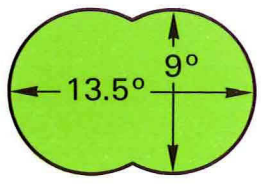
Marconi Avionics the suppliers of the LANTIRN Head Up Display (HUD) have delivered over 4000 HUDs to air forces throughout the free world, more than all other manufacturers combined. This unique background of experience, stretching back over 20 years, has culminated in the LANTIRN design, the first holographic HUD system designed for quantity production. The design draws on extensive company funded research into both the electronic circuitry necessary for raster operation and into practical methods of employing diffractive optics in a head up display. This effort was fully vindicated when the Marconi design was chosen over all others for fitting to the USAF F-16 and A-10 aircraft.

MARCONI AVIONICS

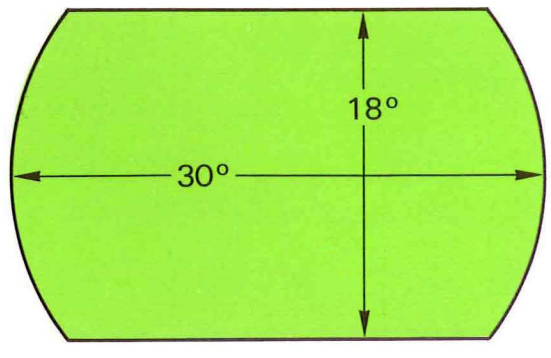
# From the World's Most Experienced Head Up Display Supplier

The wide field of view possible with the Marconi LANTIRN system is illustrated graphically here for a typical fighter aircraft installation.

This expanded field of view enables the pilot to fly with confidence at low level in conditions of total darkness when his only 'window on the world' is that provided by his head up display of night sensor information.




*Conventional Optics Field of View*




*LANTIRN HUD Field of View*

The Marconi LANTIRN design features a unique stroke-write-in-raster fly-back technique which allows all mission symbology to be superimposed on the raster picture derived from the night vision sensor. This involves writing the normal day time display at eleven times the normal rate during the vertical retrace period of the sensor picture scan.

## A Wide Angle Holographic Raster HUD

MARCONI AVIONICS

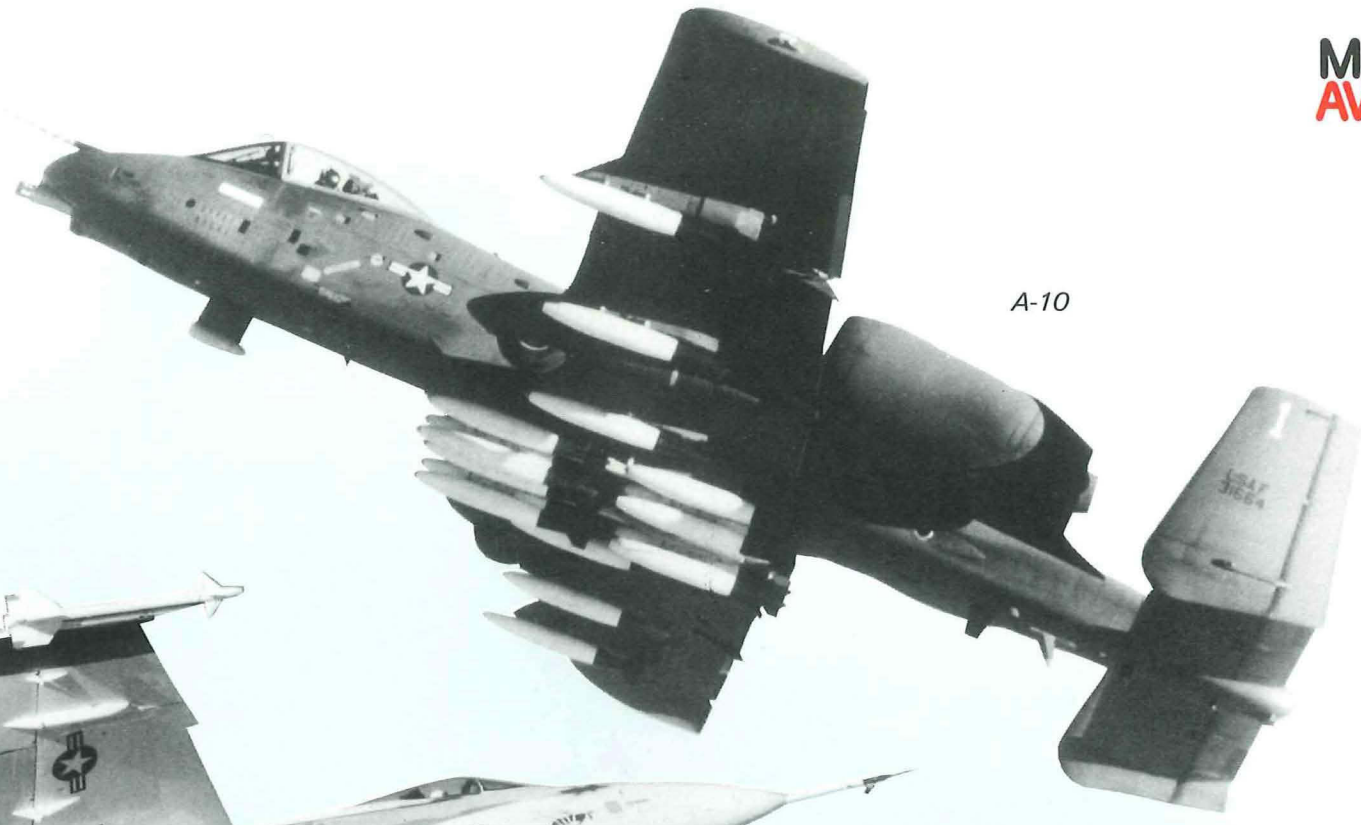
# Providing a Wide Angle 'Window on the World'

