

GEC AVIONICS

***By Night as by Day...***  
***Operate in the Light of Experience***

[www.rochesteravionicarchives.co.uk](http://www.rochesteravionicarchives.co.uk)



# By Night as by Day.....

## The Need...

The modern sophisticated enemy will operate 24 hours a day. Night time provides the perfect cover for reinforcement or redeployment involving mass vehicular movement.

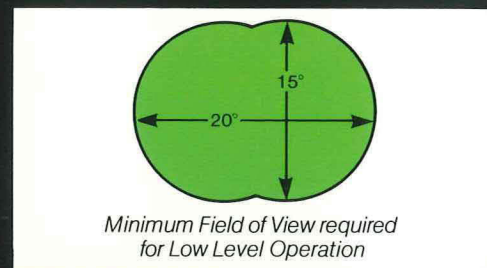
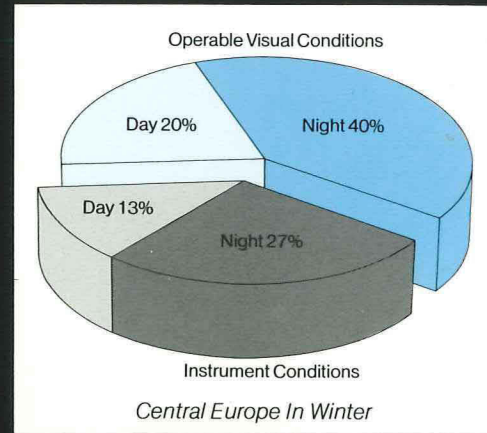
The plethora of battlefield defenses with a 24 hour capability requires that attack aircraft operate by night as by day to survive.

Ultimately high speed low level with a stand off first run attack capability is the answer.

Possession of this capability through the 24 hours can triple the available operating window allowing a 200% increase in air effort.

## The Requirements...

Experience has shown that the minimum instantaneous HUD field of view required for successful night low level operation is 20° x 15°. It is essential to portray sensor video on the HUD at 1 to 1 scaling perfectly registered against the actual outside scene.



In the attack phase of any mission a larger instantaneous field of view increases operational effectiveness and allows greater weapons system flexibility.

A full cursive overlay of in-flight symbology together with thermal cueing information provides the final element for full mission confidence.



1 to 1 FLIR Imagery with Flight Symbology and Target Cueing

## The History...



**A-7E** In 1971 GEC Avionics successfully integrated a raster HUD with a LLTV sensor for the USN A-7E. In 1973 the integration was extended to accommodate the TRAM FLIR using an 875 line standard with symbology overlaid by analog scan conversion. This is the world's only combat proven production dual mode HUD.



**RAE Hunter** This is a research program being conducted by RAE Farnborough. The HUD interfaces with LLTV and the GEC Avionics TICM II FLIR and gives a 625 line raster. Symbology is achieved by independent generators—cursive for day, raster, with composite video, for night. This HUD has been the main UK development tool for fast jet night attack research.



**LANTIRN** A major breakthrough in diffractive technology led to the selection in open competition for the USAF LANTIRN program. The HUDs supplied give massive 30° x 18° FOVs. These HUDs are dual mode giving full cursive flight symbology in raster mode which is written in the flyback period of the CRT. A 525 line standard is standard convertible to 875 if required.



**F-16 C/D** The F-16 C/D production aircraft will feature a raster and cursive HUD as standard fit. This HUD uses conventional optics and has an IFOV of 20° x 15°.



