HUD 2020

Head Up Display
for
Commercial Aviation

MARCONI
ELECTRONIC SYSTEMS

twenty-twenty or **20-20,** *adj.*

having normal visual ability.

INTRODUCTION

Marconi has an unrivalled pedigree in the design development and manufacture of Head Up Displays (HUDs). We have delivered more than 10,000 systems for over 50 different aircraft types.

Marconi supplied the World's first HUD in 1962 for the UK Buccaneer combat aircraft.

The latest generation fighters on both sides of the Atlantic, the F-22 'Raptor' in the U.S. and Europe's Eurofighter, are also equipped with Marconi HUDs.

The primary advantage of a HUD is the ability to present important aircraft performance and control information to the pilot in his forward field of view. Without reference to head-down instruments, the pilot is continually aware of the aircraft's position, true flight path and energy state.

As the world's number one HUD supplier, Marconi has now advanced Head Up Display technology in the commercial air transport market with HUD 2020.

The facts; HUD 2020 will offer the operator a range of operational, safety and financial benefits.

Operational Benefits:

HUD 2020 can significantly enhance the operational effectiveness of an aircraft by increasing the pilot's ability to land and take-off during low visibility conditions or at night at unimproved airports.

FACT:- 97% of the airports in the U.S. do not have CAT III capability.

Safety Benefits

HUD 2020 displays primary flight, navigation and guidance information to the pilot in his forward field of view. This increases the pilot's situational awareness by giving him more time looking out of the cockpit during the critical phases of flight. HUD 2020 presents the pilot with a collimated display (focused at infinity). The pilot therefore has immediate access to flight information without the need to move his head and refocus as required to view the head-down instrumentation.

FACT:- It takes 3 seconds to transfer focus from the horizon, down to the instrument panel and back to the horizon. During this time the aircraft has travelled 300m (1000 feet).

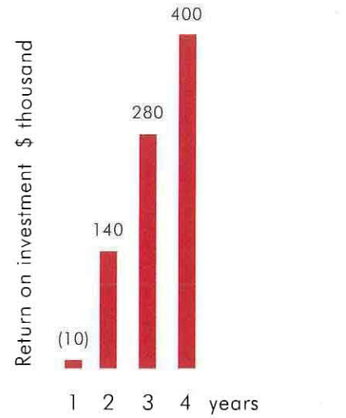
Financial Benefits

HUD 2020 reduces the likelihood of aircraft on ground incidents such as tailstrikes, runway excursions, and heavy landings.

The flight path vector in HUD 2020 enables pilots, to "spot land" the aircraft and provide important cues if drift or sideslip develop prior to touchdown.

HUD 2020 also reduces the number of costly diversions due to adverse weather conditions.

FACT:- Delays and Diversions cost US Airlines more than $1.5B per year (more than $350,000 per aircraft/year).



HUD 2020 improves situational awareness in all phases of flight and embraces technology adaptable to future developments in sensors and enhanced visual systems.

Civil Air Transport's requirement for HUDs

Requirements/Operations	State of the Art	HUD 2020
Cat III Operation	✓	✓
Runway Excursion "Black Hole Approach"	≈	✓
Tail Strike Avoidance	No	✓
Hard Landing Avoidance	No	✓
Digital Technology	No	✓
21st Century (F3)	No	✓
Demonstrated Growth (Raster Capability)	No	✓
Integrated Solution	No	✓

THE SOLUTION

HUD 2020 represents state-of-the-art proven technology, incorporating a wealth of features, many of which are unique to this design.

HUD 2020 has the design advantage of being fully raster capable, to be compliant with emerging technologies such as Enhanced Vision Systems (EVS).

Configured to fit multiple aircraft types for both pilot and co-pilot stations, the unique digital interface presents symbology at high levels of dynamic occlusion.