A tactical air fleet loses much of its value if it is restricted to daylight only operation. Against an opponent using a night attack doctrine, tactical aircraft must be able to seek out and destroy their targets in total darkness. The Marconi LANTIRN HUD makes this possible by superimposing navigation and attack symbology on a wide angle head up raster scan of night sensor information.

With this equipment the pilot can navigate to the target area, seek out and destroy his targets and return to base in conditions of darkness and poor visibility that would ground tactical aircraft with conventional equipment. He can fly safely and confidently well below radar acquisition altitude and can locate and attack even camouflaged targets using a Forward Looking Infra-Red (FLIR) sensor. With the weapon aiming precision available from the LANTIRN HUD, enemy night attacks can be rapidly countered.

The LANTIRN HUD Turns Night into Day for the Tactical Fighter Pilot

MARCONI AVIONICS

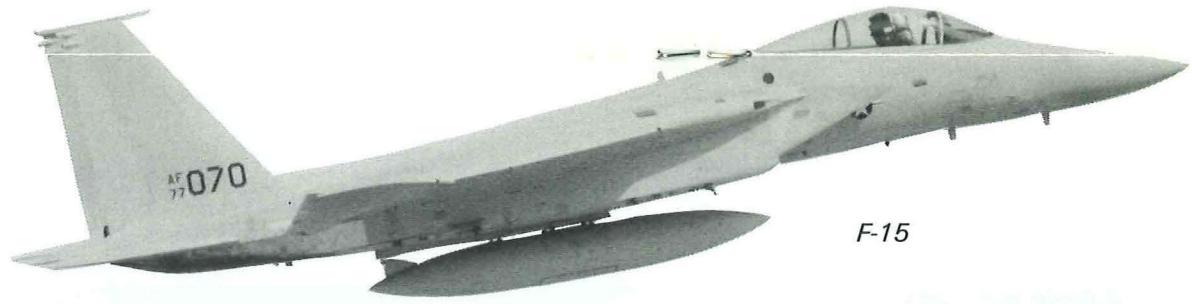


A-10

F-18

F-16

# The Marconi LANTIRN HUD gives Day Fighters 'Round-the-Clock' Capability

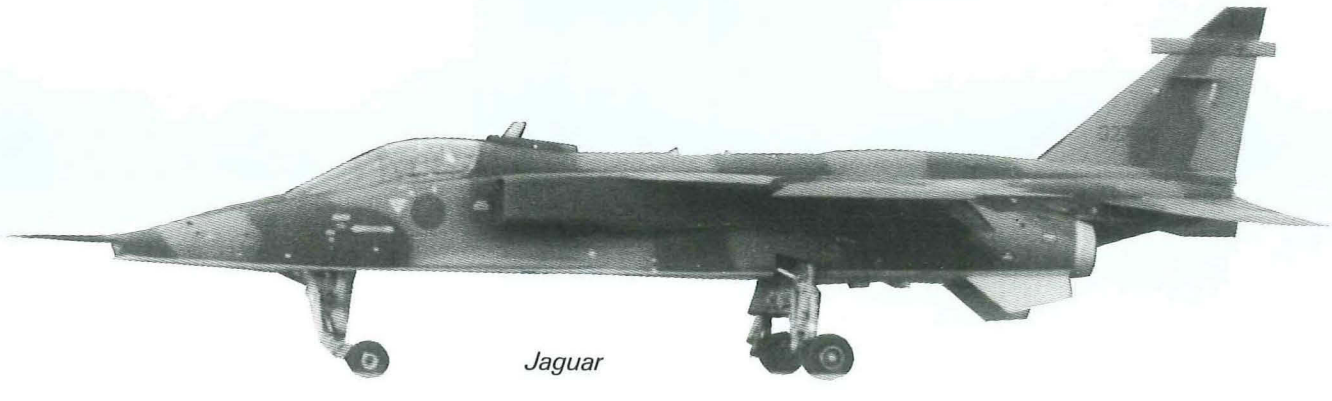


F-15

A-7

Tornado

Harrier

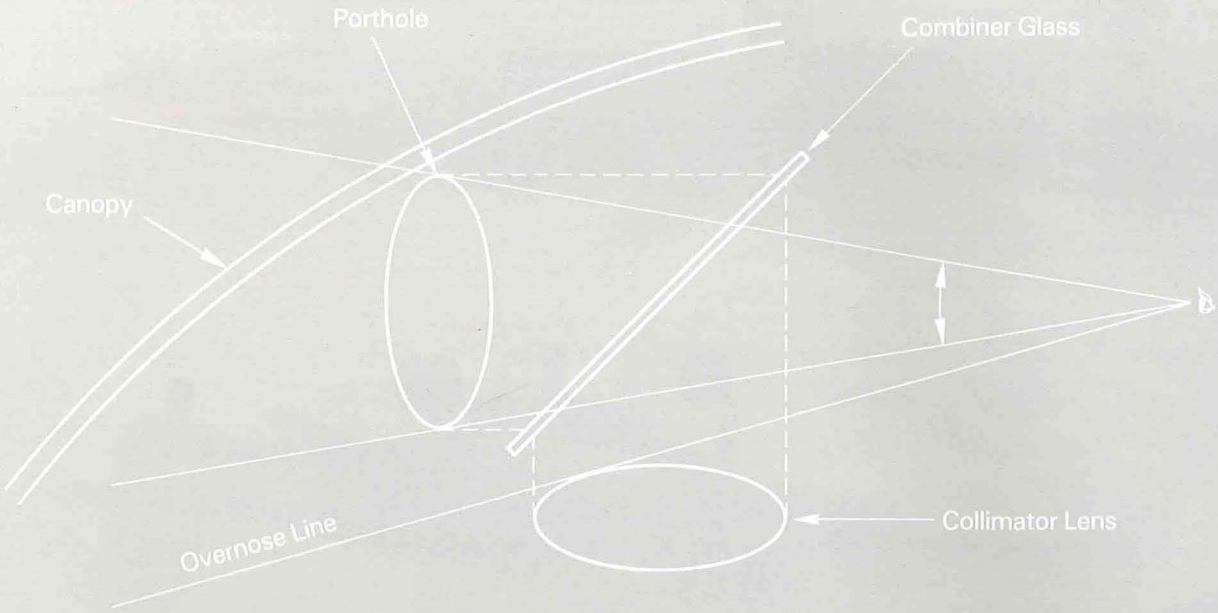


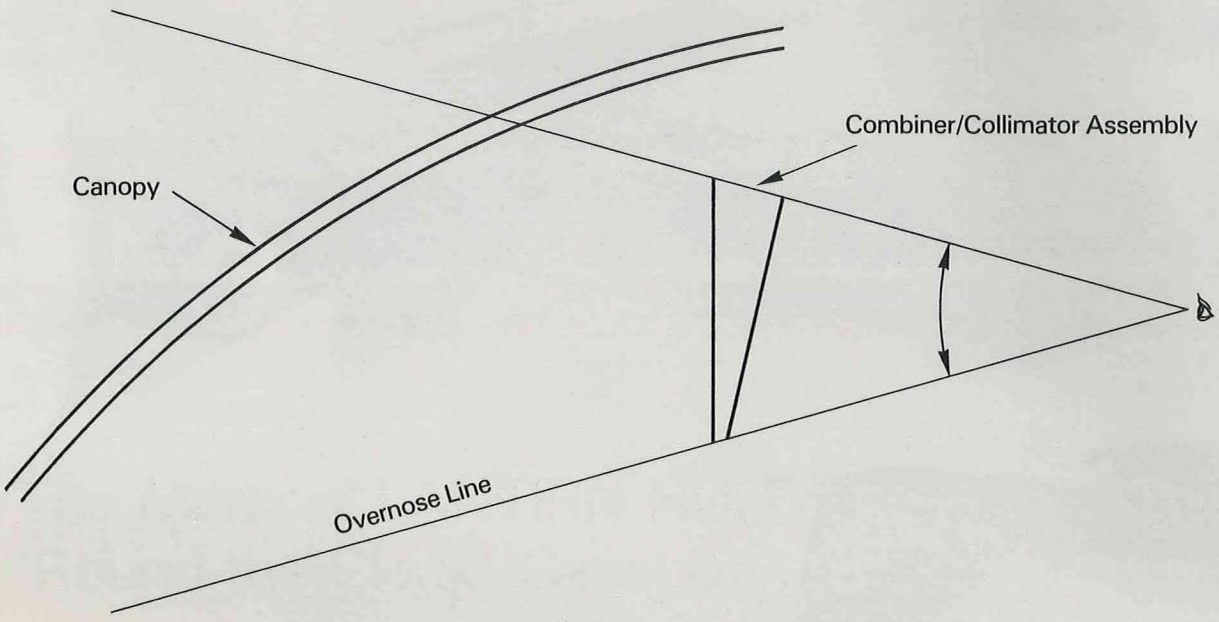
Jaguar

A major feature of the Marconi LANTIRN HUD design is its ease of fitting to a wide variety of cockpits. This allows it to be retro-fitted to existing tactical aircraft with a minimal effect on the current cockpit configuration.

This ease of installation is inherent in the Marconi design which locates the larger optical elements above the instrument panel, just forward of the ejection clearance line. Electronically, the modular interface and high level language programmable computer provides the flexibility to communicate with a wide variety of different aircraft systems.

