is to increase both fatigue and the psychological burden on the pilot. Then consider the perspective of the nonpilot passenger who is used to flying on the airlines where they can have a drink and breathe normally in a temperature-controlled, comfortable cabin. Let's face it; who wouldn't be at least mildly uncomfortable with the idea of having to wear an oxygen mask in such a strange environment?

Cabin pressure is maintained by "packing" air at a fairly constant flow through a sonic nozzle and then controlling the flow of air out of the cabin. Because there is already a constant flow of air out of the cabin through cracks, doors, window assemblies, and other leakage points, it is far easier to pump in more air than is necessary and maintain the desired cabin pressure by regulating the opening of an outflow valve. Initially, manufacturing capability made leak-tight cabins impossible, but over the years it has become evident that developing a leak-tight cabin is not only disproportionately expensive but may not be such a good idea anyway. The constant airflow keeps cabin air fresh.

FIXED ISOBARIC SYSTEMS

In the early days of general-aviation pressurization systems, a fixed isobaric system was used that consisted of a primary valve and a secondary, or safety, valve. The primary valve utilized an aneroid that was factory preset to maintain a given cabin altitude, typically 8000 feet. The safety valve, independent of the primary, was set to open under any one of three conditions: when the cabin experienced maximum delta p, negative delta p, or when the aircraft was sitting on the ground.

Maximum delta p represents how much cabin pressure is allowable relative to the lower, outside ambient air pressure. It is analogous to how far you can blow up a balloon safely. On start-up, once the engine is operating, there is some airflow into the cabin. As power is increased to takeoff, the inflow rate is sufficient to pressurize the cabin. The aircraft leaves the ground and climbs in an unpressurized mode with the valve open. Throughout this portion of the climb the cabin pressure parallels the outside ambient air pressure until it reaches the fixed set point of the aneroid. As the aircraft climbs through 8000 feet, the valve closes and maintains an 8000-foot cabin altitude even though the aircraft continues its ascent. The aircraft maximum altitude is limited only by the structural strength of the cabin—maximum delta p. If the aircraft continues to climb, the valve will open up as necessary to prevent the cabin pressure from exceeding maximum delta p. The effect under those conditions will be for the cabin altitude to climb above 8000 feet.

Negative delta p represents a situation where the outside air pressure is greater than the pressure inside the cabin. Negative pressure is, well, a negative situation, as the airframe structure is designed to contain pressure like a balloon rather than withstand outside pressure like a submarine. Negative delta p occurs when the aircraft descends faster than the valve can outflow cabin pressure, resulting in cabin pressure greater than ambient.

The third condition, when sitting on the ground, is important because if both valves remained closed on the ground there could be sufficient pressure to make it difficult to open cabin doors and/or emergency exit windows in an emergency.