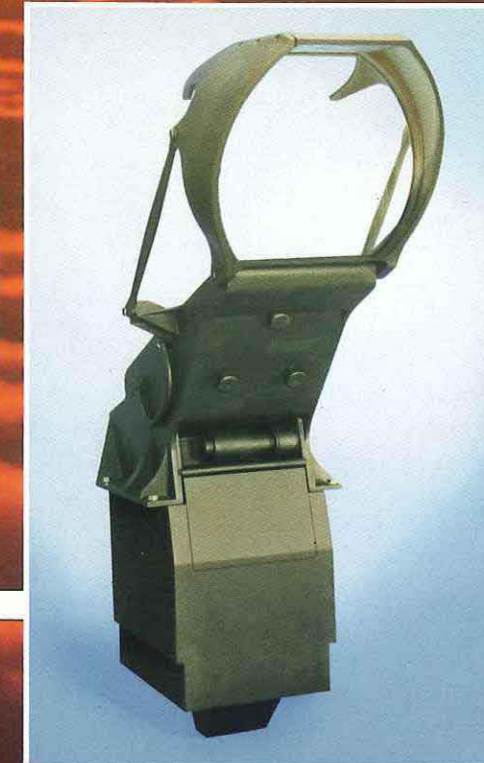
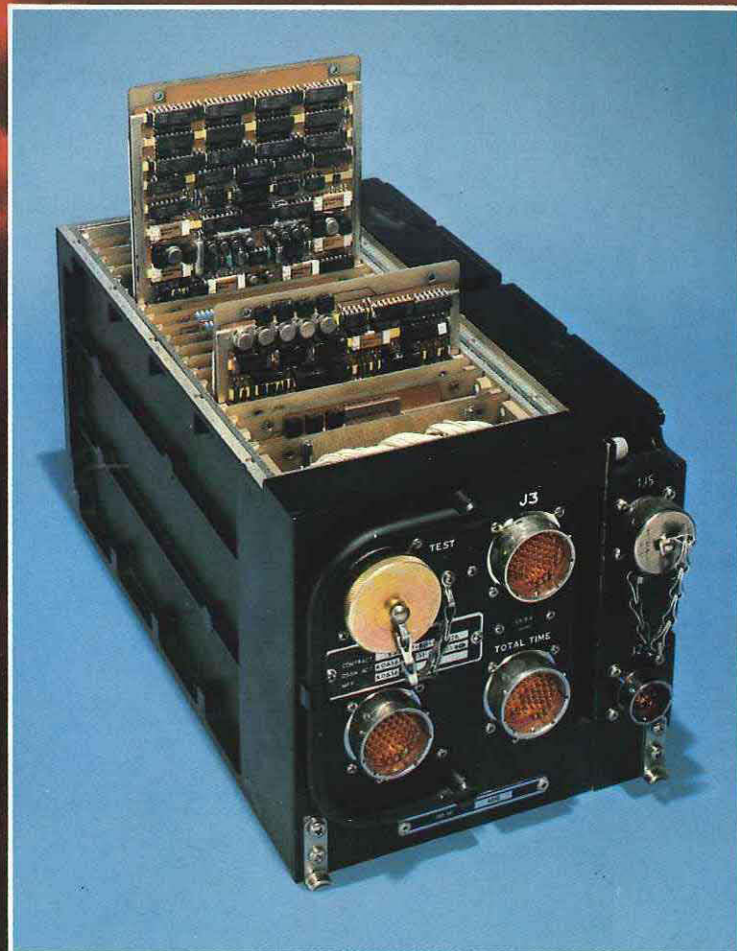
# The Equipment.....

## Pilot's Display Units...

- All dual capable – cursive and raster
- Symbology cursively overwritten on raster in CRT Flyback period
- More grey scales available for sensor video
- Designed for 525, 625, 875 line standards
- Highly accurate
- Full windscreen compensation

## The Electronics...

- Common for refractive and diffractive PDUs
- First joint application of MIL standards 1589B, 1750A and 1553B
- 64K addressable memory
- Provides power rails for PDU
- Features self contained weapon aiming calculations
- Contains scan conversion and video mixing circuits
- Modular interface for ease of integration
- Cooling by either forced air or tray mounted fan
- Power supply: 3 phase 115V 400Hz. Power dissipation: 230W



## Current Diffractive Optics Solutions...

- Large IFOV 30° x 18°
- Optimum head motion box
- Total undistorted view of outside scene
- Designed for ease of retrofit to fighter cockpits
- Selected in open competition for USAF LANTIRN program

## A Conventional Refractive Solution...

- Developed from mature AFTI F-16 optical design
- 25° TFOV
- 20° x 15° IFOV
- Standard equipment for F-16 C/D models
- Easily installed in all current fighter aircraft





## The Confidence...

### Through evolutionary design

Current designs have been perfected through 20 years of HUD development and production, with deliveries to date in excess of 5500 shipsets. All designs are modular in construction and feature extensive built in test. This equipment reflects the benefits gained from a successful Reliability Improvement Warranty program carried out for the USAF.



