

DISPOSITION OF PUBLIC COMMENTS

AC 25-11B, *Electronic Flight Displays*

Prepared by Dale Dunford, ANM-111

No.	Reference	Requested Change	Disposition
Commenter: Thales			
1.	Appendix 6 paragraph 2.1.3	<p>Appendix 6 – paragraph 2.1.3 “Availability of Primary Flight Information”:</p> <p>Appendix 6, paragraph 2.1.3 specifies: “Since the flight information displayed on the HUD is visible only to one pilot, it cannot be used as the single remaining display to comply with § 25.1333(b). The rule requires that, after the loss of other flight information displays, one display of the information essential to the safety of flight remains available to both pilots, not just one pilot.”</p> <p>In addition part § 25.1333(b) specifies: “The equipment, systems, and installations must be designed so that one display of the information essential to the safety of flight which is provided by the instruments, including attitude, direction, airspeed, and altitude will remain available to the pilots, without additional crewmember action, after any single failure or combination of failures that is not shown to be extremely improbable;”</p> <p>Since the flight information displayed on the HUD is visible only to one pilot, and since in most cases, failures of flight parameters shown in the HUD are not independent of those shown on the same pilot’s head-down primary flight display, the HUD (single) may not be a suitable means to comply with § 25.1333(b) following loss of primary head-down flight displays. The rule in appendix 6 paragraph 2.1.3 requires that at least one display of information essential to safety of flight remain available to the (both) pilots, not just one pilot.</p> <p>Does it mean that when HUD is used for primary flight information display backup solution of head-down displays, HUD dual is mandatory? If agreed, it should be detailed and mentioned in paragraph 2.1.3.</p>	<p>No, the designation of a HUD as primary flight display does NOT mean that two HUDs must be installed for compliance with § 25.1333(b).</p> <p>The rule requires that “at least one display remain” after single and certain multiple failures.</p> <p>The installation must be designed so that no single failure will cause loss of ALL displays of safety-essential flight information, and that no combination of malfunctions not shown to be extremely improbable can do so. This is typically accomplished through redundancy and independence of display systems.</p> <p>In the case of a failure condition where all displays but one have failed, then for compliance with § 25.1333(b), that one display cannot be a HUD because it is visible only to one pilot. The combination of malfunctions that would cause loss of all displays, but a single HUD, must be extremely improbable.</p> <p>A single HUD cannot serve the purposes of a single standby flight display. It might be possible, on the other hand, to show that a single head-down display of safety-essential flight information could serve this purpose, if it is visible (and usable) to both pilots.</p> <p>See revised paragraph 2.1.3 in response to Rockwell comment #1 to clarify meaning.</p>

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2.	Appendix 6 paragraph 4	<p>Appendix 6 paragraph 4 “HUD Design Eyebex Criteria”</p> <p>Many of Appendix 6 paragraph 4 HUD design eyebox criteria are directly issued from SAE AS 8055 “Minimum Performance Standard for Airborne Head Up Display (HUD).</p> <p>In addition, Appendix 6 paragraph 1.3, SAE AS 8055 is listed to “provide guidance for designing and evaluating HUDs.”</p> <p>Does only areas extracted from SAE AS 8055 and included in Appendix 6 paragraph 4 of this AC are applicable and considered as requirements?</p>	<p>Please note that appendix 6 of the proposed AC has been renumbered as appendix F in the final AC.</p> <p>The FAA intends that AC 25-11B, with Appendix F, provides adequate guidance as means of compliance for HUD installations on transport category airplanes. References to industry standards such as SAE AS 8055 are meant to show the source of many of the guidelines in Appendix F and the consistency of AC 25-11B with many of the details of the industry standards.</p> <p>Appendix F, however, expands on the HUD eyebox standards in AS 8055, for installation purposes, to consider the relationship between the eyebox dimensions and its location with the design eyepoint of the pilot’s station.</p> <p>The technical information found in the industry standards that has not been included in AC 25-11B may be useful to the designer, but is not considered an essential means of compliance for transport installations.</p>

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Commenter: Airbus			
1.	Appendix 6 paragraph 3.1.3.1	<p>Appendix 6 paragraph 3.1.3.1 Command Guidance: “When the HUD is used to monitor the autopilot, it should display the following information: [...]” Autopilot disconnect warning (visual).”</p> <p>Since autopilot disconnection does not require an immediate crew reaction, a warning as per § 25.1322 definition is not required. Indeed, on Airbus designs and thanks to the fly-by-wire concept and because normal law is kept, aircraft trajectory is maintained safely after autopilot disconnect. Thus, current Airbus HUD solutions, already approved by FAA, do not use any visual alert for autopilot disconnect but only an aural alert (cavalry charge).</p> <p>Proposed change: Airbus suggests modifying the wording to “Autopilot disconnect visual alert if relevant or necessary.”</p>	<p>Non-Concur</p> <p>FAA regulation § 25.1329(j) requires a warning for autopilot disconnect.</p> <p>AC 25.1329-1B also provides the following guidance: “Since it is necessary for a pilot to immediately assume manual control following disengagement (manual or automatic) of the autopilot, a warning (both visual and aural) must be given.”</p> <p>“Although HUDs are typically not intended to be classified as integrated caution and warning systems, they may display cautions, warnings, and advisories as part of their FGS function. In this regard, HUDs should provide the equivalent alerting functionality as the head-down PFD(s). Warnings that require continued flightcrew attention on the PFD also should be presented on the HUD.”</p> <p>See revised paragraph 3.1.3.1 in response to Garmin comment #1 and Rockwell comment #4.</p>
2.	Appendix 6 paragraph 3.1.3.1	<p>Appendix 6 paragraph 3.1.3.1 Command Guidance: “When the HUD is used to monitor the autopilot, it should display the following information: • Situation information based on independent raw data. [...]” Independent raw data should be displayed in the HUD during critical flight phases only (e.g., Loc + G/S deviations for ILS or L/DEV + V/DEV for RNP/LPV).</p> <p>Proposed change: Airbus suggests modifying the wording to “Situation information based on independent raw data during critical flight phases.”</p>	<p>Non-Concur</p> <p>The FAA requires display of “situation information,” such as localizer and glide slope deviations during an ILS approach, whenever command guidance for tracking the flight path is provided. The pilot is expected to follow the guidance (or monitor that the autopilot is following the guidance) and also use the situational information to cross-check flight technical error.</p> <p>See revised paragraph 3.1.3.1 in response to Garmin comment #1 and Rockwell comment #4.</p>

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3.	Appendix 6 paragraph 4.7.1.1	<p>Appendix 6 paragraph 4.7.1.1 Background Light Conditions: The text specifies a background (ambient) lighting conditions from 0 to 10,000 foot Lamberts (fL).</p> <p>Airbus considers that it is not possible to show compliance with this requirement. Indeed, the lighting value of 0 fL corresponds to a theoretical absolute dark which cannot be simulated. A minimum value of 5 fL would be more realistic.</p> <p>Proposed change: Airbus suggests replacing the wording “from 0 to 10,000 foot Lamberts (fL)” with “from 5 to 10,000 foot Lamberts (fL).”</p>	<p>Concur</p> <p>Industry standards cite 0 to 10,000 fL, as has the FAA HUD issue paper used for many years.</p> <p>The use of a minimum of 5 fL has been used in one set of projects and is acceptable because there is no practical safety effect.</p> <p>We revised the wording “from 0 to 10,000 foot Lamberts (fL)” with “from <u>5</u> to 10,000 foot Lamberts (fL).”</p>

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No.	Reference	Requested Change	Disposition
Commenter: Boeing Commercial Airplanes			
1.	p. 22, para. 16(b)(8)	<p>The proposed text states: “(8) The display system components should not cause physical harm to the flightcrew under foreseeable conditions relative to the operating environment (for example, turbulence, or emergency egress).”</p> <p>RECOMMENDATION We suggest adding the following examples of foreseeable conditions to those already listed: bird strike, hard landing, and emergency landing.</p> <p>RATIONALE Installations of display system components, such as HUD, which place equipment in close proximity to the flightcrew, may require significant additional certification activity to address these additional conditions. The installation of HUD may have ramifications for integrity of supporting primary aircraft structure, and the potential for laceration or impact injury to flightcrew in the event of bird strike. The flightcrew should be protected from serious head or neck injury from nearby HUD equipment under turbulence, hard landing, and emergency landing conditions that may result in exposure to significant vertical loads.</p>	<p>Concur</p> <p>The recommended change is identical to an FAA issue paper.</p> <p>We revised paragraph 3.3.8 as follows: “The display system components should not cause physical harm to the flightcrew under foreseeable conditions relative to the operating environment (for example, turbulence, or emergency egress, <u>bird strike, hard landing, and emergency landing</u>).</p>
2.	pp. A5-1 to A5-4; para. 1	<p>Appendix 5’s table of regulations appears to be incomplete.</p> <p>RECOMMENDATION We suggest adding the following regulations to the list of regulations that should be considered when certifying an electronic display system:</p> <ul style="list-style-type: none"> - § 25.561 (Structure- General), - § 25.562 (Emergency landing dynamic conditions) , - § 25.601 (Design and construction – General), - § 25.785 (Seats, berths, safety belts, and harnesses), and - § 25.1447 (Mixture controls). <p>RATIONALE Installations of display system components such as HUD, which place equipment in close proximity to the flightcrew, may require significant additional certification activity to address these additional regulations.</p>	<p>Please note that appendix 5 of the proposed AC has been renumbered as appendix E in the final AC.</p> <p>Appendix E was not in the scope of this change to the AC. However, some regulations should be added, since they relate to HUD installation requirements. This AC does not have specific means of compliance guidance for §§ 25.561 and 25.601, so they are not added to the list.</p> <p>We added the following regulations to Appendix E:</p> <ul style="list-style-type: none"> • § 25.562 (Emergency landing dynamic conditions) • § 25.785 (Seats, berths, safety belts, and harnesses) • § 25.1447 (Equipment standards for oxygen dispensing units)