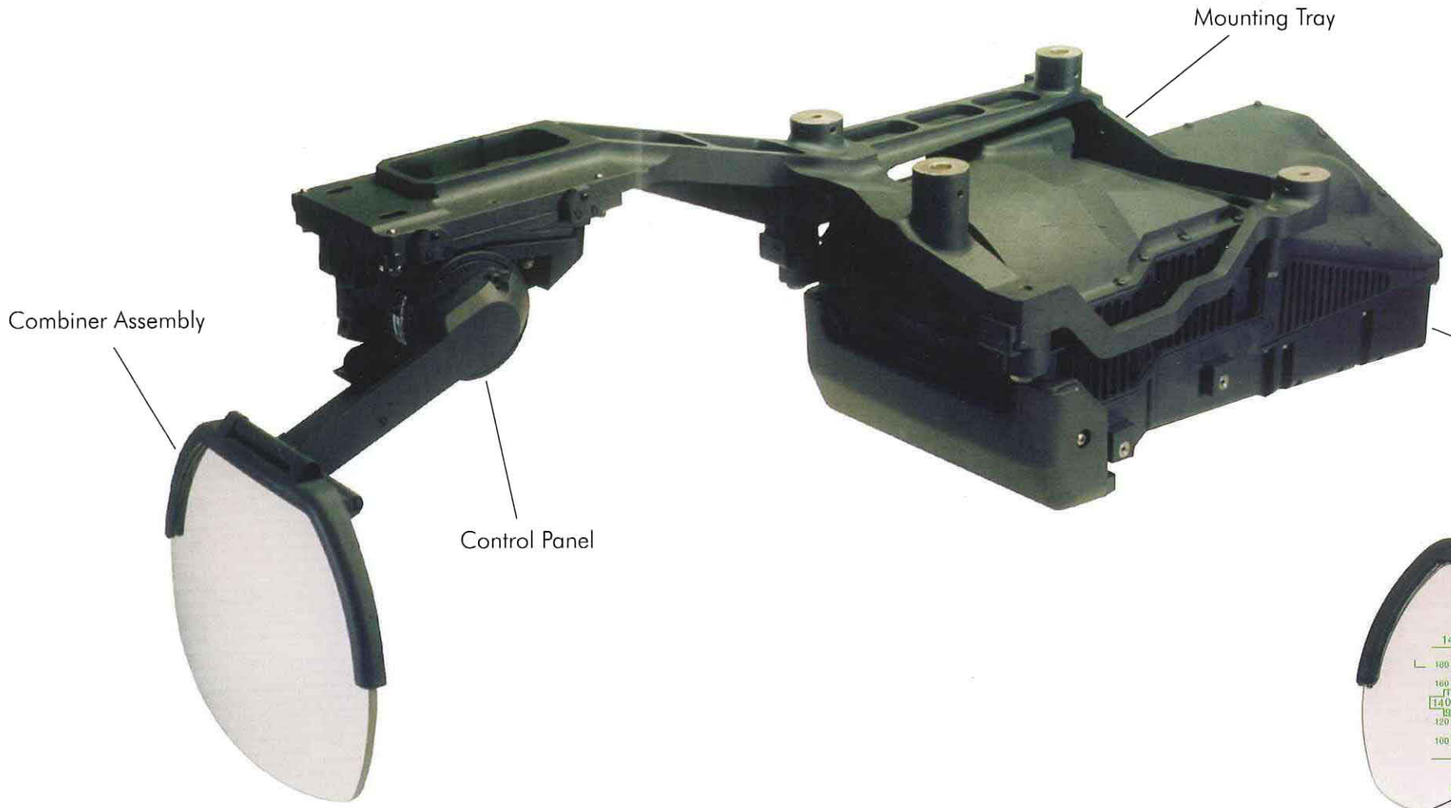
HUD 2020 presents a clear unambiguous view of the aircraft situation across the operating spectrum.

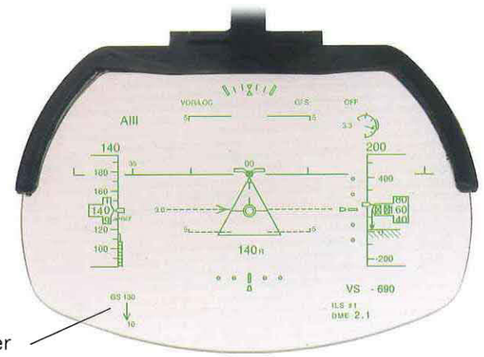
HUD 2020 Advantages;

Raster capable. The smallest dual stroke/raster HUD in the industry, resulting from over 30 years experience in the design and installation of raster capable HUDs to the demanding defence and aerospace market.

Digital interface. HUD 2020 is the only HUD to offer this architecture, resulting in;

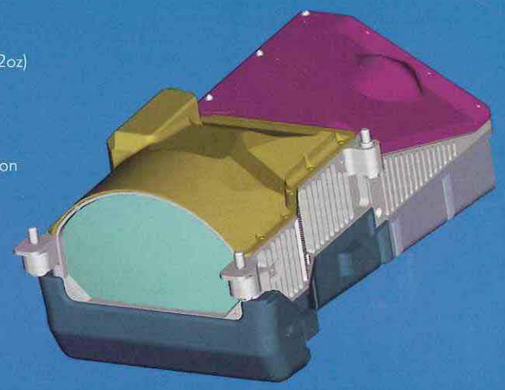
- Significant reduction in aircraft wiring.
- Increased separation between the Overhead Unit and drive circuits without degradation to the display.





