

Ultra-long-range

PUSHING THE LIMIT

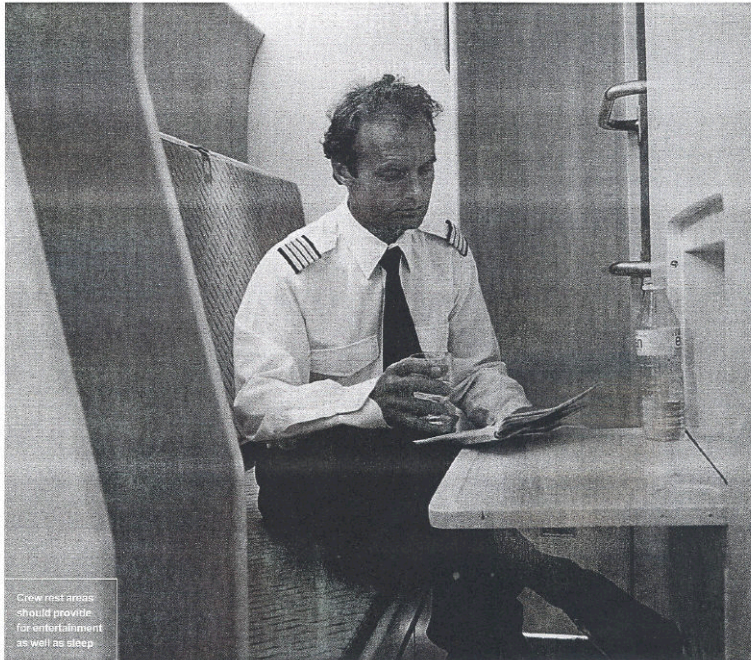
Flights lasting 16h or more bring their own problems for crews and passengers alike - but worries centre on tiredness and boredom rather than physical well-being

DAVID LEARMOUNT / LONDON

When Airbus and Boeing first promised airlines aircraft that would enable them to operate ultra-long-range (ULR) flights, the industry knew it had to work out a human factors strategy for flying them safely. Now, with a few thousand ULR flying hours under its belt, the industry has met for the first time to review whether its strategy was right.

The main problem was expected to be enabling crews to cope with the unprecedented long duty periods without suffering dangerous fatigue. The second was to make the experience as pleasant - or as bearable - as possible for passengers, and to determine if the long confinement in an aircraft cabin would constitute a threat to their health and well-being.

Procedures projected from existing knowledge and recent research were care-



Crew rest areas should provide for entertainment as well as sleep

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fully developed to enable the airlines and regulators to venture into this uncharted territory as safely as possible. Today, the ULR pioneers – Emirates and Singapore Airlines (SIA) with their Airbus A340-500s – appear to be finding that the carefully devised techniques and procedures work in practice.

On 3 February 2004, SIA set a new world distance record for commercial services, when one of its Airbus A340-500s flew non-stop from its Changi, Singapore base to Los Angeles airport. The 14h 42min flight covered a distance of 14,100km (7,600nm) – 1,000km further than the previous record (Hong Kong to New York Newark). The return leg, against the prevailing upper winds, took more than 18h. SIA then broke its own record with direct flights from Changi to Newark – a distance of 16,600km westbound and 15,800km eastbound – the flights taking about 18h in each direction.

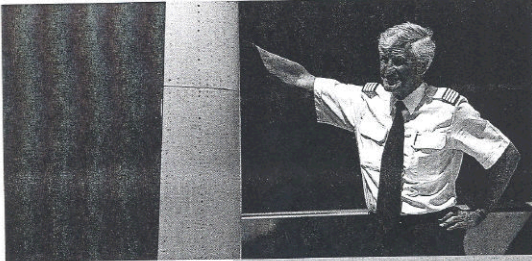
Fewer passengers

To ensure that passengers on these routes are comfortable, SIA has configured its A340-500s with just 181 seats, compared to Airbus's three-class specification of 313 seats. The airline offers two cabins: business (64 seats) and "executive economy". In the latter, seat pitch is a relatively generous 37in (94cm), and a two-three-two configuration enables seats to be wider than normal. Also, both cabins have a stand-up social area with a snack bar – not a "self-service alcohol bar", the carrier adds. The cabin-crew/passenger ratio is higher on the ULR services, SIA says, but that is mainly to allow for three or four of the crew to be taking a proper sleeping rest break at any given time during the flight.