MARCONI AVIONICS



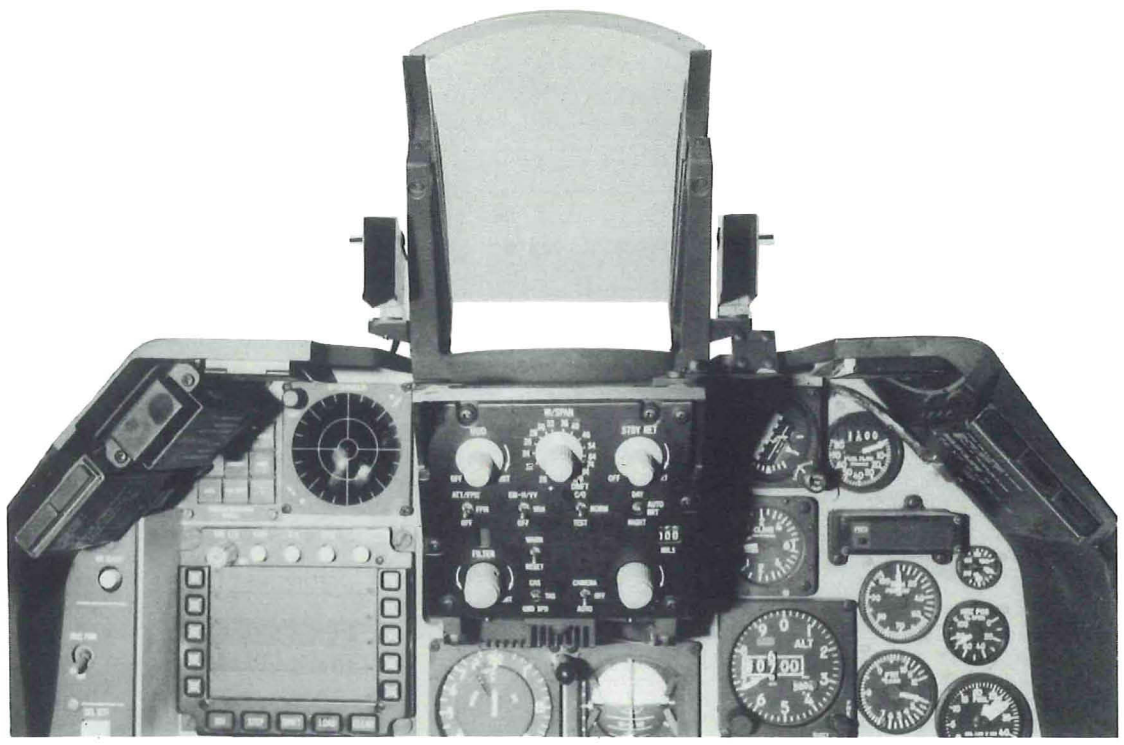




The Marconi LANTIRN HUD uses diffractive optics to overcome the limitations on field of view inherent in conventional refractive systems. In refractive systems the exit lens of the optical system collimates the CRT picture and reflects it from the combiner glass to the pilot's eyes. The image of the exit lens seen in the combiner thus acts as a port-hole through which the pilot can see his display superimposed on the real world. In these systems collimation cannot be performed at the combiner since the optical power needed for collimation produces unacceptable aberrations of the real world scene.

In the LANTIRN system advantage is taken of the very wavelength-selective optical properties of diffractive systems to create