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3.	p. A5-7 to A5-9, para. 2	<p>Appendix 5’s list of advisory circulars appears to be incomplete.</p> <p>RECOMMENDATION We suggest adding AC 25-17A, “Transport Airplane Cabin Interiors Crashworthiness Handbook,” to the list.</p> <p>RATIONALE Installations of display system components such as HUD, which place equipment in close proximity to the flightcrew, may require significant additional certification activity with respect to cabin safety requirements.</p>	<p>Concur</p> <p>We added AC 25-17A and AC 25.562-1B to Appendix E.</p> <p>See other revisions to the list of ACs in response to CAAC comment #5.</p>
4.	p. A6-3, para. 1.1	<p>This appendix addresses both the installation of a single HUD, typically used by the left-side pilot, as well as special considerations related to dual HUDs, one for each pilot.</p> <p>We suggest identifying the applicability of each paragraph to either single or dual installations.</p> <p>RATIONALE It is unclear whether the individual paragraphs in this appendix are guidance for single-HUD installations only, or whether they may also be applicable to dual-HUD installations. Labeling the paragraphs or otherwise specifying their applicability would be extremely helpful to applicants using the AC.</p>	<p>Non-concur</p> <p>There are no sections that apply to only single-HUD installations. All sections apply to single- and dual-HUD installations, except for those sections that explicitly say they are added to address dual-HUD in particular.</p> <p>We did not change the AC in regard to this comment.</p>
5.	p. A6-3, para 1.2	<p>This paragraph is titled, “Definition of Head-Up Display.” However, this is not a “definition;” it is a description of the typical HUD today.</p> <p>RECOMMENDATION We suggest changing the paragraph title to “HUD Description,” and starting the first sentence with: “Current technology HUDs are a display system ...”</p> <p>RATIONALE As proposed, the “definition” is so narrow that future HUD technology would not fit within it.</p>	<p>Non-concur</p> <p>The first sentence of the paragraph captures the essence of what a HUD is. The remaining sentences provide elaboration.</p> <p>We did not change the AC in regard to this comment.</p>

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6.	p. A6-4 para. 2.1.3	<p>The proposed text states:</p> <p>“2.1.3 Availability of Primary Flight Information. Since the flight information displayed on the HUD is visible only to one pilot, it cannot be used as the single remaining display to comply with § 25.1333(b). ...”</p> <p>RECOMMENDATION We suggest identifying this information as applicable to single HUD installations only, and adding availability considerations of dual HUD installations.</p> <p>RATIONALE As proposed, this paragraph assumes a single HUD installation; however, there may be differences for dual HUD installations. Specifying the differences would be beneficial to applicants using the AC.</p>	<p>Non-Concur.</p> <p>Actually, the guideline is applicable to single- and dual-HUD installations, alike. Section 25.1333(b) requires <u>one display of the information essential to the safety of flight which is provided by the instruments, including attitude, direction, airspeed, and altitude will remain available to the pilots, without additional crewmember action.</u></p> <p>In the failure condition where the SINGLE remaining display is a HUD, the information it displays is visible to only one pilot and the condition is not permissible per § 25.1333(b).</p> <p>Any failure condition that results in multiple displays remaining, and at least one is visible to each pilot, complies with § 25.1333(b).</p> <p>However, see clarifying language added in response to Rockwell comment #1.</p>

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7.	p. A6-5, para. 2.2.2	<p>The proposed text states:</p> <p>“2.2.2 Special Considerations for Dual-HUD Installations. In a dual-HUD installation, both pilots could possibly experience incapacitating injuries as a result of flight or gust loads. This possibility becomes a safety-of-flight issue, since the entire flightcrew would be incapacitated. If analysis of the installation geometry indicates that flight or gust loads may produce occupant contact with the HUD installation, then the FAA may need to provide an issue paper providing project- specific means of compliance.”</p> <p>RECOMMENDATION We suggest revising the entire text to read as follows:</p> <p>“2.2.2 Special Considerations for dual-HUD Installations. For dual-HUD installations, the applicant must address single events that could simultaneously incapacitate both pilots and therefore become safety-of-flight issues. Examples of such single events are flight or gust loads, a hard landing, or emergency landing. The FAA may need to provide an issue paper providing project- specific means of compliance if the installation geometry indicates that such events may produce occupant contact with the HUD installation”</p> <p>RATIONALE The dual-HUD installation should also prevent serious injury to the flightcrew under hard landing and emergency landing conditions, which could affect both flightcrew simultaneously. A hard landing scenario may also be considered a safety-of-flight condition. The flightcrew should not be incapacitated in an emergency landing condition, as they have subsequent duties to secure the airplane and assist with evacuation.</p>	<p>Concur</p> <p>We revised paragraph F.2.2.2: to read as follows:</p> <p>“Special Considerations for Dual-HUD Installations. <u>For dual-HUD installations, the applicant must address single events that could simultaneously incapacitate both pilots and therefore become safety-of-flight issues. Examples of such single events are flight or gust loads, a hard landing, or emergency landing. The FAA may need to provide an issue paper providing project- specific means of compliance if the installation geometry indicates that such events may produce occupant contact with the HUD installation.</u>”</p>

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8.	p. A6-5, para. 3.1	<p>The proposed text states:</p> <p>“3.1 Intended Function of HUDs. The applicant is responsible for identifying the intended function of the HUD. The description of the intended function should include the operational phases of flight and concept of operation—including how, when, and for what purpose(s) the HUD is to be used.”</p> <p>RECOMMENDATION The example given in the last sentence of this paragraph should be strengthened to better reflect an intended function or deleted. As a description of the intended function, it does not provide much value in terms of guidance.</p> <p>RATIONALE Improved guidance would be beneficial for better understanding and compliance.</p>	<p>Concur</p> <p>We revised the last sentence of paragraph F.3.1 as follows:</p> <p>“For example, the HUD may display situational information and/or guidance information, be a supplemental display of primary flight information in all phases of flight, <u>display command guidance for Category II, manual, and/or monitoring autopilot-coupled instrument approaches, display guidance for visibility takeoff, display enhanced vision imagery and synthetic vision video. See paragraph 2.11.c of the AC for additional guidance.</u>”</p>
9.	p. A6-6, para 3.1.3.1	<p>This paragraph describes what information should be displayed when the HUD is used to monitor the autopilot.</p> <p>RECOMMENDATION The HUD information is no different from that of the primary flight display (PFD). We suggest deleting this entire paragraph.</p> <p>RATIONALE Since other sections in the appendix state the HUD and PFD should have the same information displayed, paragraph 3.1.3.1 is unnecessary. The intended function should dictate the information displayed.</p>	<p>Non-Concur</p> <p>While there may be few, if any, differences in the information displayed on the HUD and the head-down primary flight displays, the point is that pilots using them are not expected to scan head-down flight displays for the same information.</p> <p>See our revisions in response to Garmin comment #1 and Rockwell comment #4.</p>

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10.	p. A6-6, para 3.1.3.2	<p>This paragraph lists the additional flight parameter information that the HUD should display, if required, to enable the pilot to operate the airplane during phases of flight for which the HUD is approved.</p> <p>RECOMMENDATION We find the list incomplete and unnecessary, and suggest the paragraph be deleted altogether.</p> <p>RATIONALE Since other sections in the appendix state that the HUD and primary flight display should have the same information displayed, paragraph 3.1.3.2 is unnecessary. Further, if a specific HUD indication is needed for operational approval, it will be addressed at that time when needed; however, all scenarios cannot be anticipated in the AC. The intended function should dictate the information displayed.</p>	<p>Non-Concur</p> <p>This paragraph was intended to provide examples of additional information, not be an exhaustive list. It is meant to reinforce the idea that such information should be on the HUD so that the pilot using the HUD does not need to scan head-down to monitor them.</p> <p>We did not revise the AC in response to this comment.</p>
11.	p. A6-7, para. 3.2	<p>This paragraph describes HUD controls.</p> <p>RECOMMENDATION We suggest adding guidance that HUD deployment mechanisms should avoid having any “false detents” or “false latch” indications.</p> <p>RATIONALE A HUD combiner may contain a swing-arm deployment mechanism. Such mechanisms should avoid presenting any “false detents” or “false latch” indications between the stowed and deployed positions to preclude the flightcrew from inadvertently mis-stowing the combiner. A mis-stowed combiner could swing into the flightcrew headpath under turbulence or landing conditions and present a distraction or injury hazard.</p>	<p>Concur, with revision</p> <p>The recommended addition should be added to paragraph F.2.2.1, since it is intended to provide for flightcrew safety, and the latching mechanism is not really a HUD control.</p> <p>We revised paragraph 2.2.1 as follows: “HUD equipment introduces potential hazards that are not traditionally associated with head-down electronic flight deck displays. The HUD system must be designed and installed to prevent the possibility of pilot injury in the event of an accident or any other foreseeable circumstance such as turbulence, hard landing, or bird strike. <u>For airplanes with § 25.562 in the certification basis, the HUD installation</u>, including the overhead unit and combiner, must comply with the head injury criteria defined in § 25.562(c)(5). <u>A HUD combiner with a swing- arm deployment mechanism should be designed to avoid false detents and flash latch indications between the fully stowed and deployed positions. A mis-stowed combiner could swing inadvertently into the path of the pilot’s head and cause injury.</u> Additionally, the HUD installation must comply with the occupant injury requirements of §§ 25.785(d) and (k) and the retention requirements of § 25.789(a).”</p>

