Flight Test *Safety* Fact

Published for the Flight Test Safety Committee

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A Limited Survey of Cold Weather Flight Test Safety

Mark Jones Jr

It's winter in the Northern Hemisphere, and though Florida—where I am writing from—has very little "cold weather" in which to conduct flight test, it is home to the world-renowned McKinley Climatic test facility, a large hangar capable of creating some of the most harsh cold weather climatic conditions in the world. Many readers are familiar with the facility, and many have flown airplanes to Eglin Air Force Base to use the facility. It has also been around for a long time, which means many "classic" and iconic aircraft have been tested there. I learned a lot about cold weather testing the first time I was ever part of a test team that took an airplane there. Cold weather testing seems to be less familiar to many of us, if only because the meteorology and physics that shrouds the subject is less familiar to many of us—at least, that's how it seems to me, which leads me to two more observations.

Second, flight test is still mysterious, and that's wonderful. I've been part of test programs and heard talks of unexplained aerodynamic phenomena. Why does the right wing drop during high speed dives? After months of diagnostic tests—using a laser to validate the aircraft symmetry and rerigging flight controls and so on—we still didn't know. Why did the Super Hornet test pilot say something felt strange, and how long did it take the test team to believe him and validate what he felt (2022 FTSW)? These are just two examples of the mysteries of nature and physics.

Flight Test exposes us to beauty and humor and many other emotions and human experiences. I remember the mesmerizing but simple beauty of the pristine, snow covered fields near International Falls Airport and the beautiful way the anti-ice fluid flowed over the wing during the takeoff roll. Humor also shows up all over the place, and though the picture here is not strictly "flight test," it made me laugh.

Finally, some of the mystery is simple ignorance and forgetfulness. I think this principle applies to humans in general—we forget things our fathers knew. We forget the lessons of history. We discover someplace new only to discover that the people there already knew. This applies specifically to our knowledge and experience in flight test. As I surveyed the historical landscape of cold weather testing, I

was surprised how little has changed. If that's the case, then cold weather testing should not be so mysterious. This is the classic flight test paradox—we keep forgetting to learn the lessons learnt—so in this edition of the Flight Test Safety Fact, we will conduct a flyover of cold weather testing, digging into the annals of our history to share various resources from SETP, SFTE, and FTSC. We also mark the fifth anniversary of the FTSF by reviewing some of our summary data and reflecting on the purpose of the Flight Test Safety Committee and the FTSF. I hope this slightly longer than usual edition warms your head and heart alike. I hope it rekindles a fire inside you. And I hope you continue to share this resource with those around you and share with us the things you are doing, learning, writing, and exploring.

Consistent with the stated intent above and in closing this first column, I share two reminders. The purpose of this newsletter is to introduce readers to the many flight test safety resources of the FTSC, and in some cases to introduce members of SETP and SFTE to the FTSC. There is also the benefit that we can introduce FTSC members to resources available through the SETP and SFTE partnership. Thus, we begin by revisiting the purpose of the Flight Test Safety Committee as published in its charter and on its website.

> The Flight Test Safety Committee (FTSC) was formed jointly in November 1994 by members of the Society of Experimental Test Pilots (SETP), the Society of Flight Test Engineers (SFTE) and the American Institute of Aeronautics and Astronautics (AIAA). These and numerous additional organizations presently comprise the FTSC.
>
> The purpose of the FTSC is to initiate and sustain a flight test related safety organization intended to promote flight safety, reduce the risk of mishap, promote risk reduction management and continually improve the profession's communication and coordination. To facilitate these goals, the committee will develop, implement and maintain a computerized data base, readily available to all members and member organizations, containing flight test-related data collected from the industry.
>
> Read the mission statement or download the charter here: https://flighttestsafety.org/about-ftsc.

