

EFVS for Helicopters by Elbit Systems

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Agenda

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Commercial Aviation

1. What is EFVS for A/C

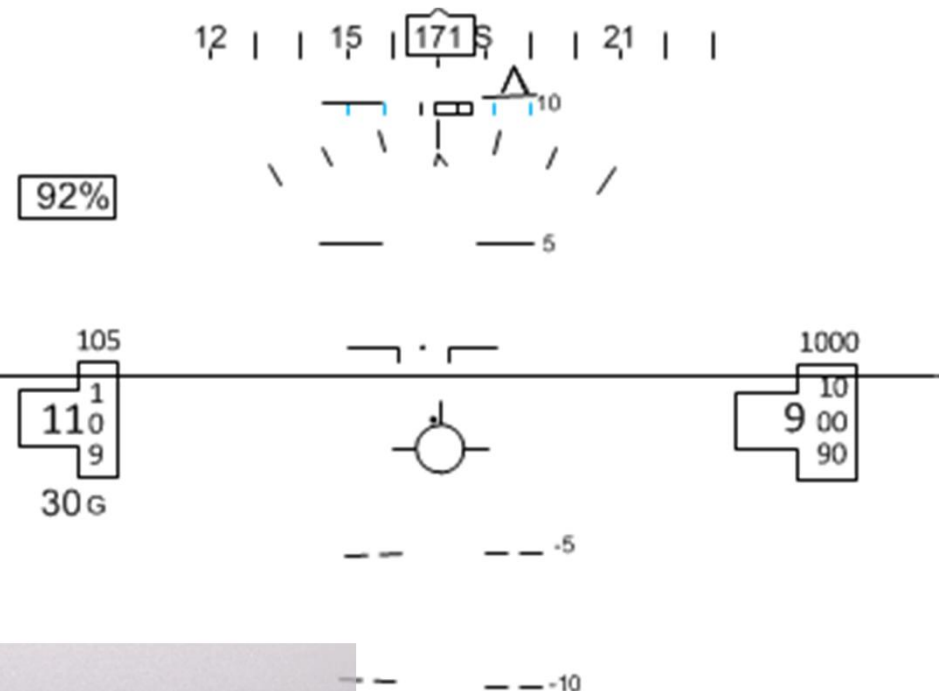
1. System
2. Regulations

2. What is EFVS for H/C

1. What is the need
2. Objectives of EFVS for H/C
3. System
4. Examples of use