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12.	p. A6-7, para. 3.2	<p>This paragraph describes HUD controls.</p> <p>RECOMMENDATION We suggest expanding this paragraph to address controls that must be immediately accessible.</p> <p>RATIONALE There is no mention of controls that must be immediately accessible. Are there any that can be specified and/or is there guidance to determine whether a control needs to be immediately accessible?</p>	<p>Non-Concur</p> <p>In the general case, there may be no HUD control that must be immediately accessible. However, to follow the guidance of paragraph F.3.2.4 for ease of use, minimize crew workload, and view control selections, the effective design solution is to make the HUD controls, in effect, immediately accessible.</p> <p>The only control that the FAA specifically requires to be immediately accessible is for HUDs that display vision system video (e.g., EFVS and SVS). This AC is not intended to provide guidance for this functionality. Instead, it is covered by AC 21-167 and the related special conditions that the FAA issues.</p>
13.	p. A6-7, para. 3.2.3	<p>The proposed text states:</p> <p>“3.2.3 Control Integration. To the greatest extent practicable, HUD controls should be integrated with other associated flight deck controls to minimize the flightcrew workload associated with HUD operation and to enable flightcrew awareness.”</p> <p>RECOMMENDATION We suggest expanding this paragraph to clarify its objective.</p> <p>RATIONALE It is unclear what is intended by this guidance. More specificity would be beneficial from a compliance standpoint.</p>	<p>Concur</p> <p>The objective, stated in the first sentence, is to minimize flightcrew workload and enable flightcrew awareness of HUD modes. A particular solution is not specified, and the practical means for following this guideline will depend on the airplane and the installation.</p> <p>We revised the paragraph as follows:</p> <p>“To the greatest extent practicable, HUD controls should be integrated with other associated flight deck controls to minimize the flightcrew workload and error associated with HUD operation and to enhance flightcrew awareness of HUD modes.”</p>

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14.	p. A6-8, para. 3.3.2.3	<p>The proposed text states:</p> <p>“3.3.2.3 HUD Optical Performance. ... When both pilot’s eyes view the HUD with from any off-center position within the design eyebox, optical non-uniformities shall not produce perceivable differences in the binocular view. ...”</p> <p>RECOMMENDATION As written, this proposed sentence is confusing as to whether it refers to one pilot and his/her two eyes, or to the eyes of two different pilots (we assume it is the former). We suggest revising it as follows:</p> <p>“3.3.2.3 HUD Optical Performance. ... When both <u>pilot’s</u> eyes <u>of a pilot</u> view the HUD with from any off-center position within the design eyebox, optical non-uniformities shall not produce perceivable differences in the binocular view. ...”</p> <p>RATIONALE Clarification is needed.</p>	<p>Concur</p> <p>We revised paragraph F.3.3.2.3, HUD Optical Performance, as follows:</p> <p>“As far as practicable, the optical performance of the HUD must not cause distortions that degrade or detract from the flightcrew’s view of external references or of other aircraft. The optical performance should not degrade or detract from the flightcrew’s ability to safely perform any maneuvers within the operating limits of the airplane, as required by § 25.773. Where the windshield optically modifies the pilot’s view of the outside world, the motions and positions of conformal HUD symbols must be optically consistent (i.e., aligned and scaled) with the perceived outside view. To avoid distortions, the optical qualities of the HUD should be uniform across the entire FOV. When both <u>pilot’s</u> eyes <u>of a pilot</u> view the HUD with from any off-center position within the design eyebox, optical non-uniformities shall not produce perceivable differences in the binocular view. <u>SAE</u> ARP 5288, Transport Category Airplane Head Up Display (HUD) Systems, provides additional guidance.”</p>

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15.	p. A6-8, para. 4.1	<p>The proposed text states:</p> <p>4.1 Design Eye Position (DEP). ... Fixed markers or some other means should be provided at each pilot station to enable the pilots to position themselves in their seats at the DEP for an optimum combination of outside visibility and instrument scan. The HUD installation must comply with §§25.773 and 25.1321. The HUD must be able to accommodate pilots, from 5_____ to 6_____ at the DEP with their shoulder harnesses and seat belts fastened, to comply with §25.777. ...”</p> <p>RECOMMENDATION We suggest deleting this text.</p> <p>RATIONALE It is unclear what guidance this portion of the text adds to the referenced regulations. The HUD-specific guidance is contained in the last sentence of the paragraph (i.e., “The design eyebox should be positioned around the DEP.”) and should be retained.</p>	<p>Non-Concur</p> <p>This paragraph refers to the combined requirements of FAA regulations §§ 25.773 and 25.777, and the associated guidance in AC 25.773-1, to indicate that they must also be considered for the design of the HUD eyebox. It is important that the pilot can see all the information displayed in the HUD while properly seated at the DEP, which is defined by AC 25.773-1 and used for compliance with these regulations. Therefore, the eyebox must contain the DEP, though not necessarily at the very center, but at a minimum with displacements defined in paragraph F.4.2.3.</p> <p>However, in response to Rockwell comment #10, we revised the now second-to-last sentence of paragraph F.4.1 to say:</p> <p>“The DEP must be centered within the minimum design eyebox dimensions found in paragraph F.4.2.3 of this appendix.”</p> <p>And we added the following:</p> <p>“Actual HUD eyeboxes are larger than these minimum dimensions and, if not centered around the DEP, they need only be large enough that this minimum sub-volume is centered around the DEP.”</p>
16.	p. A6-9, para. 4.2.1	<p>There appears to be a missing word before “be” that makes this sentence awkward.</p> <p>RECOMMENDATION We suggest revising the text as follows:</p> <p>4.2.1 Display Visibility Requirements. ... Each flight instrument for use by any pilot, including the flight information displayed in the HUD, for use by any pilot must be plainly visible at that pilot’s station with minimum practicable deviation from the normal position and forward line of vision. ...”</p> <p>RATIONALE Our suggested revision improves readability.</p>	<p>Concur</p> <p>We revised the second sentence of paragraph F.4.2.1 to say:</p> <p>“Each flight instrument, including the flight information displayed in the HUD, must be plainly visible to the pilot at that pilot’s station with minimum practicable deviation from the normal position and forward line of vision.”</p>

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Commenter: Boeing Commercial Airplanes			
17.	p. A6-10, para. 4.3.1	<p>EDITORIAL ONLY COMMENT: The proposed text states:</p> <p>4.3.1 Symbol Positioning. The accuracy of symbol positioning relative to the external references, or display accuracy, with respect to the pilot’s view of the real world through the combiner and windshield from any eye position within the HUD design eyebox. “Conformality” is not a word recognized by the industry (nor the dictionary, for that matter).</p> <p>RECOMMENDATION We suggest replacing it with the word conformance.</p> <p>RATIONALE Our suggested revision improves readability and conveys the correct intent.</p>	<p>Non-Concur</p> <p>The terms “conformal” and “conformality” have been commonly used in industry standards for HUD for many years. Conformal symbology is positioned in the HUD using the angular scale and alignment (registration) of the outside (real world) view.</p> <p>We did not change the AC in regard to this comment.</p>
18.	p. A6-11, para 4.3.2.3	<p>EDITORIAL ONLY COMMENT: The title seems to be an erroneous cut-and-paste from Table 1 in the AC, and doesn’t have anything to do with the content of Table A6-1.</p> <p>RECOMMENDATION We suggest correcting the title of Table A6-1 to something such as, “Allowable Accuracy Errors for Conformal HUD.”</p> <p>RATIONALE Correction is necessary. Table A6-1 is titled: “Topics Within the Guidance of This AC”</p>	<p>Concur with revision</p> <p>We changed the title of the table to “Display Error Tolerances.”</p>

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No.	Reference	Requested Change	Disposition
Commenter: Boeing Commercial Airplanes			
19.	p. A6-12 para. 4.7.1.2	<p>The proposed text states:</p> <p>“4.7.1.2 Luminance Control.</p> <p>The HUD must have adequate means to control luminance so that displayed data is visible to the pilot. ...”</p> <p>always</p> <p>The term “always” in this paragraph could be interpreted to mean that the HUD data cannot be dimmed off or to a very low setting.</p> <p>RECOMMENDATION We suggest revising the text by deleting the word “always.”</p> <p>RATIONALE HUD data can be allowed to dim to a very low level and to “off.”</p>	<p>Non-Concur</p> <p>The intent is that there will be sufficient range of luminance control for the HUD, such that it can be adjusted for all foreseeable lighting conditions. Except for the “OFF” position, the lowest setting should cause information to disappear. However, the FAA understands that luminance can be so low in bright light conditions that some displayed information is not visible by the pilot.</p> <p>We revised the first sentence as follows:</p> <p>“The HUD must have adequate means to control luminance so that displayed data can always be made visible to the pilot.”</p>
20.	p. A6-14 para. 5.1.3.1	<p>The proposed text states:</p> <p>“5.1.3.1 Consistent Displays and Format. The layout and arrangement HUD and head- down display formats of the same information need to convey the same intended meanings. For example, the relative locations of barometric altitude, airspeed, and attitude should be similar. Likewise, the acronyms and relative locations of flight guidance mode annunciations for thrust and lateral and vertical flight path should be similar.”</p> <p>RECOMMENDATION We suggest revising the entire text so that it reads as follows:</p> <p>“5.1.3.1 Consistent Displays and Format. The content, arrangement, and format of the information on the HUD must be sufficiently compatible with the head-down displays to preclude pilot confusion, misinterpretation, or excessive cognitive workload.”</p> <p>RATIONALE Our suggested revision results in more specific testable guidance.</p>	<p>Concur, with revision</p> <p>We revised paragraph F.5.1.3.1, Consistent Displays and Format, as follows:</p> <p><u>“The content, arrangement, symbology and format of the information on the HUD should be sufficiently compatible with the head-down displays to preclude pilot confusion, misinterpretation, increased cognitive workload or flightcrew error. (See paragraphs 5.3 and 5.6 of this AC.)</u> The layout and arrangement HUD and head-down display formats of the same information need to convey the same intended meanings. <u>(See paragraph 6.2 of this AC)</u> For example, the relative locations of barometric altitude, airspeed, and attitude should be similar. Likewise, the acronyms and relative locations of flight guidance mode annunciations for thrust and lateral and vertical flight path should be similar.”</p>

