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PERCHANCE TO *Dream*

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Crew rest facilities assume critical importance when flights exceed 16 hours.

Crew rest facilities conducive to deep sleep, as on the Boeing 777-200LR, require caution about possible effects of sleep inertia, initial disorientation/ grogginess after waking.

Despite the difficulty researchers have in scientifically isolating the effects of crew rest facilities on quantity and quality of in-flight sleep from other aspects of alertness management, there is no debate about the importance of the sleeping environment. Crew rest facilities designed around guidelines from the 1990s for *long-range* operations, flights of 12 to 16 hours, have been accepted by the airline industry as a significant factor in counteracting fatigue. Since 2005, some airlines also have found that part of the guidance published for *ultra-long-range* (ULR) operations has the potential to improve pilots' and flight attendants' ability to obtain sleep on long-range flights as well. All ULR operations require optimizing time spent in crew rest facilities, protecting crew sleep from disruption except during emergencies and crew coordination to manage sleep inertia after in-flight rest.

Operating Singapore–New York flight sectors with the Airbus A340-500, Singapore Airlines averaged 18.5 hours flight time and 20.5 hours duty time when it set the precedent for ULR operations. The term means out-and-back flights between an approved city pair using a specific aircraft type with a defined departure window and planned flight-sector lengths, or block times, greater than 16 hours and flight-duty periods from 18 to 22 hours. Other airlines have planned or launched ULR operations under evolving regulatory oversight methods that focus on operations specifications for proposed city pairs rather than applying prescriptive rules to all airlines. For example, Delta Air Lines began using the Boeing 777-200ER and Air India began using the 777-200LR for daily New York–Mumbai operations in November 2006 and August 2007, respectively.

During a ULR flight, one captain — the pilot-in-command of the flight — and one first officer typically comprise the main crew. Another captain and another first officer, comprising the relief crew, alternate with the main crew in flight deck duty and in obtaining sleep during at least two precoordinated in-flight rest periods. Cabin crewmembers take rest similarly. Before and after ULR flights, pilots and flight attendants follow prescribed sleep schedules designed to enable them to be fully rested and alert before the next flight.

In 2005, the ULR Crew Alertness Steering Committee cosponsored by Airbus, Boeing Commercial Airplanes and Flight Safety Foundation — distilling consensus recommendations from specialists who participated in workshops over four years — said that a high priority in airline preparations for ULR flights should be to integrate fatigue risk management systems into safety management systems, with crew rest facilities as one of many elements.[1]

"Preventing degradation of crew alertness and performance during ULR flights involves issues beyond simply managing fatigue as practiced in current long-range operations," Capt. Dennis Dolan said in a letter (*ASW,* 8/06, p. 6) as president of the International Federation of Air Line Pilots' Associations (IFALPA). "IFALPA urges the promotion and adoption of the Flight Safety Foundation ULR Crew Alertness Steering Committee recommendations and guidance material to all regulatory agencies that will be providing the oversight that is necessary to maintain existing standards of safety during these longer range operations. A cautious approach is warranted until such time as a sufficient body of information is available from which to make more specific conclusions."

The steering committee postponed development of detailed recommendations to improve crew rest facilities — relative to existing specifications for long-range operations — pending discussions of proposed standards and recommended practices for fatigue risk management, scheduled for fall 2007 within the International Civil Aviation Organization.

For example, in the United States, the Federal Aviation Administration (FAA) advisory circular for crew rest was published in 1994 as one acceptable means of compliance with regulatory requirements for on-board sleeping quarters and rest facilities "for flight crewmembers to obtain sleep of adequate quality during flights scheduled for more than 12 hours during any 24 consecutive hours."[2] A related document used by many states — the aerospace recommended practice for crew rest facilities published by SAE Aerospace in 1992 — was reaffirmed by specialists with only format/editorial changes in December 2006.[3] The steering committee's *Ultra-long Range Crew Alertness Initiative – Recommended Guidelines* also specify crew rest facilities mostly comparable to those required for long-range operations. "Because on-board crew sleep is a critical factor in ULR operations, the quality of the crew rest facility is of paramount importance," these guidelines say.

In the FAA guidance, the key ideas are to provide enough separate sleeping surfaces for crewmembers taking simultaneous rest periods; adequate volumes of space for ingress/egress, changing clothes and sleeping with adequate privacy; minimum dimensions for each sleeping surface; physically isolating the crew rest facility "in a location where intrusive noise, odors and vibration have minimum effect on sleep"; designing the facility for a background noise level of 70 to 75 dB(A) during cruise flight; and ensuring that only relevant announcements via the public address system reach sleeping crews, such as notification of in-flight smoke/fire/fumes, aircraft depressurization or preparation for landing.

This guidance also says that airflow and temperature controls in the crew rest facility should provide "a uniformly well-ventilated atmosphere free from drafts, cold spots and temperature gradient." Occupant seat belts for each seat and bunk, illuminated signs that convey the on-duty captain's instructions to fasten seat belts, approved emergency oxygen equipment for the emergency descent after cabin depressurization and emergency lighting also are considered important equipment.

The SAE Aerospace recommended practices currently apply to "commercial transport aircraft capable of ultra long range operations with augmented/enlarged crew complement." Elements that go beyond the FAA guidance include optional inclusion of sleeping seats that meet SAE criteria as a flat horizontal sleeping surface; level sleeping surfaces during cruise; private access to a nearby lavatory; a method to bar entry of passengers; individual reading lights; smoke detector; consideration of humidification; an audible signal to summon sleeping crewmembers to the flight deck; nonintrusive intercom; and secure stowage so that crewmembers' carry-on bags, clothing and shoes cannot be dislodged by severe turbulence.