Sample of Cold Weather Flight Test Safety Papers

Inside this edition of the FTSF are sundry examples of cold weather testing. The purpose of sharing these links and papers is to point readers to the myriad resources provided by FTSC, SETP, and SFTE and to highlight the historical trajectory of flight test. Starting with the most recent, and thence in no particular order...

In 2023, Bell presented its artificial icing test campaign, as pictured here, which highlighted an artificial ice system.(access the report here). The photo caught my eye because I'd seen it in paper almost five decades older. In 1974, the Society of Flight Test Engineers held its annual symposium in Anaheim, California. The Los Angeles chapter hosted the event, and the final paper presented was US ARMY HELICOPTER ICING TESTS, by LTC Warren E. Griffith II and CPT Marvin L. Hanks of the US Army Aviation Engineering Flight Activity, Edwards Air Force Base, California. The paper included a schematic of the newly designed Helicopter Icing Spray System deployed from a CH-47, depicted here, which is still in use today—it has been upgraded but is very similar to its original design. The paper has been shared by SFTE and is attached to this pdf.

Figure 1: Bell 525 immersed in HISS Spray Cloud

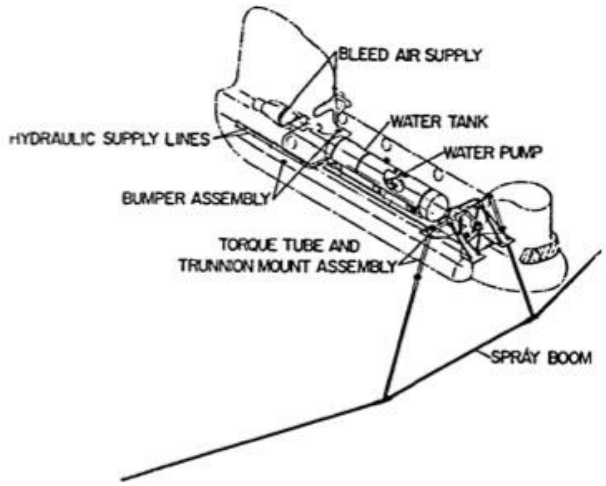
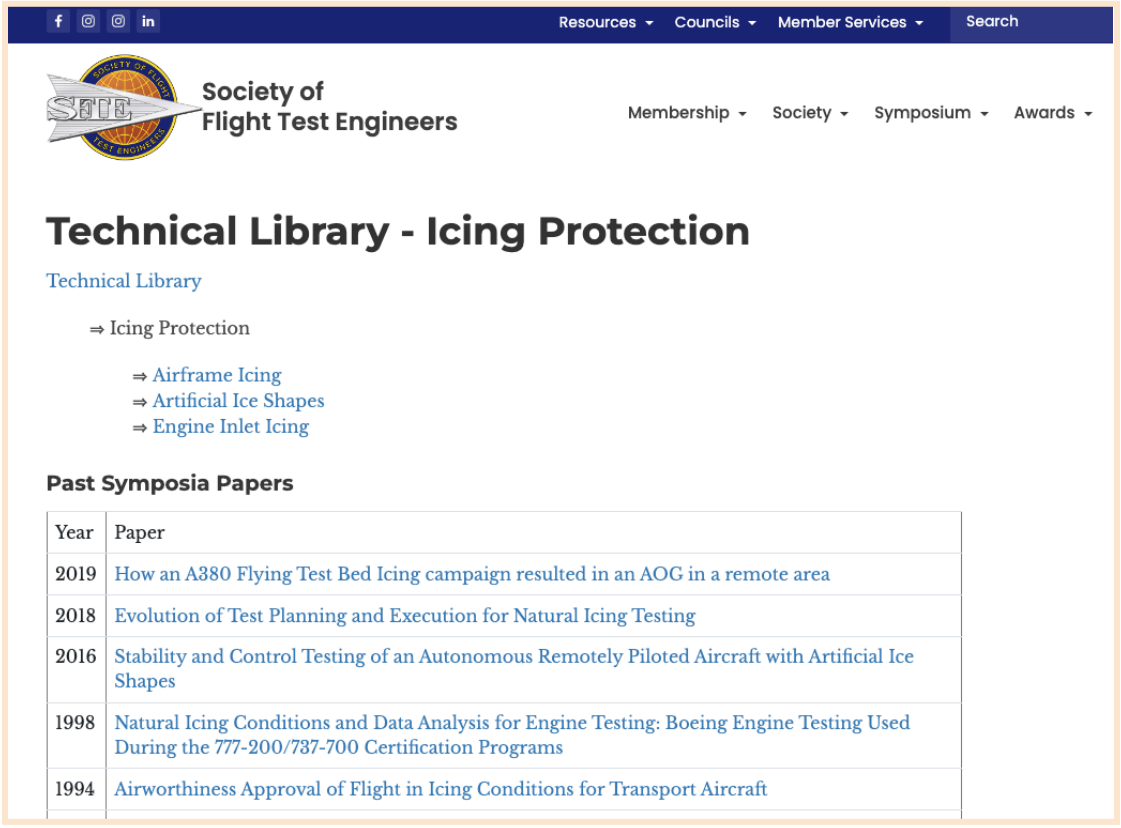


