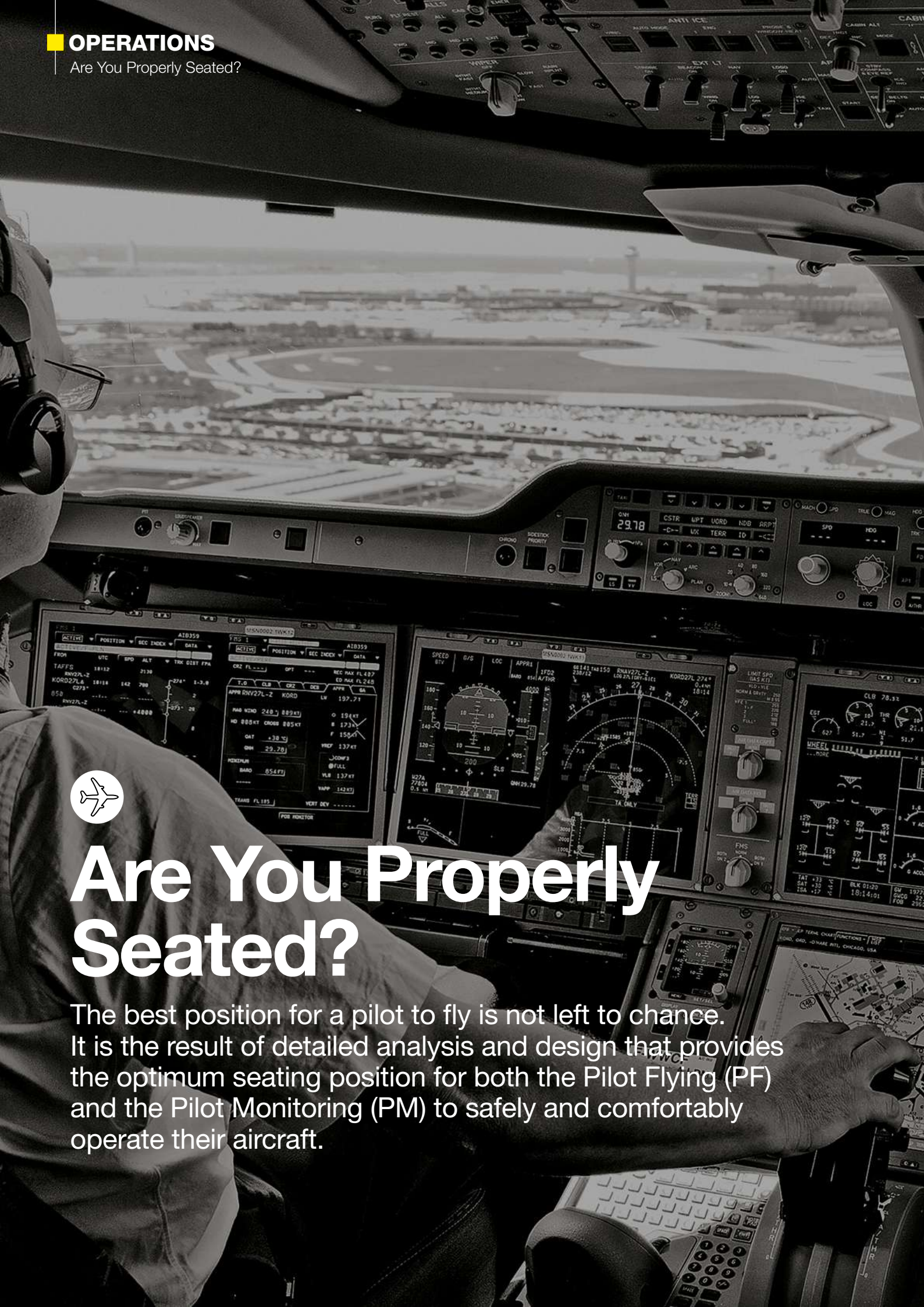


Are You Properly Seated?

