

In-flight flight crew rest facilities

Background

This position paper provides generic guidance for the design and specification of dedicated flight crew rest facilities provided for the exclusive use of flight crew on commercial transport aircraft operated with augmented flight crews. The main purpose of such facilities is to provide flight crew members with an adequate rest environment before commencement of the next in-flight duty period.

Exclusions

These guidelines are not intended to apply to:

1. Rest facilities provided for the use of crew other than flight crew.
2. Rest facilities provided for flight crew being repositioned as passengers.
3. Seconded passenger seats. In some national civil aviation regulations, seconded passenger seats are permitted as “rest facilities” for off-duty flight crew. They are, consequently, sometimes used for this purpose. IFALPA considers that seconded passenger seats are not satisfactory as flight crew rest facilities and should therefore not normally be used as such.

A - Definitions

- ▶ **Augmented crew** - A flight crew that comprises more than the minimum number required to operate the aeroplane and in which each flight crew member can leave their assigned post and be replaced by another fully qualified flight crew member for the purpose of in-flight rest.
- ▶ **Flight crew** - A properly licensed crew member charged with flight deck duties essential to the operation of an aircraft during a flight duty period.
- ▶ **Flight crew rest facility** - A dedicated, enclosed, in-flight rest facility provided for the use of off-duty flight crew for the purposes of obtaining rest and/or sleep. It includes a rest area or a rest area plus a sleep area.
- ▶ **Micro-climate** - Environmental characteristics of a flight crew rest facility, including temperature, temperature gradient, air flow, relative humidity, and lighting.
- ▶ **Rest area** - Part of a flight crew rest facility provided for the purposes of obtaining seated rest and for changing and stowing clothing and other personal effects.
- ▶ **Resting seat** - A reclining seat specially designed for the purposes of flight crew rest.
- ▶ **Sleep area** - Part of a flight crew rest facility provided for obtaining sleep and which includes one or two sleeping surfaces.
- ▶ **Sleeping surface** - A cushioned, horizontal surface such as a bed or bunk.

B - Physical characteristics

B.1 Configurations

B.1.1 A flight crew rest facility should be a dedicated enclosed space meeting the recommendations included in this document. A dedicated enclosed space provides essential privacy and a base for other features such as noise control and stowage.

B.1.2 A flight crew rest facility may consist of a rest area only or a rest area that includes a sleep area. It should not consist of a sleep area only. Figure 1 below illustrates a possible general arrangement for a single-occupant rest facility including a rest area and a sleep area.

B.1.3 The type of flight crew rest facility provided should be related to the type and length of duty. When a flight crew rest facility consists of a rest area only, it should be acceptable only for operations involving a minimal increase in flight duty periods above those permitted for a non-augmented crew.

B.1.4 A flight crew rest facility may include a reclining seat that converts to a sleeping surface. If so, the facility should meet the requirements of section B.3 when used as a rest area and, the requirements of section B.4 when used as a sleep area.

Notes:

1. *The timing and duration of duty periods in aviation operations are highly variable. In some circumstances mandatory off-duty periods may be short, or may occur in an “alert” phase of the crew member’s circadian cycle. In such circumstances, rest in a suitable reclining seat may be more practical than, and preferable to, rest or sleep in a bed or bunk.*
2. *Optimally, a flight crew rest facility should offer both options of seated rest or bunk sleep. It is appreciated, however, that in some operations it may be inappropriate or unnecessary to provide permanent beds or bunks.*
3. *Flight crews are confined for long periods to flight deck seats. Periods of horizontal rest away from the flight deck can provide significant postural and circulatory relief from the constrained flight deck posture. To provide such benefits, however, the surface upon which rest is obtained should be of a form and a size which permits bodily movement even while sleeping.*

B.2 Location

B.2.1 Flight crew rest facilities should be separated from, but located as close as possible to, the flight deck. Proximity to the flight deck is considered to be important for security, convenience and ready access in case of emergency. Exact locations may vary according to aircraft type.