Figure 1. Helicopter Icing Spray System.

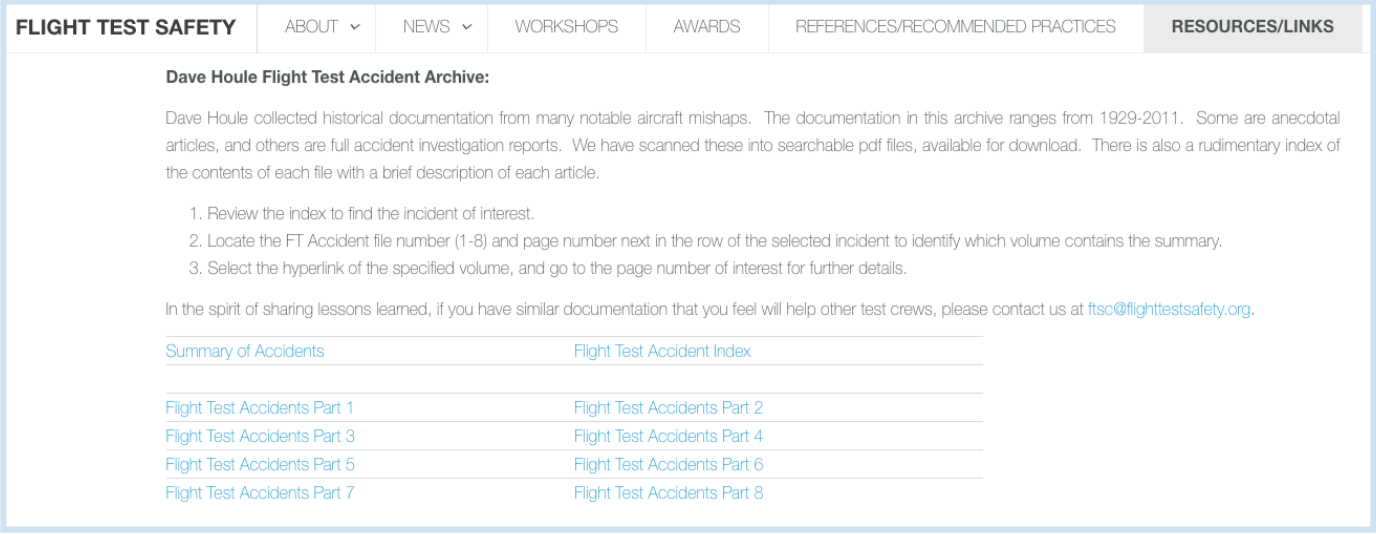
Airworthiness Approval of Flight in Icing Conditions for Transport Aircraft, J.C.T. Martin (Flight Test Engineer), Transport Canada (AARDC) - This technical paper comes from SFTE's 1994 symposium and is available for members, but it highlights a new subject based user interface for SFTE's technical papers. The paper is also included as an attachment inside this pdf, shared by SFTE for those readers of FTSF who may not be members of SETP or SFTE. I found the paper using the new user interface on SFTE's website, pictured below. They have several quite nice links to topical collections of technical papers. SFTE has just recently republished all its technical content to its new database, and it has a reciprocal sharing agreement with SETP.