It is the carefully monitored operating experience of SIA above all, with its particularly long routes, that has enabled the industry to assess its strategy. Last month, in Los Angeles, all the participants in the preparatory studies met to assess whether the system has been working. The answer, it was agreed, is that it has been. "The meeting was very successful...[we found] there was nothing significant that required change," is the initial reaction of Flight Safety Foundation (FSF) executive vice-president Bob Vandel.

It is still early days in operational terms, says Boeing's human factors scientist Dr Curt Graeber, with much work to be done before full validation of the scientific methodology can be claimed and mathematical models can be used with confidence to predict the optimum crew operating patterns for any given ULR sector.

In 2001 a ULR crew alertness steering committee (CASC) was assembled and co-ordinated by the FSF, with participation



"Work will be required to ensure ULR operations have a scientifically sound basis"

CREW ALERTNESS STEERING COMMITTEE

from the regulatory authorities and sponsorship by Airbus and Boeing, which both knew that they could not sell their ULR aircraft without a thorough procedural assessment of the new type of operation. The airframes and engines were not the unknown quantity: the effect of the longest sectors ever flown in commercial aviation on the people in the aircraft was.

The CASC developed a consensus for the operating model now in use. United Arab Emirates aviation authority GCAA and Singapore civil aviation authority CAAS have based their operating guidelines for the ULR pioneers on this consensus. But, the CASC has concluded: "Additional work will be required to ensure that ULR operations have a scientifically sound basis, and that the scientific community has sufficient funding to continue basic research, apply evolving knowledge, model flights, and monitor crew alertness and performance."

The number of flights operated since Emirates began its non-stop services from Dubai to Sydney and the USA, and SIA began serving first Los Angeles and later New York from Singapore, has not yet provided sufficient experience or data to constitute full validation. But the Los Angeles workshop review confirmed the industry is on the right track. "The in-flight studies confirmed that the sleep, alertness, and performance capability of the subject crews was no lower than that seen on long-haul trips lasting less than 16 hours flight time," Graeber says.

"The meeting was very successful," says Vandel, who has overseen the CASC from its outset. "We had approximately 90 representatives of airlines, regulatory authorities, research organisations and pilot unions. I think the most obvious result of the meeting was that we validated the result of the report of the Foundation published two years ago," he says, adding: "As with most documents, we were able with more science and a full year's experi-

ence to identify small areas [for potential improvement], but there was nothing significant that required change."

Out of the CASC studies and the pioneer airlines' practical ULR experience will also emerge a recommended model for what Vandel calls a fatigue risk management system (FRMS), which would apply not only to ULR flights.

Extending sectors

ULR operations are defined as flight sectors of 16h or more from gate to gate, which means flight and cabin crew duty times of at least 17h. Formation of the CASC in 2001 was the result of the airlines' and authorities' recognition that they had been extending sector times continuously through aviation's history without any fundamental changes to the ways of operating them, or of caring for passengers.

When the Boeing 747-400 entered service in 1989, followed by the A340 five years later, the longer sector capabilities of these aircraft called for measures such as augmenting the crew. An augmented crew can be two pilots plus a relief pilot who takes over to allow each operating pilot a rest period during the en-route sector, or alternatively two complete crews. But while the airlines had to satisfy their aviation authorities that they had taken measures to ensure that the operating crew had access to rest of sufficient duration and quality – including sleep – during

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the flight to ward off fatigue, there was no scientific review of the human factors relating to the increase in crew duty time, or to the effects on passenger welfare, despite the fact that both these types were capable of 15h sectors.

The CASC's formation was an acknowledgment that crew endurance had reached the limits of what was safe without a scientific review to determine how best to proceed. The single most significant finding to emerge from the CASC studies does not sound like rocket science: that the only means of improving crews' alertness and measurable performance during ultra-long operations was to enable the pilots to obtain high quality sleep in horizontal bunks during some stage of the flight.