B.2.2 The aft section of an aircraft fuselage is considered to be an unsuitable location. Remoteness from the flight deck, and consequent potential difficulty of access to the flight deck through passenger cabins, presents unacceptable hazards in an emergency.

B.3 Rest Area

B.3.1 A rest area should be a dedicated enclosed space.

B.3.2 A rest area should include one or two resting seats. It should not include more than two resting seats. Dual occupancy of a flight crew rest facility is considered to be the maximum density acceptable.

B.3.3 A sufficient number of resting seats in multiple single-occupant rest facilities or in two-occupant rest facilities should be provided to accommodate the number of flight crew members off-duty at the same time.

B.3.4 A resting seat in its “seat” position should provide adjustable tilt, adjustable backrest angle, and adjustable lumbar support. In its fully extended position it should provide a smooth level surface at least 1950mm long x 760mm wide. Minimally modified passenger seats are unlikely to meet these requirements. Even “sleeper” seats, as used in some premium passenger cabin applications, while fulfilling adjustment requirements, are too narrow (500mm) to permit desirable freedom of movement when in their fully extended position.

B.3.5 Sufficient space should be provided in a rest area to permit resting seats to be extended to their fully reclined position while preserving space for movement within the rest area.

B.3.6 Sufficient space with sufficient standing headroom to permit changing clothes while standing should be provided. Such space may be measured with a resting seat in its upright position.

B.3.7 A rest area need not be a geometrically regularly shaped space. Critical dimensions, however, should not be less than:

- ▶ standing headroom: 1900mm minimum
- ▶ clothes-changing space: 1900mm high x 850mm wide x 850mm deep.

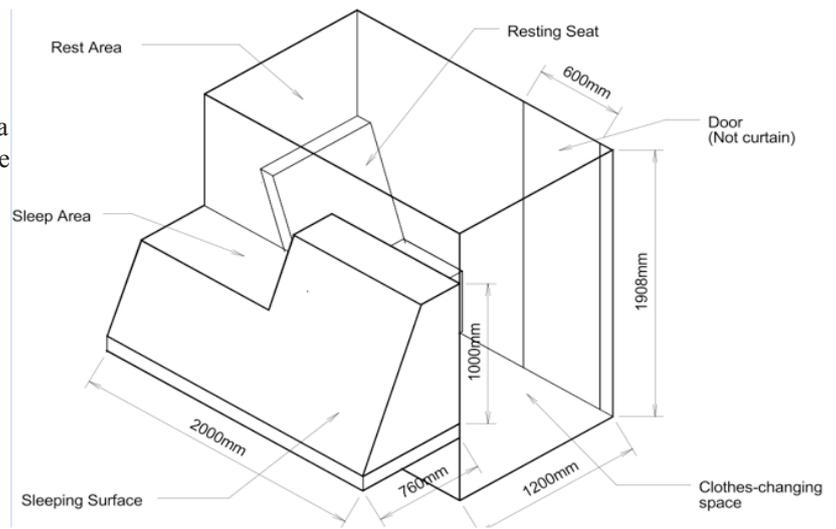


Figure 1. A possible general arrangement for a single-occupant rest facility incorporating a rest area and a sleep area.

B.3.8 Minimum dimensions for a two-occupant rest area may be less than twice the dimensions for a single-occupant rest area. Sufficient space, however, should be provided for:

- ▶ both resting seats to be fully reclined simultaneously
- ▶ entry, exit and movement within the rest area (for access to lockers) while both resting seats are fully reclined. Unencumbered clothes-changing space when one resting seat is fully reclined.

B.3.9 Separate stowage lockers for each occupant's personal effects should be provided. Suggested minimum dimensions for stowage lockers are:

- ▶ clothes hanging space: 900mm high x 550mm wide x 140mm deep
- ▶ flight bag/shoes/etc. stowage: 450mm high x 550mm wide x 300mm deep

B.3.10 A fixed safety mirror of at least 300mm x 200mm should be provided to aid dressing.

