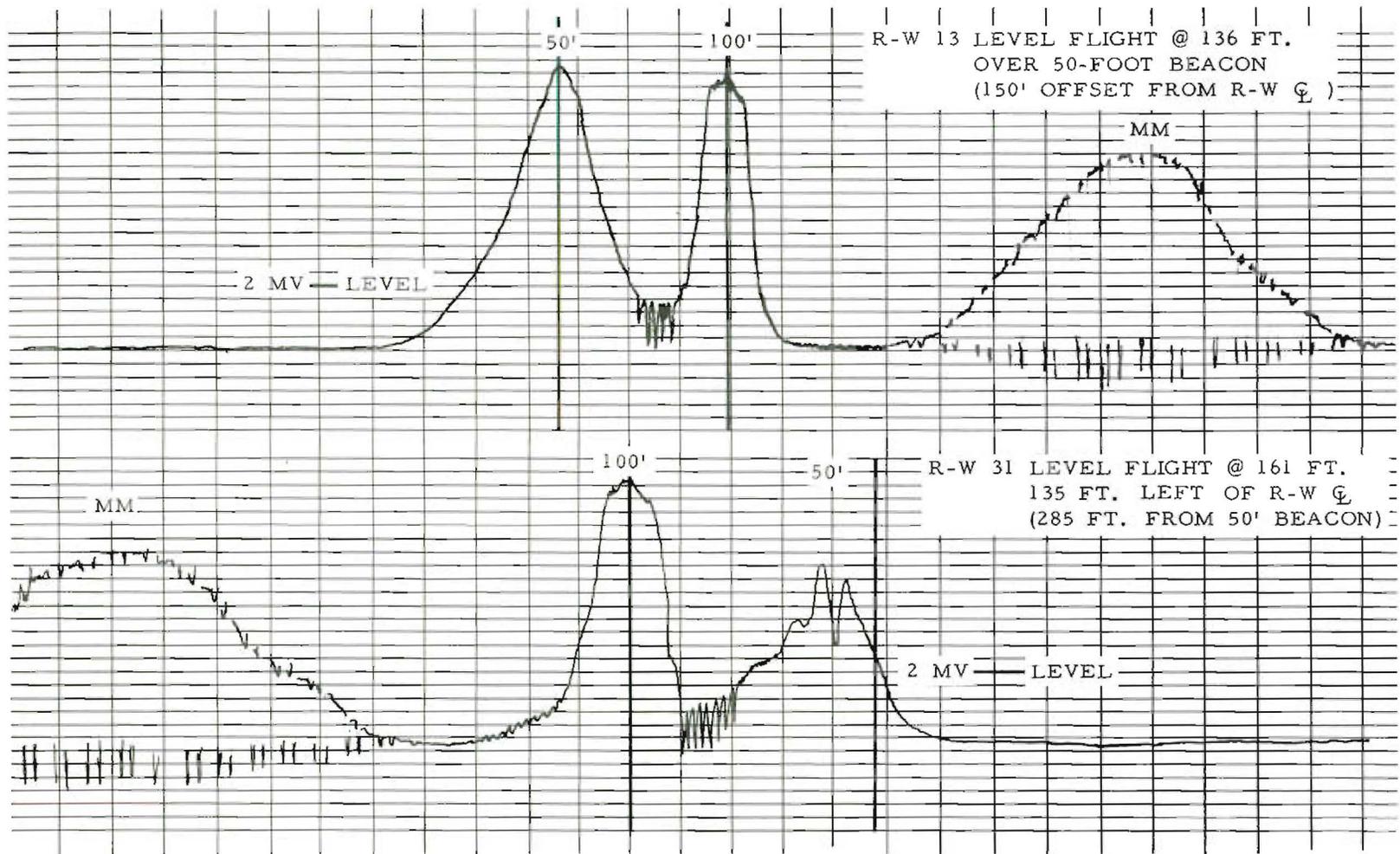


FIG. 3 FLIGHT CHECK RECORDINGS ILLUSTRATING PATTERN
BREAK-UP WITH BEACON ANTENNA OFFSET