

# Investigating Hypoxia

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Photo by PH2 Bruce Trombecky

In the last 10 years, naval aviation recorded more than three dozen episodes of hypoxia, 12 of which involved the FA-18. Three of the Hornet episodes resulted in Class-A mishaps. In one instance, the first report of the mishap's scenario seemed peculiar: The aircraft crashed during a transit flight, leaving a crater, and the pilot did not eject. Before all the evidence was gathered and analyzed, the investigator's gut feeling had him thinking hypoxia was a factor. But gut feelings are not admissible, so what definitive evidence was available to indicate hypoxia as the cause? Here are some thoughts from the lead investigator:

**Aircraft history and maintenance.** Did the aircraft have recent problems with the LOX or OBOGS system, or the canopy seal? Have there been instances of the O<sub>2</sub> hose being stepped on or pinched? A review of the MAFs

will provide many answers; also, scrutinize pilot aviation life-support system (ALSS) history.

**Pilot history.** A review of the pilot's 72-hour history is critical. Pilots likely to succumb quickly to hypoxia are often fatigued and smokers.

**ATC tapes.** Radar tapes provided by the FAA, the Air Force's 84th Radar Evaluation Squadron (RADES), or ships, will give clues to aircraft maneuvers. Incapacitation and loss of control at high altitude generally result in the pilot flying a meandering course and altitude, followed by an uncorrected dive to impact.

**Pilot voice.** ATC voice recording, aircraft voice recorders, or wingman statements will provide evidence of the pilot's condition. Missed calls, slurred speech, slow vocal tempo, microphone-keying activity, and unresponsiveness to commands indicate hypoxia. The NTSB

provides the Naval Safety Center with expert voice analysis.

**Non-volatile data recorders.** An intact recorder can provide detailed information on control inputs (or the lack of), power manipulation, and warnings and cautions. Alone or matched with radar tapes, data recorders give dramatic insight to what was or was not occurring in the cockpit.

**Wreckage evidence.** You can expect aircraft fragmentation and many very small pieces at the crash site. A thorough sifting of dirt and collection of parts is required. In most cases, pieces will be unrecognizable, but even the smallest of identified pieces can provide evidence. For example, the position of the ejection handle or bleed-air-shutoff valves can provide useful clues.

The value of reporting physiological events cannot be overstated. Increasing awareness and improving training to counter the effects of events such as hypoxia are key to overcoming them. Share your experiences, report these events, and improve your awareness of physiologic events. For more information on aviation-mishap investigations, visit our website at: [www.safetycenter.navy.mil/aviation/investigations/](http://www.safetycenter.navy.mil/aviation/investigations/). 

Mr. Clark and Maj. Megown are investigators with the Naval Safety Center.

## Medical Investigation of Suspected Hypoxic Events

We do a very thorough job of investigating mishaps that involve fatalities. But, when it comes to physiologic events such as hypoxia, we sometimes drop the ball, particularly when the events don't result in a mishap or a fatality. Here are several medical considerations when investigating hypoxic events:

Encourage all aircrew to promptly report any suspected physiologic events. Events involving suspected problems such as oxygen-system contamination are time-critical, because the clinical evidence may be extremely short-lived. Make sure the involved aircraft and gear are "downed." It's easy to release the aircraft and gear if you determine further investigation isn't needed, but you may lose critical evidence if aircraft are re-used before you get to them. Besides, anyone who uses the aircraft or gear may be at risk. Have EIs performed on all suspect equipment.

Perform at least a focused history and physical examination on affected aircrew. Pay particular attention to the neurological and cognitive exams, but don't omit the cardiovascular and pulmonary systems, vital signs, and drug/supplement use history. Obtain a 12-lead electrocardiogram (ECG) and pulse oximetry. A chest X-ray is indicated if you suspect atelectasis or other lung disorders. Collect urine and venous blood samples from affected aircrew. Order a complete blood count (CBC) at the absolute minimum, but consider toxicological studies as well. Arterial blood gas (ABG) and carbon-monoxide level (smokers) tests may be indicated in some cases.

Contact the Naval Safety Center aeromedical division at 757 444-3520 ext. 7268 (DSN 564) for additional assistance.