B.3.11 In-Flight Entertainment (IFE) outlets with independent controls should be provided for each resting seat

B.3.12 In two-occupant rest areas, light spill from IFE video screens, reading lights, personal electronic equipment, etc, should be screened to minimize inconvenience to the other occupant.

B.4 Sleep Area

B.4.1 A flight crew rest facility incorporating a sleep area should include space and fittings additional to those provided in a flight crew rest facility consisting of a rest area only. (Essentially, the addition of a sleep area to a flight crew rest facility should provide dedicated, horizontal sleeping surfaces in the form of beds or bunks in addition to the facilities provided in a rest area. See subsection A "Definitions").

B.4.2 A sleep area should include one or (at most) two sleeping surfaces. Dual occupancy of a flight crew rest facility is considered the maximum density acceptable.

B.4.3 A sufficient number of sleeping surfaces should be provided to accommodate the number of flight crew members off-duty at the same time.

B.4.4 Each sleeping surface should have minimum dimensions of 2000mm in length and 760mm in width.

B.4.5 Unencumbered space above each sleeping surface should be provided to permit easy access and upright sitting on a sleeping surface. Vertical clearance above each sleeping surface should be at least 1000mm in a zone extending from the head of the sleeping surface to at least 1000mm along the length of the sleeping surface and extending at least 300mm in from the edge. Figure 2 below illustrates sleeping surface minimum dimensions and minimum unencumbered space which should be provided above each sleeping surface.

B.4.6 Upholstery of sleeping surfaces should provide sufficient support and resilience to avoid complete compression of the upholstery at pressure points such as hips and shoulders. Although materials are not specified in this paper, it is suggested that mattress cores be made of a laminate of 80mm thick, high resilience polymer foam, with a top surface layer of 20mm tick, softer foam.

B.4.7 In sleep areas incorporating two sleeping surfaces in an over-and-under arrangement, unencumbered space above each sleeping surface should still be provided. Where vertical space is limited it is suggested that provision of such space might be achieved by longitudinal displacement or orthogonal orientation of sleeping surfaces.

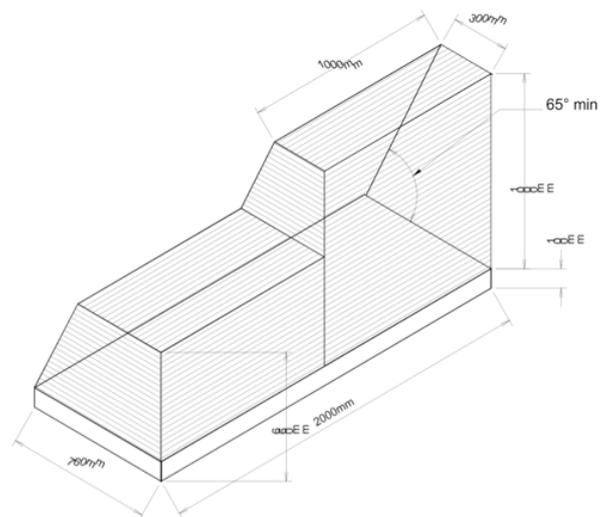


Figure 2. Sleeping surface minimum dimensions. Shaded space indicates minimum unencumbered space which should be provided above each sleeping surface.