a combiner possessing optical power which only effects the narrow band of green light emitted by the CRT phosphor. A combiner of this sort can then perform the display collimation task with negligible effect on the real world scene.

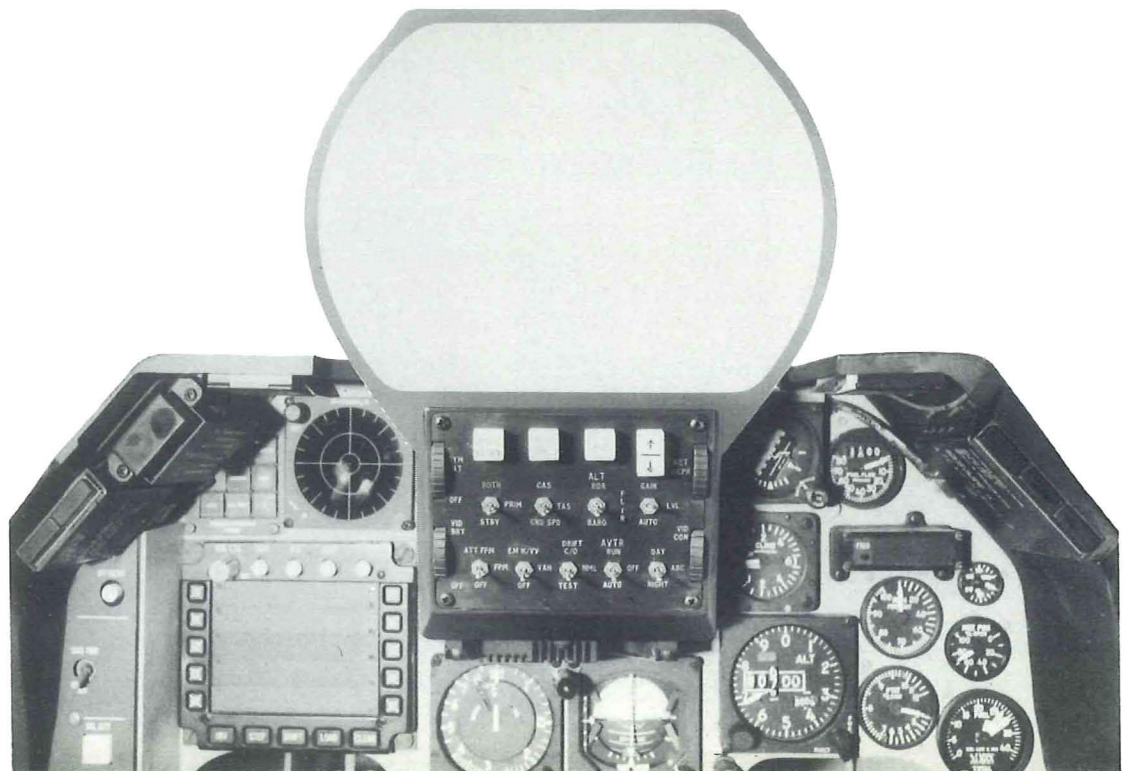
Indeed, because of the narrow frequency band in which the combiner operates, the diffractive system allows more light from the outside to reach the pilot than is possible with the normal refractive combiner. Also, in the band in which it does operate, the diffractive combiner is extremely efficient with very low optical losses. For a given display brightness, this allows the cathode ray tube to be operated at reduced power, thereby prolonging tube life, reducing heat generation and increasing system reliability.

