

## MILITARY STANDARD

## AIRCREW STATION VISION REQUIREMENTS FOR MILITARY AIRCRAFT

TO ALL HOLDERS OF MIL-STD-850B:

1. THE FOLLOWING PAGES OF MIL-STD-850B HAVE BEEN REVISED AND SUPERSEDE THE PAGES LISTED:

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
1	3 November 1970	(REPRINTED WITHOUT CHANGE)	
2	23 November 1984	2	3 November 1970
5	23 November 1984	5	3 November 1970
6	23 November 1984	6	3 November 1970
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10	23 November 1984	10	3 November 1970

2. RETAIN THIS NOTICE AND INSERT BEFORE TABLE OF CONTENTS

3. Holders of MIL-STD-850B will verify that page changes and additions indicated above have been entered. This notice page will be retained as a check sheet. The issuance, together with appended pages, is a separate publication. Each notice is to be retained by stocking points until the Military Standard is completely revised or canceled.

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Army - AV  
Navy - AS  
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**1. PURPOSE AND SCOPE**

**1.1 Purpose.** The purpose of this document is to establish requirements for providing adequate external vision from within the aircrew stations of military aircraft.

**1.2 Scope.** The requirements contained herein apply to external vision from aircraft procured by the military departments. The general vision requirements are for the various type seating arrangements and limited aircraft missions.

**2. REFERENCED DOCUMENTS**

**2.1** The issues of the following documents in effect on date of invitation for bids or request for proposal form a part of this standard to the extent specified herein.

**STANDARDS****Military**

MIL-STD-1333	Aircrew Station Geometry for Military Aircraft
MS33573	Dimensions, Clearance, Cockpit, Fixed Wing Aircraft
MS33574	Dimensions, Basic, Cockpit, Stick Controlled, Fixed Wing Aircraft
MS33575	Dimensions, Basic, Cockpit, Helicopter
MS33576	Dimensions, Basic, Cockpit, Wheel Controlled, Fixed Wing Aircraft

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

**3. DEFINITIONS**

\* **3.1 Types of cockpit seating arrangements.** The vision criteria set forth in this standard are applicable to the following types of cockpit seating arrangements:

- (a) Single pilot
- (b) Tandem pilot
- (c) Side-by-side pilot.

\* **3.2 Types of aircraft.** The vision criteria set forth in this standard are applicable to the following types of aircraft:

- (a) Fighter/attack
- (b) Bomber/transport

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- (c) ASW/patrol
- (d) Helicopter
- (e) V/STOL
- (f) Trainers.

3.3 Design eye position. The design eye position shall be that eye position as defined by MS33573, MS33574, MS33575, and MS33576 or MIL-STD-1333.

- 3.4 Clear vision area. The clear vision area is defined as that area of transparent material through which vision is unobstructed by structure, edge bonding material, or any material which prohibits clear vision. These areas shall be kept clear of obstructions to vision such as misting, rain, icing and insects.

#### 4. GENERAL REQUIREMENTS

4.1 Vision requirements. The vision requirements set forth in this standard were based on utilization of monocular vision. The reference plane from which the vision angles are specified shall be the pilot's horizontal vision plane (or line) with respect to the specific aircraft longitudinal fuselage reference line. The zero reference in azimuth shall be straight ahead of the design eye position.

4.1.1 Extent of external vision. The maximum practicable external vision shall be provided for the pilot(s). The vision requirements established herein are minimal and are subject to further definition by the procuring activity. Particular consideration shall be given in each case to the external vision provided in conjunction with the specified mission of the aircraft. For landing approach conditions, downward and forward vision shall be provided to insure effective vision of all ground and shipboard landing aids specified by the procuring activity. For carrier aircraft, the landing area, landing aids, and stern of the carrier (drop lights) must be visible from landing pattern altitude in level flight at glide slope intercept. The landing area, including the contiguous areas port and starboard, must be visible on the glide slope. The pilot's vision of these landing aids shall be provided when the aircraft longitudinal fuselage reference line is pitched at the critical approach conditions  $V_{pa}$  (min). Verification for meeting this requirement shall be accomplished as specified in 4.1.2.2.