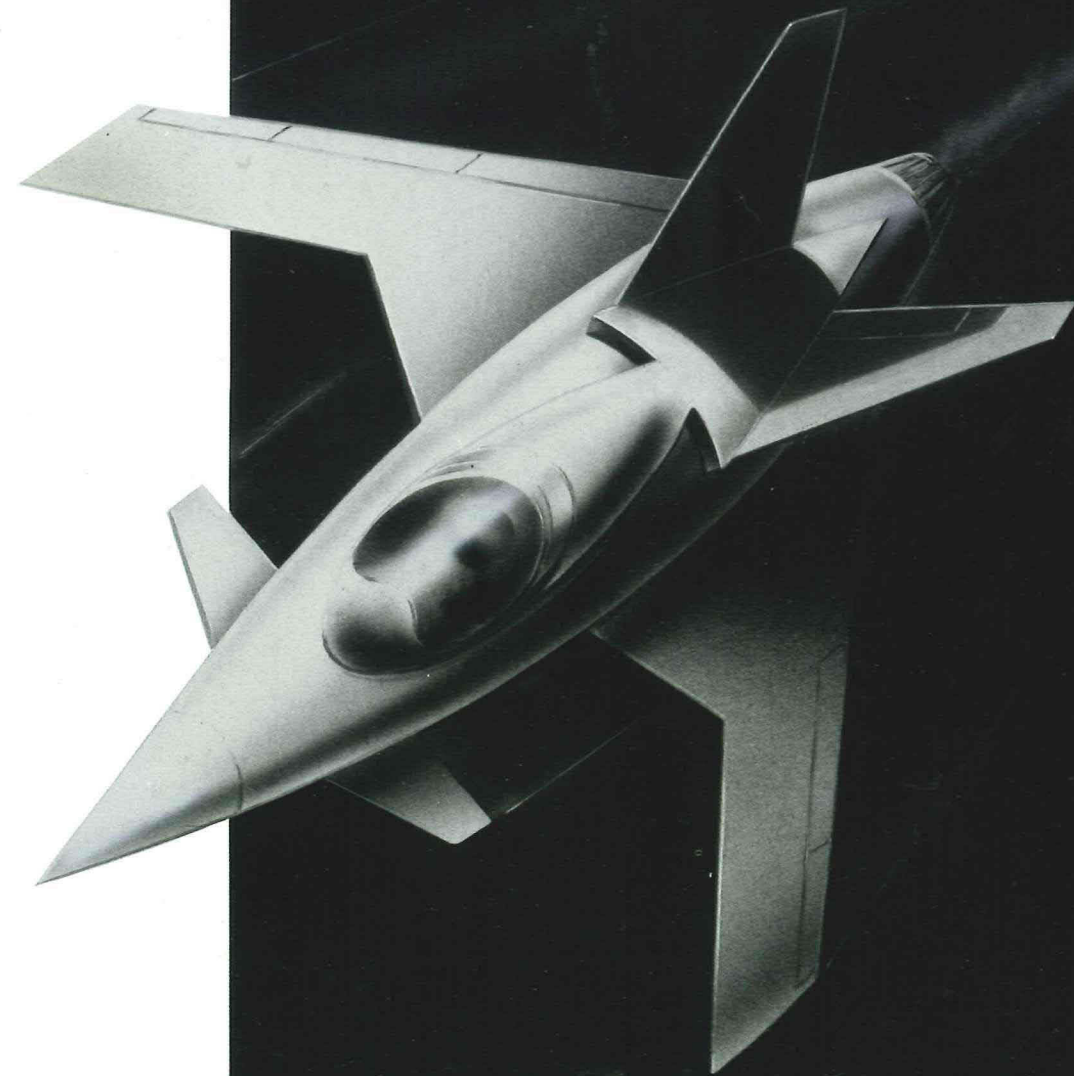
### The Complete Capability...

These display systems are capable of integration with any LLTV or FLIR sensor. However, Marconi Avionics possess a total night vision systems capability, reflecting the state of the art in sensor and display technology. The displays readily integrate with our TICM II FLIR which with the addition of thermal cueing provides 24 hour mission capability. The operational flexibility of this package can be enhanced by the inclusion of 'Cats Eyes' night vision goggles, with their unique combination of see through and diffractive optics compatibility.



## The Future.....

Studies have led to the requirement for a series of designs for extremely large IFOV dual capability head-up displays. Marconi Avionics have responded to this challenge through technology and have pursued the use of diffractive optics to provide fields of view of 40° x 30° whilst retaining optimal head motion box geometry together with the Marconi Avionics traditions of noise free raster, accuracy of symbol positioning and aberration free outside scene viewing. All these new designs have been carried out specifically to comply with the fighter pilot's own stated needs.







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