Two factors increase the field of view available from the LANTIRN system. First, because the combiner is outside the prime optical module it can be made physically larger. Second the design selected moves the combiner back to the ejection line closer to the pilot. This increases the angle subtended at his eye and further improves the field of view.

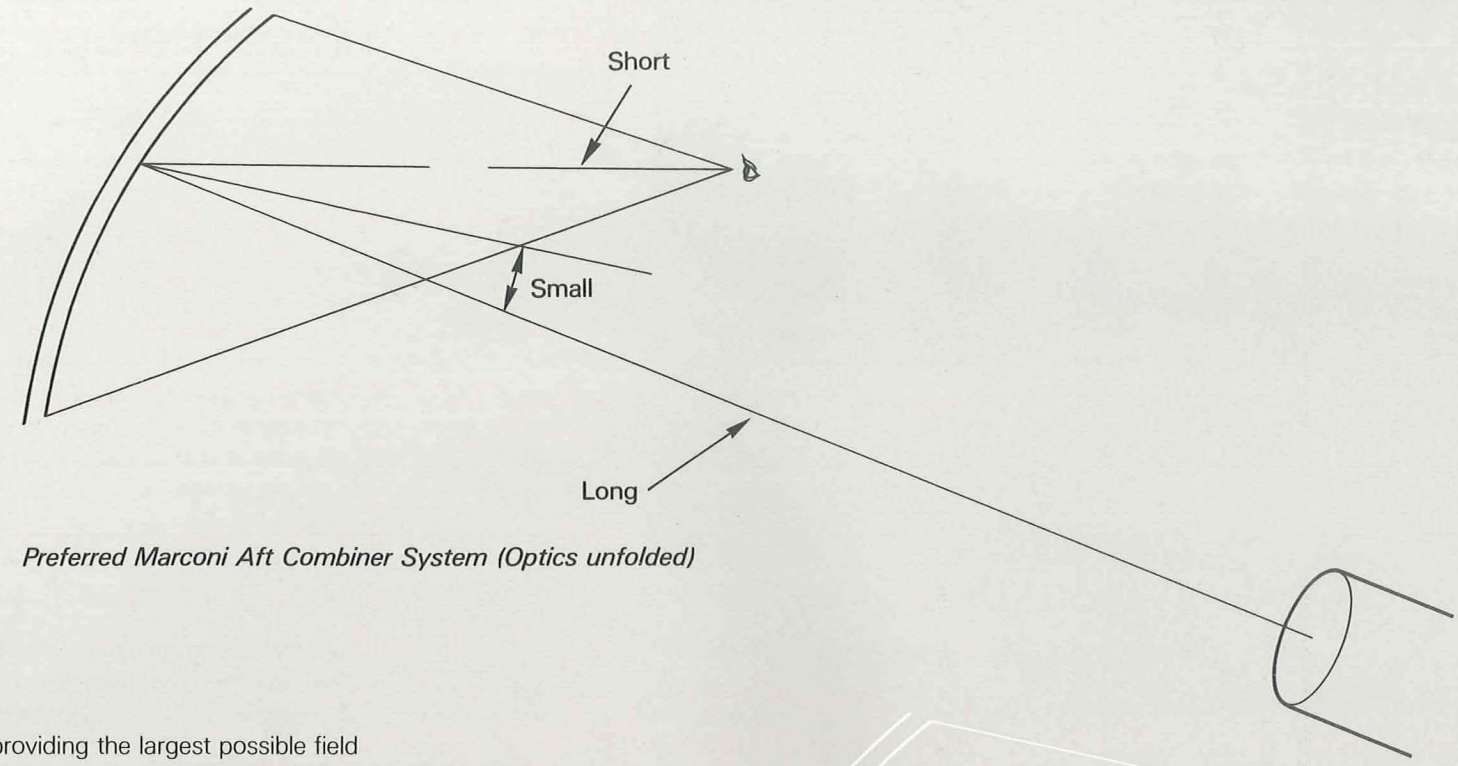


Placing the combiner at the aft end of the LANTIRN HUD greatly eases the problem of adapting the system to a wide variety of cockpit configurations.

The new LANTIRN HUD is designed to be installed in the same space of the existing HUDs — in both the F-16's and A-10's widely different cockpits. This ability to provide the largest possible instantaneous Field of View within conventional cockpit constraints directly aids designs for retrofit to most current tactical fighters.