3. Word on certification

4. Roadmap





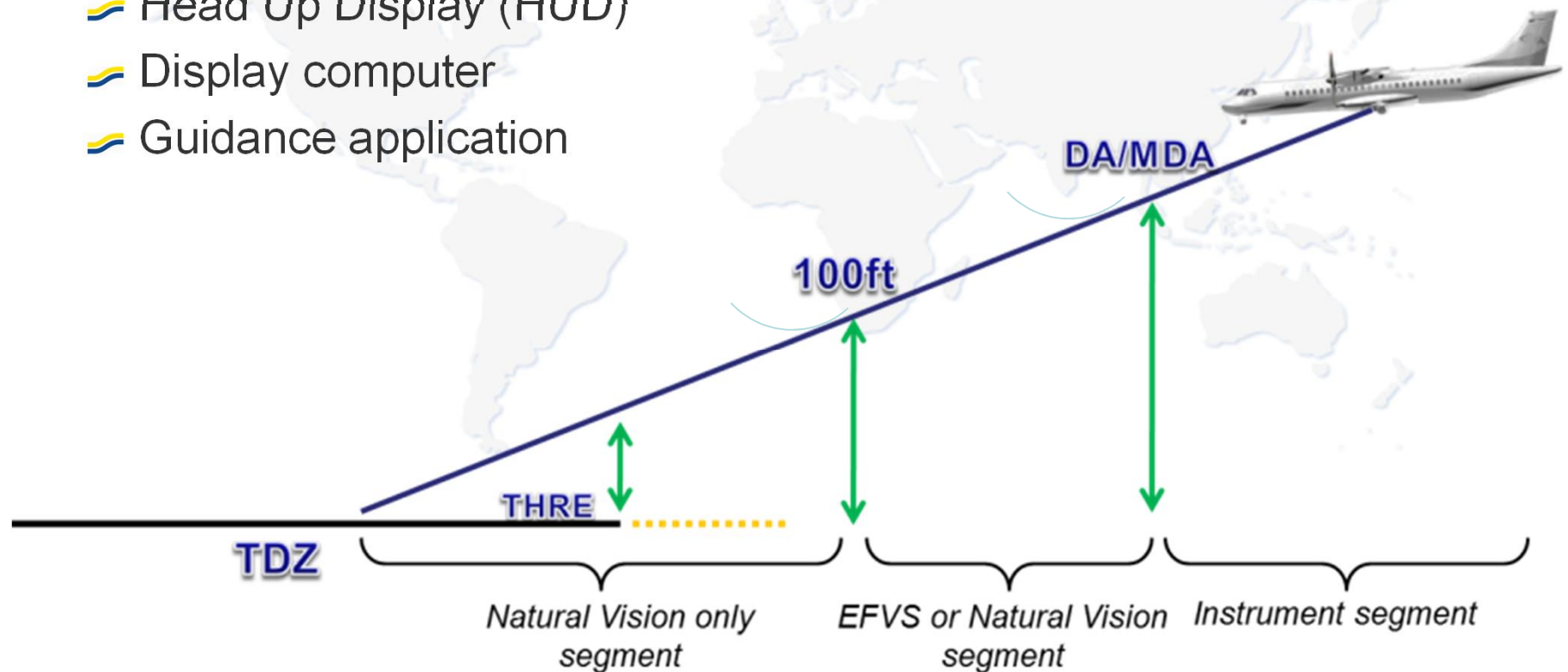
1 - What is EFVS for A/C

1 -1 – What is EFVS for A/C

▲ **System for Enhanced safety & Reduction of minima**

▲ **System building block are usually:**

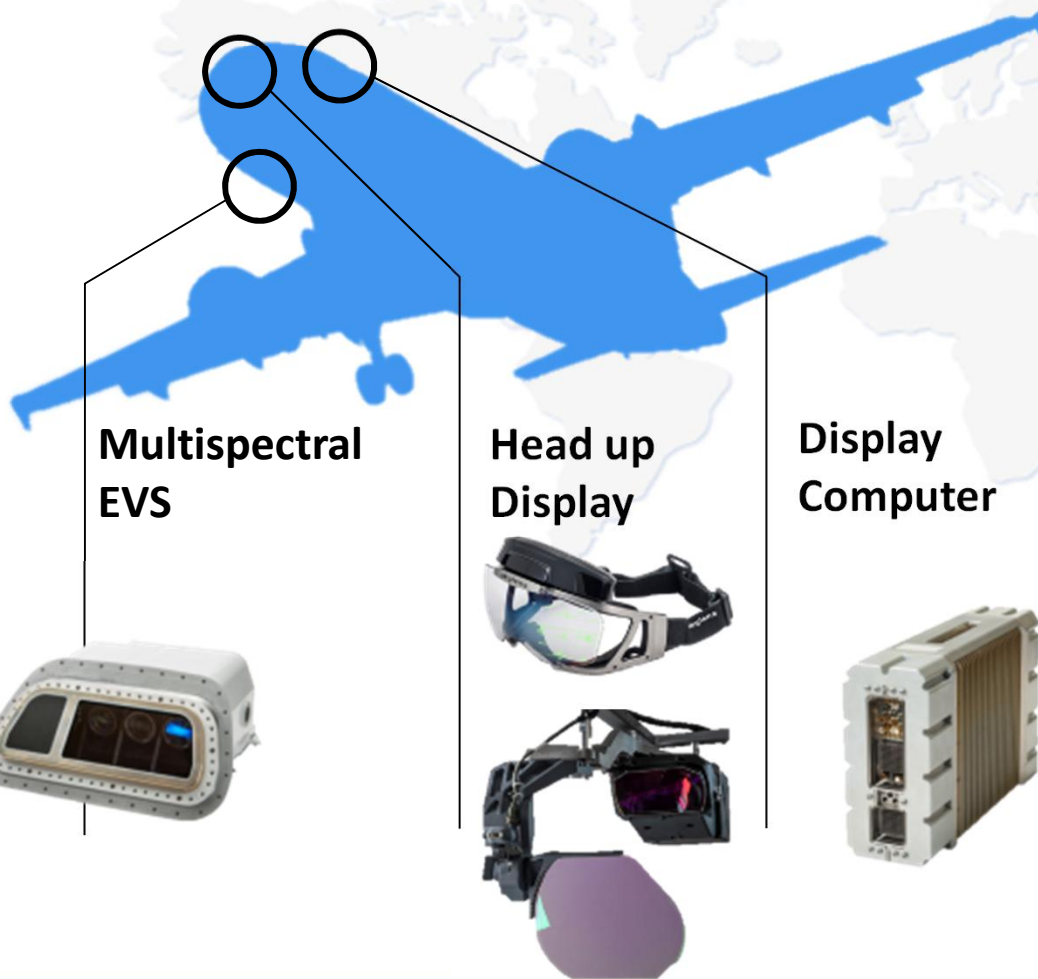
- Enhanced Vision System (EVS)
- Head Up Display (HUD)
- Display computer
- Guidance application



