Use of Helmet Mounted Display on Tactical Transport Aircraft

Antonio Ledda, Ilaria Sale, Maurizio Spinoni
Alenia Aeronautica S.p.A.
Corso Marche 41
10146 Torino TO
Italia

Tel. +39 011 9960 464
Fax. +39 011 9960 415
e-mail aledda@aeronautica.alenia.it; isale@aeronautica.alenia.it; mspinoni@aeronautica.alenia.it

1 Introduction

Today many different models of Helmet Mounted Displays (HMDs) are basic equipment on state-of-the-art fighter aircraft and combat helicopters.

It is out of doubt that their introduction has increased weapon systems performances beyond those made available by use of Head-up Displays (HUDs) alone: in fact, the possibility of presenting to the pilots the required information in their complete field of regard provides a great improvement in situation awareness and enemy engagement capabilities, both in the A/A fighter close combat environment and in combat helicopters A/S engagement.

Future weapon systems will probably lack HUDs while more sophisticated HMDs present colour symbology, multi-sensor imagery and reproduce enhanced reality information to the pilots' eyes.

As far as tactical transport aircraft are concerned, HMDs have not seen practical operational use, although they offer potential advantages in conjunction with HUDs or stand-alone.

Starting from these basic considerations, Alenia Aeronautica have recently initiated an investigation on the possibility of adopting state-of-the-art HMDs, on board the C-27J, as an alternative solution to the conventional HUD.

This paper describes the first phase of this investigation, based on theoretical study aimed to identify basic ergonomic, functional and symbology requirements for a potential application of HMD on the C-27J Spartan.

2 Background

The presentation of head-up symbology to the pilots of transport aircraft has many advantages: in fact civil transport aviation applications see now commonly the HUD as part of "hybrid" automatic landing systems, in order to increase operational capability and reduce landing minima in adverse weather conditions.

On board military transport aircraft use of a HUD is a mean to increase tactical performances above the limits imposed by the use of head-down information only; this is particularly true for tactical flight at low level and operations at night or in marginal weather conditions, in which availability of HUD allows Forward Looking Infra-Red (FLIR) or Night Vision Imaging System (NVIS) sensors imagery presentation to the pilots while looking outside of the cockpit.

Paper presented at the RTO SCI Symposium on "Critical Design Issues for the Human-Machine Interface", held in Prague, Czech Republic, 19-21 May 2003, and published in RTO-MP-112.

The HMD, with its intrinsic capability to present off-boresight symbology, could potentially prove to be beneficial for the maximum exploitation of tactical capabilities.

In fact current state-of-the-art HMDs, although not yet technologically mature to be operated as true Primary Flight Displays, can display HUD-like symbologies and additional tactical information for specialised tasks such as low altitude aerial delivery, low level flight and tactical landing.

Since Alenia Aeronautica are involved in the design and production of state-of-the-art military transport aircraft such as the C-27J Spartan, a study has been conducted to evaluate the possibility of enhancing tactical transport mission performances by adopting a HMD.

The initial phase of this study has involved the analysis of ergonomic issues (e.g. pilots acceptability, monocular vs. binocular presentation) as well as operational issues (e.g. type of symbologies, line-of-sight tracking, NVIS integration compatibility).

Other integration issues (e.g. head tracking sensors cockpit installation, wiring, stowage) have not been addressed in detail in this initial phase of the study.

Subsequently, a mission analysis has been performed to individuate the mission phases in which use of a HMD could provide operational advantages and increase safety. From this analysis the “dimensioning mission phase” has been derived.

Later on specific information and symbology requirements have been individuated for the dimensioning mission phase.

In a follow-on phase the evaluation of the proposed HMD design will be carried on the Alenia Aeronautica C-27J Spartan Engineering Flight Simulator, in order to test the proposed HMD layout and symbology in a simulated realistic operational scenario.

According to the results of the flight simulation tests, dedicated flight test activity will possibly be also considered.

3 The Alenia Aeronautica – Lockheed Martin Aero C-27J Spartan

As said above, Alenia Aeronautica consider potential use of HMD as a way to increase operational effectiveness of their C-27J Spartan tactical transport aircraft.

Design and development of the C-27J was a joint enterprise of Alenia Aeronautica in Italy and Lockheed Martin Aeronautical Systems (LM Aero) in U.S.A.

