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# REDUCTION OF GLARE FROM THE LANDING LIGHTS OF THE OH-58:
# AN EVALUATION OF FOUR POTENTIAL SOLUTIONS


By

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Four potential solutions to the OH-58 landing lights glare problem were evaluated. The four solutions consisted of: (1) placing a metal shield beneath each landing light; (2) placing shields on each side of the cockpit extending out laterally and forward from the instrument panel; (3) taping over the inside one-half of each chinbubble; and (4) taping over the sides of the plexiglass sheet and light well. The first three solutions were all found to be very effective but the preferred solution was the placing of

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered) shields beneath the landing lights (Solution 1) since this involved no visibility loss or extra material inside the cockpit. However, the overheating of the plexiglass sheet over the light well caused by these metal shields will have to be overcome before this solution is acceptable. It was also found that the tape over the inside one-half of each chinbubble is a very good field-expedient "quick fix."

ACKNOWLEDGMENT

Appreciation is expressed to Mr. Joseph Dierker, U.S. Army Aviation Systems Command, who initiated this project by suggesting two of the potential solutions. Appreciation is also expressed to CW4 Edward Gilmore, project officer for the U.S. Army Aircraft Development Test Activity (Prov), and to Dr. James Kishi, CW4 Richard Seefeldt, and Mr. Richard Followill, of the same agency, who flew the aircraft and made observations.

## SUMMARY

Four potential solutions to the OH-58 landing lights glare problem were evaluated. The four solutions consisted of: (1) placing a metal shield beneath each landing light; (2) placing shields on each side of the cockpit extending out laterally and forward from the instrument panel; (3) taping over the inside one-half of each chinbubble; and (4) taping over the sides of the plexiglass sheet and light well. The first three solutions were all found to be very effective but the preferred solution was the placing of shields beneath the landing lights (Solution 1) since this involved no visibility loss or extra material inside the cockpit. However, the overheating of the plexiglass sheet over the light well caused by these metal shields will have to be overcome before this solution is acceptable. It was also found that the tape over the inside one-half of each chinbubble is a very good field-expedient "quick fix."



ROBERT W. BAILEY
Colonel, MSC
Commanding

## INTRODUCTION

When the landing lights of the OH-58 are turned on a large veiling glare is reflected from the aircraft windscreens whenever the aircraft is within approximately 30 feet of the ground. The problem is created by the light reflected from the ground area directly below the chinbubble which passes up through the chinbubble and reflects from the aircraft windscreen into the pilots' eyes. Of course, the lighter or more reflective the ground surface the greater the amount of glare. Also, the problem is more severe for the forward landing light which directs its illumination at a more downward angle, including the area directly beneath the chinbubble, than for the rear landing light which directs most of its illumination well in front of the aircraft.

Basically, there are two types of solution to this problem. One approach is to prevent the light from the landing lights from reaching the ground area directly beneath the chinbubble, thereby eliminating the source of the problem. This is the approach used in Solution 1 (Figure 1). The second approach is to prevent the light reflected from the ground directly beneath the chinbubble from reaching the windscreen by means of opaque shields or tape. This is the approach used in Solutions 2 and 3 (Figures 2 and 3). Solution 4 (not shown) which did not successfully use either one of these approaches proved to be totally ineffective.

Specifically, Solution 1 (Figure 1) consisted of placing a metal light shield under each landing light. Solution 2 (Figure 2) consisted of placing opaque light shields in the cockpit between the chinbubble and windscreen. These shields, one on each side, extended from the top of the instrument panel laterally and forward to the base of the windscreen. Solution 3 (Figure 3) consisted of taping over the inside one-half of each chinbubble which is the part of the chinbubble which transmits most of the offending light. Solution 4 (not shown) consisted of applying a one-inch wide strip of tape along the edges of the plexiglass sheet over the light well and taping over small holes in each side of the light well. All testing was done with the landing light switch rewired to OFF, FORWARD, and BOTH as described in both TB 43-0001-1-2, Equipment Improvement Report and the Maintenance Digest, April 1975. In this configuration, the second position (FORWARD) turns on the rear landing light (which points in a more forward direction) and the second position (BOTH) turns on both lights.