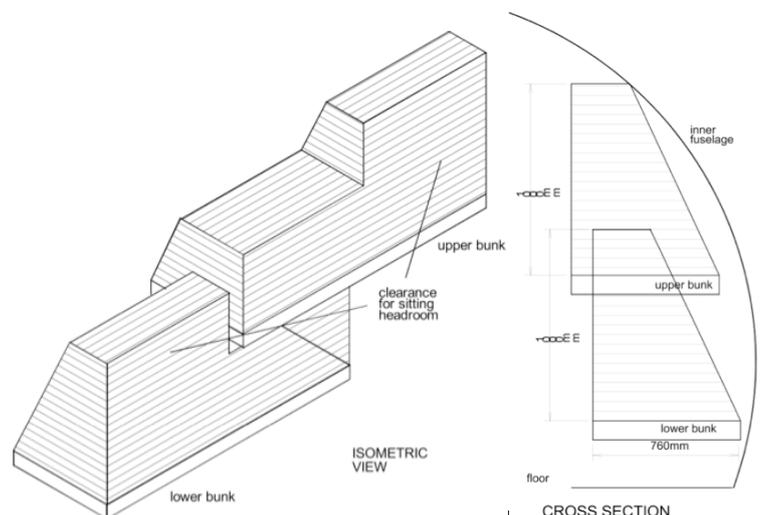


Figure 3. A possible arrangement for over-and-under bunks, preserving sitting headroom.

B.4.8 Sleeping surfaces should be configured to be as level as practicable during cruise. In some aircraft types the aircraft's cruise attitude differs significantly from its attitude on the ground.

B.4.9 Preferably, sleeping surfaces should be oriented longitudinally fore-and-aft. This recommendation is likely to be more critical in aft fuselage locations. Athwartships orientation in the aft fuselage may be subject to undesirable exposure to "z-axis" oscillations.

B.5 Privacy

B.5.1 In the interests of privacy (particularly with regard to mixed gender flight crews) as well as to facilitate sleep, single-occupant rest facilities are preferred to multiple-occupant facilities.

B.5.2 Entrance doors should have latches which prevent inadvertent access by passengers. A latching device requiring two simultaneous actions to operate is suggested.

B.5.3 A placard should be affixed to the entrance door to inform passengers that the door does not provide access to a toilet and should not be entered. Wording such as "Crew Only", or a sign intelligible irrespective of language, should be considered.

B.5.4 A lavatory dedicated for crew use only should be provided adjacent to, or in close proximity to, the flight crew rest facility. Optimally, this should form part of the rest facility complex and permit exclusive private access by occupants of the rest facility/flight deck. As a minimum requirement, access between rest facility and toilet should be screened to ensure privacy when entering and leaving.

B.5.5 If a flight crew rest facility includes more than one sleeping surface, provision should be made to ensure privacy for each individual occupant. For sleeping surfaces in an over-and-under arrangement, side curtains should be provided. For side-by-side sleeping surfaces a divider panel should be provided.

C - Environment

When off-duty from the flight deck, crews are still confined to the aircraft and its unnatural environment. Some measures are necessary to make a flight crew rest facility an environment conducive to recuperative sleep.

C.1 Lighting

C.1.1 A rest area should be provided with controllable (dimnable) general lighting.

C.1.2 Each sleeping surface and each resting seat should be provided with a reading light controllable for direction, focus, and intensity.

C.1.3 In two-occupant rest facilities, provision should be made to limit light spill between resting seats or sleeping surfaces.

C.1.4 Light spill from the environment external to the Flight Crew Rest Facility should be prevented.

C.2 Noise

(Noise level in flight crew rest facilities raises issues at two levels. The first relates to noise intensity appropriate for a sleep area. The second relates to its status within the context of total daily noise exposure. As duty periods lengthen, total daily noise exposure is a source of concern.

C.2.1 Background or ambient noise levels within a flight crew rest facility should not exceed 65dB(A) (see Notes). This is a high figure for any form of sleeping accommodation. In future, application of measures such as noise-cancelling technology may permit a reduction of this level.

C.2.2 The noise frequency spectrum should not contain peaks (or "tones") in narrow frequency bands which exceed the intensity of their surrounding frequencies by more than 5dB. A high level of background noise is more tolerable for sleeping if it is free of attention-engaging features.

C.2.3 Sources of transient and percussive noise outside a crew rest facility, such as doors, stowage bins, galleys, toilets, and public address speakers, should not produce sound levels within the flight crew rest facility which exceed the background noise level by more than 3dB(A).

C.2.4 Seals isolating a flight crew rest facility from the remainder of the aircraft interior should provide an effective noise barrier while permitting pressure equalization in the event of cabin depressurization.

