Flight Test *Safety* Fact

Published for the Flight Test Safety Committee

Letter to the Editor - Pete Winters

On the fateful day when the YF-16 took its first flight, "Pete" Winters watched from the control tower at Edwards AFB, where he was the Supervisor of Flying (SOF). No SOF wants that to happen on his watch, but fortunately, this wasn't Pete's first rodeo: "I ejected during the F-111 high AOA program in 1972, many years after the aircraft had been in service, in combat in Vietnam. The pylon lug pictured is the largest piece of debris from the airplane after it struck the ground at over 500 kts with nearly 30,000 lbs of fuel." He responded last month to share a chapter of his story, one that history shows is rich with experience. "The F-111 was meant to be the 'do-all fighter' when in fact, it was a medium bomber. The test program never changed to reflect the actual mission. This 'mission drift' resulted in two lost aircraft. The first occurred during gun testing in a 2g turn at 30,000 ft. The capsule chute failed to deploy and killed both crew members. The second was a loss of aircraft in spin testing with successful capsule ejection. This was the first ejection after the capsule ejection system had been re-engineered. A new anti-spin system had already been engineered and proved in test flights six months after the loss of the first aircraft. We also evaluated supersonic failure of beta limiting system—the aircraft almost went into roll/yaw coupling with augmentation off at Mach 1.6. I flew this test and refused to go to Mach 1.8 to see what it would do there. Any aerodynamics professor or test pilot can tell you that if you go fast enough an aircraft will roll/yaw couple unless it has a damping system or other protection. Finally, we also did nuclear weapons delivery envelope expansion: I performed a dive at 1.3M to level at 1000 ft MSL and decelerate to to 1.2M while opening the bomb bay to release the weapon at the right speed. (I don't know how a tactical pilot could ever reach these conditions.) Norm Suits flew the 1.6M release. At all supersonic releases the bomb tended to fly formation with the airplane as it dropped through the supersonic shock wave. On Norm's drop, the bomb decided to fly close formation and struck the fuselage just missing the horizontal. The bottom line from these examples: Test plans and objectives should be re-examined throughout the test program and adjusted for the real mission and risks." *Charles "Pete" Winters*

Flight Test Safety Committee

Tom Huff, Chairman chairman@flighttestsafety.org
Society of Flight Test Engineers edir@sfte.org
Society of Experimental Test Pilots setp@setp.org
Contact *Flight Test Safety Fact*
Mark Jones Jr, mark@flighttestfact.com

scalpels not spears

In his book *Great at Work*, Morten Hansen coined the phrase "fight then unite" to describe a constructive interpersonal/team dynamic he identified in high performing groups: Conflict.

Conflict can be healthy. Furthermore, lack of conflict may suggest unhealthy norms or behaviors like group think. Conflict is familiar to most in the flight test community. Those with a military background recognize Red Flag and wargaming as two of countless examples of healthy conflict. Others may have heard of "Red Teaming," and the phrase "blameless postmortem" is a term from the design thinking vernacular with similar meaning. These all suggest that conflict can be good when they contribute to stronger discourse and, ultimately, better solutions. You will see different opinions in these pages. Furthermore, I want us–the people in this community, the readers of these articles and newsletters–to disagree. In fact, this is one of my editorial core values, one of the things I want to spread. This newsletter is a forum for dialogue and even conflict. But there is a norm I believe we should adopt with the written word: **Words should be scalpels not spears.** I don't think words should be spears hurled at one another, even though "spears" is part of the lexicon in military aviation. As professionals, I believe it's acceptable to cut each other with our words—if we have to—but only when one handles words with precision, expertise, and care, like a surgeon with a scalpel. We must handle our words with care, and our conflict must lead to better discourse and stronger solutions. I say this all for two primary reasons. First, I want to establish a way to talk about disagreement and conflict in this forum. Second, I wanted to introduce a different opinion about STPA.

Don't Rule Out STPA

Douglas "Beaker" Wickert

STPA (Systems Theoretic Process Analysis) is a powerful tool, but we must use it for the right job. Trying to drive a nail with a screwdriver may frustrate, but it does not mean screwdrivers are flawed. STPA is a methodical, systematic approach for building understanding of a system under test (SUT). STPA grew out of the systems-theoretic accident models, a model that explains accidents as a failure of safety controls or constraints at the system-interaction level. STPA is not a replacement for current flight test safety planning, but it is a powerful, complementary tool that can fill in gaps of understanding and highlight things we perhaps did not think to consider.

The USAF Test Pilot School now teaches STPA as part of its curriculum and the 412th TW recently experimented with STPA for test safety planning. Opinions are divided on the utility of some of the trials (see Flight Test Safety Fact 19-02).