4.1.2 External vision verification. The vision data derived in accordance with the instructions herein shall be submitted to the procuring activity for review and approval. Vision plots shall be updated on completion of design and at any time a change in the vision envelope is either proposed or completed.

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(d) The blind spot caused by the structure between the top of the wind-screen and the canopy shall not exceed  $35^{\circ}$  horizontally nor  $7^{\circ}$  vertically. Reference shaded area, figure 3.

(e) Aft vision from  $135^{\circ}$  to  $180^{\circ}$  azimuth shall be provided, as specified by the procuring activity.

5.1.2 Aft pilot position. The vision criteria set forth in this paragraph are applicable to the aft pilot station in tandem-piloted aircraft.

(a) At  $0^{\circ}$  azimuth, a minimum of  $5^{\circ}$  vision down shall be provided, measured from the aft design eye position with the forward seat in the neutral seat adjustment. The front seat headrest shall be designed to a minimum width, contoured about the upper corners and the forward seat structure; ejection rails and actuator shall be so designed and positioned as to obstruct a minimum of forward vision.

(b) The extent and quality of the aft pilot's external vision shall be as specified in 5.1.1. Various lateral eye positions in a plane through the aft pilot's design eye position may be employed to meet the above requirements. Sufficient canopy width shall be provided to permit eye movement in the frontal plane to obtain the specified external vision.

(c) The vision required by the above criteria may not be sufficient in all respects for all operational uses of an aircraft. Therefore, particular consideration must be given in each case to the vision provided in conjunction with the mission of the aircraft. In aircraft utilized for fighter-bomber missions, reconnaissance missions, search, and night intruder missions, the maximum amount of vision that can be incorporated is desirable.

## 5.2 Side-by-side pilot fighter/attack aircraft

5.2.1 The vision requirements set forth in this paragraph are applicable to side-by-side piloted fighter/attack-type aircraft (reference figure 4).

(a) The following shall be the minimum angles of unimpaired vision available to the pilot and copilot measured from their respective design eye positions:

(1) At  $0^{\circ}$  azimuth, provide at least  $13^{\circ}$  down and  $12^{\circ}$  up.

(2) From  $0^{\circ}$  through  $70^{\circ}$  left azimuth for the pilot and  $0^{\circ}$  through  $70^{\circ}$  right azimuth for the copilot, vision shall increase from  $13^{\circ}$  down to  $40^{\circ}$  down and from  $12^{\circ}$  up to  $40^{\circ}$  up. The canopy bow vision obstruction within this area shall be within the limits as specified in 5.1.1 (c).

(3) At all points between  $70^{\circ}$  and  $110^{\circ}$  left azimuth for the pilot and between  $70^{\circ}$  and  $110^{\circ}$  right azimuth for the copilot, provide  $40^{\circ}$  down and  $90^{\circ}$  up.

(4) At  $135^{\circ}$  azimuth, provide  $20^{\circ}$  down.

(b) In the cockpit area inboard of the pilot and copilot centerlines, maximum vision with a minimum of obstruction shall be provided for the pilot and copilot.

(c) Sufficient vision for the pilot(s) to see the engines with his head next to the window shall be provided where practicable.

(d) At  $90^{\circ}$  left azimuth for the pilot and  $90^{\circ}$  right azimuth for the copilot, at least  $70^{\circ}$  downward from a point not more than 14 inches outboard of the pilots' respective design eye positions shall be provided.

(e) In aircraft utilizing inflight refueling, sufficient vision must be provided for the pilot to see the tanker, refueling signal lights, boom, and probe, when in position for refueling.

## 6. BOMBER/TRANSPORT AIRCRAFT

6.1 Side-by-side pilot aircraft. The vision criteria stated in this paragraph are applicable to side-by-side piloted aircraft (reference figure 5).

(a) The following shall be the minimum angles of unimpaired vision available to the pilot and copilot left and right respectively, measured from the respective design eye positions:

(1) At  $0^{\circ}$  through  $30^{\circ}$  left azimuth, provide  $17^{\circ}$  down and  $20^{\circ}$  up.