Access the paper here: https://www.sfte.org/technical_library_-_icing_prot.php.



Many readers are aware that in-flight icing is the cause of various aircraft accidents in-service, but a recently added Flight Test Safety resource shows that Cold Weather Testing was also the context for a flight test safety mishap. The Dave Houle collection of historical documentation includes this indexed entry: "File 5 - Page 22 - Concorde Icing Trials - Article - Fixed Wing - MEL - Transport Jet - Icing Trials - Engine Stall - failed guide vanes - Unk - 1971". (The entry is formatted this way because it's part of a tabular index that points to the file with the details.)

The user interface for the Houle Flight Test Accident Archive appears below. This particular accident is a useful case study in capturing history before it's too late. The Houle Flight Test Accident Archive needs a sequel, someone who is willing to carry the baton into the next chapter for preservation of this historical information.



The screenshot shows the "Resources" webpage here: https://flighttestsafety.org/web-links. File 5 has the details of the mishap: https://flighttestsafety.org/images/F.T._Accidents_5.pdf.

Flight Test Safety Committee - Calendar of Events

Flight Test Safety Workshop
When: 30 April -2 May 2024

Where: Hyatt at Olive 8
1635 8th Ave
Seattle, WA 98101

https://www.flighttestsafety.org/workshops

Lockheed F-117 Cold Weather Testing

Al "Danger" Lawless

The McKinley Climatic Lab at Eglin AFB has been around for many decades and has somewhat recently been recognized as a national asset. Its ability to cook, freeze, rain, and snow on vehicles of all sizes is as legendary as is its ability to run turbine engines inside while replenishing the chamber with makeup air at the right temperature. The permanent staff there is, of course, as dedicated and professional as anywhere else, but their challenges were especially strong in the early 1990s before the lab's major refurbishment. I suspect the F-117 provided the last straw that justified McKinley's rehab.

The F-117 deployed to the climatic chamber for roughly 6 months in the early 90's. Between snow, freezing rain, fog, heat, and just plain cold, we went through all the paces to understand limits and develop workaround procedures for the ground crews and pilots who might have to deal with extreme weather operationally. Frankly, some of us struggled with why this was even necessary for the F-117; fewer than 60 were built and their stealth required high levels of maintenance in sheltered hangars. We knew of nobody who thought it would be a good idea to plant this recently unveiled stealth fighter in an open field in Alaska or some unspoken desert. Anyway, everyone saluted smartly and prepared all the equipment needed to tie down the airplane and to jack it up for gear

retraction. They also hooked up all kinds of instrumentation wires to a ground booth and devised adapters to connect our engine exhaust to giant steel exhaust pipes leading all the way to and through one hangar door. This team was prepared for success, but it seems the flight test gods wanted to have a little fun with us first.

The facility staff had long been dealing with icicle accumulation during cold weather tests. Apparently the moist Florida air always found its way into the chamber (go figure) and rapidly built stalactites hanging from everywhere in the exposed truss work overhead. They had a crew regularly going out on cherry pickers to scrape off the ice before it grew too big. They also had the foresight to lay nasty old twin-size mattresses all over the top of the airplane just in case a stalactite slipped by. With 95% of the F-117's upper surface snuggled nicely under those mattresses and the big ice scraped away, the gods just couldn't resist the odds. What must have been the only stalactite left hanging found its way to and through the slightly uncovered right wing near the tip.