Sleep quality

The studies recognised that the ability of individuals to sleep properly in on-board flightcrew rest areas varied considerably, and that even among those who found sleeping in the aircraft relatively easy, the quality of sleep was not as good as at home or in a hotel. One thing was certain, however: any sleep of any quality was better than none. It was also far more productive than other strategies like the use of caffeine, controlled napping, or training crews to be aware of their arousal state.

Based on the CASC conclusions, SIA

recommends its flightcrew have either one or two substantial rest breaks on their ULR sectors, with one allowing for a sleep of about 4h in specially designed crew accommodation. The accommodation includes a comfortable chair, entertainment system and proper bunk. Emirates has similar on-board crew rest facilities.

The Dubai-based airline's safety department has been reviewing feedback from the crews on long- and ultra-long flights, as well as input from its medical department. The carrier is providing summaries of crew feedback to the GCAA, with details of any action or changes implemented. SIA, meanwhile, is continuing a detailed study of crew fatigue and alertness on its ULR flights in conjunction with the European Committee for Aircrew Scheduling and Safety and New Zealand's Massey University. The latter was previously involved in a Boeing study into fatigue on 777 ferry flights with SIA pilots.

SIA has five A340-500s, even though it could operate its New York and Los Angeles services with four. This enables the carrier to roster its A340-500 crews to fly the aircraft on the relatively short Singapore to Djakarta, Indonesia route, ensuring better crew use and increasing the pilots' sector flying frequency, which keeps fundamental skills like take-off and landing sufficiently practised. This is

important because SIA's crews get four rest days either end of a ULR flight, although "one of those days on layover may include standby time in case, for example, a rostered crewmember goes sick", it says.

More work abroad

There is more work to be done, says Vandel. "As a result of this meeting we will be adding two sections in the next iteration of our FSF Digest on ULR," he says. "One will be a comprehensive review of the Singapore experience and the other will be the ULR workshop attendee's vision as to what should be included in a fatigue risk management system. We will develop and publish an FRMS guideline as we believe this should be an integral part of an airline's safety management system."

The ULR experience has lessons for airlines operating shorter routes, Vandel says. "Although this work was done with a specific focus on ULR operations, we are seeing a very definite trickle down to both long-range operations and short-sector operations," he says. "The principles laid out in our document have been used by one European low-cost carrier to improve pilot rostering within the company. Using these guidelines, that airline demonstrated improved alertness, improved pilot retention and at the same time reduced its insurance costs dramatically." ■

WELFARE

Are we there yet?: the passenger experience

Dr Annette Ruge of the UK Civil Aviation Authority's Aviation Health Unit, a member of the international team that worked on the ultra-long-range (ULR) studies, observes that for passengers, such a flight is "only 4h more" than services that have been in operation on popular routes for some time, and she is generally sanguine about passenger welfare and behaviour, even on the longest flights.

For passengers, the main problem posed by ultra-long routes is boredom and its side-effects, says Ruge, as opposed to threats to their physical well-being like deep vein thrombosis (DVT). She says healthy people do not face risks specific to the aviation environment, even on ULR flights.

Alibus bears out Ruge's assessment of the boredom issue, saying that in-service experience shows passengers clearly prefer non-stop journeys to flights with an en-route refuelling/crew-change break, but when they reach the

point where there is still about 2h to go they become restless. Passengers say they prefer non-stop ultra-long services to journeys with a break because they avoid the stresses associated with connecting flights and additional security procedures.

Old people, passengers with known medical problems and mothers with babies should seek the advice of a doctor before travelling on ultra-long or long-haul flights, Ruge advises. Because prolonged physical immobility is what makes long-haul flights unique, she says, airlines should make passengers aware of the need to exercise and limit alcohol and caffeine intake.

Passengers should be shown a video illustrating isometric exercises they can carry out in their seats. These exercises are effective, Ruge says. Travellers, like the crews, should have rest times, when the cabin is dimmed and activities like playing computer

games are banned. SIA says its ULR cabins are equipped to provide "mood lighting", which simulates night, day and dusk.

The threat of bad passenger behaviour does not appear to increase with the length of the flight, says Ruge. This aspect

has always needed skilled management by cabin crew, she says, and the additional time on board does not appear to introduce any new dimensions to the issue – although smokers will need plentiful supplies of palliatives such as nicotine patches.

Boredom is the passenger's greatest challenge

