



Occupational Stress in the Aircraft Cabin

Occupational demands, work environment and atmospheric conditions all contribute to the stress of the cabin crew member.

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by

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In a previous article (July/August 1991 *Cabin Crew Safety* Vol. 26 No. 4) the topic of stress in the aircraft cabin was discussed, and a classification of the ways in which stress can affect both passengers and cabin crews was presented. This was followed by a brief description of some of the stressors, including air pressure and air quality, and concluded with a short account of fear of flying. The present article addresses the issue of stress experienced by cabin crew members during the course of normal duties.

Under typical flight conditions, the cabin crew may be subject to stress that can be attributed to a number of sources. These include the quality of the air in the cabin, the working space and equipment used on board, the hours of work, and the social organizational aspects of the job.

Cabin Air Quality Must Be Kept Healthy

The confined spaces of the aircraft cabin must be well-ventilated to ensure the comfort and well-being of its occupants. In contrast to normal indoor air, cabin air is characterized by lower air pressure, lower oxygen partial pressure and lower relative humidity.

Air Pressure

As height increases above sea level, the pressure of the air decreases. The amount of oxygen in the air and, consequently, its partial pressure, (i.e., its contribution to total air pressure) also decrease with the result that there is less oxygen per breath. Oxygen is necessary to sustain

life and is utilized extensively by the eyes and the brain. The effects of reduced partial pressure of oxygen on the human body become more serious as altitude increases. There may be some decrement in night vision at 6,000 feet and negative effects on coordination and reaction time at 8,000 feet. Above 10,000 feet problems of vision, coordination and mental functioning become increasingly serious, and fatigue and lassitude become more apparent, until the limit of physiologically acceptable altitude is reached at approximately 20,000 feet.

Although aircraft fly at heights considerably higher than 10,000 feet, these harmful effects are minimized because the cabin is generally pressurized to an equivalent of about 6,000 feet. However, this does not mean that there are not effects from the change of pressure. The feelings of "bloating stomach" and swollen legs reported by the cabin crew are associated with carrying out physical work at reduced air pressure.

Humidity

The very cold air taken into the cabin at altitude contains less than one percent of moisture. To this is added the moisture generated by the occupants of the cabin by respiration, perspiration and any steam created by cooking food and boiling water. The air in the passenger cabin is much drier than indoor air at ground level.

The comfortable levels of relative humidity are about 40-45 percent in winter and 40-60 percent in summer. Few studies have been carried out to determine the relative humidity in aircraft, but the evidence indicates that it is low. For example, the modal level found in 48 Scandina-

vian Airways System (SAS) flights was 25 percent, with a range from 15 percent to 38 percent²; the relative humidity on one Lufthansa B-747 fell from 25 percent to 8.5 percent during flight³; and the computer model of air quality utilized by the U.S. National Research Council³ estimated a range from two percent to 23 percent.

Low levels of relative humidity lead to dry skin, dry eyes and dry mucous membranes in the nose and throat. Dry skin may lead to early aging effects; dryness of the eyes produces discomfort and it may cause particular problems for wearers of contact lenses which are not designed for use in dry air; dry mucous membranes in the respiratory tract may account for the observed increased susceptibility of cabin crew to upper respiratory tract infections such as colds and sore throats⁴.

Air Pollutants

At high altitudes, there is an increased concentration of ozone in the air and levels as high as 0.8 parts per million by volume (ppmv) have been reported in some aircraft³. Symptoms typical of ozone-toxicity have been reported three-to-four times more frequently by flight attendants in aircraft flying long distances at high altitudes than by those in aircraft flying short distances at lower altitudes. Because of the harmful effects of ozone (Table 1), the U.S. Federal Aviation Administration (FAA) has established a standard for maximum ozone levels in the cabin. This limits the ozone concentration levels to an average of 0.1 ppmv (parts per million by volume) with peaks of less than 0.25 ppmv.