## METHOD

Each solution was tested on the ground, at a two foot hover and at a ten foot hover, over a white runway surface and a sod surface. Also, baseline data were gathered by testing the present configuration (no solution applied except switch rewiring) under each condition. The data consisted of photometric readings and subjective comments for each solution under each test condition. Photometric readings were taken from three different windscreen areas under each condition. Two of these readings were taken from the left windscreen and one was taken from the right windscreen. Under each test condition, data were taken with the switch in both the FORWARD and the BOTH positions.

## RESULTS

Solutions 1, 2, and 3 were all found to be very effective in reducing glare from the landing lights. The metal shield used in Solution 1, however, became so hot that it burned the protective plexiglass sheet covering the light well. Solution 2 involved a small amount of visibility loss. Solution 3 left a small streak of glare along the lower, outer edge of the ipsilateral windscreen and a large patch of glare in the center of the contralateral windscreen, i.e., the man in the left seat could see a small patch of glare along the lower, outer edge of the left windscreen and a larger glare patch in the center of the right windscreen. The situation was just the reverse for the man in the right seat. Figures 4 through 7 show the glare on the ipsilateral windscreen in the present configuration (no solution applied) and with Solutions 1, 2, and 3 applied. The white rectangles in the background are the runway markers and the windscreen glare is seen superimposed. Tables 1 through 4 show the photometric data for the present configuration and Solutions 1 through 3. It was concluded that if the overheating problem can be solved, Solution 1 together with the rewiring of the switch, is the preferred solution since it involves no visibility loss or additional material inside the cockpit. However, Solution 3 is a very good field-expedient "quick fix."

## REFERENCES

1. Letter, AMSTE-AV, Headquarters, US Army Test and Evaluation Command, 30 October 1975, subject: "Customer Test Directive, Product Improvement Test, Landing Light Glare Reduction Assembly, OH-58A Aircraft, TECOM Project No. 4-AI-133-58A-001."

2. TB 43-0001-1-2, Equipment Improvement Report and Maintenance Digest, April 1975.

3. TM 55-1520-228-20

WHITE MARKERS

| Altitude | One Light Pos 1 | Pos 2 | Pos 3 | Two Lights Pos 1 | Pos 2 | Pos 3 |
|---|---|---|---|---|---|---|
| On Ground | 8.4 | 2.7 | 1.5 | 15.0 | 6.0 | 3.3 |
| Low Hover (2 ft) | 2.7 | .3 | .6 | 5.7 | 2.1 | 2.7 |
| High Hover (10 ft) | .6 | .06 | .09 | .54 | .12 | .18 |

SOD

| Altitude | One Light Pos 1 | Pos 2 | Pos 3 | Two Lights Pos 1 | Pos 2 | Pos 3 |
|---|---|---|---|---|---|---|
| On Ground | 2.16 | .84 | .3 | .9 | 1.47 | .48 |
| Low Hover (2 ft) | .3 | .03 | .12 | .93 | .48 | .54 |
| High Hover (10 ft) | .06 | 0.0 | 0.0 | .06 | 0.0 | 0.0 |

TABLE 1. Present configuration (no solutions applied). The glare in foot-lamberts from three different areas of the windscreens in the FORWARD position (one light) and BOTH position (two lights). Upper table is for aircraft over white runway markers and lower table is for aircraft over sod.

