Weighing the Risks of Hypoxia Training

Training sessions are a boon to aviation safety — but only when proper safeguards are applied.

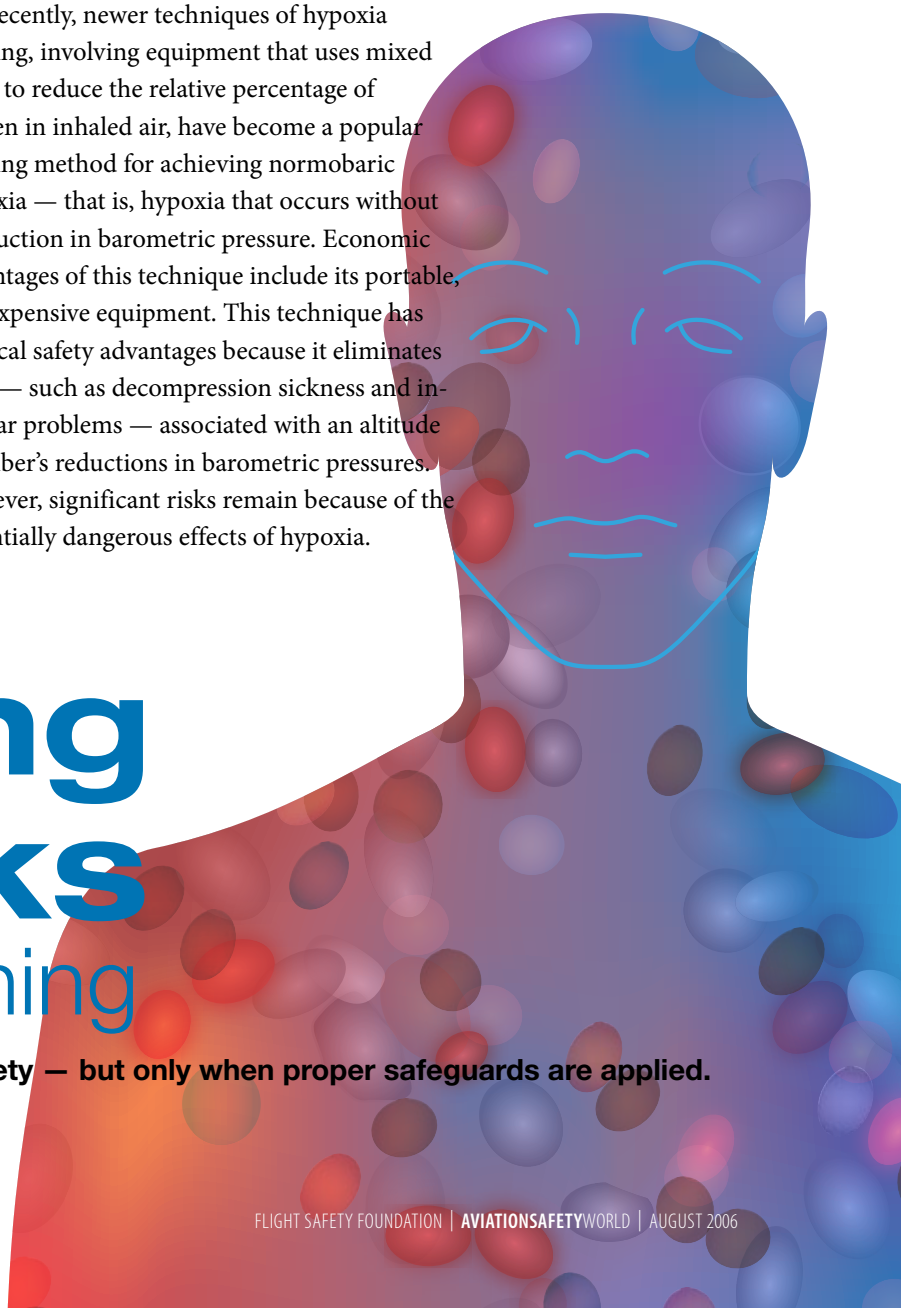
BY QUAY SNYDER, M.D.

Hypoxia remains a serious threat to aviation safety nearly 100 years after the first death in aviation attributed to this phenomenon. Training all flight crewmembers to recognize the early symptoms of hypoxia and take prompt corrective action is an essential component of any comprehensive aviation safety program. With the advent of very light jets and increased single-pilot high-altitude operations, this training takes on an even greater significance.

Hypoxia training is valuable if conducted safely, with appropriate participant screening, careful administration and pre-exposure education. If conducted without proper safeguards and participant education, however, hypoxia demonstrations can expose participants to career- and health-threatening risks without adequately training them in the prompt recognition and proper response to this insidious killer. When selecting training vendors, participants should exercise diligence in determining the safety and value of the training offered.