The best position for a pilot to fly is not left to chance. It is the result of detailed analysis and design that provides the optimum seating position for both the Pilot Flying (PF) and the Pilot Monitoring (PM) to safely and comfortably operate their aircraft.

It may be surprising that something as simple as the pilot's seat positioning can play a key role in the safe flying of an aircraft. This is why it is important to pay close attention to the seat adjustment phase during the "Before pushback and start" part of the Standard Operating Procedures (SOP). This article will describe the principle of Eye Reference Point and how this is pivotal in the design of an Airbus aircraft's cockpit. It will also illustrate how a pilot seated in the correct position will avoid the potential consequences from operating the aircraft with a poorly adjusted seating position.

CERTIFICATION REQUIREMENTS

Regulations require that the aircraft manufacturer provides a means which will aid the pilots to position themselves with precision and allowing them to have the best point of view from their seat. This is defined by the EASA CS 25.773 and FAA FAR 25.773.

A pilot who is between 1.58 m (5ft 2 inches) to 1·91 m (6ft 3 inches) tall shall have easy access to all of the aircraft's controls in the cockpit and this is stipulated by EASA CS 25.777. This requirement ensures that the design fits to the vast majority of pilots.

These requirements are taken into account when a reference point is provided for the design of any cockpit. It is often referred to as the design eye position and also called eye reference point.

> "When the pilots align themselves with the eye reference point, they will have adopted the optimum position to operate the aircraft."

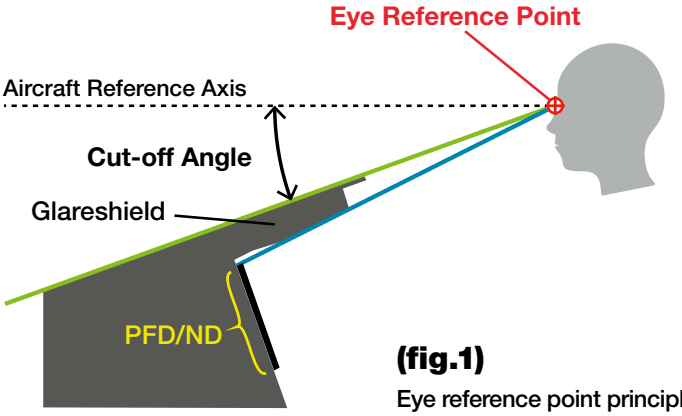
THE EYE REFERENCE POINT

Modern aircraft cockpits are built around the eye reference point. It is used to size the cockpit windows and define the location of all the controls, displays and instruments.

When the pilots align themselves with the eye reference point, they will have adopted the optimum position to operate the aircraft.

An optimized field of view

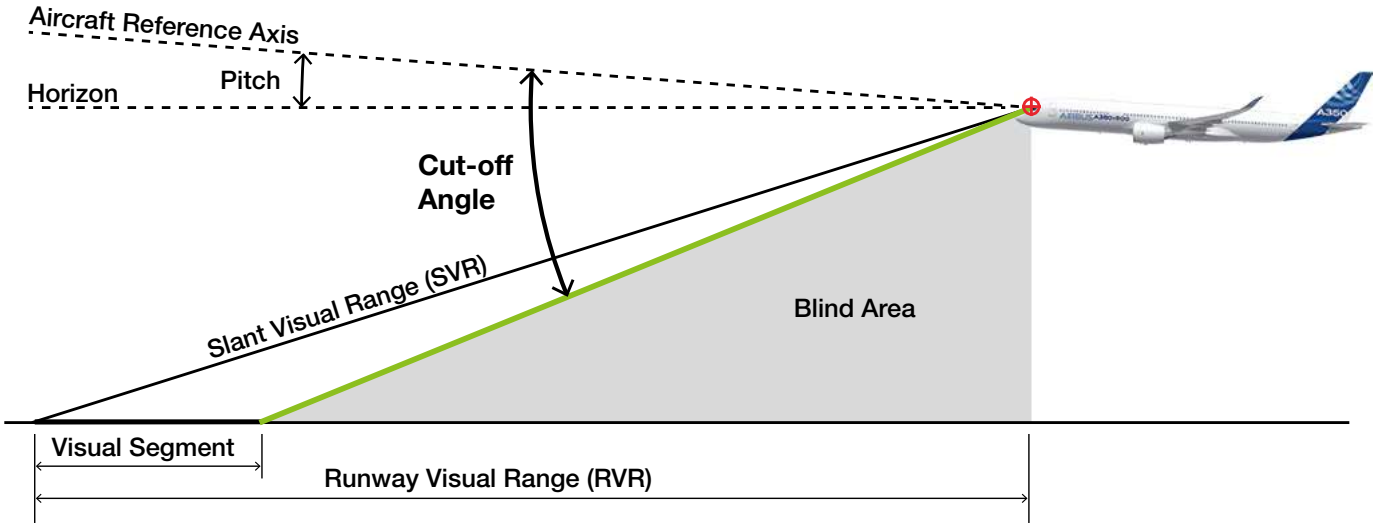
The cockpit is designed so that when the pilot has aligned themselves to the eye reference point; all of the instruments and displays on the front panel are in their field of view **(fig.1).**



