Sauna in the Gulf

By LCdr. James C. Logsdon

As the safety officer, I had tasked many of the JOs to write *Approach* articles to share their learning experiences. After I returned from a "good deal" FCF, the JOs had returned the favor by tasking me (via the ready room white board) to write this article.

The Arabian Gulf becomes comfortable by early November. I was flying an FCF C in aircraft 300. The sky was clear and the typical Gulf haze was absent. The preflight, poststart checks and launch were uneventful. Immediately off the catapult, I noticed the electronic-control system (ECS) flow had increased in force and temperature. I continued the Case I departure, and checked the cabin-temperature set to full cold. I then selected ECS manual and saw another increase in flow. The air temperature was extremely hot—similar to jet exhaust on the flight deck. I reselected ECS to auto, and debated recovering immediately. I completed the cockpit-hot checklist to the step to secure the bleed air and eliminate the source of hot air. Considering the heat uncomfortable, but bearable for a 1+15 sortie, I chose to leave on the bleed air, and continue the FCF—I chose poorly.

On the climb-out, the cockpit was least uncomfortable when I ran the defog lever full forward. This setting directs the strong, hot airflow away from my torso, hands and arms, and toward my face and head (protected by the helmet, visor and mask). Selecting ECS to OFF/RAM and cabin pressure to RAM/DUMP

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did not eliminate the hot airflow, but did reduce it the most.

The FCF checks were uneventful and completed within 20 minutes after takeoff. I continued the cockpit-temperature-high checklist, which I had shelved earlier, and climbed toward the ship. I estimate the air pouring from the ECS ducts was at least 150 degrees (NATOPS states with ECS switch to manual, the air temperature from the ducts can reach 190 degrees). The cockpit was hot, and before I did anything else, the signal-data computer (SDC) failed. This failure eliminated aircraft-fuel-quantity indications and rendered inoperative the integrated fuel and engine indicator (IFEI), except for engine rpm and temperature. The multi-purpose-color display (MPCD) also failed, but I could get the horizontal-situation indicator (HSI) data on the digital-data (display) indicator (DDI).

I contacted a squadron representative and reported the SDC failure and the hot cockpit. He asked if I had tried ECS in manual. I replied, "Yes, but that gives me a strong, insanely hot airflow."

The rep missed the significance of my comment. With the rep's assistance, I completed the cockpit-temperature-hot checklist. The next step was to secure the engine-bleed air. I did as directed, and the rep arranged a pull-forward recovery. He was concerned about the lack of engine and fuel information available to me. With the bleed

Photo by PHAN D. Pastoriza

air secured, I noticed the hot air had stopped pouring into the cockpit. Soon, I would feel more uncomfortable; the airflow had caused my perspiration to evaporate, keeping me relatively cool. At least I was cooler than I soon would feel.

While I felt changes in cockpit airflow, I didn't realize I still had been breathing on-board-oxygen-generating-system (OBOGS) air for the last minute or so. I felt confused, and then felt my oxygen hose slightly collapse while I inhaled. It then struck me, I was at 17,000 feet with inoperative OBOGS. I shut off the OBOGS and initiated the emergency-oxygen source. The rep and I had missed the significance of securing the bleed air while above 10,000 feet. This obvious consequence is not mentioned in the NATOPS procedures in the PCL.

After I went on oxygen, I descended to 2,000 feet, and aligned myself for recovery. I removed my oxygen mask when below 10,000 feet, and left it off for the remainder of the flight. It took about 10 minutes for the ship to prepare a ready deck. Meanwhile, I had to dump fuel to reach my desired landing weight. But, without any fuel indications, I had to determine an alternative method to reach max trap. The solution was to dump fuel until the aircraft was at the appropriate airspeed for 34,000 pounds. Our concern was to make sure I didn't dump too much fuel. As I configured the aircraft for landing, I realized the cockpit, without airflow, was sweltering. I engaged radalt hold and automatic-throttle control (ATC), and then held the dump switch, while S-turning behind the ship at eight miles. I had to hold the dump switch because of the SDC failure.

As I adjusted gross weight, the LSOs called to ask about my malfunction. I told them of the SDC failure, and mentioned the cockpit was very hot. I was sweating profusely and watched my flight suit turn dark green. The rep, while monitoring tower, asked whether my situation was debilitating or just uncomfortable. I was very uncomfortable, but I had no idea what "debilitating" meant at that time. I still was functioning, so I replied, "Uncomfortable."

I finally reached 141 knots (the speed incorrectly calculated by the rep for on-speed was 142 knots—the actual value should have been 139 knots, as configured), and reported ready to come aboard. I didn't feel well. I aligned with the ILS azimuth, and pushed over to capture glide slope. I backed up myself on the appropriate altitudes during the approach, similar to a night approach. I checked the heads-up display (HUD) to see the DME, but when I saw 3.6, I thought the ILS must be inaccurate. I should've been level until 3 DME, yet I was on the glide slope—not realizing I tipped over at 2,000 feet vice 1,200 feet. I was confused. Since everything looked right on the approach, I discarded the information I couldn't process and continued.