The Alenia Aeronautica – LM Aero C-27J Spartan

The C-27J aircraft combines the airframe of the well proven Alenia G-222/C-27A with new, state-of-the-art general systems and cockpit designed by Alenia Aeronautica and new avionics and propulsion systems developed by LM Aero under the principle of high commonality with the LM Aero C-130J.

The C-27J is designed to perform the following main missions:

- aerial surveillance,
- cargo transport,

- high and low altitude cargo airdrop,
- medevac,
- paratroops airdrop,
- troop transport.

The C-27J Cockpit System is based on an advanced glass cockpit concept specifically designed to allow the execution of the mission by a two person flight crew.

Five 6 x 8 inches head down colour, active matrix liquid crystal multifunction display units (CMDUs) are installed on the main instrument panel.

Each of the CMDUs is capable of presenting primary flight information, engine and aircraft system parameters, and information from navigation systems, flight plan data, TCAS, GCAS, windshear detection and defensive systems.

The C-27J integrated head down display system is optimised to provide the pilots with comprehensive situation awareness in all mission phases while maintaining the pilots' workload at an acceptable level.

The C-27J Spartan Cockpit

In addition to the CMDU display suite, a HUD system is offered as an option to potential Customers.

According to the general C-130J commonality philosophy, the C-27J HUD design is based on the C-130J HUD hardware and software, tailored to specific C-27J requirements.

Each pilot station can be equipped with one HUD. The HUD unit is equipped with a wide angle ologhraphic combiner, compatible with use of Type I and II, Class B Night Vision Goggles (NVGs).

The HUD symbology provides both pilots with all primary flight information (i.e. heading, airspeed, flight path, vertical velocity, altitude, and attitude) required for basic flight tasks and aircraft control.

The HUD is also capable to present navigation and tactical information such as approach/navigation and associated course guidance, aerial delivery information, threat alerts, TCAS information, and special alerts.

As the C-27J can be operated to perform a wide variety of missions, the HUD System provides several sets of symbols (modes of operation and data layers) according to mission tasks or flight phase.

In addition, an adequate declutter mode is provided to reduce amount of undesired information at pilots' command.

4 Helmet Mounted Display Ergonomic And Functional Requirements

In order to comply with a typical military transport aircraft mission requirements such as those for the C-27J Spartan, a candidate HMD has to provide specific ergonomic and functional features.

The HMD for such an aircraft shall be able to be operated effectively by the aircrew in the most demanding tactical operations such as Low Altitude Parachute Extraction (LAPE), Aerial Delivery, "Paradrop" missions; in addition the HMD shall adequately provide information for tactical low level flight and tactical landings operations, also at night and in marginal weather.

These general concepts imply combination of ergonomic and functional requirements which have to be carefully balanced to obtain, among other results, limitation of physical crew fatigue, simple operation, absence of induced spatial disorientation, and, over all, limitation in workload.

In order to individuate these features, a comparative analysis between "state-of-the-art" HMD applications and specific tactical transport operational and mission needs has been completed.

The HMD requirements identified so far are summarised in the following:

1. **Structural design**
   The HMD should have low weight and balanced mass; absence of ejection safety requirements could allow simplification of design and reduced weight with respect to fighter aircraft HMDs, thus allowing a more comfortable fit.
   As far as the physical fatigue aspects are concerned, it is to be considered that during a typical mission of a transport aircraft the HMD will be mainly used during selected phases of flight (e. g. tactical phases, approach).
   The HMD shall also be provided with quick, precise and permanent (i.e. not modified by frequent donning and doffing) adjustment and regulation features to allow tailoring to the user.
   Impact characteristics are to be carefully evaluated, also considering the use of HMD in conjunction with HUD.
   Compatibility with communication devices, possibly embedded, and respiratory equipment (quick-don to be evaluated) is to be provided.

2. **Display system**
   The HMD display system shall be preferably binocular, to reduce fatigue and accommodation time.
   A raster imaging capability shall be assured in order to allow contemporary presentation of symbology and video (e.g. imagery from NVIS).
   A typical FOV of 40° for each eye should be required.
   If the helmet visor is used as a combiner (embedded holographic inserts) then clear visor shall be provided in order to allow night time operations.

3. **Head position tracking**
   The HMD shall be equipped with a head position tracking system (technology TBD).
   Wide head tracking envelope shall be provided, typically 270° Azimuth, ±90° Elevation, ± 70° Roll.

4. **NVIS imaging**
   The HMD shall provide NVIS imagery to the pilot; this could be done either by means of incorporated NVIS sensors or by presentation of images derived from remote steerable sensors.