(fig.1)
Eye reference point principle

A pilot needs to have good situational awareness during a flight. Alignment using the eye reference point enables the pilots to have an optimal field of view through the cockpit's windows to see what is around them outside the aircraft. The eye reference point position ensures the pilot can maintain the best cut-off angle that will provide the longest visual segment **(fig.2)**. This is especially important to get visual references during Low Visibility Operations (LVO).

(fig.2)
Cut-off angle



A consistent viewpoint

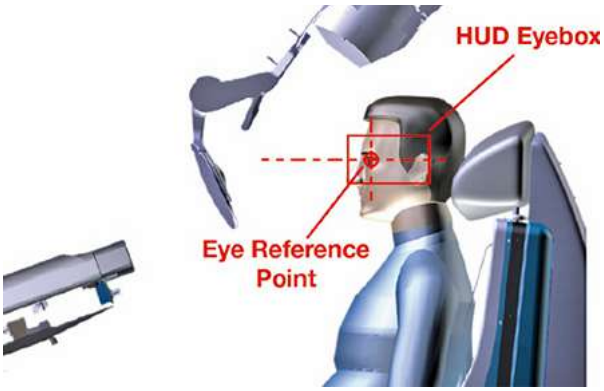
Having a consistent viewpoint gives several operational advantages such as easing the handling of the aircraft by providing pilots with a consistent visual reference, repeatable at every flight. This is especially useful during final approach to be familiarized with the final approach path angle and also for the flare phase.

Since the A300 Airbus has provided an eye reference indicator on the centre structure of the windshield in all Airbus aircraft **(fig.3)**. It enables flight crew to adjust their seat position so that their eyes position matches the eye reference point. The indicator is a device that is fitted with 3 balls painted red or white. To achieve a correct seating position, pilots must align the red and white ball meaning that the white ball is hidden when in the correct position.

(fig.3)
Example of the eye reference indicator in the A350

» Using Head Up Display (HUD)

HUD symbols are fully visible when the pilot's eyes are closest to the eye reference point. An "eye box" is defined as an area around the eye reference point that gives a position tolerance range **(fig.4)**. Hence the pilot correctly sees indications on the HUD when their eyes are positioned inside this virtual box. The HUD eye box area extends further aft than forward to allow HUD readability when seated in a more reclined position for comfort.