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No.	Reference	Requested Change	Disposition
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21.	p. A6-15, para 5.1.3.6	<p>The first sentence of the proposed text states:</p> <p>“5.1.3.6 Command Information. When command information (e.g., flight director commands) is displayed on the HUD in addition to the head- down displays, the HUD depiction and guidance cue deviation scaling need to be with that used on the head-down displays. ...”</p> <p>RECOMMENDATION It is unclear what the term “consistent” means, as used in this text. It seems to imply that a flight path vector (FPV) must be displayed on the head-down display (HDD). If this is so, then we suggest either moving or repeating this paragraph in Appendix 1.</p> <p>RATIONALE Appendix 1 currently contains guidance about consistency between HUD and HDD when it comes to the FPV presentation. It would seem appropriate to include this guidance about consistency in the FPV-based command information there as well.</p>	<p>Non-Concur</p> <p>The FAA does not require, and never has required, an FPV on the PFD just because there is one on the HUD.</p> <p>It is acceptable for the HUD flight director to be FPV-referenced, while the one on the PFD is referenced to the boresight (airplane) symbol.</p> <p>The intent is that the command guidance displayed in the HUD be consistent with the command guidance on the PFD. In other words, while not always identical, it should not be contradictory.</p> <p>As the commenter says, the HUD flight director can be more sensitive. Nevertheless, the HUD should not command a pitch up or roll left, for example, when the PFD commands pitch down or roll right.</p> <p>This is consistent with the guidance found in AC 25.1329-1B.</p>

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No.	Reference	Requested Change	Disposition
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22.	p. A6-15, para. 5.1.3.6	<p>The proposed text states:</p> <p>“5.1.3.6 Command Information. When command information (e.g., flight director commands) is displayed on the HUD in addition to the head-down displays, the HUD depiction and guidance cue deviation scaling need to be consistent with that used on the head-down displays.”</p> <p>RECOMMENDATION We suggest deleting the last sentence. “Consistent” doesn’t yield the same performance. “Consistent” needs to be defined in this situation. The objective should be that the pilot senses an equivalent error on the HUD and the PFD (i.e., would not want to show an error of 2 flight director bar widths on the PFD and only a quarter ball error for the HUD guidance cue).</p> <p>RATIONALE Flight technical error when using a HUD is typically less than when using a PFD. It is not because of inconsistent deviation scaling, but because of the HUD’s increased scaling so smaller errors can be seen. Consistency can be achieved with attitude director indicator (ADI) scaling and/or flight director error gains.</p>	<p>Concur with revision</p> <p>We revised paragraph F.5.1.3.6 to say:</p> <p>“When command information (e.g., flight director commands) is displayed on the HUD in addition to the HDDs, the HUD guidance cue and path deviation scaling (<u>i.e., dots of lateral and vertical deviation</u>) need to be consistent with that used on the HDDs. <u>There may be cases when the other pilot is using the head-down display of guidance and path deviations to monitor the flying pilot’s performance. Therefore, the HDD must have path deviation scaling that is sufficiently consistent with the HUD so as not to mislead the monitoring pilot.</u>”</p> <p>As the commenter says, the HUD flight director can be more sensitive. Nevertheless, the HUD should not command a pitch up or roll left, for example, when the PFD commands pitch down or roll right. Nor should the HUD show 2 dots of deviation when the head-down display shows one dot.</p>

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No.	Reference	Requested Change	Disposition
Commenter: Boeing Commercial Airplanes			
23.	p. A6-21, para. 6.3.2	<p>The proposed text states:</p> <p>“6.3.2 Assurance of Head- Down Scan. The applicant should explain how the scan of the head-down instruments is ensured during all phases of flight, and, if not, what compensating design features help the flightcrew maintain awareness of key information that is only displayed on head- down displays (e.g., powerplant indications, alerting messages, and aircraft configuration indication). The applicant should describe which pilot scans the head-down instrument indications and how often. For any case in which at least one pilot is not scanning the head-down instruments full- time, the design should have compensating design features that ensure an equivalent level of timeliness and awareness of the information provided by the head-down visual indications.”</p> <p>RECOMMENDATION We recommend deleting this entire paragraph. It appears to be an operational requirement, rather than a design or manufacturing requirement.</p> <p>RATIONALE It is unclear how the requirements of the paragraph could be a consideration for Part 25 certification. If operational approval and training requirements are part of this guidance, they should be separately identified as such.</p>	<p>Non-Concur</p> <p>This guideline has been used consistently and successfully since the first dual-HUD installation approval. The applicant’s concept for the flightcrew’s use of the displays, HUDs and head-down, must be explicitly defined so that a correct flight test evaluation of the suitability of the design can be performed. The results of this evaluation might lead to certain required flightcrew procedures or limitations for the use of the dual-HUD configuration.</p> <p>We did not change the AC in regard to this comment.</p>
24.	p. A6-22, para. 6.4	<p>The proposed text states:</p> <p>“6.4 Reassessment. The applicant should globally reassess the alerting functions to ensure that the flightcrew is aware of alerts and responds to them in a timely manner. ...”</p> <p>RECOMMENDATION We suggest this text be deleted or further clarified.</p> <p>RATIONALE It is unclear what is intended in this paragraph, particularly the phrase “globally reassess.” Is this an increased method of compliance with §25.1322 (Flightcrew alerting) when an HUD is installed and, if so, what is the scope of the §25.1322 compliance?</p>	<p>Non-Concur</p> <p>The way the flightcrew uses the dual-HUD configuration can have significant impact on the awareness of both pilot’s to the visual indications of alerts. Visual alert indications that are only presented head-down may not be sufficiently conspicuous to the pilot(s) using the HUD, compared to using the head-down PFD. This guideline does not require a particular design feature, but requires a global assessment to determine that the visual alerting design and concept for use of the dual-HUD installation are mutually acceptable.</p> <p>We did not change the AC in regard to this comment.</p>

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No.	Reference	Requested Change	Disposition
Commenter: Garmin			
1.	Appendix 6, paragraph 3.1.3.1	<p>In Appendix 6, paragraph 3.1.3.1, “Situation information based on independent raw data.”</p> <p>The reference to independent raw data is not clear.</p> <p>RECOMMENDATION Suggest clarifying the data and sources from which to be independent.</p>	<p>Concur</p> <p>We revised paragraph F.3.1.3.1, Command Guidance, to say:</p> <p>“When the HUD is used to display flight guidance, either for manual control or for monitoring the autopilot, it should display the following information:</p> <ul style="list-style-type: none"> • Path deviations based on sources of raw data that are independent from those used by the autopilot. • Autopilot operating mode. • Autopilot engage status. • Autopilot disconnect warning (visual).”
2.	Appendix 6, paragraph 3.1.3.2	<p>Appendix 6, paragraph 3.1.3.2 states “The HUD should also display...if required....”</p> <p>This statement is ambiguous with respect to whether the additional information is required or not.</p> <p>RECOMMENDATION This paragraph should be removed or it should be revised to indicate that the information may be displayed on the HUD.</p>	<p>Non-Concur</p> <p>See response to Boeing comment #10.</p>

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No.	Reference	Requested Change	Disposition
Commenter: Garmin			
3.	In Appendix 6, paragraph 3.3.2.3	<p>In Appendix 6, paragraph 3.3.2.3, this statement referring to both pilots is not understood:</p> <p>“When both pilot’s eyes view the HUD with from any off-center position within the design eyebox, optical non-uniformities shall not produce perceivable differences in the binocular view”.</p> <p>Does this mean both pilots, or both eyes of the pilot using the HUD? Previous paragraphs state that each HUD is only used by one pilot.</p> <p>RECOMMENDATION Suggest clarifying this.</p> <p>RECOMMENDATION Also suggest changing the phrase “view the HUD with from any off-center position” within the statement quoted above to “view the HUD from any off-center position” (i.e., remove the word “with”).</p>	<p>Concur</p> <p>We revised paragraph F.3.3.2.3, HUD Optical Performance, to say:</p> <p>“As far as practicable, the optical performance of the HUD must not cause distortions that degrade or detract from the flightcrew’s view of external references or of other aircraft. The optical performance should not degrade or detract from the flightcrew’s ability to safely perform any maneuvers within the operating limits of the airplane, as required by § 25.773. Where the windshield optically modifies the pilot’s view of the outside world, the motions and positions of conformal HUD symbols must be optically consistent (i.e., aligned and scaled) with the perceived outside view. To avoid distortions, the optical qualities of the HUD should be uniform across the entire FOV. <u>When the pilot views the HUD with both eyes from any off-center</u> position within the design eyebox, optical non-uniformities shall not produce perceivable differences in the binocular view. SAE ARP 5288, Transport Category Airplane Head Up Display (HUD) Systems, provides additional guidance.”</p>
4.	Appendix 6 paragraph 4.2.1	<p>Appendix 6 paragraph 4.2.1 sentence 2 states: “...for use by any pilot be plainly..”</p> <p>RECOMMENDATION This should state: “...for use by any pilot should be plainly...”</p>	<p>Concur with revision</p> <p>We revised the second sentence of paragraph 4.2.1 to say:</p> <p>“Each flight instrument, including the flight information displayed in the HUD, must be plainly visible to the pilot at that pilot’s station with minimum practicable deviation from the normal position and forward line of vision.”</p>