(continued)

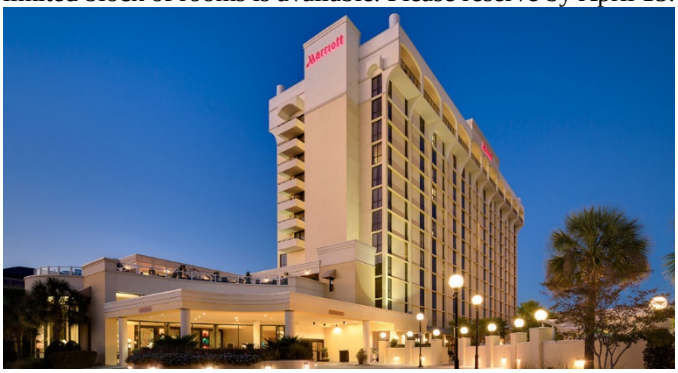
FTSW to feature *Flying*'s Peter Garrison

The Flight Test Safety Workshop will feature Flying magazine author and aircraft designer Peter Garrison as its dinner keynote speaker. Garrison studied English at Harvard and taught himself aerodynamics, enough to design and build two models of his own aircraft, the Melmoth. A photograph of the first appears below. He has over 4,000 hours of flight time and holds numerous ratings: a single-/multi-engine commercial pilot license with instrument, Learjet, helicopter, seaplane, glider, gyroplane and hot-air balloon ratings. For more information: https://www.flyingmag.com/g00/bio/peter-garrison-contributing-editor.

(Photo credit: Wikipedia)

Book Hotel Rooms by April 15

Visit the workshop website to reserve a hotel room at the special rate: https://www.setp.org/symposium/meetings/workshop/ A limited block of rooms is available. Please reserve by April 15.



LeVier Award Nominations due 29 Mar

For more information: http://flighttestsafety.org/awards/35-awards/information/54-tony-levier-flight-test-safety-award.

The FTSC will also award the Bombardier Aerospace FTSW Best Presentation Award to a presentation at the 2019 workshop in Charleston, as it does each year.

Don't Rule Out STPA (continued)

This difference is primarily due to the workload and time involved in performing the analysis, but there is no denying that STPA can highlight system-level hazards that might otherwise be missed. In particular, when integrated early in the system design process, STPA can highlight system design flaws prior to testing. As such, it is a particularly useful system engineering design tool that should be applied during engineering development. For this reason, the Air Force Test Center (AFTC) has an ongoing effort to encourage Program Managers to adopt and evaluate STPA. Maj Sarah "Pancho" Summers is leading AFTC's engagement effort with the AF Acquisition Enterprise. Additionally, a pilot project that partners AFTC action officers with the program office for a hypersonic system is already underway.

There are no silver bullets in safety and STPA is not a panacea. At the heart of STPA is a "process model" that informs safety controls. Errors in the process model can easily result in accidents. STPA can identify those scenarios, but it will not prevent them if the model is incorrect. In flight test, we are often testing because we do not know if our model is accurate. A common objective in flight test is to define the safe operating limits of the system. Until test verifies the safe envelope, there will be uncertainty in boundaries and blind-spots in the model.

Understanding uncertainty is the heart of Risk Awareness (see Flight Test Safety Fact 19-01). STPA and Risk Awareness are complementary tools, the yin and yang of safe flight test. STPA attempts to identify loss scenarios and introduces safety controls to prevent losses. Risk Awareness encourages teams to acknowledge uncertainty and define the boundaries between what is known and unknown. If I were leading a squadron to the first flight of a new X-plane today, I would be using STPA to do our scenario planning and hazard identification. I would also be asking the team to put confidence intervals on what we think we know and to explicitly identify what we do not really know. STPA would help build our understanding of the SUT. Risk Awareness would remind us to proceed with humility because we do not really understand until we have tested.

In summary, we need to use all of our tools, but we need to use them in the manner for which they are intended. STPA will not do our thinking for us, but it is a particularly powerful tool for guiding and building Risk Awareness.

Editor's Note: Beaker passed on this link: http://psas.scripts.mit.edu/home/2019-stamp-workshop/. The free workshop addresses applications of STPA globally, and is a great way to stay up to date on advances in the field.

Up Next In April, we'll share a letter from LCDR Kurt Pfeffer (USCG), a VX-20 test pilot from NAS Pax River: "I'm a former Marine and current Coastie, with a background in C-130, G100, and GV aircraft." In the future, we'll also discuss Airshows and Test Teams. Our readers admit they like "airplane stories," so if you have opinions or anecdotes about this topic feel free to send them in before next month. Finally because it wouldn't fit on the previous page, we close with this picture from Pete Winters, one of two helmets he used during his F-111 flight test days, from an area of delightful ornamentation together with variable sweep visors and wings.