(2) The vertical angles of clear vision in the area between  $30^{\circ}$  and  $70^{\circ}$  left azimuth shall increase from  $17^{\circ}$  down to  $35^{\circ}$  down and from  $20^{\circ}$  up to  $40^{\circ}$  up.

(3) At all points between  $70^{\circ}$  and  $110^{\circ}$  left azimuth, provide  $35^{\circ}$  down and  $40^{\circ}$  up.

(b) To the right of the pilot's centerline the angular vision downward and upward may decrease slightly from  $17^{\circ}$  and  $20^{\circ}$  specified in (a) (1) above due to the increase in distance from the design eye position to the windshield.

(c) The transparent area shall extend to  $135^{\circ}$  left azimuth at the eye level but the vertical angles of vision may decrease below those values at  $110^{\circ}$ . Sufficient vision for the pilot to see the engines with his head next to the window shall be provided where practicable. If sufficient vision is not provided, provisions must be made for another crewmember to view the engines.

(d) At least  $70^{\circ}$  downward vision from a point not more than 14 inches outboard of the design eye positions shall be provided. Sufficient headroom shall be provided to permit this eye position.

(e) The entire transparent area between  $20^{\circ}$  right and  $30^{\circ}$  left shall be free of windscreen structure or posts. No windscreen post or structure shall exceed 2.5 inches in width when projected onto a plane perpendicular to a line between the post or structure and the pilot's design eye position.

(f) Vision throughout the entire overboard area aft to the seat reference point is desirable, though often not practicable due to structure, overhead console, etc. However, transparent material should be utilized to the maximum extent practicable throughout this area.

## 7. ASW/PATROL AIRCRAFT

7.1 The vision criteria stated in section 6 for bomber/transport aircraft are the minimum applicable to ASW/patrol aircraft. Maximum vision downward consistent with structural integrity shall be provided for pilot and copilot between  $30^{\circ}$  and  $135^{\circ}$ , measured from the design eye position. When lookout stations are specified by the procuring activity, vision available at these stations shall be  $75^{\circ}$  fore and aft or horizontally and  $85^{\circ}$  downward measured from zero reference.

## 8. HELICOPTERS

8.1 Side-by-side pilot. The vision requirements set forth in this paragraph are applicable to side-by-side piloted helicopters and are given relative to the longitudinal fuselage reference line (reference figure 6).

(a) Controls, consoles, and instrument panels shall be so located as not to restrict vision, with particular emphasis on adequate over-the-nose visibility. Insure that mounting and reinforcing frames or strips which divide transparent areas and form obstructions to vision are not more than 2 inches wide when projected onto a plane perpendicular to a line between the structure and the pilot's eyes at the design eye position. Distribute such obstruction to avoid critical vision areas.

(b) The following minimum angles of unimpaired vision, designated with respect to the right side pilot, shall be available to the pilot from the design eye position as shown on MS33575. When a co-pilot is designated on the left side, equivalent vision angles shall be provided for that side.

(1) At  $0^{\circ}$  azimuth,  $25^{\circ}$  down and  $20^{\circ}$  up shall be available.

(2) From  $10^{\circ}$  left azimuth to  $10^{\circ}$  right azimuth, downward vision shall increase from  $20^{\circ}$  to  $30^{\circ}$ .

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(3) In the area between 10° right azimuth and 135° right azimuth, 50° of downward vision shall be available.

(4) From 0° to 80° right azimuth, upward vision shall increase from 20° to 40°.

(5) From 80° right azimuth to 100° right azimuth, upward vision shall be 40°.

(6) From 100° right azimuth to 135° right azimuth, upward vision requirement may decrease gradually from 40° to 20°.

(7) From 10° left azimuth to 100° left azimuth, 20° up and 20° down shall be available.

(c) There shall be no vertical obstruction between 20° right and 20° left of the longitudinal axis relative to the design eye position.