Elbit's ClearVision™ EFVS System – Fixed wing



CLEARVISION



**Multispectral
EVS**



**Head up
Display**



**Display
Computer**



1-2 Regulations and MOCs (Not full list)

▲ Applicable regulations :

- ✚ EU OPS Subpart E, Appendix 1 to OPS 1.430 (h) or 14 CFR 91.175(l) and (m) (to be replaced by 91.176 per NPRM)

▲ MOC

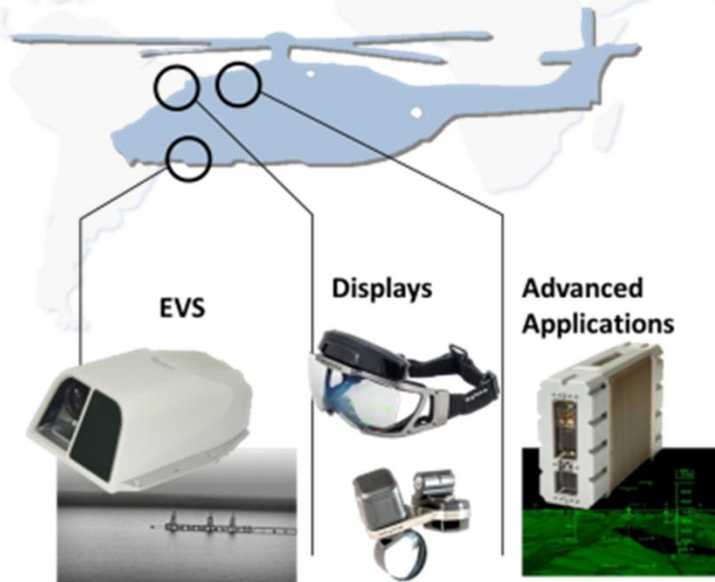
✚ EFVS Operations

- AC 20-167A Airworthiness approval of EFVS systems
- AC 90-106A EFVS systems certification and operational approval

▲ Technical Standards

- RTCA DO-315B/DO341 MASPS for EVS, SVS, CVS, EFVS
- ARP 5288/AS 8055 (Transport Category Airplane Head Up Display (HUD) Systems)