WHITE MARKERS

| Altitude | One Light Pos 1 | Pos 2 | Pos 3 | Two Lights Pos 1 | Pos 2 | Pos 3 |
|---|---|---|---|---|---|---|
| On Ground | .27 | 0.0 | 0.0 | .75 | .06 | .12 |
| Low Hover (2 ft) | .18 | 0.0 | 0.0 | .27 | .03 | .03 |
| High Hover (10 ft) | 0.0 | 0.0 | 0.0 | .06 | .03 | 0.0 |

SOD

| Altitude | One Light Pos 1 | Pos 2 | Pos 3 | Two Lights Pos 1 | Pos 2 | Pos 3 |
|---|---|---|---|---|---|---|
| On Ground | .06 | 0.0 | 0.0 | .15 | 0.0 | 0.0 |
| Low Hover (2 ft) | 0.0 | 0.0 | 0.0 | .03 | 0.0 | 0.0 |
| High Hover (10 ft) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

TABLE 2. Solution 1 (shields under landing lights). The glare in foot-lamberts from three different areas of the windscreens in the FORWARD position (one light) and BOTH position (two lights). Upper table is for aircraft over white runway markers and lower table is for aircraft over sod.

WHITE MARKERS

| Altitude | One Light Pos 1 | One Light Pos 2 | One Light Pos 3 | Two Lights Pos 1 | Two Lights Pos 2 | Two Lights Pos 3 |
|---|---|---|---|---|---|---|
| On Ground | .96 | 0.0 | .06 | 1.05 | 0.0 | 0.0 |
| Low Hover (2 ft) | .6 | 0.0 | 0.0 | .84 | 0.0 | 0.0 |
| High Hover (10 ft) | .09 | 0.0 | 0.0 | .33 | 0.0 | 0.0 |

SOD

| Altitude | One Light Pos 1 | One Light Pos 2 | One Light Pos 3 | Two Lights Pos 1 | Two Lights Pos 2 | Two Lights Pos 3 |
|---|---|---|---|---|---|---|
| On Ground | 0.0 | 0.0 | 0.0 | .42 | 0.0 | .03 |
| Low Hover (2 ft) | .12 | 0.0 | 0.0 | .36 | 0.0 | 0.0 |
| High Hover (10 ft) | .03 | .03 | .03 | .18 | 0.0 | 0.0 |

TABLE 3. Solution 2 (shields inside cockpit). The glare in foot-lamberts from three different areas of the windscreens in FORWARD position (one light) and BOTH position (two lights). Upper table is for aircraft over white runway markers and lower table is for aircraft over sod.

WHITE MARKERS

| Altitude | One Light Pos 1 | One Light Pos 2 | One Light Pos 3 | Two Lights Pos 1 | Two Lights Pos 2 | Two Lights Pos 3 |
|---|---|---|---|---|---|---|
| On Ground | .06 | .78 | .6 | 1.29 | 2.49 | 2.25 |
| Low Hover (2 ft) | .15 | .54 | .66 | .72 | 0.0 | .36 |
| High Hover (10 ft) | 0.0 | 0.0 | .09 | .3 | 0.0 | .09 |

SOD

| Altitude | One Light Pos 1 | One Light Pos 2 | One Light Pos 3 | Two Lights Pos 1 | Two Lights Pos 2 | Two Lights Pos 3 |
|---|---|---|---|---|---|---|
| On Ground | 0.0 | .18 | .15 | .45 | .36 | .54 |
| Low Hover (2 ft) | 0.0 | .06 | .15 | .3 | .15 | .42 |
| High Hover (10 ft) | 0.0 | 0.0 | 0.0 | .03 | .03 | .03 |

TABLE 4. Solution 3 (tape over inside one-half of each chinbubble). The glare in foot-lamberts from three different areas of the windscreens in FORWARD position (one light) and BOTH positon (two lights). Upper table is for aircraft over white runway markers and lower table is for aircraft over sod.