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5.	Appendix 6, paragraph 4.2.2	<p>In Appendix 6, paragraph 4.2.2, “It should be large enough that the required flight information is visible to the pilot at the minimum displacements from the DEP listed below.”</p> <p>RECOMMENDATION This statement references a list of displacements, but this statement is not clear where the list is (we assume it is paragraph 4.2.3, but suggest making it clear by referencing that section).</p>	<p>Concur</p> <p>We revised paragraph 4.2.2 to say:</p> <p>“The HUD design eyebox should be laterally and vertically positioned around the respective pilot’s DEP. It should be large enough that the required flight information is visible to the pilot at the minimum displacements from the DEP <u>specified by paragraph 4.2.3 of this appendix</u>. The symbols must be laid out and positioned such that excessive eye movements are not required to scan elements of the display. The displayed symbols which are necessary to perform the required tasks must be visible to the pilot from the DEP. <u>The DEP used for evaluation of the eyebox location</u> must be the same as that used for the basic flight deck in accordance with AC 25.773-1.”</p>
6.	Appendix 6, paragraph 5.1.4.2	<p>In Appendix 6, paragraph 5.1.4.2, “While the head-up and head-down displays may display present information (e.g., flight path, situational, or aircraft performance information) differently.”</p> <p>It is stated that information can be presented differently, but that seems to conflict with paragraph 5.1.3.</p> <p>RECOMMENDATION Suggest clarifying what information can be different.</p> <p>RECOMMENDATION Also suggest changing the phrase “display present information” within the statement quoted above to “display presented information”.</p>	<p>Concur</p> <p>We revised paragraph F.5.1.4.2 to say:</p> <p>“While the head-up and head-down displays may display present information (e.g., flight path, situation path deviation, or aircraft performance information) <u>in a different manner, the meaning must be the same and differently, and any differences...</u>”</p>

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7.	Appendix 6, paragraph 5.2.1	<p>In Appendix 6, paragraph 5.2.1, it is stated that HUD alerts must gain attention by other means due to lack of color. It also states the alert “attention-getting properties should be consistent with those used on the head-down displays.”. Is this meant to imply that the head-down display can’t use color as an additional means to gain attention?</p> <p>Suggest clarifying if the head-down display can use color plus another means, or whether color alone is acceptable.</p>	<p>Non-Concur. No, the statement is not meant to imply that head-down displays cannot use color.</p> <p>Paragraph 5.8.1 recommends: “If color is used for coding at least one other distinctive coding parameter should be used (for example, size, shape, location, etc.). Normal aging of the eye can reduce the ability to sharply focus on red objects, or discriminate blue from green. For pilots with such a deficiency, display interpretation workload may be unacceptably increased unless symbology is coded in more dimensions than color alone.”</p> <p>There may be color displays that also use non-color features (e.g., flashing, outline boxes, bold-face, size, etc.) to distinguish alerts from other information and to distinguish the type of alert (e.g., warning, caution, advisory) in addition to color. For example, if the color PFD does not rely on color, alone, to visually distinguish alerts from other information, where practical, then the HUD should use consistent means to do so in its monochrome display.</p> <p>AC 25.1322-1 says “For monochromatic displays, § 25.1322(e) requires that visual alert indications presented on monochromatic displays use display coding techniques (for example, shape, size, and position) so the flightcrew can clearly distinguish between warning, caution, and advisory alerts.”</p> <p>Although we did revise the paragraph in response to other comments, we did not change the AC in response to this one.</p>

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No.	Reference	Requested Change	Disposition
Commenter: Garmin			
8.	Appendix 6, paragraph 5.2.2	<p>In Appendix 6, paragraph 5.2.2, “The applicant should either provide in the HUD the guidance, warnings, and annunciations of certain systems, if installed, such as a Terrain Awareness and Warning System (TAWS), or a traffic alert and collision avoidance system (TCAS) and a wind shear detection system.”</p> <p>This statement seems incomplete, if not provided in the HUD, where should the information be provided?</p>	<p>Concur</p> <p>The assumption is that there are already locations, other than the HUD, that such alerts are already displayed, perhaps on the PFD, navigation display, radar display, etc.</p> <p>We revised paragraph F.5.2.2 as follows: “The applicant should either provide in the HUD the guidance, warnings, and annunciations of certain systems, if installed, such as a Terrain Awareness and Warning System (TAWS), or a traffic alert and collision avoidance system (TCAS) and a wind shear detection system.”</p>
9.	Appendix 7 paragraph 2.3.2	<p>Appendix 7 paragraph 2.3.2 states: “... the source of the weather information should be indicated on the selector and the resulting display.”</p> <p>While this is beneficial for wide range data such as NEXRAD, it is not useful or even desirable for local area text-based data such as METARS. In the case of METARS, the latest available information is desirable and the pilot wouldn’t make any decisions based on the source of this data.</p> <p>RECOMMENDATION This paragraph should be amended to state that the source should be indicated when necessary to help the pilot make informed decisions about the quality of the information. This same issue may apply to Appendix 7 paragraph 2.3.3.</p>	<p>Non-Concur</p> <p>Paragraph G.2.3 addresses enabling the flightcrew to distinguish the source of the weather information rapidly, accurately, and consistently, especially when more than one source is available. Indicating the source selected and source of the information is consistent with normal practice. This is only one accepted means and other means can be presented to the FAA for consideration. From the human factor standpoint, humans tend to use all available information to make decisions including METAR.</p> <p>We did not change the AC in response to this comment.</p>

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No.	Reference	Requested Change	Disposition
Commenter: Rockwell Collins			
1.	Paragraph 2.1.3 on Page A6-4	<ol style="list-style-type: none"> 1. It is presumed that this text does not preclude certification of HUD as a PFD. 2. Given that a HUD could be positioned directly in front of each pilot in a dual HUD installation, both pilots could have the same information available. <p>RECOMMENDATION Please provide clarifying text that would accommodate a dual HUD installation or otherwise provide clarification for why this usage would by not be compliant with § 25.1333(b).</p>	<p>Concur</p> <ol style="list-style-type: none"> 1. Correct, the FAA does not preclude approval of the HUD as PFD. 2. Correct, but if one HUD is the <u>single remaining display</u>, then for that failure condition it could not comply with § 25.1333(b), because only one pilot could use it. <p>We revised paragraph F.2.1.3 as follows: “<u>There might be failure conditions which result on loss of all but one display of primary flight information. For such a condition, a HUD as the only remaining display could</u> not comply with § 25.1333(b), since the HUD is visible only to one pilot. The rule requires that, after the loss of other flight information displays, the “one display of the information essential to the safety of flight” remains available to both pilots, not just one pilot.”</p>

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2.	Paragraph 2.2.1 on page A6-4	<p>By reference to regulations §25.562(c)(5), §§25.785(d) and (k), and §25.789(a), it is implied that Head Injury Criterion (HIC) is being introduced into AC 25-11. It also implies that HIC is being required regardless of aircraft type (e.g., whether the aircraft is already designed for 16g).</p> <p>RECOMMENDATION If the interpretation provided by these comments is inaccurate in any way, please provide clarifying text that would indicate when HIC is (or is not) required as a condition for HUD installation approval.</p>	<p>Concur</p> <p>Yes, because the location of additional equipment (HUD projector and combiner) is in close proximity to the pilot’s head, head injury criteria becomes a factor not typically addressed for other electronic displays.</p> <p>No, the HIC requirements of § 25.562 would only apply to airplanes with that rule in the certification basis.</p> <p>We revised paragraph F.2.2.1 as follows: “HUD equipment introduces potential hazards that are not traditionally associated with head-down electronic flight deck displays. The HUD system must be designed and installed to prevent the possibility of pilot injury in the event of an accident or any other foreseeable circumstance such as turbulence, hard landing, or bird strike. <u>For airplanes with 25.562 in the certification basis, the HUD installation,</u> including the overhead unit and combiner, must comply with the head injury criteria defined in § 25.562(c)(5). <u>A HUD combiner with a swing-arm deployment mechanism should be designed to avoid false detents and flash latch indications between the fully stowed and deployed positions. A mis-stowed combiner could swing inadvertently into the path of the pilot’s head and cause injury.</u> Additionally, the HUD installation must comply with the occupant injury requirements of §§ 25.785(d) and (k) and the retention requirements of § 25.789(a).”</p>
3.	Paragraph 3.1.2.2 on page A6-6	<p>Given the reference by example to several regulations, it is implied that multiple unmentioned regulations may also be invoked at the discretion of the FAA, including the need for monitors.</p> <p>RECOMMENDATION The regulations cited by example essentially relate to placement of displays and information. Please provide clarification that limits this section appropriately or broadens it to include intended topics for considerations.</p>	<p>The intent was to list regulations that guidance in the AC was relevant to, not an exhaustive list of all regulations that must be complied with.</p>

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Commenter: Rockwell Collins			
4.	Paragraph 3.1.3.1 on page A6-6	<p>The term “Command Guidance” in this section title typically means flight director or equivalent guidance for manual flying, though it can optionally be coupled to an autopilot. However, the text in this section only discusses autopilot monitoring.</p> <p>RECOMMENDATION Please consider adding text related to expectations for HUD monitoring of the flight director function, or otherwise provide text that obviates this apparent topical omission.</p>	<p>Concur</p> <p>We revised paragraph 3.1.3.1, Command Guidance, as follows:</p> <p>“When the HUD is used to display flight guidance, either for manual control or for monitoring the autopilot, it should display the following information:</p> <ul style="list-style-type: none"> • Path deviations based on sources of raw data that are independent from those used by the autopilot. • Autopilot operating mode. • Autopilot engage status. • Autopilot disconnect warning (visual).”
5.	Paragraph 3.1.3.1 on page A6-6	<p>The fourth bullet indicates that an autopilot disconnect warning visual indication would need to be displayed on a HUD when the HUD is used to monitor the autopilot. In many current installations, this indication is typically a flashing red warning (per 25.1329) displayed on the PFD or autoflight system status panel and is accompanied by an aural alert.</p> <p>RECOMMENDATION Please provide text to clarify whether the current aural alert accompanied by a visual alert on the HUD, PFD or some mode/alert panel (in foveal view) would be sufficient.</p>	<p>Concur with no change</p> <p>Whether or not the autopilot disconnect is visually alerted elsewhere, it should be visually alerted on the HUD, particularly when it is also alerted on the PFD.</p> <p>AC 25.1329-1B says: “Although HUDs are typically not intended to be classified as integrated caution and warning systems, they may display cautions, warnings, and advisories as part of their FGS function. In this regard, HUDs should provide the equivalent alerting functionality as the head-down PFD(s). Warnings that require continued flightcrew attention on the PFD also should be presented on the HUD (for example, TCAS, windshear, and ground proximity warning (GPWS) annunciations). If master alerting indications are not provided within the peripheral field of view of the pilot while using the HUD, the HUD should provide annunciations that inform the pilot of caution and/or warning conditions.”</p> <p>We did not revise the AC in response to this comment.</p>