Notes:

1. At a background noise level of 65dB(A), about half the general population would be expected to experience difficulty sleeping. Other factors, however, modify this expectation for flight crews. The constancy of background noise, its frequency spectrum characteristics, personal experience with a fragmented sleep regime, and habituation to the aircraft environment would be expected to

make this a more tolerable level for experienced crews than it is for the general population. Consequently, it may be reasonable to expect that fewer than half the population of flight crews would experience difficulty in sleeping in a rest facility with background noise at 65dB(A).

2. Examination of total daily noise exposure for flight crews indicates that, in long duty periods, total exposure may exceed levels which risk noise-induced hearing loss (>85dB(A)). At such high noise exposure levels, adverse cognitive and physiological effects also occur. These would be expected to impair flight crews' performance at their tasks. To help counter such effects of prolonged high noise exposure, periods of respite from noise during a duty period are advisable. Flight crew rest facilities should be capable of providing such respite periods. For them to be effective for this purpose, however, their noise levels should be substantially lower than they are currently. A noise level of 65dB(A) in rest facilities would be low enough to provide respite from the otherwise noisy work environment.

3. With future improvements in technologies of active noise cancelling, materials science and design, the 45 dB(A) level remains IFALPA's long term aim.

C.3 Vibration

C.3.1 The motion sickness generating potential of rest facilities in different locations within the aircraft should be assessed with particular regard to exposure to low frequency z-axis oscillations in the range 0.1Hz to 0.63Hz. Recommended "Comfort boundaries" for z-axis vibration acceleration within this frequency range can be found in References 1 and 2.

C.4 Micro-climate

C.4.1 Sufficient air flow should be provided to maintain a uniformly ventilated atmosphere. Air flow volume of 0.3 cubic meters per minute per occupant (0.3m³/min/occupant) should be the minimum provided. Air flow volume of 0.7 cubic meters per minute per occupant (0.7m³/min/occupant) is recommended.

C.4.2 Air should be positively exhausted from a rest facility rather than forced by inlet pressure.

C.4.3 Air flow should be free of drafts. Velocity of air passing over sleeping surfaces should not exceed 12 meters per minute (12m/min).

C.4.4 One gasper air supply nozzle should be provided for each sleeping surface. Gasper air flow should not exceed 8 litres per minute (8l/min).

C.4.5 Temperature should be within the range 18 - 23°C and be stable within $\pm 1.5^\circ\text{C}$.

C.4.6 It is recommended that, if possible, temperature within a rest facility should be adjustable by the occupant/s.

C.4.7 The temperature gradient between any two points within a flight crew rest facility (in operation, but without occupants) should not exceed 3 degrees Celsius per meter (3°C/m).

C.4.8 Relative humidity should be maintained at a level equivalent to that within the flight deck of the aircraft. A dedicated humidifier for the flight crew rest facility may be required to achieve this.

Note:

Not all aircraft flight decks are equipped with humidifiers. Where these are employed, flight decks have a relative humidity level higher than that in the passenger cabin. Moving to and from environments with markedly different relative humidity is not desirable when sleep is the aim.

C.5 Hygiene

C.5.1 Construction and fitting of rest facilities should avoid the use of materials which provide a harbour for pathogens. For example, low-grade acoustic shielding such as carpet applied to walls, should not be used.

C.5.2 Provisions should be made to ensure that flight crew rest facilities are maintained hygienically. Maintenance should be incorporated into the operator's routine hygiene operations.

C.5.3 Porous bedding materials such as pillow covers, sheets, blankets etc. should be laundered after each use.

C.5.4 Mattress covers should be removable for laundering.

D - Safety

D.1 No Smoking

D.1.1 As required by State of Registration regulations, if smoking is not permitted in the aircraft a smoke detector with central alarm (as installed in aircraft toilets) should be fitted.

D.1.2 Illuminated "No Smoking" signs, which may introduce unwanted lighting to a flight crew rest facility, should

not be used. Instead, non-illuminated “No Smoking” placards may be affixed in prominent visible positions.