Ozone affects the respiratory system and causes coughing, irritation of the throat, chest discomfort and difficulty in breathing. Eye discomfort has also been reported. These effects do not usually persist beyond four hours after exposure. However, further exposure to ozone within 48 hours tends to produce greater effects. Those who suffer from asthma appear vulnerable to more asthmatic attacks when exposed to increased levels of ozone. People who are active during exposure to ozone, and therefore breathing more air, are more vulnerable to its effects than people who are sedentary. Cabin crew members consequently suffer from the effects of ozone more than passengers.

The earth is continually bombarded by radiation from outer space. In addition, certain unstable substances such as radium and potassium-40 occur naturally in the earth's crust, and these provide additional sources of emissions. Industrial and medical processes add further quantities of radiation to the background levels to which we are continually subjected. At sea level, the cosmic and terrestrial sources contribute approximately equal amounts of radiation. The special problem associated with aviation derives from the dramatic increase in cos-

mic radiation levels at typical cruising altitudes.

Physicists have defined units, the curie and the rad, which measure, respectively, the level of emissive activity of a substance, and the amount of energy absorbed as radi-

**Table 1
Some Effects of Ozone**

Concentration (ppmv)	Effects
0.02	Smell detectable
0.10	Irritation in eyes, nose and throat
0.20	Strong smell
0.25	[FAA peak limit in cabin]
0.30	Difficulty in breathing
0.50	Nausea and headache
1.50	Severe coughing and excessive sputum
5.0	Stupefaction, risk of death

tion passes through matter. Since the deleterious effect of radiation upon the human body depends upon the nature of that radiation, a factor of quality, QF, is taken into account. If the absorbed energy, measured in rads, is multiplied by QF, we obtain a measure of dosage in rems, an abbreviation of "rads equivalent man."

Maximum permissible annual doses (MPD) recommended by the International Commission on Radiological Protection are 5,000 millirem (mrem) for radiation workers and 500 mrem for the general public. On the basis of data collected in the 1960s, it was estimated that the average annual dose for a person on the ground in the United States was 44 mrem from cosmic radiation and 40 mrem from terrestrial radiation, although by the mid-1970s this was considered to be an underestimate in respect to terrestrial sources³.

The effects of radiation, which include short- and long-term bodily effects as well as genetic damage, are cumulative over time. It is, therefore, important to take note of both dosage rate and period of exposure when assessing the acceptability of radiation hazards. Radiation causes cell destruction and cell damage. Those tissues in which cells are frequently replaced — for example, bone marrow — are more sensitive to the effects of radiation than organs with slower replacement — for example, the brain and the central nervous system. Thus, children are more sensitive than adults; and in the fetus, relatively small doses may cause leukemia, deformity or stillbirth.

Levels of cosmic radiation increase as altitude increases, thus creating a potential hazard for aviation personnel. Cabin crew members flying an average schedule could experience an increase in the annual radiation dose by 250 mrem. There is a greater hazard to those flying

frequently at very high altitudes, and a busy schedule on supersonic flights could result in an annual increase of up to 700 mrem.

The most widely-discussed air pollutant in the cabin is environmental tobacco smoke (ETS), a complex mixture of gases and particles of which nicotine and carbon monoxide are the major components. It is technically difficult to carry out studies of ETS in the aircraft cabin and much of the work has consisted of extrapolation from other studies. However, one study of cabin air carried out during 48 flights on passenger aircraft concluded that nicotine concentrations and carbon monoxide concentrations were about one-tenth of the limit for working environments set by OSHA (U.S. Occupational Safety and Health Administration)².

The quality of cabin air is the focus of numerous complaints by cabin crew members and it is possible that ETS may cause some annoyance among non-smokers. However, the symptoms attributed to ETS, such as eye discomfort, coughing and respiratory complaints, are those known also to be associated with ozone and low levels of humidity. Further study is required to order the measure the effects of ETS both in the aircraft cabin and elsewhere.