5. **Symbology**
   The HMD symbology shall be arranged in several dedicated presentations (formats) for specific tasks; this will allow the pilots to maintain adequate situation awareness in all mission phases, limiting workload.

   This shall be obtained by means of a flexible symbology generation capability, able to display different formats in relation to the phases of flight and with multiple declutter levels, selectable by the pilot possibly via easily reachable controls (e.g. on the control wheel).

In addition, the symbology cognitive features shall be carefully designed in order to avoid the increase of mental effort or induced disorientation in interpreting "world referenced" information when looking off-boresight (e.g. presentation of attitude information)

5 Definition Of The Dimensioning Mission

In order to proceed with the HMD symbology analysis the first step was to define the "dimensioning" mission and to delineate the operational needs.

This analysis has individuated the LAPE (Low Altitude Parachute Extraction) as a typical case of very critical tactical mission, where the use of HMD could greatly enhance operational effectiveness.

The LAPE mission consists in the release of a palletised load from the aircraft flying at a very low altitude (about 10 ft AGL). During the release the aircraft is not expected to touch down. The release zone selected for LAPE releases is normally a flat terrain strip possibly clear of obstacles along the ingress and egress trajectories.

As additional consideration the tactical scenario of a LAPE mission can be highly hostile in terms of presence of threats and terrain profile.

A C-27J Spartan performing a LAPE mission

The LAPE procedure can be decomposed in a number of main phases:

– Penetration: during this phase the crew members review the mission tasks and take care of the self defence system and navigation data. The penetration to the release area is flown at low level, performing terrain masking manoeuvre in order to reduce the exposure time to the possible threats present on the hostile zone.

– Reconnaissance: is a critic phase in which the pilot has to fly near the terrain to inspect the Release Zone. In the reconnaissance phase the pilot has to verify the characteristics of the strip, i.e. length, slope, obstacles, surface type.

– Circuit: is the phase of the mission in which the aircraft is more vulnerable to enemy fire; this phase is usually performed quickly to reduce exposition. In this phase the aircraft loses the residual altitude in order to link up the final approach path. The circuit is made up of a cross wind, down wind and a base turn during which the pilots have to carry out the LAPE check list.

– Final: this phase may be very demanding especially if the terrain configuration is such to require a steep descent angle.

– Release: the release of the load in a LAPE mission is very critical due to the necessity to maintain constant a reduced clearance with the ground (10 ft typical) until the load separation.

– Climb: during the climb phase the aircraft has to be flown with an optimum climb rate to guarantee a fast departure from the release zone and reaching of the escape altitude.

– Escape: during this phase the pilot follows the escape route to exit the operational area as soon as possible. In this phase the pilots carefully monitor the radar warning messages, attitude, climb and navigation data.

From the above description it is clear that the LAPE mission provides a large number of operational conditions in which to evaluate the implications of a HUD or HMD integration.

6 Helmet Mounted Display Symbology Requirements

After having defined the dimensioning mission, it is possible to determine the necessary symbologies to be displayed on the HMD to effectively carry out the mission tasks.

For the purposes of the present study only the symbology concerning the dimensioning mission and, specifically, to the selected mission phases have been object of analysis.

The symbology analysis has been carried out in the following steps:

1. Definition of information requirements, i.e. which type of information is needed in the different mission phases in order to allow accomplishment of the associated tasks.
2. Definition of symbology requirements, i.e. which type of symbology is to be provided in order to convey the required information in the most effective manner to the flight crew.
3. Definition of mechanisation and presentation mode, i.e. characteristics of symbologies behaviour, movement, parameters variation, presentation in off-boresight, boresight, and ground stabilisation.
4. Definition of symbology automation and priority, i.e. association of groups of symbols or their mechanisation to key mission events triggered by pilot actions, and relevant presentation priority in case of conflicts between symbols.
5. Definition of declutter philosophy, i.e. how and which symbols are to be removed from the HMD presentation in order to reduce clutter without hindering information transfer to the crew.

Table I, provided at the end of this paper, represents a synthetic overview of the results of the above summarised analysis.

Among the topics discussed and examined during the analysis, the key points are briefly resumed in the following for each of the above steps.