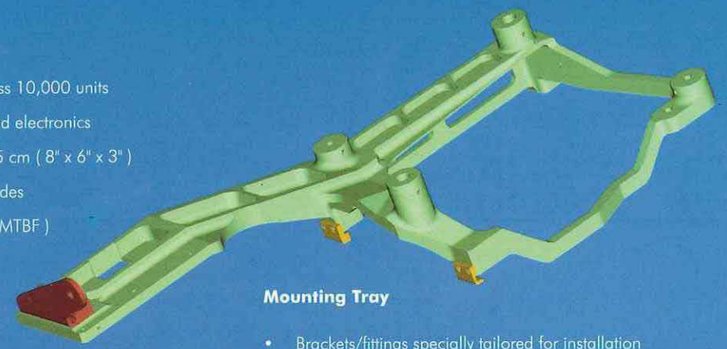
Combiner Assembly

- Lightest combiner available 340gms (<12oz)
- Large field of view (FOV) 30° x 25°
- Synthetic / holographic assembly
- Meniscus coating providing 100% reflection
- Includes brightness and contrast controls
- Stows to an upper folded position



Overhead Unit

- Based on 35 years experience across 10,000 units
- Contains Optical Assembly, CRT and electronics
- Large Eye Motion Box 20 x 15 x 7.5 cm (8" x 6" x 3")
- Includes both Stroke and Raster modes
- Extremely reliable (> 6,500 hours MTBF)



Mounting Tray

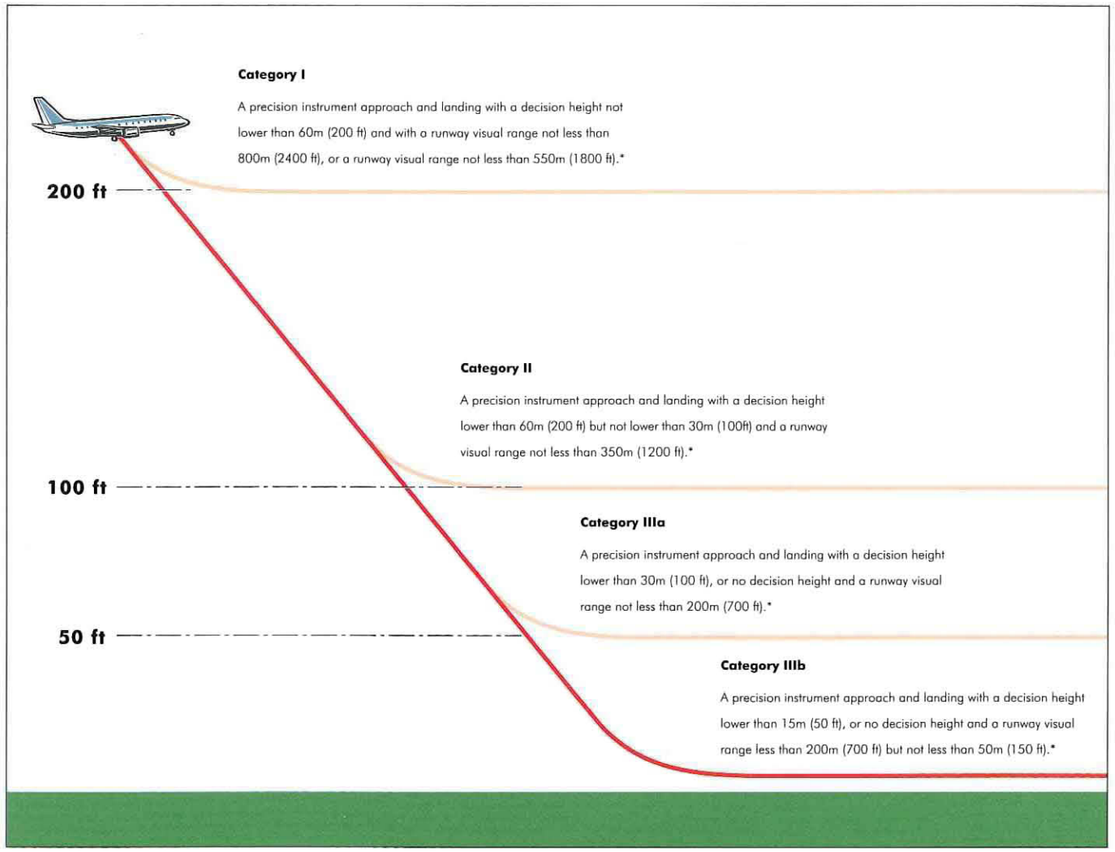
- Brackets/fittings specially tailored for installation
- Spherical bearings used on mounting tray
- Mounting Tray aligned to aircraft axes

Why do commercial aircraft need HUD 2020?