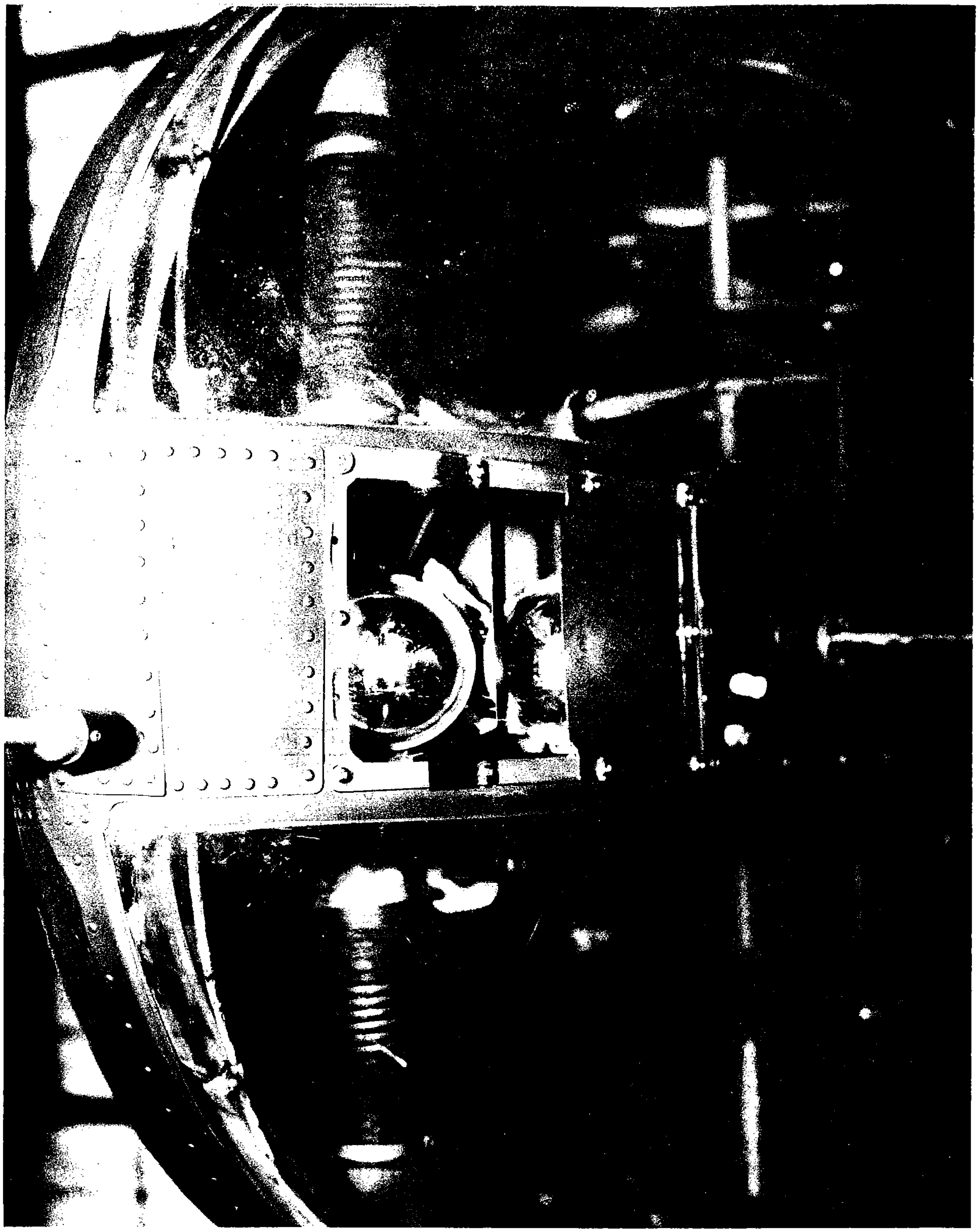

FIGURE 1. Solution 1 - Metal shield beneath the landing light.

