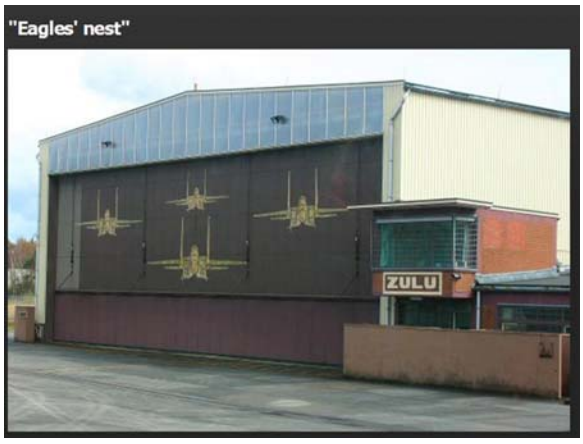
HRO Before We Knew It Was Called HRO

By David A. Christenson

Long before I knew that Karlene Roberts, PhD, at UC Berkeley would codify certain behaviors as High Reliability Organizing (HRO), we were using the principles in the early 1980's while trying to continually improve our system of maintaining, launching and recovering weapons-loaded F-15 Eagles at Soesterberg Airbase, in The Netherlands. This short article contains at least two examples of HRO implementation.

We were "Eagle Keepers," the crew chiefs that came together for a special tour at the alert barn as small teams of volunteers from the rest of the flight line where routine training operations were the day-to-day business of the 32nd Tactical Fighter Squadron Wolfhounds. The chosen few were assigned temporary 6 to 8-month tours to work the priority mission of the air base by quickly responding to aviation threats to North Atlantic Treaty Organization (NATO) forces by the air assets of the Warsaw Pact with real, not inert training, weapons. We were known as "The Queen's Own" and had the Dutch crown over the wolf designed by Disney, surrounded by oranges, the symbols of the House of Orange on our squadron's patch.

The mechanics on "alert duty" kept three birds ready to fly 24/7/365. Two birds were primary, on 5-minute alert, and one was a 15-minute backup. I had the privilege of serving the crew chiefs and the "Eagle Drivers," the pilots who flew America's air superiority jet fighters, in the position of Non-Commissioned Officer In Charge (NCOIC) of the Quick Reaction Alert-Interceptor Force (QRA-I), more commonly known in the fighter world as "Zulu Alert." It was a special place to be at an interesting time. One pilot described it as, "guarding 400,000 square miles of airspace from the commie hordes on the other side of the Iron Curtain."



F15 Eagle Escorting a Russian “Bear” Bomber Probing Our Defenses

1978 -1982 was my tour of duty at Camp New Amsterdam and a time of transition for the U.S. Air Forces in Europe. Fighter squadrons were upgrading to new aircraft. Ours was moving up from the F-4E to the F-15C/D at CNA. It was an opportunity to take a fresh look at everything and make our new operation shine from the ground up.

Most of us were accustomed to years of busting knuckles on the F-4, some of us on multiple models (F4-C/D/E and the RF4). We respectfully likened the Phantom’s aerodynamic qualities to “a flying brick,” referring to its glide path of 6-feet down for every 1-foot forward. We had learned about the ways these birds could literally eat a mechanic alive using the suction power of an engine intake if you got too close or by cycling electrical power as generators came on or dropped offline. You did not want to be “that guy” in the training film where at precisely the time a crew chief was attempting to remove before flight the centerline tank safety pin by reaching inside the Auxiliary Air Door it came slamming shut when power dropped to the stay open side of the actuator control mechanism. The razor edge of the door fitting into the airframe under 3,000 pounds per square inch of hydraulic pressure making the door close in a heartbeat would take your arm off quite neatly. “Don’t be that guy,” was sage advice. Clear communications with the pilot running the engines were more than a little important, especially at certain times.