Head-Up Display technology enables pilots to hand-fly aircraft as precisely as Autoflight systems, but with increased situational awareness and a greater degree of safety.

Autoland systems are now common on larger aircraft in an effort to diminish the effects of poor weather disruptions. Although successful in their application, they can only assist in the landing phase of flight, and only at suitably equipped airports. They cannot assist with taxi, guidance whilst on the ground, and are not capable of providing take-off guidance.

HUD 2020 is designed to complement Autoland systems.



Category I

A precision instrument approach and landing with a decision height not lower than 60m (200 ft) and with a runway visual range not less than 800m (2400 ft), or a runway visual range not less than 550m (1800 ft).*

Category II

A precision instrument approach and landing with a decision height lower than 60m (200 ft) but not lower than 30m (100ft) and a runway visual range not less than 350m (1200 ft).*

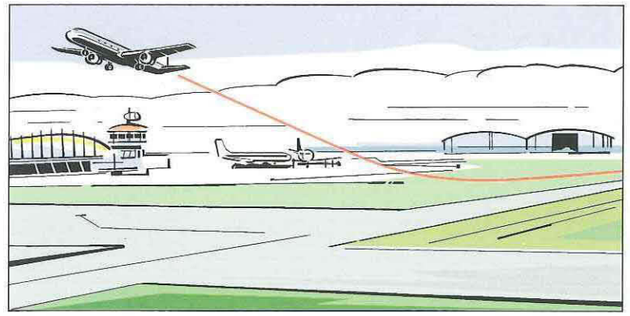
Category IIIa

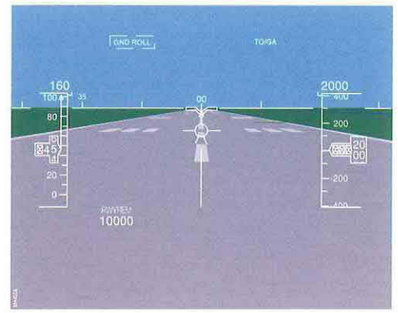
A precision instrument approach and landing with a decision height lower than 30m (100 ft), or no decision height and a runway visual range not less than 200m (700 ft).*

Category IIIb

A precision instrument approach and landing with a decision height lower than 15m (50 ft), or no decision height and a runway visual range less than 200m (700 ft) but not less than 50m (150 ft).*

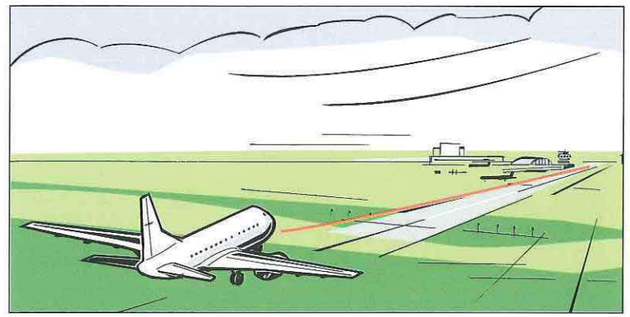
*(ICAO - IS&RP Annex 6)

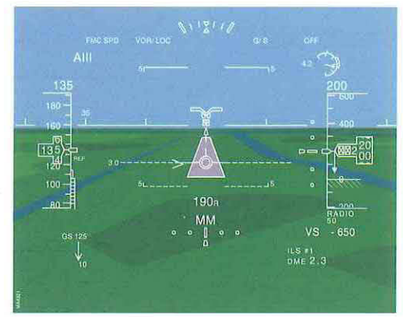




Take Off and Go-Around

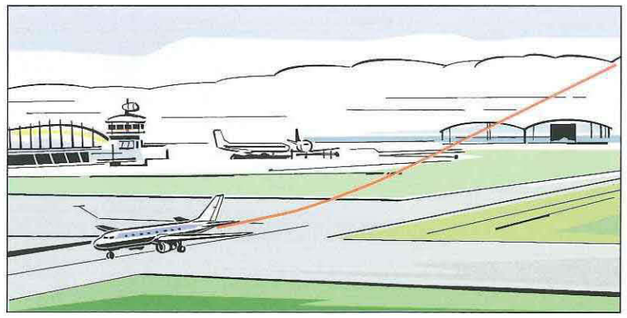
The HUD provides positive guidance and 'v' speed bugs which enable take off in reduced runway visual range conditions (RVR) down to 90m (300ft).

