

E LIOTT



Approach and Landing Situation Display

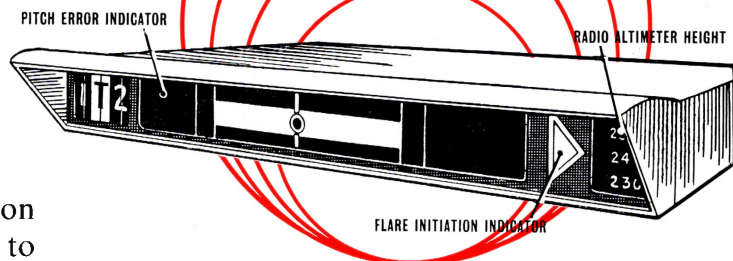


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APPROACH AND LANDING SITUATION DISPLAY

The Elliott Approach and Landing Situation Display is a head-up display which presents to the pilot simple and unambiguous information of autopilot state and the aircraft's position relative to the flight path. The display is associated one with each left and right monitored autopilot, radio altimeter and radio systems, and is designed for mounting on the top surface of the glare shield, one in front of each pilot, such that it does not interfere with the pilot's normal field of view.

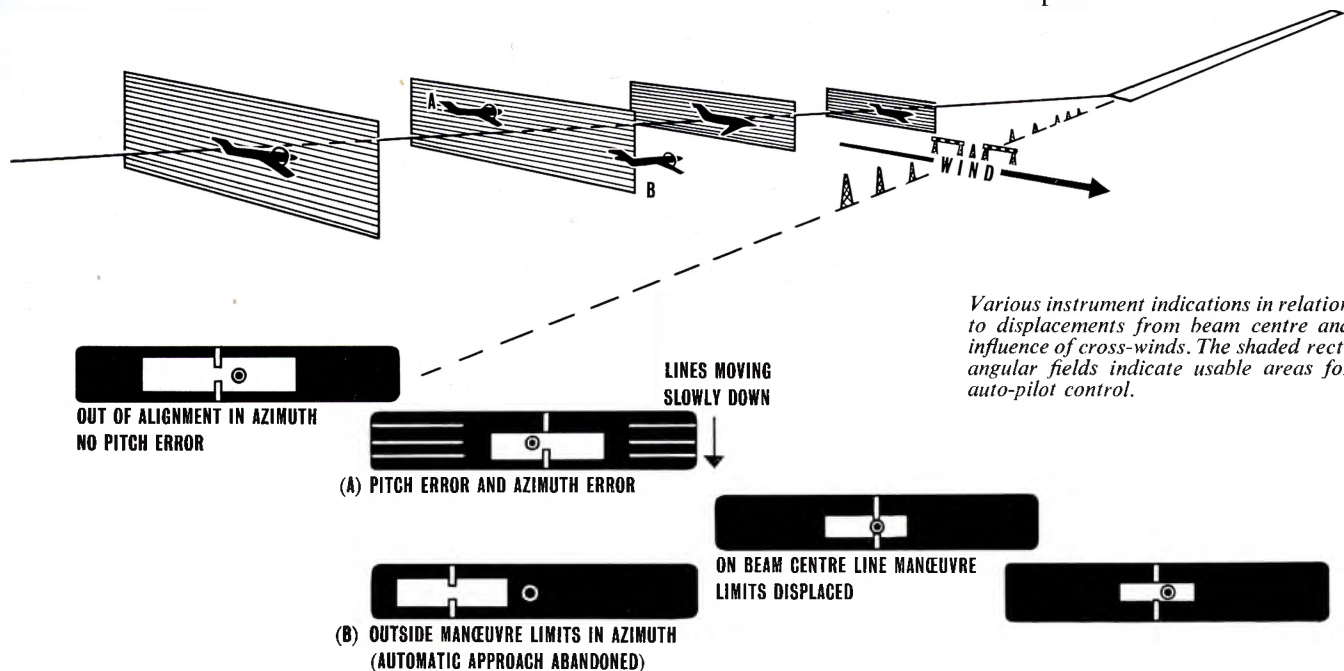
- Self monitored fail-safe.
- Positive indications of autopilot 'state'—either No. 1 or No. 2 system.
- Autothrottle warning.
- Analogue indication of aircraft's position relative to the flight path.
- Separate indications of height error.
- Roller tape indication of radio altimeter height.
- Autoflare initiation indicator.