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No.	Reference	Requested Change	Disposition
Commenter: Rockwell Collins			
6.	Paragraph 3.1.3.2 on page A6-6	<p>The third bullet uses the terms “decision height” and “minimum descent altitude” as examples. However, on a recent project we were directed by an FAA ACO to use the terms “RA minimum” and “BARO minimum”. The concern is that there may be terminology that is more ‘mandatory’ than is reflected here.</p> <p>RECOMMENDATION Please ensure that the guidance presented here reflects any mandatory terms. Otherwise, it should be noted in the text that the applicant may select text that is consistent with and appropriate to the stated cockpit human factors design philosophy.</p>	<p>Non-Concur</p> <p>The FAA ACO direction is appropriate. Paragraph F.3.1.3.2 does not intend to specify the actual displayed nomenclature of the parameter, but to identify the parameter as an example.</p> <p>This FAA does not maintain a list required nomenclature for every parameter for the HUD. We did not revise the AC in response to this comment.</p>
7.	Paragraph 3.3.2.1 on page A6-7	<p>The term “significant” is not defined or discussed quantitatively or qualitatively, so no guidance is provided that could be used for design consideration related to Interior View.</p> <p>RECOMMENDATION Please consider adding text that would define or otherwise bound the subjective interpretation of the term “significant.”</p>	<p>Non-concur</p> <p>Means of compliance for pilot compartment view requirements can be found in AC 25.773-1. This AC is simply recognizing that the combiner could potentially be a significant visual obstruction, but the FAA does not permit it do so. If it does obscure any of the flight deck controls, indicators or other flight instruments, it should be considered significant.</p> <p>We did not revise the AC in response to this comment.</p>
8.	Paragraph 3.3.2.2 on page A6-8	<p>The term “significant” is not defined or discussed quantitatively or qualitatively, so no guidance is provided that could be used for design consideration related to Exterior View.</p> <p>RECOMMENDATION Please consider adding text that would define or otherwise bound the subjective interpretation of the term “significant.”</p>	<p>Non-concur</p> <p>Means of compliance for pilot compartment view requirements can be found in AC 25.773-1. This AC is simply recognizing that the combiner, since it is located in the pilot’s outside view, could potentially be a significant visual obstruction, but the FAA does not permit it do so.</p> <p>We did not revise the AC in response to this comment.</p>

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No.	Reference	Requested Change	Disposition
Commenter: Rockwell Collins			
9.	Paragraph 3.3.2.2 on page A6-8	<p>It is noted that technology now permits video presentation on the HUD. Thus, while symbology is displayed none of the controls are masked; however, when video is displayed, there is potential to obscure some of the glareshield controls.</p> <p>RECOMMENDATION Please consider additional text that would further clarify the guidance when video is also presented on the HUD.</p>	<p>Non-Concur</p> <p>The FAA agrees that new vision system technology may display video on the HUD. However, not all HUDs do so, and the FAA decided to not include the additional requirements and criteria for the display of video on the HUD in this AC. The FAA issues special conditions for the display of video on the HUD and also provides means of compliance guidance for vision systems, including display on the HUD in AC 20-167.</p> <p>We did revise paragraph 1.1 Purpose, by adding the following sentence: “This appendix does not provide the guidance for display of vision system (e.g., EFVS and SVS) video on the HUD. The airworthiness requirements and means of compliance criteria for display of video on the HUD may be found in special conditions issued by the FAA and in AC 20-167.”</p>
10.	Paragraph 4.1 on page A6-9	<p>This section states that “The design eyebox should be positioned around the DEP.” – could be interpreted to mean that the HUD eye reference point (ERP) has to coincident with the airplane DEP.”</p> <p>It is noted that several HUD installations have been approved with the HUD ERP slightly offset from the airplane DEP. These offsets have been used to maximize basic HUD performance characteristics (e.g., FOV) while maintaining clearance to aircraft structure/skin.</p> <p>RECOMMENDATION Please consider additional text that would accommodate this slight offset.</p>	<p>Concur</p> <p>That the entire eyebox should contain the DEP does not mean that the DEP must precisely coincide with the eye reference point (ERP). The design eyebox may be larger than the minimum dimensions specified in paragraph F.4.2.3.</p> <p>The intent is to ensure that the eyebox contains the DEP, and that the eyebox is large enough that displacements of 1.5 inches left/right, 1.0 inch above/below, and 2.0 inches fore/aft of the DEP are also contained within the eyebox.</p> <p>We revised the now second-to-last sentence of paragraph 4.1 to say: “The DEP must be centered within the minimum design eyebox dimensions found in paragraph F.4.2.3 of this appendix.”</p> <p>We also added: “Many HUD eyeboxes are larger than these minimum dimensions and if not centered around the DEP, need only be large enough that this minimum sub-volume is centered around the DEP.”</p>

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11.	Paragraph 4.2.1 on page A6-9	<p>Wording in the second sentence that states “for use by any pilot be plainly visible at that pilot’s station” does not read correctly and may be missing words.</p> <p>RECOMMENDATION Please consider correcting this apparent grammatical omission.</p>	<p>Concur</p> <p>We revised the sentence in paragraph 4.2.1 to say: “The fundamental requirements for instrument arrangement and visibility in §§ 25.773, 25.777, 25.1301, and 25.1321 apply to HUDs. Each flight instrument, including the flight information displayed in the HUD, for use by any pilot must be plainly visible to the pilot at that pilot’s station with minimum practicable deviation from the normal position and forward line of vision.”</p>
12.	Paragraph 4.2.2 on page A6-9	<p>The first sentence states that “The HUD design eyebox should be laterally and vertically positioned around the respective pilot’s DEP.” This could be interpreted to mean that the HUD eye reference point (ERP) has to coincident with the airplane DEP.</p> <p>It is noted that several HUD installations have been approved with the HUD ERP slightly offset from the airplane DEP. These offsets have been used to maximize basic HUD performance characteristics (e.g., FOV) while maintaining clearance to aircraft structure/skin.</p> <p>RECOMMENDATION Please consider additional text that would accommodate this slight offset.</p>	<p>Non-Concur</p> <p>See reply to Boeing comment #10.</p>

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13.	Paragraph 4.2.2 on page A6-9	<p>The last sentence states that “The HUD DEP must be the same as that defined for the basic flight deck in accordance with AC 25.773-1.” This explicitly state that that the HUD eye reference point (ERP) has to coincident with the airplane DEP.</p> <p>It is noted that several HUD installations have been approved with the HUD ERP slightly offset from the airplane DEP. These offsets have been used to maximize basic HUD performance characteristics (e.g., FOV) while maintaining clearance to aircraft structure/skin.</p> <p>RECOMMENDATION Please consider additional text that would accommodate this slight offset.</p>	<p>Concur</p> <p>However, the intent is not to specify that the DEP and ERP be coincident, but that the minimum dimensions of the eyebox specified in paragraph F.4.2.3 contain the DEP and are centered around it. Since the actual eyebox may be larger than these minimum dimensions, it is not necessary that the entire eyebox be centered around the DEP, or that the ERP be coincident with it the DEP. Any offset of the DEP from the ERP (center of the actual eyebox) is permissible because the minimum sub-volume with the dimensions of paragraph F.4.2.3 are centered around the DEP.</p> <p>We revised paragraph F.4.2.2 to say:</p> <p>“The HUD design eyebox should be laterally and vertically positioned around the respective pilot’s DEP. It should be large enough that the required flight information is visible to the pilot at the minimum displacements from the DEP <u>specified by paragraph 4.2.3 of this appendix</u>. The symbols must be laid out and positioned such that excessive eye movements are not required to scan elements of the display. The displayed symbols which are necessary to perform the required tasks must be visible to the pilot from the DEP. <u>The DEP used for evaluation of the eyebox location</u> must be the same as that defined for the basic flight deck in accordance with AC 25.773-1.”</p>

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14.	Paragraph 5.1.3.2.2 on page A6-14	<p>The preceding text in Appendix 6, 5.1.3.2.1 states “Symbols that have the same meaning should have the same shape and appearance.” Does this apply to paragraph 5.1.3.2.2?</p> <p>In order to make the HUD and Heads-Down Display (HDD) symbology the same, this would imply that the HDD should use a red overlaid “X” for failure, instead of replacing the data value with a red “failure flag”. Was this intended?</p> <p>RECOMMENDATION Please provide clarifying text. It is proposed as acceptable that two different symbologies that have the same commonly understood meaning could provide the same information when taken in context.</p> <p>(Example: A red traffic light suspended above a road intersection and a red octagonal sign affixed to a post next to the intersection would convey a similarly understood message: STOP.)</p>	<p>Concur</p> <p>The intent is not to use the same symbol on the HUD and on head-down displays, but with different meaning.</p> <p>While not ideal, it might be acceptable to use different depiction for a failure flag on HUD and head-down displays. The key is that it is not confusing, misleading, or prone to misinterpretation. See paragraph 5.6 of the AC.</p> <p>We moved the text of paragraph F.5.1.3.2.1 into table F-2 and revised it as follows:</p> <p>“Symbols that have the same meaning should have the same shape and appearance. Likewise, HUD symbols that have similar shape and appearance as head-down display symbols should have the same meaning. It is not acceptable to use similar symbols for different meanings. Symbols that have the same meaning should have the same shape and appearance on the HUD and head-down displays.”</p> <p>The FAA prefers that the same displays features be used for the reason stated above, but recognizes that it may not always be practical.</p>
15.	Paragraph 5.1.3.3 on page A6-14	<p>This section states that information displayed on the HUD that is common with HDD information should be displayed in exactly the same manner (resolution, range, labeling, terminology, etc.) on the HUD as the HDD.</p> <p>There is concern that the use of the word “should” in this section would preclude consideration of exceptions on a case-by-case basis.</p> <p>RECOMMENDATION Please provide clarifying text. It is noted that while the design principle is appropriate, it also would be appropriate to allow exceptions for HUD unique considerations such as clutter minimization.</p>	<p>Concur</p> <p>In keeping with paragraph 5.6 of the AC, we added the following sentence to paragraph F.5.1.3.3: <u>“If the design has exceptions to this principle, then they should be justified by necessity or impracticality, and shown not to increase workload or the potential for confusion or flightcrew error.”</u></p>

