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Position

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Head-Up Display (HUD) and Vision Systems

Please Note: This Position Paper supercedes a previous publication, 15POS04 Head-Up Display (HUD) and Vision Systems

Background

IFALPA believes that the use of HUDs and Vision Systems can significantly contribute to flight safety. It increases pilots' situational awareness by the use of the Flight Path Vector (FPV) and the ability to see the outside view and projected infinity image at the same time. IFALPA supports their installation and operational use. The HUD should be certified and fit for operational use during the entire flight. Tactical information, previously only available head down on the PFD is available on a HUD in line with the outside view. The outside view can be supported by Enhanced Vision Systems (EVS), Synthetic Vision Systems (SVS) or a combination of both, a Combined Vision System (CVS).

This paper discusses the basic design, training and operation of Head-Up Display (HUD) and Vision Systems.

IFALPA recommendations

DESIGN & DISPLAY INFORMATION

Information displayed on the HUD should at least include the following:

1. Airspeed
2. Altitude
3. Heading/Track
4. Vertical Speed
5. Attitude with pitch/bank references
6. Vertical path / Glideslope where applicable
7. Flight Path Vector
8. Flight guidance when applicable
9. Status indication (e.g. FMA, navigation sensors)
10. Aircraft Energy State (e.g. Thrust or equivalent energy state display)
11. Alerts and Warnings (e.g. Windshear, EGPWS, ACAS)

All information displayed on a HUD should be consistent with the information available head down:

- The same symbology should be used on the HUD and head down displays, without restricting the usability, e.g. due to clutter effects.
- Flight guidance, whether FPV or attitude based, should be equal head up and head down.
- The information displayed head up and head down should be based on the same sensory data.

The HUD should cover a lateral field of view to display actual drift at maximum allowed crosswind for landing. When during other flight phases than landing the drift exceeds the lateral field of view means should be provided to indicate the actual FPV is out of view. Vertically an angle of 30° should be covered which should be reasonably split above and below the horizon.

The HUD should be clearly legible at all foreseeable lighting conditions and feature an automatic brightness adaption and manual brightness control for each HUD.

IFALPA strongly recommends dual-HUD/Vision System installations. For single HUD/Vision System installations, means should be provided to enable the pilot monitoring to fulfil their tasks, e.g. mirrored presentation of the displayed imagery/ appropriate symbology from the HUD/Vision System.

The HUD should be continuously available for use during the entire flight, irrespective of weather conditions. Cabling, size and weight should not restrict pilot access to instruments and controls, their seat, nor degrade pilot comfort.

Automatic and/or manual declutter modes should be made available to the crew.

TRAINING AND OPERATION

Use of the HUD/Vision Systems should be the preferred method of operation, but remains at pilot's discretion ultimately.

Use of HUDs and Vision Systems should be adequately trained, especially when used during take-off, approach and landing. HUDs and Vision systems have visual similarities with head down displays but significant differences in design and operation. In initial and recurrent training consideration should be given to:

- crosswind operation and any limitations with regard to the field of view and extended (projected) horizon line;
- symbology of the HUD (i.e. clutter, brightness control, infinity projection), specifically for night operations;
- eye fixation on the HUD instead of seeing through the HUD, and missing out on outside cues;
- attention capture/tunnelling on the HUD display resulting in decreased situational awareness (the HUD may possibly not display weather, EGPWS, engine parameters, traffic or navigational information);
- crew awareness of correct AFDS modes, because of limited amount of information on the HUD;
- (in)consistency of information displayed head up and head down;
- obscuring the outside visual details by HUD clutter;
- low visibility operations, when using the HUD for lower take-off and approach minima;
- HUD usage and guidance during aircraft upset;
- HUD usage and guidance during alerts and warnings (e.g. Windshear, EGPWS, ACAS); emphasis should be put on the use of the correct eye reference position, especially when using EVS;
- if applicable, difference in pilot technique when flying FPV based compared to attitude based. This is especially the case when the head down guidance is attitude based, and the HUD is FPV based;
- if applicable, the difference in FPV or attitude based guidance during landing, regarding aiming point and flight path;
- developing an effective scan of the HUD, which may require a greater range of eye movement than when using the PFD

Pilots should maintain currency in both the use of HUDs and Vision Systems, as well as in the use of head down indication systems, in all flight phases.

When operating aircraft with and without a HUD as a result of mixed fleet flying, the related risks should be addressed and mitigated; recency requirements should be established for both types of aircraft.

Operational credit for lower approach minima can only be received with enhanced vision systems (EVS) that display electronic real-time images of the actual external scene on a HUD or combined vision systems (CVS). The sole use of synthetic data (SVS) should be restricted for use above MSA or the applicable approach minimum for situational awareness, due to possible inconsistencies between displayed image and actual outside scene.