Carbon Dioxide

Carbon dioxide is a product of respiration. It occurs in the air in very small quantities, comprising about 0.03 percent by volume under normal conditions. Under conditions of inadequate ventilation, the level of carbon dioxide will increase and will cause occupants to feel increased discomfort, headache, drowsiness and general feelings of malaise. A small increase in carbon dioxide will cause an increase in the rate of respiration. This rate is doubled at concentrations of three percent³, which is the FAA limit for the concentration of carbon dioxide. As concentrations of carbon dioxide increase, breathing becomes increasingly difficult, and concentrations above five percent are potentially life-threatening. One study of cabin air that measured carbon dioxide concentrations during 48 flights reported that these concentrations were about 0.013 percent, which is four times the normal concentration level² at which no adverse health effects would be expected³.

Working Space and Equipment Can Impose Physical Stress

The flight attendant's job involves strenuous, physical work. The requirement to adopt awkward working pos-

tures, to lift heavy items and to push and pull loaded service carts contributes to the stress placed on cabin crew members. Some of this stress could be alleviated by the incorporation of data describing human dimensions and strength capabilities to the design of the working environment, even considering the constraints of space and weight within the aircraft cabin. In addition, the maintenance of equipment in good working condition can assist in the reduction of stress.

The consequences of a poorly-designed working environment are the various musculoskeletal disorders of which cabin crew members complain. These include increased fatigue and a greater likelihood of injuries such as cuts, bruises, burns and scalds.

On the ground, the domestic kitchen is the most dangerous place in the home because of the concentration there of activities involving heat and sharp implements. Simi-

larly, in an aircraft, the galley is the place where accidents and injuries such as burns, cuts and scalds are most likely to happen. The small size of the galley and the awkward postures that are required to work there increase the risk of these injuries.

The activities associated with food carts or service trolleys are physically demanding and can cause physical strain. More body strength is available for pushing movements compared with pulling, but often it is necessary to pull the cart and twist the body at the same time to look in the direction of the movement.

Repetitive strain injuries (RSI) is the term given to a number of different injuries that have only recently been recognized as occupational injuries. These injuries to arms, wrists and hands result from activities involving repetitive and twisting movements; they are painful and can be disabling. While research is being carried out to devise therapies for these injuries, including surgery, the only palliative recommended to date is complete rest⁵.

Sleep Disturbance and Deprivation Are Major Stressors

One of the major stressors experienced by those occupationally involved in flying is that of sleep deprivation and disturbance. (*Proceedings of the 43rd FSF International Air Safety Seminar*, November 1990, Rome, Italy: "Fatigue in Long-haul Operations; Sources and Solutions," and "Nature of Subtle Fatigue Effects in Long-haul Crews.") This is not confined to crew members on long-haul flights, but has also been reported by those involved in short-haul schedules who associate their sleep

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problems with early morning flights¹. There is some evidence to suggest that these problems increase, rather than decrease, with time on the job. Sleep difficulties may be associated with failure to sleep, with waking during the sleep period and failing to return to sleep again, and with waking before the end of the normal sleep period.

Many bodily processes operate on a cycle that corresponds to the period of the rotation of the earth. Sleep, digestion and elimination, as well as changes in body temperature, heart rate and kidney function are all subject to circadian (24-hour) rhythm. Other processes operate on cycles longer or shorter than 24 hours, such as the menstrual cycle of 28 days and some hormonal changes which have a ninety-minute cycle. The important role of cyclic processes in bodily functioning is becoming increasingly recognized. It has been shown, for example, that there is an optimum time in the menstrual cycle to undergo breast surgery and that there is a time-of-day factor in the administration of drugs to maximize their effectiveness.