My breathing was strange. My breaths were long, shallow puffs, which worried me, because I was not controlling my breathing. Combined with the confusion and increasing fatigue, I now fully realized I was *in extremis* just inside two miles from the ship. I quickly reviewed my landing checklist, and to my dismay, found I was at half flaps versus full. I selected full flaps and wondered what else I had missed. On-speed was now about 133 knots at full flaps, and I had significantly less fuel than I thought. I wasn't sure about my remaining fuel, but there was nothing to do now. I thought about telling my situation to paddles, but I couldn't figure out what to say; I was on my own. My peripheral vision had diminished, and I began to fixate.

I flew a reasonable pass, basically staring at the ball. Fortunately, lineup was solved during the approach and didn't significantly deviate. After trapping on the 3-wire, I thoroughly was confused and exhausted. I was directed out of the landing area, figured I still was functioning, and continued to taxi. It did not occur to me to raise the canopy to let in cool air, or request to be shut down where I trapped. Instead, I taxied to the bow and back to a parking spot. Once parked and secured, I raised the canopy. A maintenance technician tried to talk to me over ICS, but he later said I was unintelligible. I don't recall this event, but I do remember feeling cold as the canopy was raised. I shut down the aircraft and climbed down the ladder. I essentially collapsed on the flight deck, consumed my water bottle, and awaited medical attention. After a brief rest, I was escorted to medical for examination and given intravenous fluids. The docs said my fatigue and confusion were caused by hyperventilation. The hyperven-

tilation was the strange breathing I had during my approach; my body's last-ditch effort to cool itself. This hyperventilation accelerated the dehydration process, but, the heat was the biggest factor in my seriously deteriorated condition.

The hot cockpit air was caused by an ECS duct-seal leak. The net effect was incompletely conditioned bleed air from the engine had poured into the cockpit. The hot-ECS air had damaged the SDC. The multipurpose color display (MPCD) failed from overheating, but was undamaged.

I should have discontinued the flight and landed with an immediate recovery. Instead, I chose to weather the hot air and continue the FCF. I did not secure the bleed air, because doing so would require emergency oxygen (a fact forgotten just 20 minutes later). The FCF was completed, I headed back to the ship, and prepared to continue troubleshooting the hot air until recovery time. The result was an SDC failure, which compounded the hot-cabin temperature.

The rep was concerned with the SDC failure, and missed the significance of the hot-cabin temperature. It was the SDC failure that met his threshold for a pull-forward recovery. He noted the high cockpit temperature, and had assumed I would let him know if it really was bad. He had heard when I said that ECS-manual selection caused insanely hot air, but he thought nothing of it. Different people easily interpret words differently. My voice inflection did not give him any clues to my deteriorating state, despite his being alert for such cues, especially after my communication with the LSOs. By the time such inflection would have been obvious, I effectively was beyond communicating: busy on the approach.

We, as pilots, understand the effect of system degrades and malfunctions on aircraft performance. However, no such metrics exist for pilot degrades. Asking me how I was doing, in this case, was akin to asking someone drinking alcohol if they still are sober enough to drive. In both cases, judgment is compromised. It was difficult for me to convey my situation at first, because I did not recognize the seriousness, and later, because I was unable to find the words. When asked to choose between uncomfortable and debilitating, I could not choose between those two extremes, and chose the answer in between. This answer was reasonably interpreted as merely very uncomfortable, but not life threatening. Otherwise, the rep would have considered recommending the jettisoning of the canopy before I lost consciousness. A better metric would have been to ask me to describe my performance on a scale instead of two extremes—like on a scale from 1 to 10. I might have replied with more useful information.

The most serious situation was the rapid deterioration of my faculties. The total time from feeling relatively well to being *in extremis* was measured in minutes. I have no idea why I selected half flaps when dumping fuel. Perhaps my mental performance already had deteriorated. I'm glad I caught it, prevented a wave off or injury, and avoided damage to the arresting-gear crew and engine. Fortunately, the rep had arranged the pull forward well before I was in serious trouble.

LCdr. Logsdon flies with VFA-113.

Wow! Talk about living on the edge. This aviator is fortunate he made it back alive. Obviously, he was dealing with a number of physiological issues, such as heat, hyperventilation, dehydration, and altered mental state. Any one of these issues could have been incapacitating, but, when combined, could have made a recipe for a fatal disaster. This article is an excellent example of how rapidly a situation can fall apart, requiring immediate action by the pilot to keep a mishap from occurring.

Let's look at two of these issues. The first is hyperthermia. Exposure to hot cockpit temperatures because of a malfunctioning ECS, combined with protective clothing that allows little if any airflow to promote cooling, and with rapid water loss due to profuse sweating, was a prescription for a mishap. Although incapacitating hyperthermia is rare, even mild heat stress in a flight environment is enough to cause confusion, exacerbated fatigue, and increased susceptibility to other physical-stress concerns.

The second issue was hyperventilation. This bodily reaction is a result of low blood pressure or a low oxygen state. Unfortunately, with the body's quest to increase the available supply of oxygen by breathing faster, carbon dioxide is exhaled, bringing on another set of problems that can compound an already bad situation.—Aeromedical Division, Naval Safety Center.