Information Requirements

The following information elements have been considered mandatory:

- Basic flight information
- Navigation Information (NAV), including Lateral Deviation Indicator, Vertical Deviation Indicator, Bearing pointers, Navigation aids.
- Tactical information (TACT), including self defence, release zone, timings, release symbology, way-points indicators, markers, locator lines, ground proximity warnings.
- Cautions and warnings attention getters

Symbology Requirements

The symbology will be based on a standard mix of digital (numeric) and analogical symbols as applied on state-of-the-art HUD and HMD applications; as far as possible commonality with C-130J and C-27J HUD symbology concepts will be pursued.

To reduce clutter within the small HMD FOV, it has been considered acceptable to privilege the use of digital presentation of parameters. This could have adverse effects such as a reduction of attentional capture. However, digital information should be used sparingly and in such a way that its spatial location helps conveying meaning or identification. For example, airspeed should be located left of altitude and heading should be displayed between airspeed and altitude.

Specific symbology will be provided to support tasks such as lining-up with release corridor and maintain terrain clearance, especially when pilot is looking in a off-boresight direction.

Point of Interest (POI) Locator Line (LL) will be provided to indicate the relative azimuth and elevation vector between a fixed point of reference on the HMD and a selected POI outside the HMD FOV. The LL concept has been used with great success on some HUD applications, as well as during HMD experimental and operational flight test.

A properly designed and implemented LL symbology can help the pilot to quickly and intuitively perform a visual location task. Design features can be added to the LL to provide additional information such as angular distance between the centre of the HMD FOV and POI. Also POI identification information can be included in the LL mechanisation

It has been considered that system status information is not essential for display on the HMD; this information is available on Head Down Display (HDD) formats and includes, typically:

- Auto Pilot Mode Status
- Mission Data Block
- Navigation Data Block
- Message Annunciation Window

Details of system and sub-systems failures, mission warnings and special alerts will continue to be displayed head down and through auditory warnings. Only "Attention Getters" will be provided on the HMD to recall pilot attention on HDDs.

Mechanisation and presentation mode

The symbology will be arranged in formats and layers, activated upon pilot request or pilot action on aircraft systems according to mission needs; this has been considered a key feature to reduce workload for the operation of a HMD in the C-27J.

In our view one of the major issues to be considered when developing a set of symbologies for a tactical transport aircraft HMD is to define the presentation behaviour of each symbols when the pilot moves his/her head. In fact, there are symbols that are required to be presented to the pilots' eye only when he/she is looking in a boresight direction, while others require to be presented also when the pilot is looking in a off-boresight direction.

Since the manoeuvring performances of C-27J make the aircraft perfectly suited for low-level tactical navigation and terrain masking flight profiles, off-boresight information is intended to keep the pilot informed of the primary flight parameters while performing outside scanning tasks (e.g. maintain terrain separation, release area acquisition, line-up turns).

The flight parameters information will include airspeed, altitude, acceleration (i.e. energy cue) and vertical velocity and attitude.

Off-boresight presentation of attitude parameters has been considered a critical issue due to the well known potentially disorientating effects caused by coupling head and aircraft movement with attitude display changes.

In order to avoid these consequences it has been considered to use attitude symbology specifically designed for non ground-stabilised presentations (an example of this type of symbology is the Arc Segment Attitude Reference - ASAR); this symbology could also be augmented by guidance symbology or additional aircraft parameters.

During the experimental phase of the activity the modes of transition between boresight and off-boresight attitude symbology presentation will require to be analysed and optimised.

In addition to the attitude information, other symbology sets will be presented both in boresight and off-boresight direction; they will include tactical information from self defence system and ground proximity warnings.

Tactical symbology will also include ground stabilised symbology, such as way-points markers, drop zone area, etc

Each pilot will be provided with the same type of symbology, appropriately differentiated according to own line of sight direction; inter-stations symbology, such as indication of partner line of sight direction will be provided on pilots request.

Automation and Priority

HMD symbology will be arranged in a Basic Format that could be supplemented by two data layers: Navigation and Tactical layers.

The Navigation Layer will include information to perform accurate and timely navigation on planned route, following steering indications. This format will include symbology to support roll-out and runway line-up (on equipped airfields), take-off, approach .

The Tactical Layer will include an additional set of symbols related to tactical operations in high threat areas.

The selection of each format will be performed manually by the pilot or automatically following the activation of specific on-board systems.

Top priority will be given to information associated to safety; this will include flight parameters, ground proximity warnings, systems warning attention getter and of course self defence system (e.g. Missile Warning).

Top priority information will be presented regardless of head orientation.