There is also a rhythm in the level of performance of mental tasks which appears to reflect the rhythm of body temperature⁶. This typically rises to a peak at 2000-2100 hours during a normal day, and passes through a trough at 0400-0500 hours, after which a rapid rise occurs between 0800 and 1100 hours, followed by a more gradual rise until the evening peak (Figure 1). It has been suggested that accidents are more likely to occur during the trough in the early hours of the morning. Although anecdotal evidence appears to favor this view, it is very difficult to collect the necessary evidence to support a

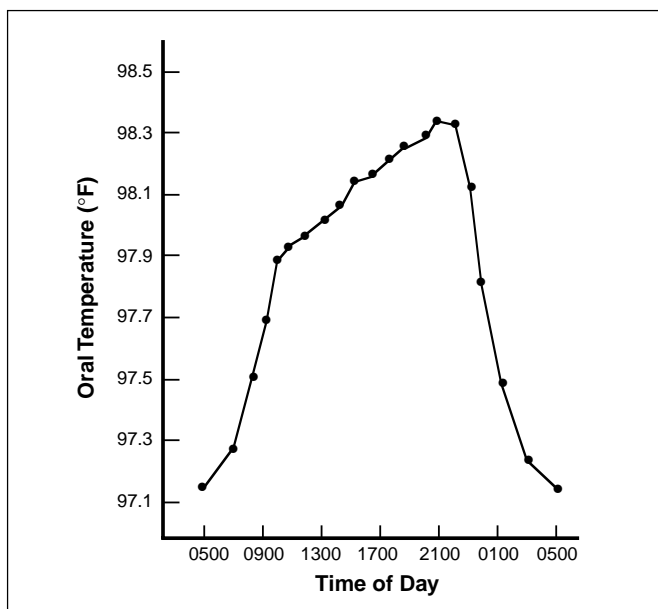


Figure 1

firm conclusion.

Work schedules that demand wakefulness when the body expects to be asleep lead to the disturbance of body rhythms with consequential digestive problems, menstrual irregularities, difficulties in keeping awake and general feelings of malaise. These schedules also require that sleep take place during periods of natural wakefulness. The difficulties in sleep experienced by many people in these circumstances result in sleep deprivation and consequent fatigue.

Efforts to keep awake when body rhythms expect sleep, such as by drinking strong coffee, will increase the difficulties later when sleep is attempted during a period of natural wakefulness. Attempts to induce sleep by the use of drugs or alcohol is inadvisable because these alter the normal sleep

pattern and can have deleterious effects after their use has been discontinued.

There is a wide range of individual differences in the response to the disturbance of body rhythms. Some people appear quite unaffected by "jet-lag" while others experience considerable malaise and feelings of distress. There are morning-active (M-type) people (larks) and evening-active (E-type) people (owls), and it is the latter who appear more flexible in adapting to shift work⁷.

It has been suggested that E-type people have a natural periodicity longer than 24 hours and continuously need to adapt to the standard 24-hour period, with the result that, under normal circumstances, they go to bed when they are not sleepy and get up when they are still tired. Such people are likely to cope more readily with nighttime activity.

The ability to nap also appears to be a personal characteristic. Those who are able to nap when the opportunity is offered find these brief periods of sleep highly restorative, while others find that the after-effects of a nap are more unpleasant than the feelings of fatigue which the short rest is intended to assuage.

The problem of disturbed sleep is a perennial one. The only complete solution, i.e., to ensure that all schedules permit crews to work only during daytime hours, is quite impractical (though some optimizing might be possible in some cases). The issue must be addressed by alleviating the symptoms as best as possible, while methods must be sought to help crew members sleep when sleep is scheduled.

It is unfortunate that drugs are considered by some persons as the only practical source of relief available⁸ to regulate sleep. Mild tranquilizers so frequently prescribed

during the past 20 years have now been shown to have deleterious long-term effects. In addition, the normal pattern of sleep in relation to the different stages of sleep is affected by these drugs.

The use of drugs prescribed for insomnia is not appropriate in cases where sleep problems arise from disturbed body rhythms. Alcohol has a sedative effect, but it is not recommended to induce sleep or relaxation. Although the time taken to fall asleep may be reduced, there may be increased incidence of waking later in the cycle and, in common with the tranquilizing drugs, alcohol alters the normal pattern of sleep.

Because the disadvantages of chemical methods of sleep induction outweigh their advantages, the search for practical and non-harmful methods has focused upon relaxation techniques. These include the various methods of inducing relaxation that are also used more generally to cope with the stressful events in daily working life.