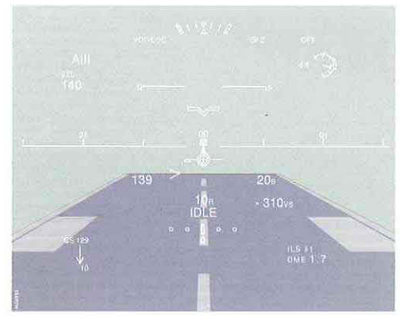




Approach

The HUD provides guidance from localizer capture right down to touchdown, including all the necessary annunciations from "outer marker" to "idle". The symbology auto-declutters at Cat III decision height.





Landing Mode

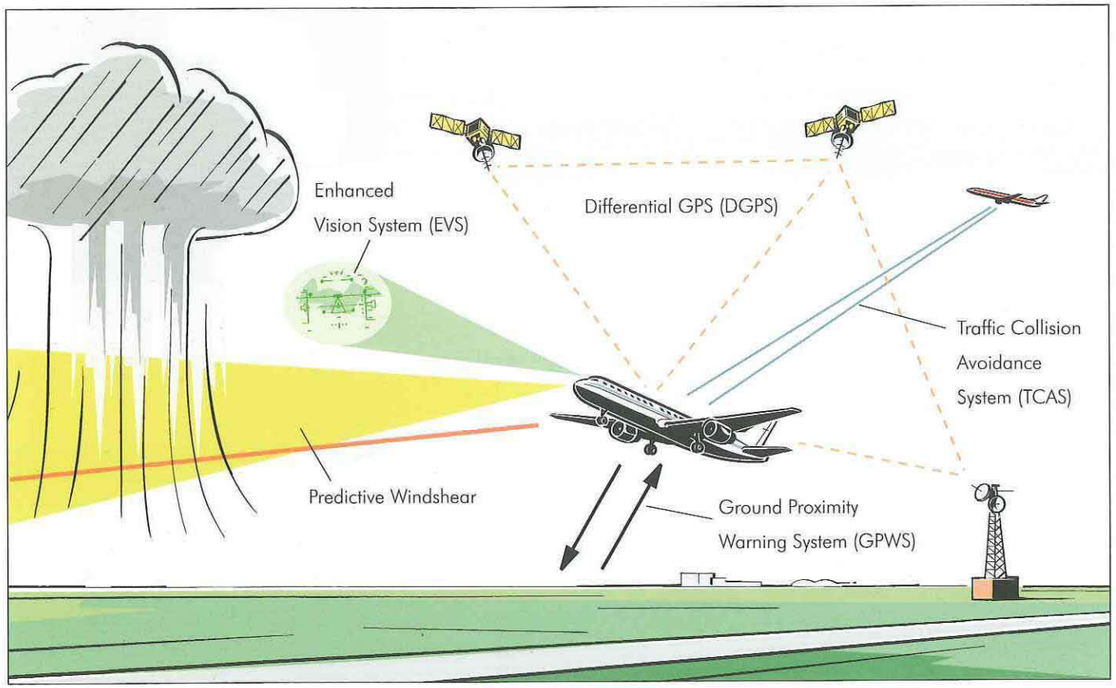
From Cat III decision height, the HUD provides guidance down to touchdown including a flare cue and engine idle prompt. Positive centreline rollout guidance is also provided.

THE FUTURE

HUD 2020 has been designed and developed for future growth with emerging technologies.

Marconi is well positioned to integrate future enhanced technologies with the HUD system, which will typically include :

- Differential GPS (DGPS)
- Enhanced Vision System (EVS)
- Traffic Collision Avoidance System (TCAS)
- Predictive Windshear
- Ground Proximity Warning System (GPWS)
- Enhanced GPWS



"American Airlines is pleased to announce that Marconi Electronic Systems has been selected as the Head-Up Display supplier for our new 737 aircraft. Marconi is the world's largest HUD supplier with over 10,000 units in service. We are excited about this new partnership to provide our pilots with the leading-edge technology to enhance safety and situation awareness."

Captain Rick Owens, 737 Fleet Manager, American Airlines.

Following an intense international competition, Marconi Electronic Systems has been selected by American Airlines for the supply of 75 HUD 2020 Head-Up Displays for their new 737-800 aircraft, with an option for a further 425 systems.

The programme will be undertaken by Marconi at its facility in Rochester, UK, underlining its position as the world's No.1 supplier of HUD technologies and systems.

HUD 2020
HEAD-UP DISPLAY

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