D.2 Communications

D.2.1 Provisions should be made for a number of channels of communication with occupants of the flight crew rest facility. Because occupants may be sleeping - or awake but with visual attention diverted - auditory, rather than (or in addition to) visual alerting signals should be employed in establishing communication. Ideally, alerting signals should be configured as a differentiable set of pulsed “Patterson alarms” in an appropriate urgency hierarchy.

D.2.2 An auditory alarm should be provided to alert occupants of the need to return to the flight deck. The alarm should convey sufficient urgency to awaken a sleeping occupant. The suggested option is a distinct pulsed “Patterson alarm” with peak sound intensity at 1 metre of 10dB(A) above the level of background noise.

D.2.3 Activation of the “Fasten Seat Belts” alerting system in anticipation of turbulence or landing should activate an auditory alerting signal. The alerting signal should convey less urgency than the “Return to Flight Deck” alarm. The suggested option is a distinct pulsed “Patterson alarm” with a peak sound intensity at 1 metre of 6dB(A) above background noise level.

D.2.4 Consideration may be given to attenuation, via an interlock mechanism, of the “Fasten Seat Belts” alert if and only if personnel restraints and baggage restraints are engaged.

D.2.5 A two-way communication system between the flight deck and the rest facility should be provided. The auditory alerting signal for this communication system should convey less urgency than the “Fasten Seat Belts” alert. The suggested option is a distinct pulsed “Patterson alarm” with a peak sound intensity at 1 meter of 3dB(A) above background noise level.

D.2.6 The communication system should include provisions for communication from occupants of the flight crew rest area to the main flight attendant station.

D.2.7 The aircraft’s public address system should be such that routine passenger announcements are not fed to the flight crew rest facility.

D.3 Restraint

D.3.1 Each sleeping surface and each resting seat should be equipped with suitable approved lateral and vertical restraint systems.

D.3.2 Provisions should be made to secure the contents of stowage lockers for clothing and personal effects against turbulence in flight.

D.4 Access & Evacuation

D4.1 Entrance doors should be secured with suitable double-action latches to inhibit unauthorized access. To permit emergency access and evacuation it should not be possible to lock entrance doors. Keys should not be required to open entrance doors from either side.

D.4.2 Access through rest facility doorways should be unimpeded to permit assisted evacuation of incapacitated occupants. Assisted evacuation of a 95th percentile male should be demonstrable.

D.5 Emergency Equipment

D.5.1 “Drop-down” oxygen supply equipment should be provided for each sleeping surface and each resting seat.

D.5.2 Portable emergency equipment such as breathing equipment, fire extinguishers, fire gloves, and flashlight should be provided.

D.5.3 Emergency lighting should be provided.

E - Security

E.1 Flight crew rest facilities should be located adjacent to, but separate from the flight deck (para B.2.1).

E.2 Provisions should be made for a lavatory dedicated to flight crew use, adjacent to both the flight deck and the flight crew rest facility (or facilities), which can be screened from view by passengers when accessed from either area (flight deck or rest facility), and whose access is controllable by the flight crew. Ideally the screening mechanism should be a separate security door or at least a latchable privacy door.

E.3 Sufficient water should be stored on the flight deck and/or in the flight crew rest complex to facilitate the hydration needs of the operating flight crew for the maximum required diversion time in the event of an in-flight security event.

References.

1. AIPA-RS 001-1998 (Revised Jan 2012) – Rest Facilities for Flight Crew in Flight
2. AS 2670.1-2001 (ISO 2631/1-1997) - Evaluation of human exposure to whole body vibration. Part 1: General Requirements.
3. AS/NZS 1269.1:2005 - Occupational noise management. Part 1: Measurement and assessment of noise immission and exposure.
4. FAA AC 121-31 - Flight crew sleeping quarters and rest facilities.
5. SAE ARP1323 - Type measurements of aircraft interior sound pressure levels During Cruise.
6. SAE ARP4101/3 - Crew rest facilities
7. SAE ARP4245 - Quantities for description of the acoustical environment in the interior of aircraft.
8. SAE ARP4769 - Crew rest container for main deck or lower deck.