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Staying Safe during an Aircraft Depressurisation

Passenger Information Bulletin

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Infrastructure, Transport, Regional Development and Local Government.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction.

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Aircraft depressurisation events are rare, but they can occur with little or no warning. The faster you put on your oxygen mask, the better the chance that you will stay safe and remain capable of helping children and others. Reading this safety bulletin will help ensure that you can recognise and appropriately react to an aircraft depressurisation if one should occur.

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WHY ARE AIRCRAFT PRESSURISED?

Modern aircraft are designed to fly at high altitudes. (For example, large jet aircraft normally cruise at an altitude of 28,000 – 35,000 ft). This is because aircraft consume less fuel and can fly in relatively smooth air, avoiding bad weather and turbulence. However, the human body is not designed to survive at such high altitudes so the air pressure inside the cabin needs to be controlled.

The air pressure inside the cabin cannot be kept the same as the ambient air pressure at ground level as doing so would put excessive stress on the aircraft. Therefore, air pressure altitude inside the cabin (as measured by the equivalent outside altitude) gradually rises from takeoff to a maximum of 8,000 ft during the cruise. During the descent to the destination airport, the cabin pressure altitude is gradually reduced to match the ambient air pressure of the airport. Without a fully functional pressurised cabin, passengers and crew need to use oxygen systems at the altitudes typically attained during cruise (see Figure 1).

Figure 1: Passenger oxygen marks

WHAT IS DEPRESSURISATION?

Depressurisation, also called decompression, is the reduction of atmospheric pressure inside a contained space such as the cabin of a pressurised aircraft.

Boeing 737 loss of pressurisation

On 9 November 2005, a Boeing 737 aircraft operating from Sydney to Melbourne was cruising at 40,000 ft. After feeling an upset in the stomach and discomfort in the ears, the captain noticed that the cockpit instruments indicated the cabin was quickly depressurising.

The captain commenced an emergency descent to 10,000 ft where supplemental oxygen would not be required for breathing. He attempted to inform the cabin crew of the emergency descent but the announcement was not heard on the passenger address system in the cabin. Oxygen masks in the cabin fell from the overhead panels but not all passengers used them.

After descending for 11 minutes, the aircraft levelled off at 10,000 ft and the flight continued to Melbourne. There were no reported injuries to passengers or crew.

(ATSB Investigation Report 200505683)

Why can't we survive?

As aircraft climb higher into the air, atmospheric temperature and pressure fall, as does the amount of oxygen contained in the air. At an altitude of 18,000 ft, the temperature drops to -21ºC and air pressure is only half as much as it is at sea level. This means that when we take a breath at this altitude, we only breathe in half as much oxygen. At higher altitudes, conditions for human survival are even more challenging.

Depressurisation occurrences

The chances of a depressurisation problem occurring are very low, but it does happen. In the last 10 years[1], the ATSB has recorded 310 occurrences (including 124 from high capacity passenger aircraft[2]) where an aircraft pressurisation problem was cited. Although the depressurisations often occurred quickly, only two of those occurrences included evidence of a very fast or *rapid depressurisation* (a rate greater than 7,000 ft/min).

In the majority of cases, the pilots took some form of action such as descending the aircraft to a lower altitude. The deployment of oxygen masks was clearly identifiable in 57 of the 310 occurrences.

Boeing 747-400 depressurisation

On 25 July 2008, a Boeing 747-400 aircraft with 365 persons on board, departed Hong Kong on a scheduled flight to Melbourne.

Approximately 55 minutes into the flight, while the aircraft was cruising at 29,000 ft, a loud bang was heard by passengers and crew. This was followed by the rapid depressurisation of the cabin, during which time oxygen masks dropped from the overhead compartments. The pilots commenced a descent to 10,000 ft and diverted the aircraft to Manila. The aircraft landed safely.

(ATSB Preliminary Investigation Report AO-2008-053)

1 September 1998 to August 2008.

2 High capacity aircraft have more than 38 passenger seats.

WHAT CAN YOU DO?