2 - EFVS for Helicopters



2-1- What is the need for helicopters

▲ Helicopter operators share a common goal- to complete a mission and return to base, However, according to articles:

- ✚ Crews may accept a mission when the weather is bad or the weather deteriorates while on the mission
- ✚ Operations conducted in locations and without complete weather reporting
- ✚ In unplanned IMC the pilot is caught off guard
- ✚ Total darkness can easily create Instrument Flying Conditions

National Transportation Safety Board, (NTSB) Jan' 2005 - Aug' 2008

- 71 accidents related to spatial disorientation occurred
- IIMC and darkness reported as causal factors in 82% of these accidents
- Of the 71 accidents, 85% were fatal

Challenges in these conditions, and objectives of EFVS

▲ Challenges :

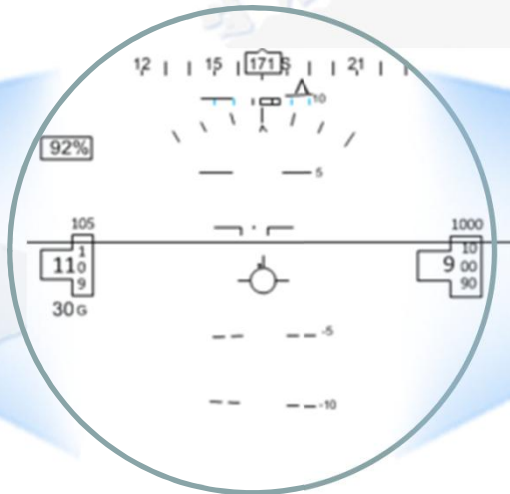
- ▬ Spatial disorientation (Such as decent into sea)
- ▬ High workload especially in:
 - Transition from IFR to VFR
 - ILS, Oil Rigs approaches
 - Off airport landing
- ▬ Difficult situational awareness in low visibility
- ▬ Reduce CFIT

▲ The objectives of our system in these conditions:

- ▬ Significant safety enhancement
 - Fly head out, minimize transition between cockpit and external world
- ▬ Gain Higher mission completion rate
- ▬ Roadmap to reduction of minima in IFR procedures:
 - Airfield ILS/ LPV
 - Oil Rigs OSAP, / ARA
 - PINS

2-2 Objectives of EFVS for H/C

- Spatial disorientation:
 - Provide conformal flight symbology in front of the pilot eyes
 - Provide video image conformal with the world



2-3 System Elements

System building blocks are :

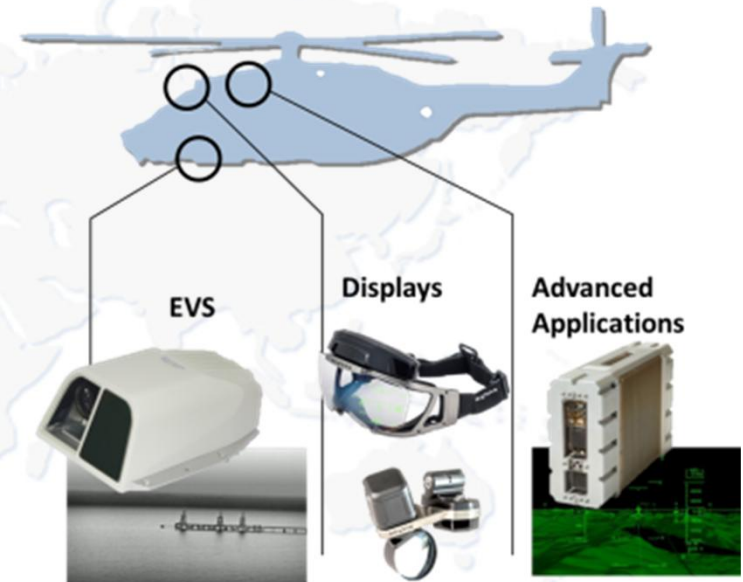
▲ **Head mounted display**

- Head tracking
- Symbology
- Video image

▲ **Processing & display computer**

▲ **High performance Multispectral
EVS sensor**

▲ **SW applications such as SVS,
Guidance, and more**



Designed for DAL A

▲ **Details in next slides**

2-3-1 -1 Skylens™

- ▶ Wearable HUD
- ▶ Right eye monocular Off-The-Visor display
- ▶ 26° by 20° Display FOV
- ▶ Displayed image focused at infinity
- ▶ Head tracking