The Eagle also had 2 jet engines, but each of them could produce 25,000 pounds of thrust and we'd heard it could literally stand on its tail and climb like a rocket with a 1.1:1 thrust to weight ratio. On the ground the even larger intakes could still eat you whole, but more likely chose to do it a piece at a time with what we affectionately called "Eagle Bites" from sharp drain tubes, open doors, and, when loaded, sharp missile fins while you moved around just a little too quickly underneath during a Zulu Alert launch. The system was filled with potential to become a disaster. Four medium range radar-guided missiles, four short-range infra-red heat-seeking missiles, nearly 1000 rounds of 20 millimeter diameter high incendiary explosive gattling gun ammunition were loaded on each aircraft filled with jet fuel. A spark of static electricity during a refueling operation could ruin everybody's day. Shaving seconds off of launch and recovery times had to be well thought out. Contingency plans needed to be practiced many times as new crews came on duty. The most common was the need to move a pilot from a broken bird scrambling on primary alert to the backup bird when the need arose. The unusual event where a mechanic went down due to an injury was also cross-trained for. We tried to be sensitive to the many ways that anything could go wrong to slow us down, and tried to imagine the terribly wrong event that could take us out.

Standard Zulu Alert Operations

We usually scrambled the birds at least once every 24-hour shift. The klaxon would blare in the hallway of the crew quarters at any time, day or night. If you were unlucky enough to be in the hallway below the horns, the sound could almost shake you to your knees. The Drivers would jump in their cockpits and spin the engines up. The Keepers would pull covers, pins and chalks all the while looking for telltale signs of trouble like the small fuel or hydraulic leak. A short taxi out of the barn to the active runway, and both birds lit afterburners to blast with enough force to push one firmly back into the ejection seat, to nose rotation, airborne, to the "gear up and locked" moment that wheels retracted up to clean up the drag points, all in less than 5 minutes from the klaxon, usually much less.

Addressing Routine Processes

It was an exciting place to work when you were busy. But things could become routine, and even slow, creating opportunities for carelessness. We often used slack time to drill, but even so, some things you just did every day so people just figured nothing's changed. The preflight inspection was something that every crew chief did every day before your bird flew out on the flightline and every morning in the alert barn. The Keepers going off shift would preflight their birds before the new crew chiefs came on every day. They had already done a post-flight inspection after the bird had flown during their tour and would

sometimes assume that everything was still “good to go” as they walked through the preflight the next morning. They knew that some things you just had to check, but most of the conditions would be stable. Even though the birds had just been preflighted, I asked the fresh on-coming crew chiefs to go through the preflight checklist again before they did anything else. It paid off several times when fresh eyes caught something that others missed. One was a “show stopper.”

Out on the flightline, the crew chiefs would set all of the switches and knobs to off or neutral during the post flight inspection and ensure that condition in the cockpit during the next preflight inspection before a pilot arrived. But in the alert barn all of the cockpit switches, and knobs had been set by the pilot driving the bird into the barn to be dialed in for rapid response launch before he shut the engines down. The pilots only had to change out their gear, but everything was set to the “go” configuration. The crew chiefs had squawked about the double preflight inspections, until an oncoming crew chief found all of his bird’s switches dialed to neutral and off one morning. The mindless actions of the off-going crew chief defaulted to his flightline routines and he was already “mentally off duty” as he set his bird up for shift change. The discovery required that the bird be called in as “down off alert status” and the on-coming pilot run his gear over to the backup bird in the revetment beside the alert barn to get back up on 5-minute status. A third pilot had to be called out to crank up the original aircraft to reset all of the systems for alert duty once more. This downtime had to be reported and explained through higher headquarters so the additional attention was not initially welcome. That is, until they found out that our additional attention to addressing the potential problems inherent in routine preflight processes had discovered and mitigated a serious delay for an actual alert response. People began to ask what else we were doing to avoid delays and continuously improve our system.

Normalization of Deviance

I had heard pilots discussing how that they would likely only have one opportunity to fire a “live” radar guided AIM7-F Sparrow missile at a drone during a training mission in their entire careers. They were so expensive that firing more that one was just not considered a reasonable use of tax payer dollars. Some had experience with live fire of these missiles at real targets flying F-4’s in the Vietnam War. They told stories about how every once-in-awhile they would lock onto a target and launch the missile off of its station on the aircraft, only to have the rocket motor fail to ignite. The pilot would soon realize that he’d need to re-acquire the target with a second missile because the first $125,000 investment was falling to the ground like a 12-foot tubular version of a 500 pound rock with fins.

