SNS COLLEGE OF TECHNOLOGY

COIMBATORE-35

DEPARTMENT OF MECHATRONICS ENGINEERING

19MCT402-APPLIED MECHATRONICS ENGG.

Unit – 3 AVIONICS

cockpit display system

The cockpit display system provides a visual presentation of the information and data from the aircraft sensors and systems to the pilot. This helps the pilot to fly the aircraft safely.

Civil cockpit display systems provides,

- Primary Flight Information
- Navigation Information
- Engine Data
- Airframe Data
- Warning Information

Apart from this data the military cockpit display system provides,

- Infrared Imaging Sensors
- Radar
- Tactical Mission data
- Weapon Aiming
- Threat Warnings

The HUD has enabled a major improvement in man machine interaction and it helps the pilot to view and assimilate the essential flight data generated by the sensors and systems in the aircraft.

HUD basically projects a collimated display in the pilot‟s head up forward line of sight, so he can view both the display information and the outside world at the same time. The pilot can able to observe both distant outside world objects and display data at the same time without changing the direction of gaze or re-focus the eyes. During the landing phase the pilot can view the essential flight data such as artificial horizon, pitch angle, bank angle, flight path vector, height, airspeed and heading with the help of HUD.

HUD uses high brightness display and it projects some of the information normally on the primary flight displays and selected systems or weapons data into the Line of Sight of the pilot without substantially dimming or obscuring the outer view. HUD allows the pilot to simultaneously see critical aircraft information while viewing the outside scene. Every HUD contains a Display generator and Combiner. The combiner combines the collimated display symbology with the outside world scene. The display symbology is generated from the aircraft sensors and systems.

The relay lens magnifies the display and corrects for some of the optical errors. The relayed display images are reflected by the fold mirror to the collimating lens

In the current HUD, Display Generator – CRT with P43 (Green) phosphor Combiner – mirror with several unusual properties:

• Reflective coating – Highly wavelength selective in angle of incidence so that only that light which impinging within a very narrow range of angles will be reflected.

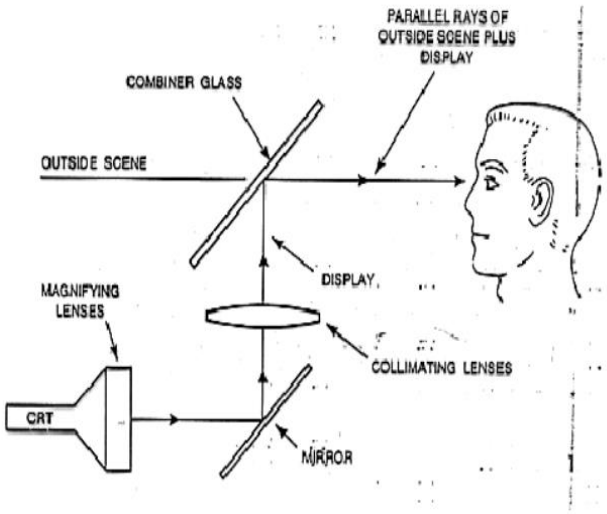
• Combiner is sometimes incorrectly referred to as Hologram, but it contains no image information as found in true hologram

High performance aircraft HUD‟s use one of two basic designs for the combiner

- Single element combiner HUD

- Three element combiner HUD

Single element combiner HUD



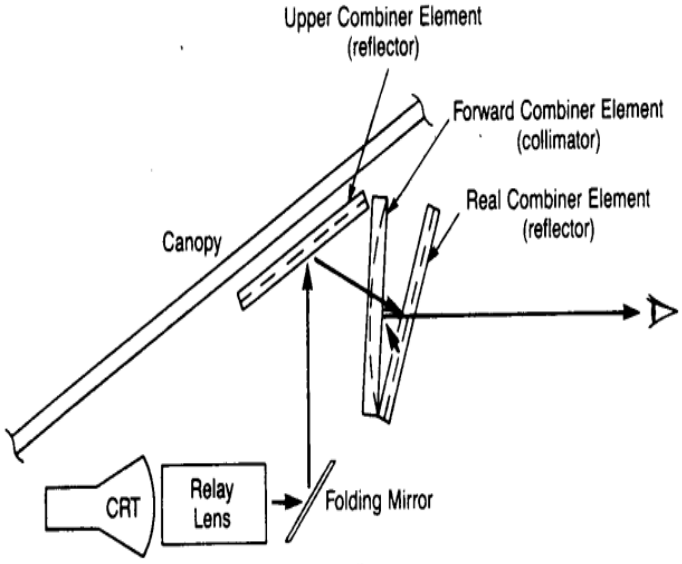
Merits

- Simplest design of the two methods
- Transmission of outside scene is higher
- Transport aircraft uses this method

Demerits

- Less advantageous than three-element combiner HUD.

Three element combiner HUD



Merits

- Used on high-performance aircraft to achieve better producibility
- This design has achieved 30o horizontal and 20o vertical field of view

- All three elements contains gelatinous combiners as the middle layer, but only the forward element is curved to collimate the image from the CRT.

Colour HUD‟s are controversial for two reasons:

- There may be some loss of brightness, although brightness is becoming less of an issue as color CRTS improve
- Colours may be confused with or lost in the natural exterior scene

Practical problem

HUD occupies large volume and the necessity to be mounted in the cockpit with the combiner in LOS to the pilot On high performance aircraft, HUD is mounted at the top of and behind the instrument panel. So that the combiner is between the top of the panel and the canopy in the pilot‟s LOS when looking straight ahead. For civil transport, HUD is mounted above the seat of each cockpit crew member, and the combiner is hinged to swing down into the LOS when HUD is in use, generally only during approach and landing. Single element combiner can be used as an alternative for civil transport.

In military Aircrafts

The pilot freely concentrates on the outside world during maneuvers. In combat situations the pilot can scan for possible threats from any direction. The military Aircrafts HUD is shown in figure 3.20. The combined FLIR with HUD enables the pilot to fly at low level by night in fair weather. This provides a realistic night attack capability.

In Civil Aircrafts

The HUD provides situational awareness and increased safety in circumstances such as wind shear or terrain/ traffic avoidance maneuvers. If the flight path vector is below the horizon the aircraft is descending. Flight path vector provides a two dimensional display of drift angle and flight path angle. It helps the pilot to land the aircraft safely in conditions of very low visibility due to fog.