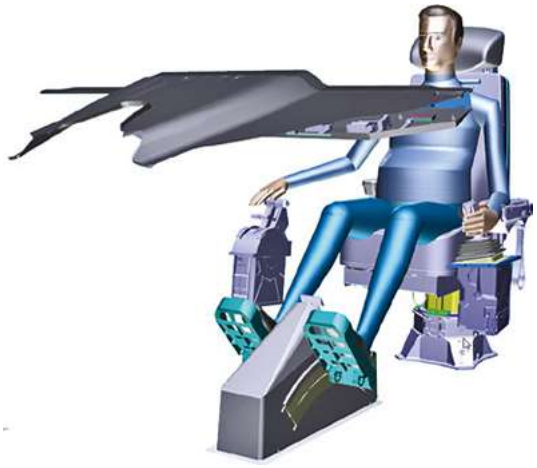


(fig.4)
HUD eyebox principle

An optimized access to aircraft controls

A pilot properly seated with their seat harness fastened is able to reach and operate all of the aircraft's controls through their full range of motion or deflection as it is defined by the design certification requirements **(fig.5)**.

(fig.5)
3D model to visualize the access to flight controls



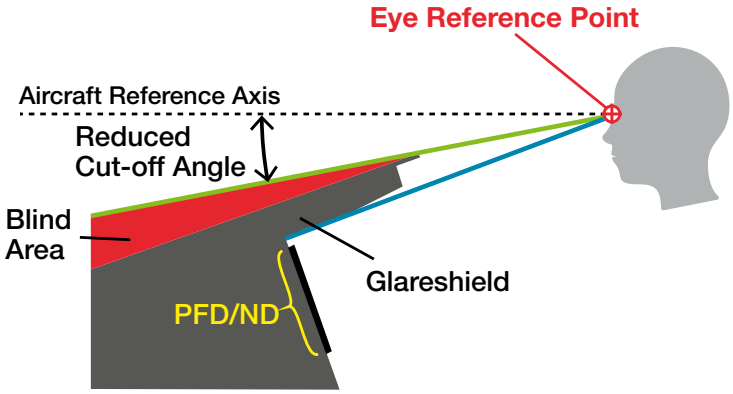
What if seated too low?

A pilot seated in a position that is too low may have difficulties to reach all of the system controls located on overhead panel.

On ground, if seated too low while taxiing the aircraft, the pilots' situational awareness can be impaired to an extent where it may increase the risk of collision with airbridges, buildings, ground support vehicles or other aircraft on the ramp.

In flight, if pilots position themselves too low, during final approach their perception of the flight path angle may be inaccurate.

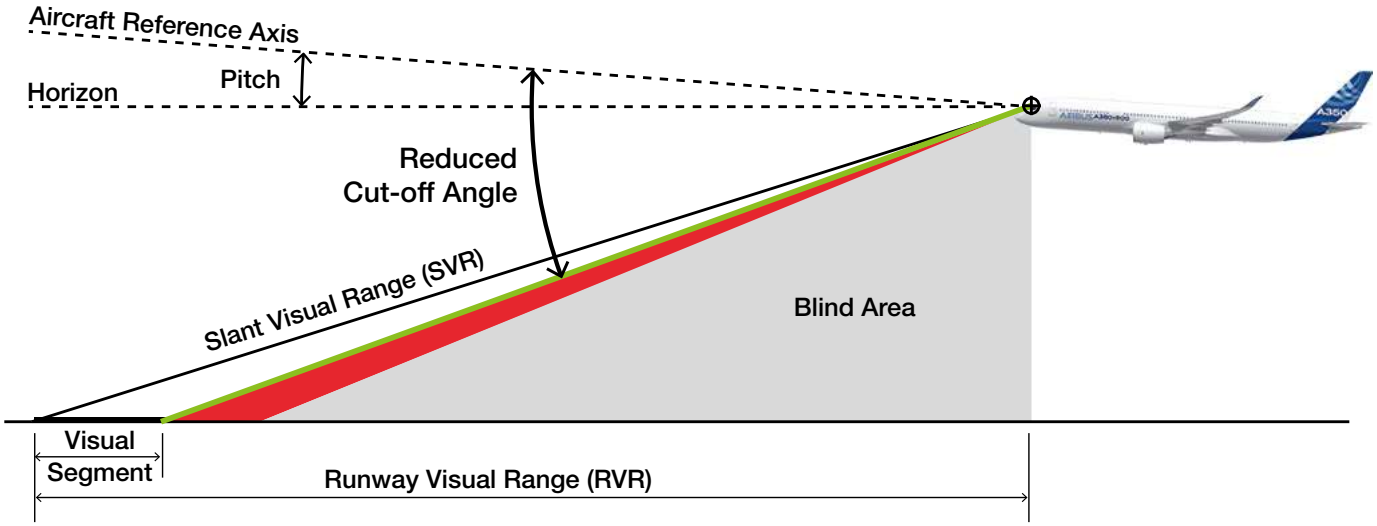
> "In flight, if pilots position themselves too low, during final approach their perception of the flight path angle may be inaccurate."