(d) There shall be no horizontal obstructions in the area extending 15° above the horizon from 135° right to 40° left and decreasing to a point 10° above the horizon at 100° left. No horizontal obstructions shall be in the area 15° below the horizon between 135° right and 100° left. If necessary, horizontal obstructions in this area shall be limited to one above the horizon and one below the horizon and shall be restricted to 4 inches in width.

\* 8.2 Single pilot/tandem pilot. The vision requirements set forth in this paragraph are applicable to single- and tandem-piloted helicopters with pilot in either forward or aft position, and are given relative to the longitudinal fuselage reference line (reference figure 7). The forward cockpit position, if occupied by other than the primary pilot (i.e., gunner or observer), also shall comply with these requirements.

(a) The following shall be the minimum angles of unimpaired vision available to the pilot from the design eye position:

- (1) At 0° azimuth, at least 25° down and 70° up.
- (2) At 20° azimuth, left and right, 25° down and 70° up.
- (3) At 30° azimuth, left and right, 30° down and 70° up.
- (4) At 90° azimuth, left and right, 50° down and 70° up.
- (5) At 135° azimuth, left and right, 34° down and 70° up.

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(b) Visibility in elevation (up) above that specified in 8.2(a) of at least 90° shall be provided. Interruptions of vision by horizontal structure of not more than 2 inches of width along or above the elevation boundary of 8.2(a) and vertical structural members of not more than 2 inches in width located in accordance with 8.1(d) are permitted.

## 9. V/STOL AIRCRAFT

9.1 The minimum vision requirements for V/STOL aircraft shall be those of the helicopter (side-by-side or tandem, as appropriate, for the configuration chosen) and of the fixed-wing-type aircraft which designates the primary mission. The precise requirements shall be specified by the procuring activity and shall consider the aerodynamic characteristics, engineering and power designs, and primary and secondary missions.

## 10. TRAINER AIRCRAFT

10.1 The extent and quality of external vision in trainer aircraft should be at least that of the aircraft which they are to represent. It is to be noted that the flight proficiency and the nature of the training flight performed will require a considerable increase in external vision. Accordingly, every attempt should be made to provide a higher degree of external vision in these aircraft than in their parent type to insure adequate safety of flight.

## 11. OTHER CREW STATIONS

11.1 In single-piloted aircraft employing tandem or side-by-side seating arrangements where the second crew station is occupied by a radar operator or bombardier/navigator, the vision requirements in the second crew station shall be as specified by the procuring activity. Insofar as practicable, the design of this crew station will follow the intent of this standard.

## 12. ADDITIONAL REQUIREMENTS

- \* 12.1 In those aircraft where the external vision need exceeds the minimum requirements specified herein, the maximum external vision that can be incorporated without sacrificing engineering integrity is desirable. When excessive solar heating through the transparent portions of the canopy roof is anticipated, means to reduce or eliminate this problem, such as by incorporation of flight crew operated extendable/retractable shields, may be employed at the discretion of the procuring activity. Methods which affect the transmissive characteristics of the clear transparencies shall be subject to the approval of the procuring activity.



### 13. RECONNAISSANCE AIRCRAFT

- 13.1 Those aircraft assigned to reconnaissance and research and night intruder missions require maximum external vision for tactical utilization of the aircraft as well as for carrier and field landing, taxiing, takeoff, approach and landing under all weather conditions.

### 14. AIRCRAFT UTILIZING INFLIGHT REFUELING

14.1 In aircraft utilizing inflight refueling, sufficient vision shall be provided for the pilot to see the tanker, refueling signal lights, boom, and probe when in position for refueling.

### 15. NOTES

- 15.1 Certain provisions of this document are the subject of international standardization agreements (NATO Standardization Agreement (STANAG) 3622, 3639 and ASCC Air Standards 10/53 and 10/55). When change notice, revision, or cancellation of this document is proposed which will affect or violate the international agreement concerned, the preparing activity shall take appropriate reconciliation action through international standardization channels, including departmental standardization offices, if required.

15.2 Data requirements. The selected data requirements in support of this standard will be reflected in a Contractor Data Requirements List (DD Form 1423) attached to the request for proposal, invitation for bid, or the contract as appropriate.

15.3 The margins of this standard are marked with an asterisk to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

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