2-3-2-2 SkyVis™

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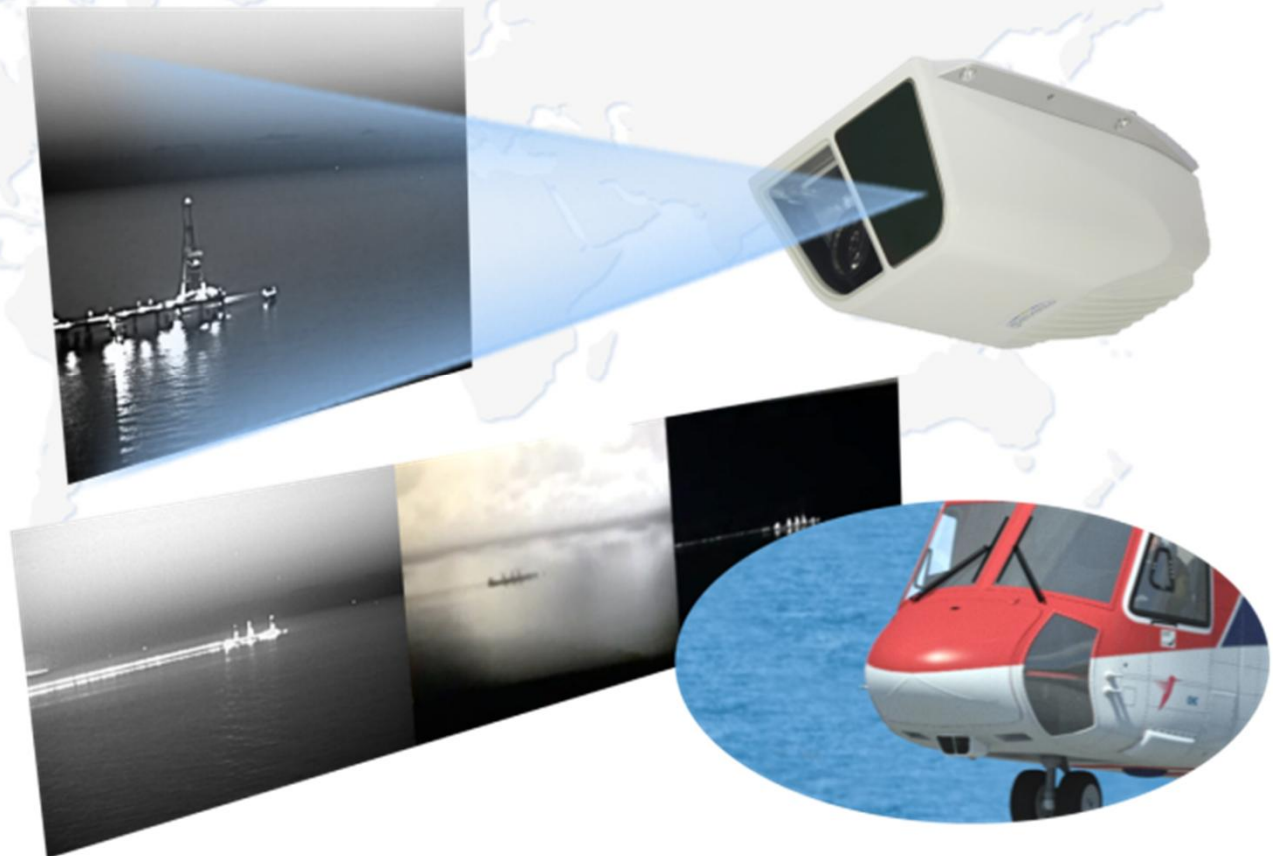
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- ▲ Mounted on NVG Mount
- ▲ Right eye monocular
- ▲ 26° by 20° Display FOV