The Elliott Approach and Landing Situation Display for showing autopilot performance and capability during an automatic landing.

PACKAGING

Basically, the display consists of three sections side by side which are packaged in a flat box having a maximum depth of 1.5 inches. The left-hand section carries status and warning information, part of which indicates if a failure occurs in either autopilot system, and part of which indicates if there is any significant deviation from the selected airspeed. The centre section indicates position in pitch and azimuth with respect to the localiser beam centre line and this is supplemented with a manoeuvre limit background which shows whether the aircraft at any time exceeds the manoeuvre capability to touchdown successfully and safely under automatic control. The right-hand section of the display carries a radio altimeter vertical tape, and flare-out check and annunciator panel.



OPERATION

Status Display

The status indicator, on the left of the display consists of three magnetic shutter type indicators, showing the state of the two autopilots and the autothrottle system. With all systems working, the symbols '1, T and 2' are visible but if either autopilot fails the appropriate number is replaced by a striped pattern on both displays and the affected display is covered by a black shutter. The same occurs with the autothrottle system, but in addition the T and striped pattern will oscillate if the airspeed deviates by more than 4 knots from the preset datum.

The magnetic indicators are of a new type, also designed by Elliott Brothers, and incorporate electrical feedback of indicated position.

Manoeuvring Display

The centre section consists of a white field position round a fixed ring mark, the width and depth of the field decreasing during the approach to represent the narrowing manoeuvre capability of the autopilot in the final stages. At the same time, the location of the fixed ring mark within the white field indicates what deviations from localiser and glideslope exist at any given moment, and provides an indication of error development or correction. If the ring moves outside the white field, the autopilot can no longer produce an adequate correction manoeuvre and the pilot must take over manually. The fixed ring mark is painted both black and white so that it shows up clearly against either white or black backgrounds and it may be made into an active flashing indicator, if desired.

Because the vertical depth of the white field is necessarily limited by the shallow instrument case, an additional height-error display is added on either side of the white field to intensify error cues, in the pitch plane. A rotating cylindrical indicator capable of showing either complete black background or moving horizontal white lines is positioned behind the white field. The cylinder remains black and black while pitch control is correct.

If a small deviation occurs, three thin white lines appear on the cylinder, which begins to rotate slowly to give nose-up or nose-down indications. Should the error continue to increase, the cylinder not only rotates faster but the lines become thicker. This is an application of the attention-getting capabilities of movement in a specially designed display. The movement also gives directional information in the early stages of attracting the pilot's attention through his peripheral vision. The instrument combines a 'soft' display with rapid attention-getting following an error. If the approach is progressing normally the pilot does not see the stripes, but he receives an unmistakable and powerful indication as soon as an error develops. The sense of rotation is such that the aircraft appears to be moving past a stationary pattern of stripes and the pilot receives a demand to fly in the direction of the glideslope centre.

The whole of the centre of the display, including the white field and rotating cylinder, is shuttered if either autopilot or instrument fail.

Radio Altitude vertical tape and flare-out annunciator panel

On the radio altitude vertical tape three height figures can be seen at all times and the figures pass the datum mark at the rate of approximately one per second during a normal approach. The pilot will probably be able to obtain some rate information from this movement. During cruising flight, the height display is covered by a cross-hatched pattern. When the pilot presses the test button for the altimeter system—probably at 1,500 ft.—the height panel gives an appropriate check read-out if the altimeter is functioning correctly and then begins to show height figures when the aircraft reaches 500 ft., the maximum height indication of the radio altimeter system. When the flare-out phase is initiated, a flag appears next to the height tape. Should the radio-altimeter system fail, the main display is immediately shuttered because altimeter failure of course causes an automatic change-over to the stand-by system.



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