If the oxygen masks drop, there is a pressurisation problem.

1. Put the nearest oxygen mask on immediately.

- Do not attempt to return to your seat.
- Do not wait for an announcement.
- Do not expect crew to help you, they will be dealing with the same problem you are.

If you feel worse immediately after putting your oxygen mask on, *do not take it off.* This condition is called the 'oxygen paradox', and is simply the body's reaction to a sudden intake of oxygen after being exposed to a lack of oxygen. You will only feel unwell for less than one minute.[3]

2. Help children and others only after you have put your oxygen mask on.

You may not have time to put a child's mask on and then put yours on before you become unconscious, so *put your mask on before* you help children and others with their masks.

Stay calm and breathe normally if you can. Hyperventilation and physical activity is not helpful, as more oxygen is required for the body to function.

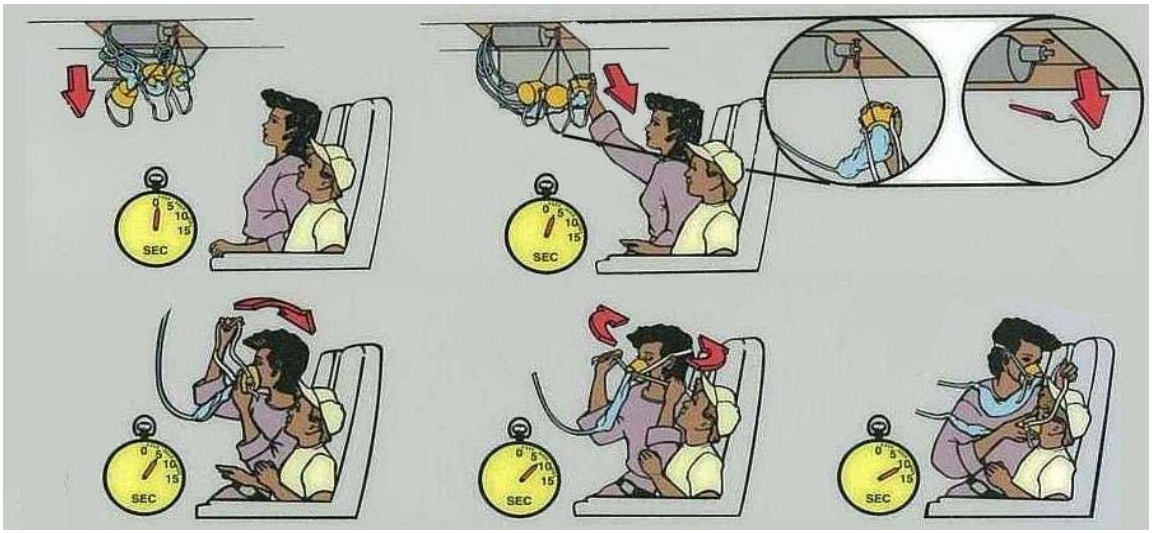
3. Fasten your seatbelt or secure yourself as best you can.

How do you use the oxygen mask?

An individual oxygen dispensing unit is required for every passenger and crew member on pressurised aircraft. There will generally be more oxygen units than there are passenger seats to account for infants. Passengers are usually provided with oxygen via oxygen masks stored above their seat and in the toilets. These masks usually have a yellow facial cup with elastic bands for securing the mask to the passenger's face. The mask typically has a reservoir bag, which collects *excess* oxygen while the user is exhaling.

3 Harding, R. M. (1999). Hypoxia and Hyperventilation. In Ernsting, J., Nicholson, A. N., & Rainford, D. J. (Eds). *Aviation Medicine* (3rd ed). Butterworth Heihemann: Oxford

Figure 2: An example of a passenger safety card showing how to use oxygen masks



The safety card in your seat pocket gives step-by-step instructions on how to use the oxygen mask. Figure 2 shows an example of an oxygen mask being used by a passenger. Once the oxygen masks drop, grab the one nearest to you, pull it sharply downwards to start the flow of oxygen, fit the mask and secure the strap behind your head.