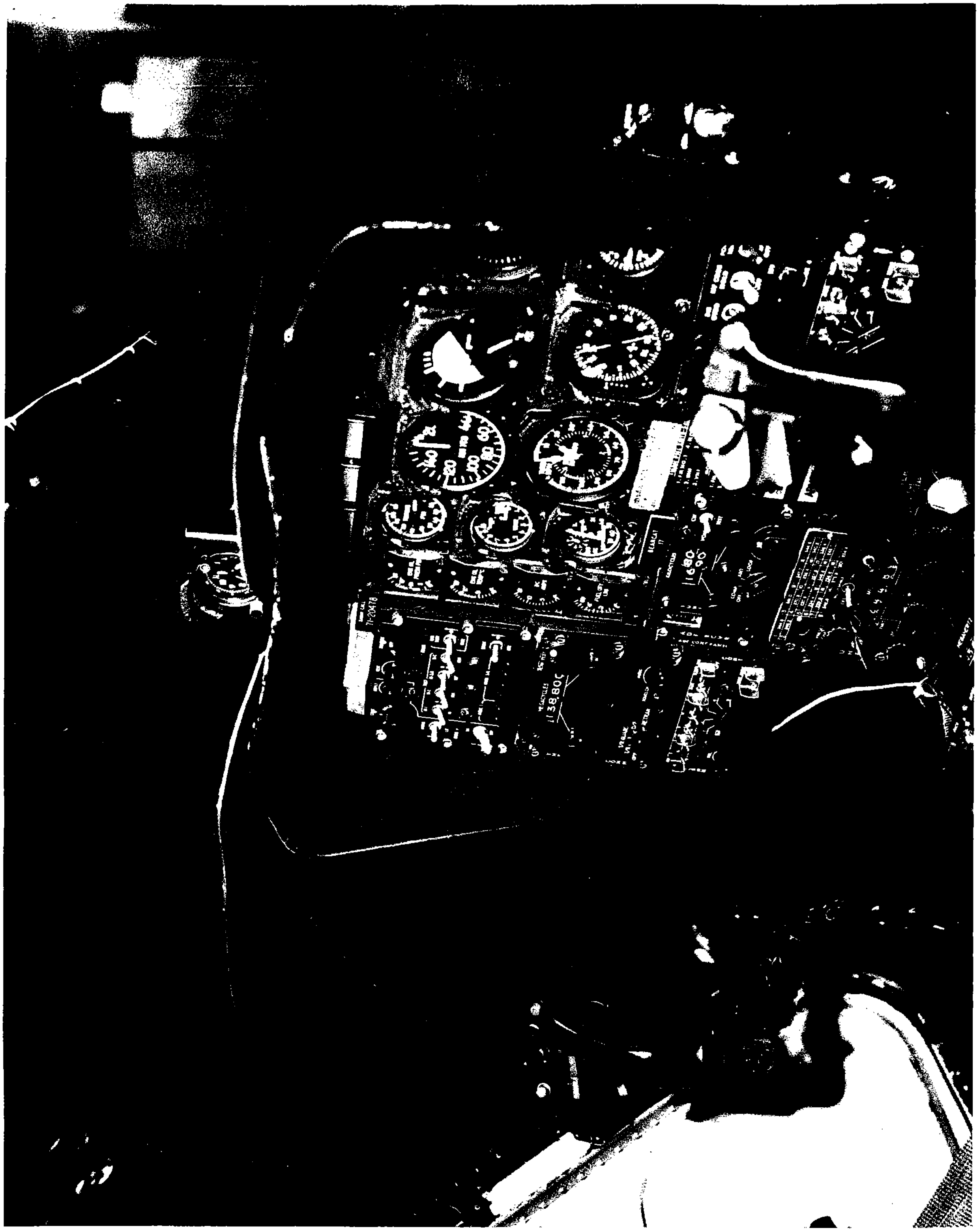

FIGURE 2. Solution 2 - Shields extending out laterally from the top of the instrument panel.