Until recently, hypoxia training was primarily conducted using hypobaric "altitude" chambers. These chambers have provided valuable experiences to flight crewmembers in the recognition of personal hypoxia symptoms, the subtle incapacitating effects of hypoxia and the unpleasant physiological effects of rapid decompression. Hypobaric training, which uses standard air composition at reduced barometric pressures, is associated with some medical risks because of the effects of trapped gases and brief exposures to hypoxia. To mitigate these risks, careful medical screening, in addition to the requirement that participants hold a current medical certificate or military flight authorization, is uniformly required. Medical monitoring with emergency equipment and/or an emergency medical treatment plan is standard. Additionally, detailed instructions are given to participants regarding restrictions on flying after training and the necessity of promptly reporting to medical authorities any unusual symptoms that occur as long as 12 to 48 hours after the training session.

Recently, newer techniques of hypoxia training, involving equipment that uses mixed gases to reduce the relative percentage of oxygen in inhaled air, have become a popular training method for achieving normobaric hypoxia — that is, hypoxia that occurs without a reduction in barometric pressure. Economic advantages of this technique include its portable, less expensive equipment. This technique has medical safety advantages because it eliminates risks — such as decompression sickness and inner ear problems — associated with an altitude chamber's reductions in barometric pressures. However, significant risks remain because of the potentially dangerous effects of hypoxia.



When administered with careful medical screening prior to exposing an individual to hypoxia, a normobaric hypoxia demonstration can be conducted safely, without compromising the effectiveness of the training. Combining the demonstration with simulator training increases the value of this training by showing the subtle — yet significant — incapacitating effects of early hypoxia. These effects become apparent very soon after exposure to hypoxia because of the complex cognitive tasks required to operate an aircraft simulator. As a result, there is no need for prolonged hypoxia exposure in an attempt to demonstrate more obvious cognitive defects, such as difficulty with writing, responding to simple questions and physical coordination, and physical changes, such as changes in skin color (cyanosis).

Upon the first recognition of any hypoxia symptoms, pilots should immediately take the appropriate corrective action (don an oxygen mask and select 100 percent oxygen flow). In flight, by the time physical symptoms are recognized, dangerous cognitive defects may already have jeopardized the pilot's ability to take the proper corrective action.

Providers of hypoxia training should carefully "screen out" potential students with pre-existing heart disease, carotid artery disease, peripheral vascular disease, seizure history, diabetic complications, anemia, recent surgery and many other conditions. Exacerbation of any of these conditions — with potentially serious medical consequences — is possible with hypoxic exposure. A medical response plan should be in place for complications experienced during training.

"Screen-in" medical criteria should include a current medical certificate and a pre-training health questionnaire to report interim medical conditions. Participants should sign an informed-consent form for the risks involved.

Participants in normobaric hypoxia demonstrations sometimes are monitored using pulse oximetry — a non-invasive method of estimating arterial oxygen concentration, often through a probe attached to a finger.[1] Unfortunately, research has shown that pulse oximetry does not adequately reflect the reduced oxygen concentrations in the blood of a hyperventilating and hypoxic person.[2] Using this tool as a safety method may provide a false sense of security.

Two key points determine the value of hypoxia training. First, the pilot must learn to recognize early signs of hypoxia. Second, the pilot must be taught to immediately take corrective action by donning an oxygen mask to rapidly clear those symptoms.

As an aerospace medicine physician engaged in the full-time practice and advocacy of aviation safety, I applaud the recent interest in hypoxia training for business aviation. Safety is enhanced by well-administered training programs. Nevertheless, programs administered in a cavalier fashion do not fulfill the goal of enhancing safety. Rather, they could put the valuable practice of hypoxia training at increased risk in the event of a medical disaster during a training program conducted without proper medical screening and administration. Furthermore, the true value of the training is compromised by a false sense of security derived from participating in inadequate training.

The optimum training for hypoxia using mixed gas breathing techniques should combine several elements:

- Instruction in the physiology of hypoxia and hyperventilation is critical for pilot education prior to experiencing the effects;
- Appropriate medical screening of participants is prudent from a liability perspective and required from an ethical perspective;
- Administration of the training should be conducted in a safe manner, highlighting the seriousness of hypoxia in aviation;
- Training should be directed toward early recognition and prompt corrective action when exposed to hypoxia;
- When possible, providing the training in a flight simulator allows for a more realistic demonstration of the subtle, dangerous effects of hypoxia and for practice of the desired learned behavior to correct the condition; and,
- Individuals and companies seeking hypoxia training should thoroughly investigate vendors for attention to participant safety and educational value in each program. ●

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Notes

1. Traditionally, pilots who undergo hypoxia training in hypobaric training chambers have not been monitored with pulse oximetry.
2. Ernsting, John. "Aeromedical Considerations for High Capacity Long-Haul Passenger Aircraft." Paper presented at the Airline Medical Directors Annual Scientific Meeting, Orlando, Florida, U.S., May 13, 2006.

Illustration: Susan Reed (FSF)