F-22 Pilot's Death May Offer Clues In Hypoxia Mystery

Aviation Week

Lara Seligman

Capt. Jeff Haney was flying over Alaska in late 2010 when an engine bleed-air malfunction on his F-22Raptor caused the control system to shut off oxygen flow to his mask.

For the next 30 sec., Haney struggled to activate his emergency backup oxygen supply, seeming not to notice as his aircraft rolled into a steep dive. At the last second, Haney tried to pull up, but it was too late. He struck the ground going faster than the speed of sound and died on impact.

This is what U.S. Air Force accident investigators believe occurred on the night of Nov. 16, 2010. Haney, a promising young pilot assigned to the 525th Fighter Squadron at Joint Base Elmendorf-Richardson, Alaska, had just completed a routine training flight. Many aspects of the crash remain unexplained, including the cause of the malfunction that led Haney's oxygen system to shut down and the reason he did not pull up sooner.

Almost seven years later, the Air Force and U.S. Navy are struggling to understand why pilots across the fleet seem to be losing oxygen during flight in increasing numbers. A recent spike in hypoxia-like cockpit incidents, in which pilots report shortness of breath, disorientation, and tingling fingers, caused the Navy to ground the T-45 Goshawk training fleet in April, and the Air Force temporarily suspended F-35A flight operations at Luke AFB, Arizona, in June due to similar problems. Meanwhile, these so-called physiological episodes (PEs) are also on the rise in the Navy's F/A-18 fleet.

The issue is a complex one that the services have so far been unable to resolve. It is not even clear that what the pilots are experiencing is actually hypoxia—defined as an insufficient supply of oxygen—or something else that causes similar symptoms, such as a change in cabin pressure, contaminated air, or even too much oxygen. Investigators are looking into a range of

possible root causes, including a problem with the Onboard Oxygen Generation System (Obogs).

Further complicating the issue, there is often no common thread between incidents. Oxygen deprivation impacts each pilot differently, both physically and psychologically. Meanwhile, the problem crosses fleets, and each platform has a slightly different system for flowing breathing air to the pilot.

Still, Haney's death may offer guidance. It occurred in the midst of a spike in unexplained hypoxia-like events among Raptor pilots starting in 2008—much like the recurring incidents plaguing the T-45, F-35A and F-18 today. Several oxygen-related incidents at Elmendorf AFB led the Air Force to ground the Raptor fleet in May, 2011. Meanwhile, the cause of Haney's death remained unknown as investigators could not recover his aircraft until spring.

Then and now, the first place investigators went to find the root cause was the quality of the air flow through the Obogs, a complex system that essentially takes bleed air from the aircraft's engine, cools it, filters it, and feeds it into the pilot's regulator and mask. But though investigators "waterboarded the Obogs"—stripping down each component in search of a possible contaminant—they never found any toxin in sufficient quantity to negatively impact the pilot, according to one former defense official with knowledge of the investigation.

When investigators finally recovered Haney's Raptor, the aircraft data recorder showed the

Obogs was not to blame for the crash, according to the Accident Investigation Board (AIB) report. About a minute before impact, the aircraft's fire protection system detected a bleed air leak in the center bleed air ducting from both engines. In order to isolate the center bleed system, the aircraft's control system acted as designed, directing shutoff of oxygen flow to certain systems, including the Obogs.

At this point, Haney's breathing was severely restricted. At first, Haney maintained a relatively stable bank angle and attitude, the report said. But within about 10 sec., the pilot initiated a 240-deg. descending right roll at greater than 45 deg. per second, pointing the nose down. The Raptor continued diving for the next 15 sec. before the pilot attempted to recover by pulling aft on the stick, pulling up at 7.4g. It was too late—the aircraft hit the ground 3 sec. later.

The AIB concluded that Haney was to blame for his own death, determining that the accident's cause was the pilot's failure to initiate a timely recovery. But questions remain about those seconds in which Haney was not making an effort to correct the steep dive of his aircraft—the Pentagon Inspector General detailed several deficiencies in the AIB's findings in a February, 2013, report.

It is likely Haney spent that time struggling to activate his emergency oxygen, the AIB report concluded. That system, which was at the time an F-22 pilot's only resource in the event of an oxygen failure at high altitudes, was activated by pulling on a ring located inconveniently in the corner of the cockpit. This process is difficult even under controlled

circumstances, much less while the pilot is hurtling toward the ground, unable to breathe and wearing bulky cold-weather gear.

The Air Force eventually determined that the root cause of the spike in F-22 PEs collectively was not, in fact, contamination of the air, which would have implicated the Obogs. Rather, the problem came down to the supply of oxygen delivered to the pilots. Investigators found that Raptor pilots at high altitude were not getting enough air, due to a faulty valve in the upper pressure garment designed to inflate under high G forces to help counteract their effect. They found that the valve was causing the vest to inflate when it was not supposed to, restricting breathing.

The Air Force replaced the valve and the emergency oxygen system with an automatic backup oxygen system across the F-22 fleet. Still, then-Maj. Gen. Charles Lyon, director of operations at Air Combat Command, reminded Congress in a September 2012 hearing that fighter pilots will never be entirely rid of PEs.

"There will be physiological incidents in the future. The harsh high-altitude, high-G environment is extremely demanding, and our pilots are aware of those demands. We encounter physiological incidents in all high-performance aircraft—it is a fact of life—due to the demands placed on our air crew," Lyon said. "The Air Force will continue to leverage lessons learned throughout this investigative process, and will invest in characterizing and understanding the high-performance aircraft environment to optimize pilot performance, not only in the F-22 but in all current and future weapon systems."