Declutter Philosophy

A maximum of 2 declutter levels shall be available for boresight/off-boresight symbology.

It is proposed that the same declutter levels are available for all phases of flight. Selecting the declutter level will apply the declutter to both boresight and off-boresight symbology.

Automatic symbology decluttering, including removal of NVIS imagery, will be activated when line of sight is directed inside the cockpit, to allow unobstructed view of cockpit instrumentation.

7 Flight Simulator Evaluation Activity

The following step of the HMD application analysis will be based upon man-in-the-loop (MITL) evaluation to be performed in a comprehensive dynamic simulation environment. This evaluation will be specifically devised to investigate in detail the adequacy of the proposed HMD implementation concepts.

The basic symbology requirements identified in the above described theoretical study will be translated in detailed requirements and implemented on an experimental HMD device, tailored to evaluation purposes, integrated on the Alenia Aeronautica C-27 Engineering Flight Simulator and Synthetic Environment.

The C-27J Engineering Flight Simulator, located at Alenia Aeronautica premises in Torino (Italy) has been used to support aircraft development and flight test. It will be also used for initial training of C-27J Customers, including the Italian and Greek Air Forces.

The Simulator is integrated within the Alenia Aeronautica Synthetic Environment that includes two Eurofighter Typhoon and one AM-X flight simulators, operators control rooms, stereoscopic visualisation equipment and extensive geographical data-base and tactical scenario generation and management capabilities.


The Alenia Aeronautica C-27J Engineering Simulator in Torino

Using real aircraft as well as custom-built hardware and simulation software, the C-27J Engineering Simulator and Synthetic Environment can be appropriately set up to allow experimentation of innovative devices such as a HMD.

By means of these tools it will be possible to fly simulated missions in a realistic tactical environment, and obtain a quantitative/qualitative evaluation figure of the proposed HMD symbology mechanisation and of the pilot workload associated with HMD operation. The assessment will be carried out according to the following steps:

HMD Equipment Selection

For the purposes of the evaluation it is not foreseen at the moment to develop a C-27J-tailored piece of equipment. Therefore the MITL evaluation will be based on HMD equipment available on the market (either non-flyable MOTS or COTS).

To this purpose it is foreseen to relax some of the most demanding ergonomic and functional requirements of the "candidate" HMD (e.g. reduced optical performances and characteristics) still granting compliance with evaluation objectives.

HMD - Flight Simulator Integration and Mission Set-up

The symbology set will be defined on the basis of detailed requirements derived from the symbology analysis; symbology will be prototyped, evaluated off-line and then implemented in the graphics generation system to drive the HMD.

Head tracking devices will be integrated in the simulator cockpit; this will include "magnetic mapping" in case of magnetic head trackers.

The possibility of providing simulation of NVIS imagery for night time missions will be considered.

Test missions and scenario will be defined and Synthetic Environment will be adapted to the mission needs.

Evaluation

The evaluation will be performed by Alenia Aeronautica Test Pilots

Different test missions will be flown in a realistic scenario, including threats.

During the evaluation it will be possible to select between different alternatives for symbology and associated mechanisation and presentation modes to allow comparison in different phases of flight (e.g. attitude information presentation).

In conjunction with symbology evaluation, a quantitative measurements of crew performances will be performed.

In particular it has been envisaged to perform the defined mission (LAPE) with and without the HMD , then comparing the level of precision obtained by the crew

In particular, some specific quantitative parameters (e.g. the precision in the alignment, in the release, in the altitude) will be recorded and then properly analysed.

It will be envisaged to apply different workload assessment techniques (such as Primary/Secondary Task Performance Measure, NASA TLX, Subjective Measures) in order to analyse the level of tasks demands, and the crew effort to maintain a consistent level of performance with and without HMD.

The results obtained will be used for further refinement of HMD requirements and, after a re-iteration of the evaluation in the simulated environment, the possibility for flight test activity will be studied.

8 Conclusions

Although becoming widely used on combat aircraft and helicopters, HMDs have not seen up to now operational use on transport aircraft.

However, there are some basic peculiarities of such displays that are of potential operational advantage when performing tactical transport missions.

Alenia Aeronautica have recently started an investigation on the possibility of adopting state-of-the-art HMDs, derived from models extensively used on combat aircraft, on board the C-27J Spartan medium tactical transport aircraft jointly developed by Alenia Aeronautica and Lockheed Martin Aero.