During recovery of the Zulu aircraft we marshaled them to face a high dirt berm to safe up their missiles before bringing them into the barn for refueling and post-flight inspection. The radar-guided missiles had a hex-shaped pin that inserted into the rocket motor and rotated from the armed to the safe position. I noticed that one of the rocket motors had already rotated to the safe position during flight!

I began to look for this safed condition on the next several launches and confirmed that it happened again several times on different missiles and aircraft over the next few weeks. I asked the crew chiefs if they ever had to rotate the arm/safe mechanism after flight in order to be able to completely insert the rocket motor safing tool. Several said yes, but hadn't thought much about it as it only happened once-in-awhile and their focus had been on doing the safing quickly in order to get the birds into the barn to refuel and rearm to get them back up on status. Their attention was on shaving off seconds of their aircraft's recovery time, not on what was happening to the missile's rocket motor.

This explained how a rocket motor would fail to work. Vibration during flight would occasionally rotate it from armed to safe so it could not fire! I notified the Raytheon representative and a week later the arm/safe tool was redesigned to fly with the missile instead of being removed before flight, folded back inline with the missile's body when in the armed position so that the mechanism could not move to safe on its own.

The entire US Air Force, Navy, Marine Corps and several of our allies used the Aim7-F Sparrow at that time. Had we gone to war before the fix, I estimated that 5 to 10 % might not have worked at all! That may sound like a small percentage to some. And others might note that there were three more to choose from. But to the NATO pilot, if a rocket motor failure happened to his first missile while 15 to 16 miles out from his target and his F-15 Eagle is in a classic head on maneuver with a MIG-25 with a closing speed four times the speed of sound, it may likely be his last few seconds in the air. He "<u>might</u>" have a second chance to get off a different missile, but the hesitation would likely prove deadly because he is now in range of Ivan's version of the beyond visual range air-to-air missile. And the rocket motor inside his first missile will fire up just fine. Very reliable.

Lessons available from these two stories include:

- Be wary of the routines in your systems. They can harbor a drift into complacency and mindless behaviors. Identify them and set up ways to eliminate them. A fresh pair of eyes could save you a lot of grief at precisely the worst time.
- Carefully observe, even do, the activities of others in your system, in order to learn what they are focused on and possibly not seeing as a result. Maybe you are a person with many years of experience. Go back to refresh your memory and look at what others question or are unaware of because they don't question. Different perspectives can illuminate potential problems. Goal orientation and fixation can also obscure real issues.

Note: The 32nd TFS was awarded the Hughes Trophy for Managerial Excellence twice, two years in a row during this period. Twice was unprecedented in the 38 year history of the trophy, much less in years back-to-back.

YouTube Video: The 32 TFS Wolfhounds in the 1980's
http://www.youtube.com/watch?v=VLIcUCY_BM4

YouTube Video: The Final Scramble of the Bitburg AB Zulu Alert's F-15s in 1994
http://www.youtube.com/watch?v=evEwvGm6LlE

About the author of this article:
David Christenson was recommended for promotion to Master Sergeant under the Stripes To Exceptional Performers (STEP) program ahead of his peers in the US Air Forces in Europe (USAFE) Command. He returned to the United States in 1982 and attended New Mexico State University 1991 through 2000 earning his Bachelors of Science Degree in Regional & City Planning and a Masters of Applied Geography Degree, both with honors, from New Mexico State University. He currently teaches Organizational Learning and High Reliability Organizing in the interagency wildland fire community and coaches OL/HRO for incident management teams as the Assistant Center Manager of the US Wildland Fire Lessons Learned Center out of the National Advanced Fire & Resources Institute in Tucson, Arizona. He has spoken in an official capacity on the subjects of OL/HRO in Spain and France in 2007, Greece in 2008, and is scheduled to do so again in Sweden during 2009.

Dave Christenson in Mann Gulch 2007