The steering committee's guidelines in part say, "Ideally, each resting pilot should have an individual sleeping compartment with facilities available to enable him or her to have a choice of a comfortable reclining seat or sleeping surface at all times. These facilities should be separated from the flight deck and not be positioned in the passenger cabin."

Research has focused in part on providing sound dampening, 16-g seats, adequate heating and ventilation, humidification systems, reading lights to minimize disturbance to sleeping occupants, vertical space and sleeping surface dimensions, handholds and other fall protection on stairs, and multiple emergency egress paths, according to Boeing.

Protecting In-Flight Sleep

Independent studies of early ULR flight operations found that the typical quantity and quality of sleep obtained by pilots, their alertness levels and their reaction-time performance were not less than those previously measured during long-range flights, the steering committee said.

In applying this guidance, and the initial requirements for ULR operations from its national civil aviation authority, Singapore Airlines has provided pilots a lie-flat bunk, a reclining seat when the bunk is stowed, temperature control, humidification and an in-flight entertainment system. Scientists found that the airline's pilots obtained, on average, total sleep lasting from about two hours 15 minutes to four hours within the maximum five-hour rest period. In diaries kept by crewmembers, turbulence was the most commonly cited factor disturbing sleep, mentioned in one-third of all entries.

An influential 1998 standard issued by the Australian and International Pilots Association gives resting pilots the choice of a private reclining seat or bunk at all times.

In early ULR operations, crews spotlighted heater failure — which can cause a crew rest facility to become cold-soaked — as a problem that can interfere severely with sleep if crewmembers have to be displaced to business-class seats in the cabin during ULR operations. Airlines similarly should be vigilant for humidifier failures and intrusive noise from loose equipment.

Wake-Up Calls

A U.S. voluntary safety reporting system contains examples of how some crews have handled problems involving a crew rest facility. In one, the captain designated as aircraft commander and one of the two first officers on a 777 were summoned from the crew rest facility to the flight deck during a long-range international sector. The captain later said, "Approximately three hours after takeoff … the on-duty flight deck crew observed fire and smoke coming from the lower right corner of the first officer's windscreen. The first officer [on duty] turned the window heat [to] 'OFF' for that pane while the captain [on duty] grabbed the Halon fire extinguisher. The flames subsided, and it was not necessary to discharge the extinguisher. … Residual smoke penetrated all areas of the cabin, crew rest areas and cockpit. I was notified of the event by the 'flight leader' (flight

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attendant in charge), and was told that we were diverting. My [first officer] and I entered the cockpit and put on our full-face oxygen mask [and] goggles. … A normal [overweight] landing was made with minimum sink rate."[4]

Emergency alert/communication systems and emergency egress procedures can come into play. "I received a report from a flight attendant in the aft crew rest area that he and two others had been awakened by fumes," said the captain of a 747-400. "He said the fumes had an electrical and/or sulfur-type smell. I secured the upper deck with additional [flight attendants positioned as guards and] sent the [pilot not flying (PNF)] to inspect and wake one of the pilots in the pilot crew rest area. … We were unable to determine the source of the fumes [in an electrical distribution panel or] eliminate the fumes from the cabin. … An emergency was declared and a timely diversion … was accomplished."[5]

Suspicion of a problem also has prompted immediate investigation of conditions in the crew rest facility. In one example, the captain of a 777 said, "Climbing through approximately Flight Level 230 [about 23,000 ft] we received [the engine indicating and crew alerting system] message 'SMOKE CREW REST F/D.' … [One] first officer went back to inspect the forward crew rest area and forward cabin. Shortly after she did so, we received a call from the purser that there was easily visible gray-white smoke in the forward cabin. … We were given a clearance to jettison fuel during descent [and diversion]. … A smooth, normal landing was achieved [and] passengers were advised to remain seated."[6]

Another example involved disrupting precoordinated sleep. The captain of a 777-200 sent the first officer to the crew rest facility because of suspected food poisoning 2.5 hours after departure on a trans-Atlantic flight. The first officer left and spent the following 90 minutes in the forward lavatory. The report said, "I … asked the [door 2L] flight attendant to wake the [PNF] first officer in the bunk and have her [return to duty] early. She returned to the cockpit within five to 10 minutes. The [ill] first officer spent most of the rest of the flight either in the lavatory or resting in the bunk."[7]

The steering committee encouraged airlines to ensure adequate training about sleep and alertness. Recurrent training also should cover emergency procedures and standard operating procedures for seat belt use in the crew rest facility and any rules on occupancy of the crew rest facility during taxi, takeoff and landing to reduce the risk of severe turbulence or other forces causing injuries.

"Interestingly, facility parameters such as the size of the crew rest facility, the size of the actual bunk and head space were rated, on average, as having little effect [either promoting or disrupting sleep]," one U.S. research team said. "Dark, quiet surroundings and a comfortable temperature and sleep surface are key elements for a sleep-conducive environment. … Finally, and perhaps most importantly, education can play a valuable role in maximizing the benefits of crew rest facilities."[8] ●

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The crew rest facility for flight attendants, as on the Airbus A340-500, has proven to be a key element of fatigue risk management systems.

Notes

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