In the initial phase of this investigation, the main effort has been devoted to the identification of the basic operational and functional requirements for such an application. To this purpose an operational scenario has been defined, typical missions decomposed in their basic tasks and specific symbology requirements derived.

Future planned developments include the set-up of an experimental phase, based upon man-in-the-loop simulation exercises on the Alenia Aeronautica C-27J Engineering Flight Simulator and Synthetic Environment, to validate the most promising operational concepts.

Acknowledgements

The Authors wish to thank all the people who contributed to the activity described in this paper and in particular Com.te Enrico Scarabotto and Salvatore Lo Presti.

List Of Abbreviations

ASAR	Arc Segment Attitude Reference
A/A	Air to Air
A/S	Air to Surface
CARP	Computed Air Release Point
CDM	Climb/Dive Marker
CMDU	Color Multi-function Display Unit
CNI-MU	Communication, Navigation, Identification – Management Unit
COTS	Commercial Off The Shelf
FLIR	Forward Looking Infra Red
FOV	Field of View
GCAS	Ground Collision Avoidance System
HDD	Head Down Display
HMD	Helmet Mounted Display
HUD	Head Up Display
ILS	Instrumental Landing System
LAPE	Low Altitude Parachute Extraction
MLS	Micro-wave Landing System
MOTS	Military Off The Shelf
NVG	Night Vision Goggles
NVIS	Night Vision Imaging System
MITL	Man-In-The-Loop
POI	Point Of Interest
TBD	To Be Determined
TCAS	Traffic Collision Avoidance System

Table I

Symbology	Presentation Modality				Symbology Layer			Note
	Boresight	Off Boresight	Ground Stabilized	Affected by Declutter	Basic	NAV	TACT	
Waterline	✓	-	-	-	✓	-	-	
Climb/Dive Marker	✓	✓	✓	-	✓	-	-	In off-boresight presentation the information associated to CDM, Attitude Bars and Bank Angle is combined in an off-boresight attitude symbology set
Attitude Bars	✓	✓	✓	-	✓	-	-	
Bank Angle	✓	✓	-	✓	✓	-	-	
Horizon Line	✓	✓	✓	-	✓	-	-	
Energy cue	✓	-	-	✓	✓	-	-	
Reference Flight Path Angle	✓	-	-	✓	✓	-	-	
GCAS indications	✓	✓	-	-	✓	-	-	
TCAS indications	✓	✓	✓	✓	✓	-	-	Symbology superimposed to computed location of intruder
Airspeed	✓	✓	-	-	✓	-	-	
Stall Airspeed	✓	✓	-	-	✓	-	-	
Groundspeed Readout	✓	-	-	✓	✓	-	-	
Vertical Velocity	✓	✓	-	-	✓	-	-	
Barometric Altitude	✓	✓	-	✓	✓	-	-	Selectable in place of Radar altitude; "simplified" symbology in off-boresight
Radar Altitude	✓	✓	-	✓	✓	-	-	Selectable in place of barometric altitude; "simplified" symbology in off-boresight
Minimums	✓	-	-	-	✓	-	-	
Heading	✓	-	-	-	✓	-	-	
Selected Heading	✓	-	-	✓	✓	-	-	
Course Deviation Indicator	✓	-	-	✓	-	✓	-	
Ground Track Indicator	✓	-	-	✓	✓	-	-	
Bearing	✓	-	-	✓	-	✓	-	
Glideslope	✓	-	-	✓	-	✓	-	Displayed when landing aids (e.g. MLS) is available on landing zone
Localizer	✓	-	-	✓	-	✓	-	
Mission Timing Indicator	✓	✓	-	✓	-	✓	✓	
Runway outline	✓	✓	✓	✓	-	✓	✓	It depicts the perimeter dimensions of the runway (dimensions inserted by pilots via CNI-MU)
Flight Director	✓	✓	-	✓	✓	-	-	
Message annunciations	✓	✓	-	-	✓	-	-	
Locator Line	✓	✓	✓	-	-	-	✓	
Waypoint Symbols	✓	✓	✓	✓	-	✓	✓	
Map cursor	✓	✓	✓	✓	✓	-	-	Indicates the point on ground corresponding to map cursor position
Drop Zone Symbol	✓	✓	✓	✓	-	-	✓	
CARP Steering cue	✓	✓	✓	✓	-	-	✓	
Threat direction	✓	✓	-	-	✓	-	-	
Chaff & Flares count	✓	✓	-	-	✓	-	-	