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16.	Paragraph 5.4.3.2 on page A6-17	<p>Appendix 6, paragraph 5.1.3.2.1 states that “Symbols that have the same meaning should have the same shape and appearance.” This would imply that the unusual attitude symbology should be the same for HUD and HDD; otherwise, there must be supporting data to request this deviation.</p> <p>RECOMMENDATION Please provide clarifying text.</p>	See response to Rockwell comment #14 .
17.	Paragraph 5.4.6.5 on page A6-20	<p>This section states that “... information displayed to the pilot using the HUD should also be displayed to the other pilot.” Add “on the HDD”.</p> <p>RECOMMENDATION It is interpreted that Section 5 applies to HUD and HDD compatibility. Therefore it is proposed that the text “on the HDD” should be added after “...displayed to the other pilot.”</p>	<p>Concur with revision</p> <p>The intent is that both pilots, the pilot using the HUD and the pilot without a HUD, are aware of the specified information regarding the pilot’s HUD.</p> <p>It probably is ideal to display the information to the other pilot head-down. It might also be displayed head up to that pilot if there is a dual HUD configuration. However, at least, it should be displayed head-down to account for times when the monitoring pilot is not using the HUD or it has failed.</p> <p>The intent, in this case, is not HUD/HDD compatibility but the availability of the same information between both pilots. The HUD-related information should be displayed to the non-HUD pilot, but not necessarily on a particular HDD, such as the PFD. It might be practical to display this information elsewhere, so long as the non-HUD pilot can easily incorporate it, for monitoring purposes, in the instrument scan.</p> <p>We revised paragraph F.5.4.6.5 to say:</p> <p>“The same information concerning current HUD system mode, reference data, status state transitions, and alert information that is displayed to the pilot using the HUD should also be displayed head-down to the other pilot. The display of this information for the other pilot should use consistent nomenclature to ensure unmistakable awareness of the HUD operation.”</p>

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18.	Paragraph 5.4.6.5 On page A6-20	<p>The section title and text could be interpreted to mean that certain display configuration modes or settings (e.g., Primary/IMC/VMC modes, declutter, scales on/off), would have to be displayed to the pilot not flying (PNF).</p> <p>By extension, it could possibly be interpreted to include other information (e.g., “Align HUD” if deemed to be an alert).</p> <p>It is noted that many HUD installations have been approved where this information is either not displayed to the PNF at all or is only displayed out of the PNF’s primary field of view (e.g., control panel on cockpit center pedestal/aisle stand).</p> <p>RECOMMENDATION Please provide text that would clarify or otherwise bound this guidance.</p>	<p>Non-Concur</p> <p>The FAA does not intend that HUD display modes, such as those identified by the commenter, be displayed to the other pilot. Rather, the intent is that the HUD status (e.g., whether it is operating, off, or failed) and alerts are displayed to the other pilot. The “ALIGN HUD” may not be specifically necessary since the result of the condition should be that the HUD will not display and that inoperable status would be displayed to the other pilot.</p> <p>The FAA does not intend that such information must be displayed on the other pilot’s PFD. It should be located, however, in that pilot’s forward field of view, not too far from the PFD, so it can be part of that pilot’s instrument scan. Center pedestal would not be a satisfactory location.</p>
19.	Paragraph 6.3.2 on page A6-20	<p>The guidance here includes assignment of an individual and time interval for scanning. However, even though the applicant is allowed to implement a design to identify “... which pilot scans the head-down instrument indications and how often ...” PF or PNF may not perform the required scan; i.e., workload reality might not reflect what is in the pilot operations manual. Thus, this guidance may present a loophole in the implied safety requirement(s) for dual HUD operation.</p> <p>The design should have compensating design features that ensure an equivalent level of timeliness and awareness of the information provided by scanning the head-down visual indication(s) only.</p> <p>RECOMMENDATION Please consider changing this section title to “6.3.2 Assurance of Head-Down Vigilance”</p> <p>Additionally, please consider including text to the effect that the design should have compensating design features that ensure an equivalent level of timeliness and awareness of the information as would otherwise be provided by scanning the head-down visual indication(s) only.</p>	<p>Non-Concur</p> <p>The FAA agrees that the design will not ensure pilot scanning performance. However, the design should be suitable for effective pilot scanning, and the FAA wants the applicant to show that across the foreseeable operating conditions.</p> <p>The evaluation may lead the applicant and/or the FAA to require certain design compensations, procedures, or limitations on the use of the dual-HUD configuration.</p> <p>The applicant should show that there is a reasonable scheme for effective instrument scanning and flightcrew awareness.</p> <p>The FAA does not intend to change the paragraph title. Flightcrew awareness is the primary objective, but in this case, the FAA wants to address the ability of the flightcrew to establish an effective instrument scan.</p>

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20.	Paragraph 7.0 on page A6-21	<p>There is concern that the phrases “may record” and “may include” will be interpreted as optional or interpreted as “must.”</p> <p>It is noted that while recording information related to “unique operational characteristics of HUDs” could be useful, many HUD installations have been approved without such recording.</p> <p>RECOMMENDATION Please consider text that would explicitly state that such HUD recording is “optional”.</p>	<p>Concur</p> <p>We revised paragraph F.7 as follows: “<u>Flight data recorders must record the minimum data parameters required by §§ 25.1459(e) and 121.344. Optionally, the flight data recorders may also record other information regarding unique operating characteristics of the HUDs.</u> For example, they may include information such as the mode in which the HUD was operating, the status (e.g., in use or inoperative), and if the display declutter mode was operating.”</p>
21.	Paragraph 2.3.12.2 on page A7-3	<p>The text could be interpreted to restrict or preclude presentation formats that would otherwise be considered superior by human factors standards.</p> <p>RECOMMENDATION Please consider text that would not link the width of weather display with the width of other systems unless the information for one is graphically overlaid on the other for the same geographic area.</p>	<p>Concur</p> <p>We did add the following sentence to paragraph G.2.3.12.2:</p> <p>“This should not be interpreted as a restriction precluding other means of presentation that can be demonstrated to be superior.”</p>
22.	Paragraph 16 on page 18	<p>This section cites AS 8034A which has never been recognized by the FAA. Rather AS 8034B has been recognized by the FAA in TSO-C113a.</p> <p>RECOMMENDATION Please consider updating this section and any other applicable references to AS 8034B.</p>	<p>Concur</p> <p>Document references have been updated to the current revisions.</p>

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No.	Reference	Requested Change	Disposition
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1.	Section 3 of main body	<p>RECOMMENDATION Propose Section 3- Cancellation to be changed into “This AC cancels AC25-11A.”</p> <p>RATIONALE Because from the document structure of AC25-11 , it is a complete AC for flightdeck electronic display, not just the supplemental to AC25-11A. If this revision only cancels AC25-11, then it is supposed that AC25-11A and AC25-11B both are effective. So, if FAA’s content is to only cancel AC25-11, how the authority and applicant choose which document (AC25-11A or Revision B) and for what reason.</p>	<p>Concur</p> <p>The original intent of this revision was not to cancel AC 25-11A, but to revise it as “Change 1.” The FAA does not cancel an AC in such cases. However, now that the FAA has decided to publish the revision as AC 25-11B instead of a “change,” there should be a statement that cancels AC 25-11A.</p> <p>We revised Section 3, Cancellation, to say:</p> <p>“This AC cancels AC 25-11A, <i>Electronic Flight Display Systems</i>, dated June 21, 2007.”</p>
2.	Section 4c p. 13	<p>For 4c, ARAC recommendations related with § 25.1322:</p> <p>RECOMMENDATION Now the new requirements “Flightcrew Alerting” for § 25.1322 have been put into effect, so the reference material in this section regarding § 25.1322 could be changed into AC25.1322-1 and its NPRM, Final Rule.</p> <p>The same recommendation is for all the same situations in the following text.</p>	<p>Concur</p> <p>Since § 25.1322 has been amended and a new AC has been published, we have made the following changes:</p> <ul style="list-style-type: none"> • Deleted all references to § 25.1322 from the paragraph 4.c of the proposed AC (paragraph 1.4.5 in the final AC). • Deleted paragraph 4.c.(3) of the proposed AC. • Deleted paragraph 4.c., Appendix 5, of the proposed AC. • Added AC 25.1322-1, <i>Flightcrew Alerting</i>, to table E-2 of the final AC, which identifies all the ACs related to AC 25-11B. • After first sentence of paragraph F.5.2.1, inserted: “<u>For additional alerting guidance, see AC 25.1322-1, Flightcrew Alerting.</u>”

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3.	Section 5	<p>For Section 5 Definitions of Terms Used in this AC.- a. A “display system” includes not only the display hardware and software components <u>but the entire set of avionic devices implemented to display information to the flightcrew.</u></p> <p>For the “entire set of avionic devices”, refers to sensors, data bus and display terminal which compromise the overall network from data or failure detection, data transmission, data processing and data display.</p> <p>RECOMMENDATION And if the display system cited hereafter are all the big display system?</p>	<p>Non-Concur</p> <p>This is not a changed area of the AC, and the comment is out of scope of the AC revision. The scope of Revision B is to add Appendices F and G and to revise the related material in the AC.</p>
4.	Section 11	<p>For Section 11. General – “The material in Chapters 2 through 9 and Appendices 1 and 2 of this AC constitute an overall method of compliance for the approval of an electronic display system.”</p> <p>RECOMMENDATION Propose: Add Appendices 6 and 7 of this AC to this sentence. “The material in Chapters 2 through 9 and <u>Appendices 1, 2, 6 and 7</u> of this AC constitute an overall method of compliance for the approval of an electronic display system.”</p> <p>RATIONALE Because this change adds appendices 6 (HUD) and 7 (weather display) as new guidance.</p>	<p>Non-Concur</p> <p>Appendices F and G are targeted at particular types and functions of displays, not all electronic displays.</p>
5.	Global?	<p>For reference documents SAE AS8034, it is proposed that the version of 8034 change from A to B, because the current version of 8034 is B.</p>	<p>Concur</p> <p>We have globally updated the revisions of referenced documents.</p>