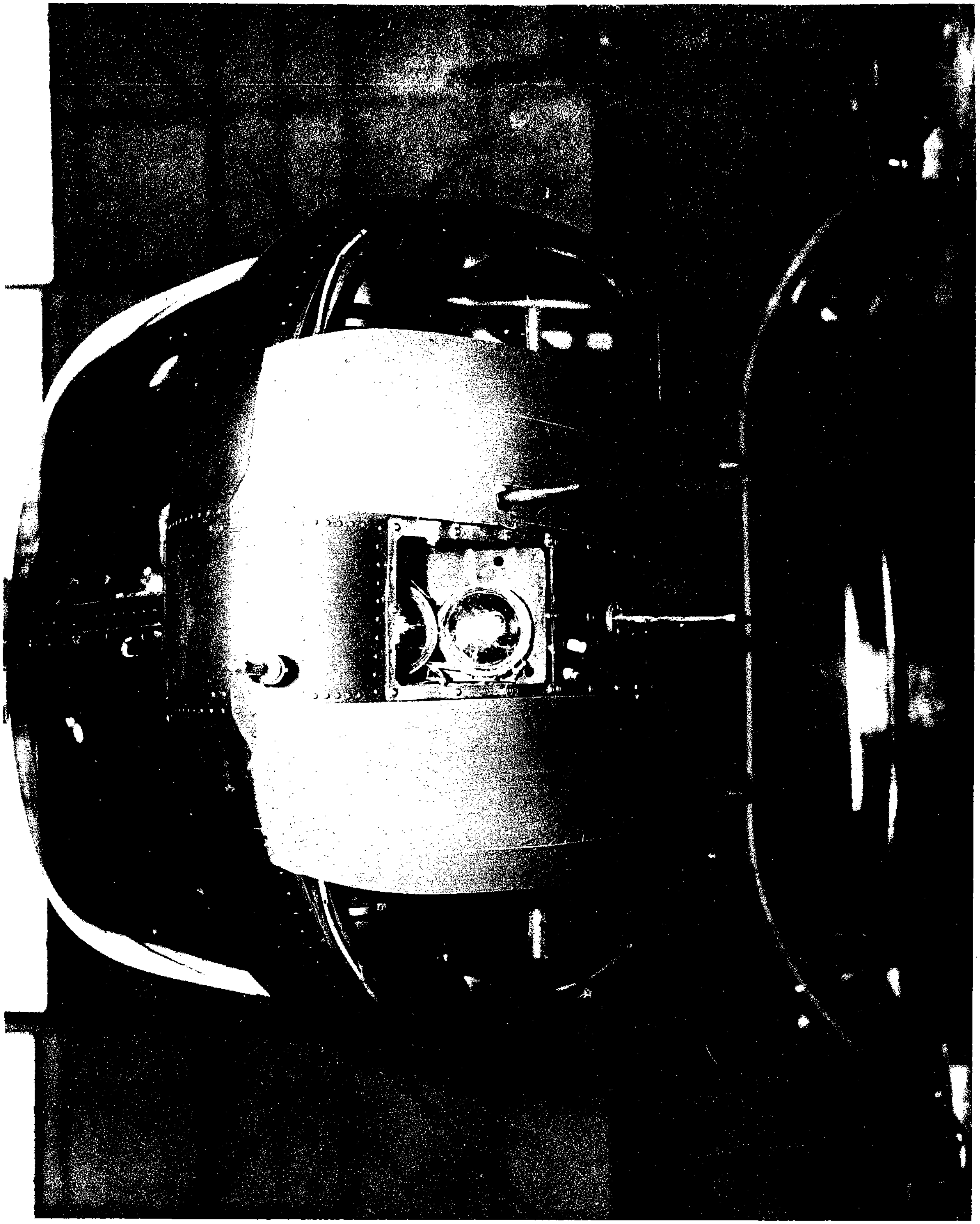

FIGURE 3. Solution 3. - Tape over the inside one-half of the chinbubble.


FIGURE 4. Present glare problem (no solution applied). Aircraft is over white runway markers (rectangular stripes in background).


FIGURE 5. Windscreen glare with Solution 1 (metal shield beneath landing light) applied. Aircraft is over white runway markers (rectangular stripes in background).


FIGURE 6. Windscreen glare with Solution 2 (shields extending laterally from the top of the instrument panel) applied. Aircraft is over white runway markers (rectangular stripes in background).