Organizational Stress Can Raise Tension Level

There are many stressful aspects of the flight attendant's job which arise from organizational and social factors. These include isolation, work organization and the flight attendant's dual safety/service role.

Isolation

Compared with other types of employment, particularly those involving the time between 0900 hours and 1700 hours, the flight attendant is less able to maintain the sort of social contacts and activities which fit in with a ground-based job that involves regular daytime hours. Because leisure time cannot be scheduled very far in advance, the ability of the flight attendant to plan ahead is curtailed. It is difficult to make commitments to educational courses or other regularly-occurring activities.

There is also organizational isolation. The flight attendant may meet other members of the cabin crew for the first time at the beginning of a duty period. The group familiarization and work coordination processes develop during the period which they are all together (a day, or possibly a week) and then the group is disbanded.

At the next duty period, another crew is assembled, and the working-together processes begin again. For the senior flight attendant, the isolation may be particularly stressful as it is compounded by the requirement to maintain some social distance from the other cabin crew members.

Work Organization

Competition between airlines has led to a proliferation of services offered to passengers to attract their business. This has had the result of putting pressure on flight attendants on some flights, particularly short-hauls, where the amount of inflight service that is scheduled is greater than the time available to complete it at an acceptable pace. This time pressure can also encourage over-loading the service carts, with consequent exposure to the possibility of muscle damage. When the demands of the schedule also interact with less-than-optimum design of galleys and equipment, the total stress on the flight attendant is increased.

Tight schedules also impact the opportunities for cabin crew to take meal breaks. One survey¹ showed that more than half those questioned seldom had time for a meal break on board during short-haul flights, and that only one-third felt like eating a meal when the opportunity did become available. More than half of the respondents said they were seldom able to relax when they were eating on board. This pattern was repeated for meal stops; only 40 percent said they had adequate time to eat during meal stops, and less than 25 percent found that the time coincided with their desire to eat.

Dual Role

There are two elements in the flight attendant's job concerned, respectively, with safety and service. The safety aspect is highly regulated both in relation to the content of training of flight attendants and in relation to some of the activities they perform during flight, such as providing safety briefings. The function of the flight attendant in regulatory terms is to safeguard passengers by providing leadership in times of emergency and by competently managing potential hazards. The behavior appropriate to this role is necessarily authoritative and commanding. Because of the high levels of safety achieved in air transportation, this role is infrequently performed, and, therefore, flight attendants are rarely called upon to exercise the skills for which their statutory training has prepared them.

It is the service role which accounts for the greater part of flight attendant job performance and the one which is emphasized in recruiting advertising ("friendly, caring personalities") and in airline advertising. The content of service training is determined by the individual airline, and its duration may vary from a few weeks to a few months.

There is a certain tension between the service and safety roles which have implications for effective job perfor-

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mance. It may be difficult in any emergency for the flight attendant to switch from being a compliant, caring personality attending to passengers' needs, to being a commanding figure of authority whose directives must be obeyed. The potential for stress in this situation can be reduced if attention is given to the issue during training. The difficulty here is that service training and safety training are usually undertaken by different organizational functions, and coordination between them may be problematic.

Paradoxically, the dramatic switch of roles demanded by a serious emergency may, because it is a rare event, be less important in relation to stress than the continual need to ensure the priority of safety in less urgent situations. Examples would include dealing tactfully but firmly with passengers who insist on bringing large amounts of hand luggage into the cabin or with those, already intoxicated, who continue to demand alcoholic drinks. In these situations, it is not a complete switch of roles that is required, but an ability to take account of both safety needs and customer satisfaction in a way which does not compromise safety. This is not an easy matter for a flight attendant untrained to handle such conflicts. ♦

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Mary Edwards, Ph.D., graduated with honors in psychology from the University of Bristol, United Kingdom. Following research into organizational structure and function, she was awarded a Ph.D. from Loughborough University of Technology. She taught courses in business psychology and held an appointment as psychologist in a government program for occupational rehabilitation.

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