Figure 3: Pull down mask to start the flow of oxygen

Do not be alarmed if the reservoir bag does not inflate. The reservoir bag may or may not inflate depending on the cabin pressure altitude and your breathing when oxygen is still flowing through the mask. The flow of oxygen to the mask is in a slow continuous stream, so you will not feel the oxygen blow out to your face.

It may be difficult to feel that oxygen is flowing. However, if you can breathe, then it is flowing. In addition, most masks have a flow indicator, such as a small green 'balloon' integrated into the reservoir bag or in the tubing.

WHAT WILL THE CREW DO?

When pilots notice that the aircraft is experiencing a pressurisation problem or a depressurisation, they will conduct a series of procedures. Pilots are trained and tested in relation to depressurisation and how to respond, so you are in safe hands.

The pilots are unlikely to make announcements as their main concern after fitting their own oxygen masks is to return the aircraft to a safe altitude where supplemental oxygen is no longer required.

Cabin crew will immediately put on the nearest oxygen mask and either place themselves in a seat and fasten the seat belt or secure themselves as best they can. Cabin crew may make an announcement but do not rely on it. If you see the oxygen masks drop – put one on straight away!

The cabin crew must look after their own safety first. If a crew member puts their own safety at risk and is injured, there will be one less trained safety professional who can assist passengers in need.

Once the aircraft is at a safe altitude, the crew will advise that it is safe to remove your mask. Cabin crew will begin using portable oxygen as they move through the cabin to assist passengers. This is because they have a higher oxygen need than those remaining seated. It is

important that you remain in your seat with your seatbelt fastened unless advised differently by the crew.

WHAT CAN HAPPEN TO YOU?

The chances of being injured in a depressurisation event are low. The key indication of a decompression is the dropping of oxygen masks from the ceiling.

Time of useful consciousness is the amount of time crew and passengers can continue to conduct duties and activities in an environment with inadequate oxygen. The time of useful consciousness is dependent on the pressure altitude inside the cabin following the depressurisation. This could be as little as 20 seconds at 40,000 feet. The actual time of useful consciousness may be shorter if you are exercising (do not attempt to run back to your seat) or for people who are smokers, are unfit, or have been drinking alcohol.

Some of the following signs and symptoms may also be evident but do not wait for them to occur before fitting your oxygen mask:

- light headedness or dizziness
- blurred vision and/or diminished hearing
- headache
- pain in the middle ear and sinuses
- discomfort or pain due to the pressure of gasses trapped in the body
- chilling of the body
- lips and finger tips turning blue.

Cracked windscreen

On 2 December 2005, a Boeing 737 cockpit window cracked while cruising at 37,000 ft which resulted in rapid changes in cabin pressure. Eleven of the 99 passengers sustained minor ear and/or nose injuries.

(ATSB Investigation report 200506298)

WHAT ELSE CAN YOU DO TO STAY SAFE?

1. Ensure you are fit to fly

Aircraft cabins are pressurised to an equivalent altitude of up to 8,000 ft. Most people can comfortably tolerate long-term exposure at this pressurisation level. However, if you are suffering from a medical condition such as heart disease, lung disease or anaemia, flying in a pressurised aircraft may increase your risk of injury, especially if a depressurisation event occurs.

2. Put your seat belt on, and keep it fastened when you are seated

Seat belts are not only critical to protect you from injuries in depressurisation events, they are a vital protection against injury in turbulence, wind shear and heavy landings. Always keep your seat belt fastened when seated.

3. Pay attention to the safety demonstration and any instructions given by the cabin crew

Although you may have seen the cabin safety demonstration many times, watching the safety demonstration every time you fly does help to refresh and reinforce important safety information so that you can react quickly in an emergency.

4. Read the safety information card in your seat pocket

The passenger safety card is provided to all passengers because it contains important safety information specific to the aircraft type you are flying on – you should read it *every time* you fly.

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