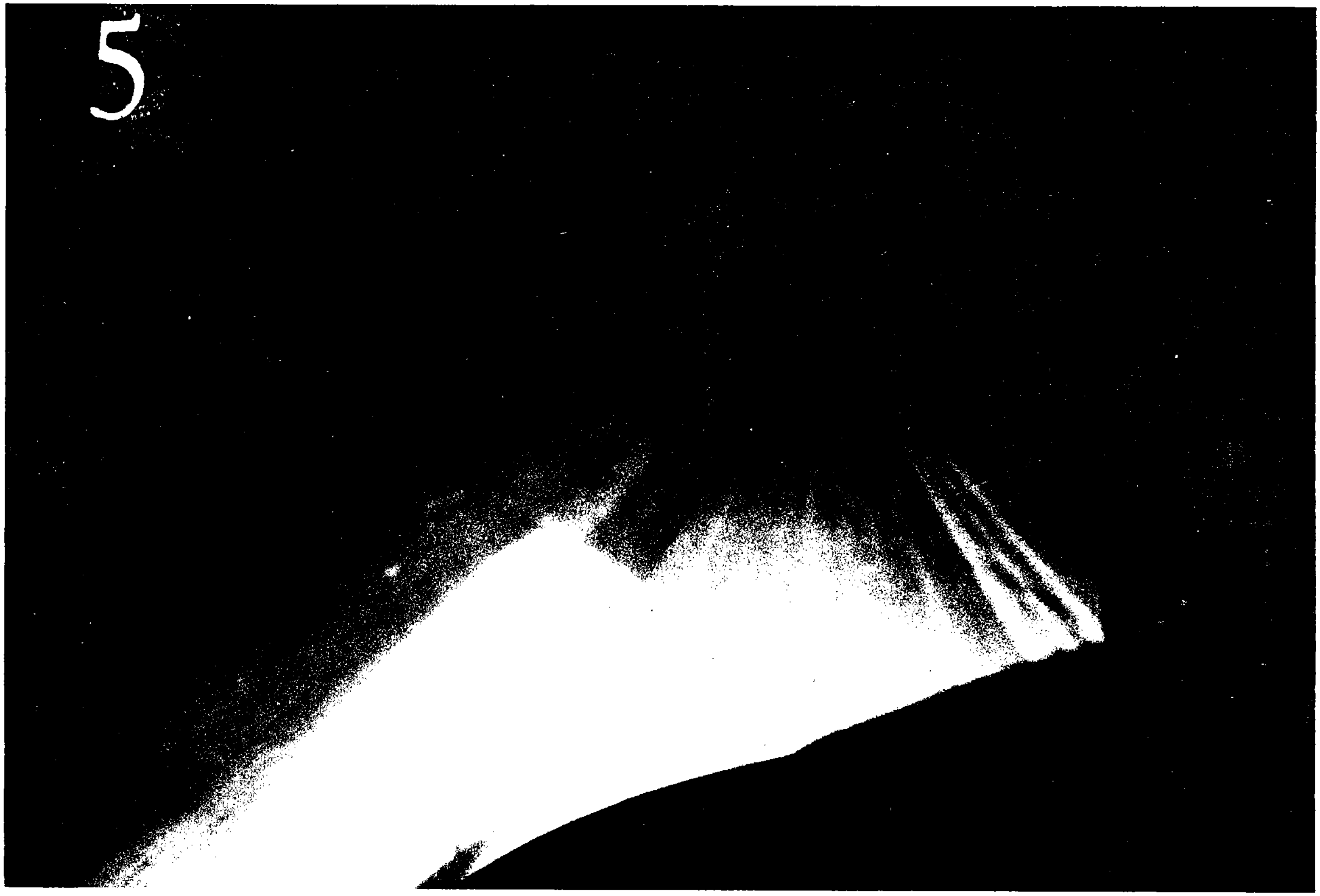

FIGURE 7. Windscreen glare with Solution 3 (tape over inside one-half of each chinbubble) applied. Aircraft is over white runway markers (rectangular stripes in background).