(fig.6)
Impact of a too low seating position

Being seated too low can also create a blind area due to the glareshield, reducing the cut-off angle and thus limiting the visual segment **(fig.6 and 7)**. Such reduced visual segment during approaches with poor visibility conditions, including Low Visibility Operations (LVO), impairs the ability of the flight crew to obtain the proper visual references for landing, increasing the likelihood of a go-around.

(fig.7)
Cut-off angle when seated too low



BEST PRACTICE

Towards the end of a flight, especially for long sectors, the pilot's position may change due to muscle fatigue often causing them to adopt a position that is lower than at the beginning of the flight. Before commencing the approach, it is recommended to re-adjust the seating position to make to reconfirm that their visual reference is aligned with eye reference point and their position is adjusted accordingly.

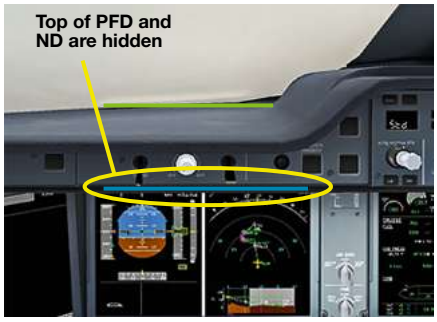
What if seated too high?

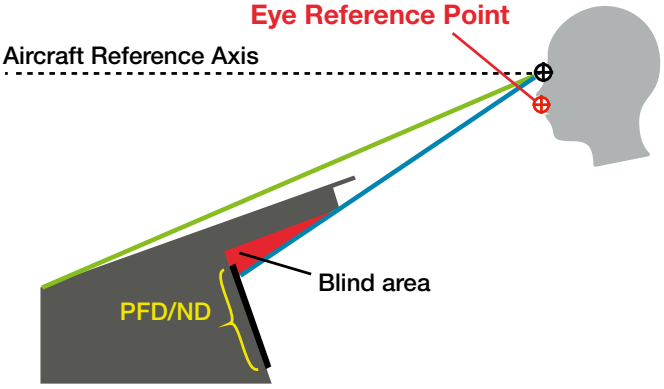
If the pilot has adjusted their seat to a position that is too high, then the same effect can be experienced as for a pilot who has positioned themselves too low. During final approach, the perception of the flight path angle may also be inaccurate.

If the pilots' eye level is above the eye reference point, then the glareshield impairs their view of the instrument panel and in some cases, hides the upper PFD and ND from view **(fig.8)**.

Additionally, operating the rudder pedals through their full range would be more difficult.

(fig.8)
Impaired view on the instrument panel when seated too high





BEST PRACTICE

During the cruise flight phase where the pilots' eye level alignment is not as critical, for increased comfort, it is common practice for the pilots to adjust their seat to be out of the eye reference point position. However, and to be prompt to face any unexpected situation, the pilots should still ensure that they can reach all of the flight controls and their view of the control panels is not impaired.

ADJUSTMENT PROCEDURE

The flight crew must adjust their seating position before the aircraft moves, typically before the pushback or engine start according to the FCOM SOP.

How does a pilot adjust their seat to position themselves correctly?