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6.	16a(3)(b) <u>1</u>	<p>For 16a(3)(b)<u>1</u>- Some manual adjustment should be retained to provide for <u>normal and non-normal operating differences</u> so that the luminance variation is not distracting and does not interfere with the flightcrew's ability to perform their tasks.</p> <p>Questions:</p> <p>3. Please explain how the manual adjustment provide for normal and non-normal operating differences. Whether it means that, for example, manual adjustment is permitted in normal operating while not permitted in non-normal operating conditions because in non-normal operating conditions, manual adjustment would require more flightcrew attention and increase their workload, distract their attention from their tasks.</p> <p>4. So, based on the above assumption, does the manual adjustment only be used in normal operating conditions, and not permitted to be used in non-normal and emergency conditions?</p>	<p>Non-concur</p> <p>This is not a changed area of the AC, and the comment is out of scope of the AC revision. The scope of Revision B is to add Appendices F and G and to revise the related material in the AC.</p>

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7.	16b(3)	<p>For 16b(3)- The display unit must be located in the flight deck such that flight, navigation, and powerplant information <u>for use by any pilot</u> is plainly visible to him from his station with the minimum practicable deviation from his normal position and line of vision when he is looking forward along the flight path (25.1321(a)).</p> <p>Question:</p> <ol style="list-style-type: none"> 1. For a two-pilot flight deck, the flight, navigation and powerplant information for use by any pilot is plainly visible to him, does that mean both pilot must see the flight, navigation and powerplant information simultaneously? Or only the pilot using these information (for example, PF or PNF according to flying duty requirement or monitoring requirement) seeing these information is OK? If simultaneous visibility is not required, that means to satisfy the visibility for a specific pilot, the information transfer between different displays is permitted. Does the cross-flight deck viewing cited in 16b(6) belong to this situation? 2. If an applicant's display system design does not satisfy the simultaneous visibility of flight, navigation and powerplant information, then does the FAA think it complies with the regulation or is an equivalent safety for the regulation from the regulation requirement point of view? 3. For the words "each, every, any" in regulations, is there any different meanings for different words? 	<p>Non-concur</p> <p>This is not a changed area of the AC, and the comment is out of scope of the AC revision. The scope of Revision B is to add Appendices F and G and to revise the related material in the AC.</p>
8.	16c(2)	<p>For 16c(2):</p> <p>Questions:</p> <ol style="list-style-type: none"> 1. Does the one side in sentence "Only displays on one side of the airplane should be affected by an engine failure" mean either the pilot or the copilot. 2. For the last sentence in 16c(2)- "Analysis should identify these failure modes and <u>show that the preceding criteria are met</u>". How to show, by analysis or by other means? I believe that the simulation test would be an acceptable means of evaluation for items that could not evaluated during flight test. 	<p>Non-concur</p> <p>This is not a changed area of the AC, and the comment is out of scope of the AC revision. The scope of Revision B is to add Appendices F and G and to revise the related material in the AC.</p>

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9.	16c(4)	For “not adversely affected” in 16c(4), how to determine whether the intended function is adversely affected or is affected? Does the analysis process consider the failure condition of the intended function?	<p>Non-concur</p> <p>This is not a changed area of the AC, and the comment is out of scope of the AC revision. The scope of Revision B is to add Appendices F and G and to revise the related material in the AC.</p>
10.	21e(2)	<p>For 21e(2) “Experience from previous certification programs has shown that the combined failure of both primary displays with the loss of the standby system can result in failure conditions with catastrophic effects”.</p> <p>Both mean two, one for pilot and the other for copilot. So, for the situation of HUD as primary display, has the wording “both” considered the HUD. Or when HUD is as primary display, the HDD on the same side is not considered the primary display? If the HUD and HDD could be primary displays at the same time, then the wording “both” should be replaced by “all”.</p> <p>The same question is applicable to all the failure condition wordings related to “both primary displays” in the failure condition tables.</p>	<p>Non-Concur</p> <p>See Appendix F, paragraph F.2.1.3 and our responses to Thales comment #1, Boeing #6, and Rockwell #1.</p> <p>When considering the combined display failures, it does not really matter whether HUD is considered primary or not. The main issue with HUD is that it is visible to one, not both pilots, and if the single remaining display is a HUD, it would not comply with § 25.1333(b).</p>
11.	table 6 in page 34	For table 6 in page 34, there is no ** in the table.	<p>Concur</p> <p>The ** note applies to hazard classifications for loss of all stabilized heading.</p> <p>We revised the table to add (**) to the Hazard Classification and Qualitative Probability entries in first row for Loss of stabilized heading in the flight deck.</p>

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12.	36b(4)(a)	<p>For paragraph 36b(4)(a) “Required engine indications necessary to set and monitor engine thrust or power should be continuously displayed in the flightcrew’s primary field of view, unless the applicant can demonstrate that this is not necessary.”</p> <p>Questions:</p> <ol style="list-style-type: none"> 1. What parameters does the “required engine indications” include? Are the indications included in the regulation requirements or are they defined during the certification process? 2. Does “continuously display” mean that the engine indications should be visible to both pilots simultaneously. 	<p>Non-concur</p> <p>This is not a changed area of the AC, and the comment is out of scope of the AC revision. The scope of Revision B is to add Appendices F and G and to revise the related material in the AC.</p> <p>We did not change the AC in regard to this comment.</p>
13.	Appendix 5	<p>For Appendix 5-related regulations and documents:</p> <p>Questions:</p> <ol style="list-style-type: none"> 1. For the regulations included in this appendix, are they all considered the certification basis of the display system during a specific certification program? 2. The title of § 25.1322 should be replaced by “flightcrew alerting.” 3. The title of § 25.1329 should be replaced by “flight guidance system.” 4. For advisory circulars listed in this appendix, not all the ACs are the current version. So, what is the FAA’s consideration for the versions of AC that could be accepted during a project? 	<p>Concur</p> <p>We have updated the titles of the regulations and document references globally to refer to the most current version.</p>

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No.	Reference	Requested Change	Disposition
Commenter: Zhang Ping Shanghai Aircraft Airworthiness Certification Center of CAAC			
14.		<p>For appendix 6, 2.1.3 “Availability of primary flight information”.</p> <p><u>“Since the flight information displayed on the HUD is visible only to one pilot, it cannot be used as the single remaining display to comply with 25.1333(b).</u> The rule requires that, after the loss of other flight information displays, “one display of the information essential to the safety of flight” remains available to both pilots, not just one pilot”</p> <p>So, the question is: If the standby instrument is available, both pilot could see the information essential to the safety of flight. Typically, the standby instrument is treated as the remaining display to comply with § 25.1333(b). Then if the meaning of the first sentence could be translated to: “the HUD could not be defined as a standby instrument or as the ultimate useful display.”</p>	<p>Concur</p> <p>See responses to Thales comment #1, Boeing #6, and Rockwell #1.</p> <p>When considering the combined display failures, it does not really matter whether HUD is considered primary or not. The main issue with HUD is that it is visible to one, not both pilots, and if the single remaining display is HUD, it would not comply with § 25.1333(b).</p> <p>We revised paragraph F.2.1.3 as follows:</p> <p><u>“There might be failure conditions that result on loss of all but one display of primary flight information. For such a condition, a HUD as the only remaining display could</u> not comply with § 25.1333(b), since the HUD is visible only to one pilot. The rule requires that, after the loss of other flight information displays, the “one display of the information essential to the safety of flight” remains available to both pilots, not just one pilot.”</p>
15.	appendix 6, 3.1.1	<p>For appendix 6, paragraph 3.1.1, what does the “energy status” means?</p>	<p>“Energy status” means a combination of airspeed, angle of attack, acceleration, deviation from desired airspeed, and proximity to low and high speed limits.</p> <p>We did not change the AC in regard to this question.</p>
16.	appendix 6, 5.1.4.2	<p>For appendix 6, 5.1.4.2, “While the head-up and head-down displays may display present information,” here, does the “present” mean “current”?</p>	<p>Concur</p> <p>See response to Garmin #6.</p> <p>We revised the first sentence of paragraph F.5.1.4.2 to say:</p> <p>“While the HUD and HDD may display present information (e.g., flight path, <u>path deviation</u> situational, or aircraft performance information) <u>in a different manner, the meaning must be the same and differently, and any differences...</u>”</p>

DISPOSITION OF PUBLIC COMMENTS

AC 25-11B, *Electronic Flight Displays*

Prepared by Dale Dunford, ANM-111

No.	Reference	Requested Change	Disposition
Commenter: Zhang Ping Shanghai Aircraft Airworthiness Certification Center of CAAC			
17.	appendix 6, 7.0	For appendix 6, 7.0 flight data recording, what does the “the mode in which the HUD was operating” mean? How many modes does the HUD will be operating and what are they?	Each HUD design may be different, with different sets of modes, but they may include selected display formats (declutter modes), display of low visibility takeoff guidance, rollout modes, and so on.
18.		For appendix 7 weather displays, the superscript and subscript of this appendix should be changed into “appendix 7” instead of “appendix 6.”	We are not sure what the commenter meant by superscript and subscript, but our copy of the document shows the correct headers and footers for Appendix 7. Please note that appendix 7 of the proposed AC has been renumbered as appendix G in the final AC.