2-3-2 HeliEVS

- ▲ High quality (Resolution, sensitivity)
- ▲ Multispectral
- ▲ Low weight



2-3-3 Symbolology

There are several types of symbology

▲ Conformal Flight data

▲ Virtual HUD

▲ Navigation data

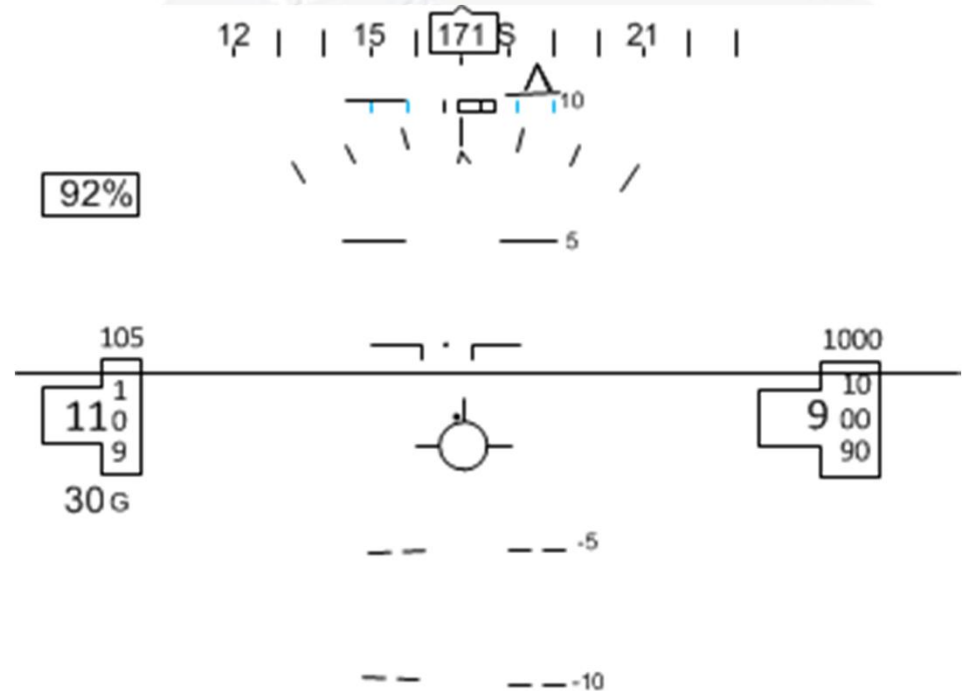
▲ Guidance

▲ Awareness data

▬ Obstacles

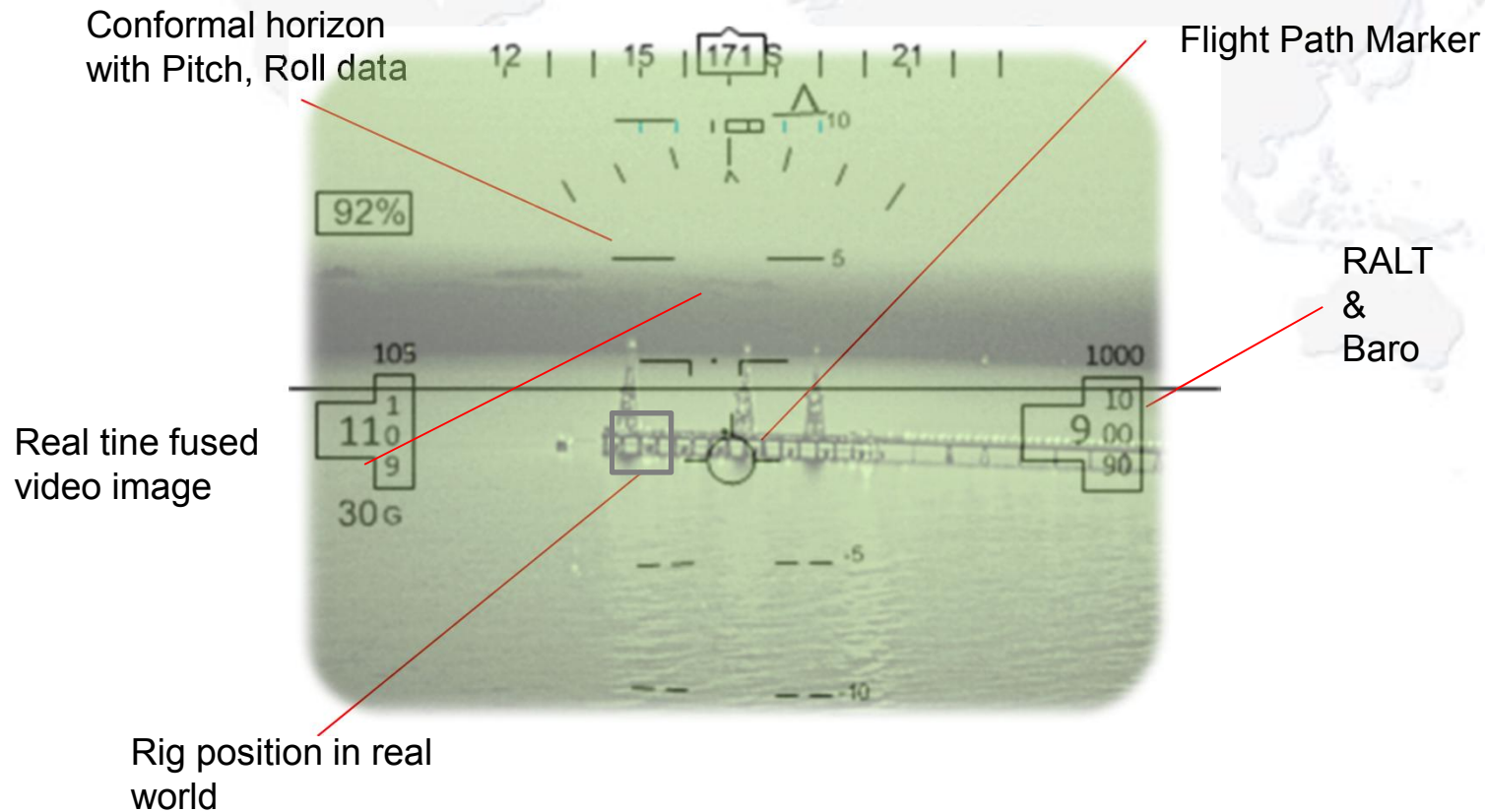
▬ TCAS

▬ AIS



Approach / go around from oil rig

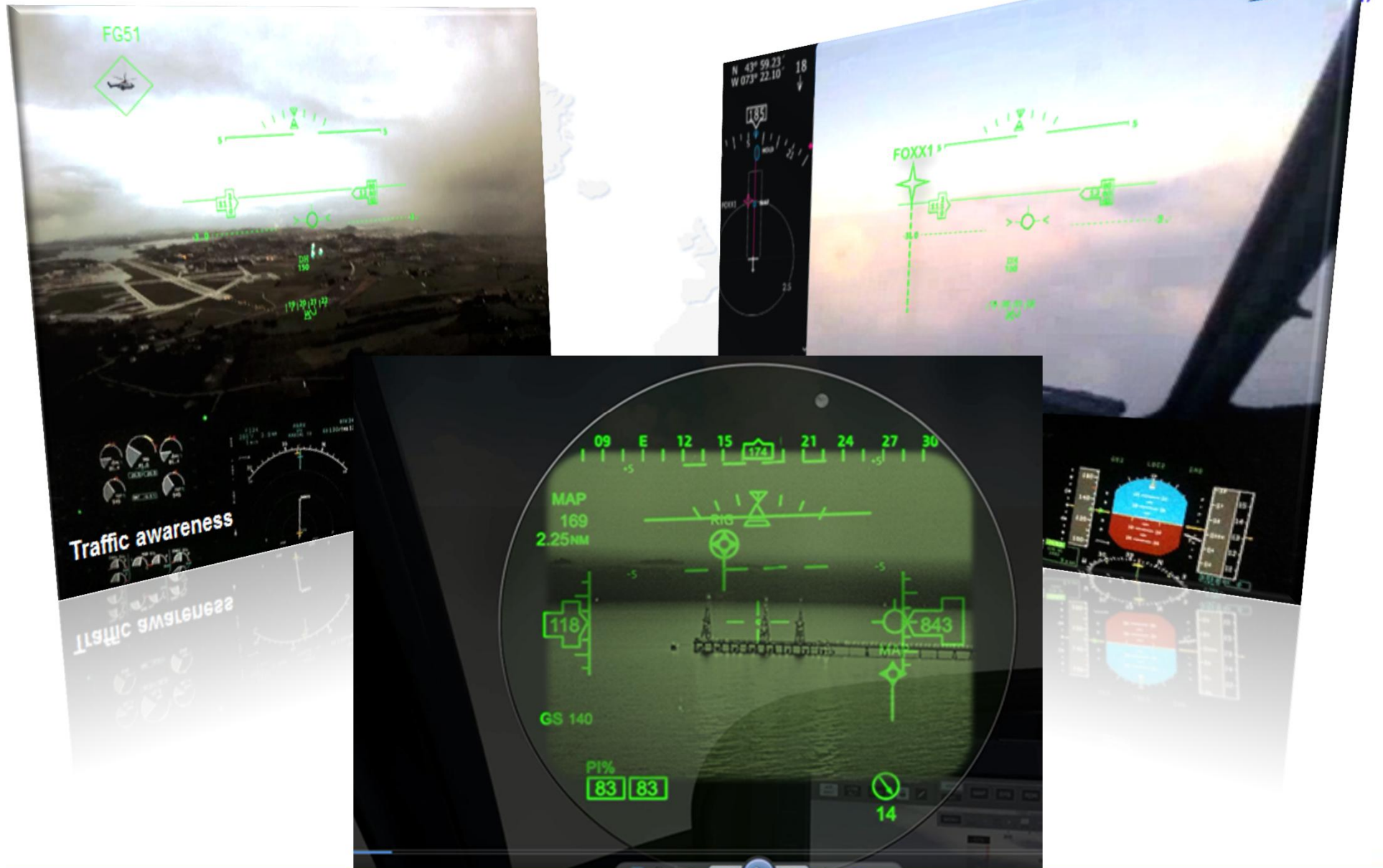
- Enables pilot to maintain spatial orientation at all time
 - Assist pilot to locate rig from great distance and “understand the approach picture”
 - Intuitive “go around”



“Head Up” solution examples

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3 - Word on certification

▲ SKYLENS™ / SkyVis™ and its installation can be certified via STC or change to existing Type Certificated aircraft by functional similarity to Head-Up Display & PoC data

- MOC

- Human Factors Aspects of Head Mounted Systems
- Method of compliance for required performance of line of sight tracking

- POC

This proof-of-concept (POC) process is initiated to provide a methodological way for validating the use of HMD systems as a HUD alternative and for collecting sufficient data to establish acceptable airworthiness criteria for such systems

4 - Summary

- ▲ Based on our long term experience with similar systems in fix wing and in military application, we asses that the system will reduce the number of accidents
- ▲ Safety will be gained from flying head out where critical parameters are available in the critical phases of flight