Step 1: Adjust the seat longitudinal and vertical position to align your eye-level with the eye reference indicator and also check that the glareshield does not obstruct the view the upper PFD and ND **(fig.9)**.

(fig.9)
Correct seat adjustment

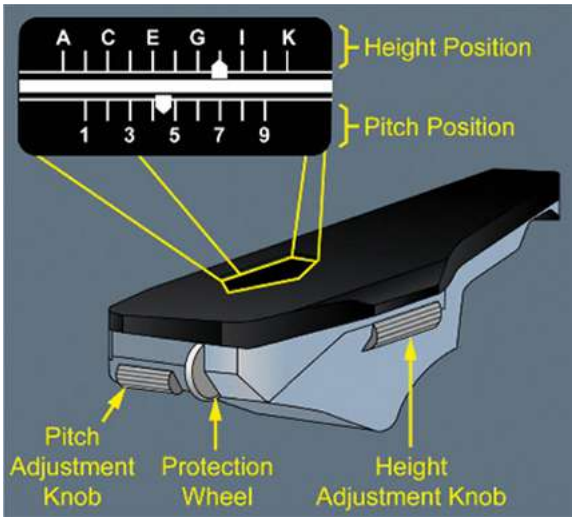
Step 2: Adjust the armrest to a position where your hand can grip the sidestick naturally without stretching the forearm and with a straight wrist. If the armrest is correctly adjusted, your forearm should rest comfortably on the armrest and you will only need to move your hand and fingers to give the appropriate inputs to the sidestick **(fig.10)**.

(fig.10)
Correct armrest adjustment

Step 3: Adjust the Pedals position using the adjustment lever. Ensure the pedals can be moved through their full range of motion with your feet they can be fully deflected and that full manual braking can be applied.

Tip: Take a note of the positions of both the armrest and pedals on their associated position indicators when your adjustment settings are correct and comfortable to save time when making seat adjustments for your next flights **(fig.11)**.

(fig.11)
Armrest position indicator



> "An armrest that is not properly adjusted makes it more difficult to make the appropriate inputs during manual flying."

The importance of armrest and pedals adjustment

» **A correct armrest adjustment for a comfortable and precise manual flying**

The hand is the most dexterous part of the body that is most capable to perform the movements of the sidestick with the most precision. When the pilot's armrest is adjusted correctly, their hand is in a comfortable position without any strain on the wrist, allowing for accurate inputs on the sidestick. An armrest that is not properly adjusted makes it more difficult to make the appropriate inputs during manual flying and a pilot can be more prone to overreaction and make excessive command inputs on the sidestick.

In addition, in turbulent conditions, the armrest stabilizes the pilot's arm to avoid involuntary sidestick inputs due to vibrations.

» **An incorrect rudder pedals adjustment can have strong impact in some phases of flight**

> "The ability to move the rudder pedal through their full range of motion is crucial."

The ability to move the rudder pedal through their full range of motion is especially crucial during the takeoff roll and initial climb after lift-off in the case of an engine failure or strong crosswinds. It is also a critical control input that is necessary during the flare and roll out in engine out or in crosswind landing conditions.

When on the ground, the pilots' seat and pedals positions must enable the pilot to apply maximum manual braking if it is required following a rejected takeoff roll or should it be required after landing.

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Adjusting the seat position may be sometimes seen as an inconsequential step in the SOP. However, a poorly adjusted seating position can have significant effect on the pilot's capability to make appropriate control inputs when flying or taxiing the aircraft.

Adjusting the seat to be correctly positioned with the pilots' eyes level aligned with the Eye Reference Point ensures that all of the aircraft flight controls and systems control panels can be reached and operated properly. It is also crucial to ensure full visibility of all the instruments or displays in the cockpit. Finally, it provides the optimum position for the pilot's field of view from the aircraft to enhance their situational awareness and have a correct perception of the flight path angle during approach.

Flight crew should keep in mind that a seating adjustment done at the right time ensures comfort and accurate aircraft handling in the critical phases of flight.