Situational Awareness
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How Do You Spell HEFOE?

By Maj. Micah Curtsinger, USMC

How many fingers do you see? Do they mean what you think they mean? These were just a couple of unexpected questions facing us at the end of a busy week in the training command.

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It was Friday afternoon and time for some division training. The lead instructor pilot (IP) briefed the sortie in accordance with the Master Curriculum Guide and SOP. He discussed techniques and common mistakes for each maneuver. The lead covered the standard four-plane emergency scenarios and a few extras.

Before we launched, the flight lead's jet went down for hydraulics, so we developed a new plan. I had intended to fly an annual standardization check ride for a fellow IP as Dash 4. Now that I was the only IP with a division-leader designation in the flight, we assumed the lead. It made sense for the other IP to remain in the front cockpit, while I monitored from the trunk (backseat). With a student solo as Dash 2, and a dualed-up student and instructor as Dash 3, we now were a light division. I believe it's entirely possible the previous lead's extrasensory perception was working overtime and advised him to steer clear of the impending excitement.

The flight progressed normally in the MOA (military-operating area) just west of NAS Meridian. After one cycle of maneuvers, our solo took the Dash 3 position in right echelon parade. We gave a preparatory "speed and angels, standby for breakup and rendezvous" call, but we only heard a response from Dash 2. With all three IPs now looking at Dash 3, the lead repeated the call. Again, only Dash 2 responded.

Just as I was about to ask for a radio check, Dash 3 aggressively pulled acute of the entire formation. He began to flash frantic HEFOE signals as he pulled off his mask. Dash 2 was directed to cross under to the left side to balance the formation. The solo quickly drifted aft, while throwing frantic hand and arm signals and pointing to his mask.

Seemingly unable to "snuggle up" so he could deliver his hand signals, the solo started to drive acute and developed a slight descent, flashing more fingers as he passed us. The lead instructor and I concurred we saw a HEFOE signal with five fingers. With one last signal as he pointed to the deck, the solo was gone.

He overbanked his jet into and below the formation, and appeared to be performing a "split-s" to the deck.

"#%@&!, dude, we gotta go get him," was my immediate call over the ICS.

The lead IP detached Dash 2 high and left for the RTB, squawked "emergency," and performed our own "Stuka" roll-in to follow the solo. Pulling through nearly 70 degrees nose low, and maintaining a tac-wing position, we only could surmise the solo had lost his engine and was on his way to the ground. Our solo leveled off at 8,000 feet, and we set up about a mile in trail. The lead methodically coordinated our exit from the MOA and declared an emergency with Center. He only could advise Center we had a NORDO (no radio) wingman with an unknown emergency. As we joined on the solo, he passed us the lead. At this point, I recommended the lead IP handle ATC comms, while I worked with the solo to determine the nature of his problems.

The solo quickly drifted aft, while throwing frantic hand and arm signals and pointing to his mask.

His speedbrakes were out, so I gave him a signal to retract them. He shook off those instructions. I was unclear why he couldn't put his boards in, so I gave him a HEFOE signal and then the international signal for "What?"

Recall the title to this story, which also could have been, "How many different ways can you spell HEFOE?"

The solo again appeared to be showing HEFOE signals, this time with two fingers. I told the other IP the solo either had an engine or an electrical problem, but I couldn't be sure. He might have a hydraulic problem because he did not respond to the speedbrake signal, and he had first tried to get our attention by pointing at his mask.

With about 25 miles until we were overhead Navy McCain, we had some time to get a better picture of what might be wrong with his jet. We tried to use HEFOE signals during the RTB to have our solo check and report on his systems. All the visual communication and heads-down time greatly undermined his formation-flying skills, so we opted to put him into loose cruise and just set up for a NORDO straight-in. We did not need to add a midair to his list of problems.

A minute or two later, he was back with us, calling "Three's up."

HEFOE stands for:

H - hydraulic
E - electrical
F - fuel
O - oxygen
E - engine

He reported his jet was fine but that his communication cord/oxygen hose had become disconnected, and he had begun to feel hypoxic. We decided to take a full turn overhead before going out for a straight-in, to allow for a complete check of his aircraft. All systems were fine, and we flew an uneventful straight-in to a full stop.

Once on deck, we discovered the reasons for our student's anxiety and his actions. Our solo first encountered arestricted flow of oxygen while simultaneously losing radio comms. Soon, his O2 completely was unavailable, so he pulled the green ring to release 100 percent oxygen from the emergency bottle. This action failed to restore airflow. Unable to breathe through his mask, he removed it and felt dizzy, which he interpreted as hypoxia. His solution was to detach from the formation for an immediate descent. Of course, the flight was only operating at 14,000 feet MSL, which, for the T-45C, puts you just under 10,000 feet of cabin pressure. After a little straight and level flight at 8,000 feet, he soon felt better.

When asked about his first HEFOE signal, the one he gave just before breaking away from the flight, he thought he'd passed four fingers. The lead instructor and I were fairly certain we saw five fingers, but the student was flying very sucked at that point. After running him down at 8,000 feet and asking for another look at his HEFOE signal, he said he'd passed two fingers. He now was quite unsure of the correct number of fingers for oxygen. An engine

Photo by MCSN Kevin T. Murray, Jr.

problem (five fingers) could have explained the aggressive maneuvering, but an electrical problem (two fingers) was harder to correlate with the student's actions. Once communications were restored and all of us wound the eight-day clock a few times, things settled down for the full stop.

What were the lessons learned? HEFOE signals are meant to help your wingman help you. You must be in a position where they can be seen and, of course, you have to pass the correct signal. We advise students hand and arm signals are harder to see when given with a green glove on a green background of flight gear. Hand signals should be passed with the sky behind, when possible. Instructors are used to seeing one particular finger, but if you are NORDO with an aircraft-system failure, you need to make sure your wingman can see and count all fingers. Ready-room discussion revealed that some aircrew were taught to remember HEFOP, with a P for powerplants. This technique could reduce the chances of confusing electrical and engine problems, not that either applied in this instance.

Your systems knowledge is of equal importance. If you can't breathe from your primary hose, aren't getting any flow from a secondary source, and have no communications or sidetones, then you almost certainly have a bad connection. Likewise, be ready to use all that stuff we learned in flight physiology. At 14,000 feet and a cabin pressure of 9,000 to 10,000 feet, it was unlikely the student was feeling hypoxia but probably was hyperventilating. This condition results in a similar feeling, but is caused by a totally different event. I hope I won't put on a bat-turn, high G maneuver to get lower if I ever encounter a hypoxic moment. The last thing my body needs at that moment is to remove what little oxygen-rich blood I have in my brain.

Crew coordination has to occur inside a multiseat aircraft and between all members of the formation. We thought the crew resource management conducted in the lead aircraft was effective. The front cockpit instructor focused on aviating, navigating, and communicating with ATC, while I tried to identify the malfunction with the wingman. On the other hand, I should have stopped troubleshooting once the student flew his jet far enough out of position for his signals to be seen. The systems failure which faced our wingman was a disconnected hose and not a burning aircraft. At his experience level, without a major malfunction, it might have made more sense to set him up for a single-ship, straight-in recovery to reduce the chances of a midair. If you are the wingman, remember this rule: Aviate first!

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