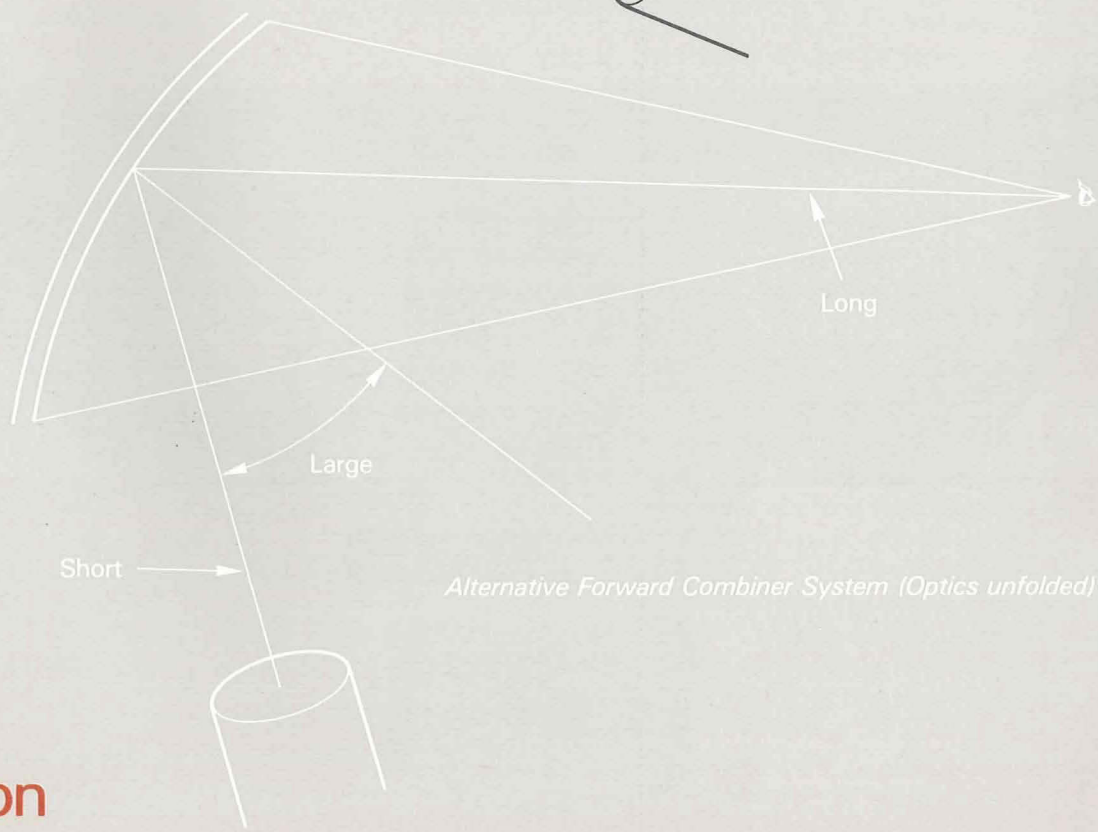
## An Adaptable Design




*Preferred Marconi Aft Combiner System (Optics unfolded)*

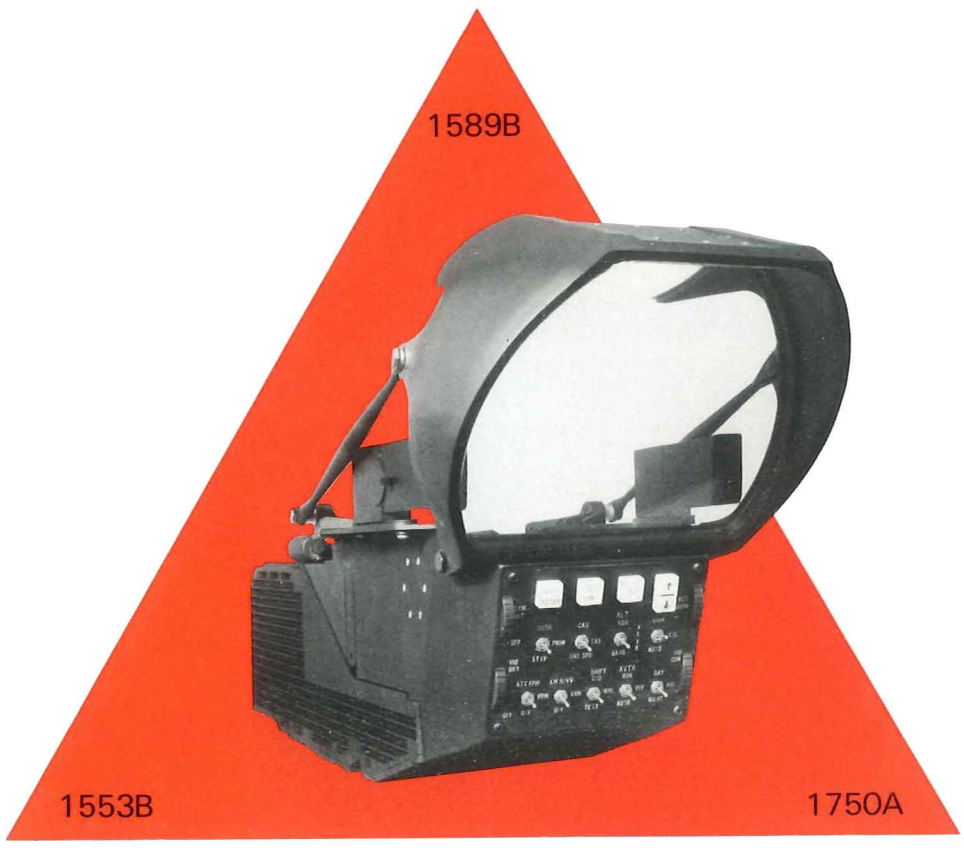
In addition to providing the largest possible field of view, the aft position of the combiner in the Marconi LANTIRN system has two other major advantages. First the optical path from the CRT to the combiner is long allowing greater control of optical aberrations and second the angle between the ray path and the normal to the collimating surface is small, reducing the amount of aberrations created in the collimation process itself. This reduction in the magnitude of and increase of optical control over aberrations in the Marconi system reduces the complexity of the collimation task and greatly simplifies the problem of manufacturing the holographic coatings required to produce the necessary diffractive properties.

The relative simplicity of the coatings used with the Marconi system lends itself to the high yield production techniques necessary for economic large scale production runs and permits better quality control on the coatings themselves.




*Alternative Forward Combiner System (Optics unfolded)*

# Designed for Quantity Production




The Marconi LANTIRN HUD is the first ever production avionic equipment to incorporate all elements of the basic design standards triad.

- MIL STD 1589B High Order Language
- MIL STD 1750A Airborne Instruction Set Architecture
- MIL STD 1553B Airborne Digital Data Bus

In addition the LANTIRN HUD is designed to possess all the advantages in reliability and ease of maintenance built into the very successful F-16 HUD. This combination of advanced standards and proven technology provides improved performance, greater flexibility and reduced life cycle costs.

Full-scale LANTIRN HUD production will take place at both the Rochester, England and Atlanta, Georgia plants. Both production lines are under the control of a single design authority with complete responsibility for design change and production monitoring. This arrangement which has been used successfully with the A-4, A-7 and F-16 programmes provides maximum programme protection and assurance of part interchangeability for all delivered items.

*Rochester, England, UK*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MARCONI AVIONICS

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