Finally, the mighty stealth fighter had only a couple days of testing to go. We were running engines at a somewhat high thrust and doing whatever cold test we had that day when the spotter out back once again said something like, "What was that?". This time it wasn't the exhaust that was smoking. It was the hangar door. Apparently the extended engine run heated the giant steel pipes that passed through the door which heated the door skins which heated the insulation between. The hangar insulation started smoldering. At this point in the program, we had a highly prized operational airplane trapped in a smoking national asset (the lab) with no real understanding of what it might take for the smolder to really ignite. Considering the testing was nearly done, the team leaders made the command decision that the smart money was in separating these assets and declaring the campaign complete. This was the final straw and it was time to get out. Instead of taking the planned three days to untie and de-instrument the airplane, the guys brought in their cable cutters and axes and pulled the F-117 out front within about an hour. Meanwhile, the fire department had a big show going on out back. Between it all was a cold hangar with open doors that created a thick fog blanketing everything.

Al Lawless

Turbo Talk

Art "Turbo" Tomassetti

Happy New Year all. I hope everyone had a safe and enjoyable holiday season. In keeping with this edition's theme of cold weather testing I will share some of my cold weather experience. The first has nothing to do with flying and goes back to a college experience. I grew up in South Florida but decided to venture far from home to attend college just North of Chicago. I had experienced winter a few times but gained some important lessons learned after four Chicago Winters.

When the lakefill on campus freezes over you can in fact reduce travel time from the dorms to the student union appreciably but just because the lake surface can now support snow accumulation, it doesn't necessarily mean it can support the weight of human beings. No I did not fall through, but the look of shock on some of the locals' faces when I told them about my shortcut inspired me not to try that again.

If 65 degrees below zero with wind chill sounds cold, there is a reason for that: IT IS COLD! Standing on the outdoor train platform waiting to return from a night out in the city required some real consideration for the appropriate personal protective equipment. Maybe if we had streaming services back then we would have stayed in the apartment. And maybe when we found out later no one really wanted to go out, but everyone thought the group did, we would have recognized a classic "Road to Abilene" groupthink scenario. Winter weather, snow, and icing

can affect vehicle performance. Assuming you can dig your brand new 1986 Dodge Charger out of the snowdrift, driving in those winter conditions is very different from cruising the strip in Ft. Lauderdale.

Moving on in life to my time as a Harrier pilot, I once supported a deployment to Norway in February. Fortunately, I had all of those lessons I learned from my Chicago college experience to tap into. They made us attend cold weather training in Wisconsin before the deployment where I learned additional cold weather skills. I am a big fan of dedicated training specific to the mission, but I am not really sure where I would find snowshoes that I could walk in if I had to eject over the Fjords from my airplane.

Finally in my post military career while working at Lockheed Martin I had the chance to visit the Climatic Chamber at Eglin AFB in FL. This is an amazing facility that can support testing in extreme hot or extreme cold for just about any type of air vehicle. I was there for the cold weather testing of the F-35B. Two things stood out to me from that visit. The first was that given the Short Takeoff and Vertical Landing (STOVL) capability of the F-35B they needed to test the aircraft in that configuration for vertical flight...

with the engine running...

at full power.

In order to do that a set of ducting had to be designed and built and installed that would move all that air out of the chamber without affecting the temperature of the testing. This is what I have witnessed over and over again in my time in the profession of flight test: Teams working together to develop solutions for incredible challenges. Whether that be to gather data in test or find fixers for things found during testing.

The second takeaway from that experience was a lesson in leadership. I helped coordinate that visit and arranged for several high-level F-35 program personnel to attend. I believe it is important for leaders to be engaged with their teams, to understand not only the product (aircraft, in this case) but the process by which the product is made, developed, tested and used. PowerPoint charts, conference room meetings, etc., are important but boots on the ground, hands on, face-to-face time is important as well.

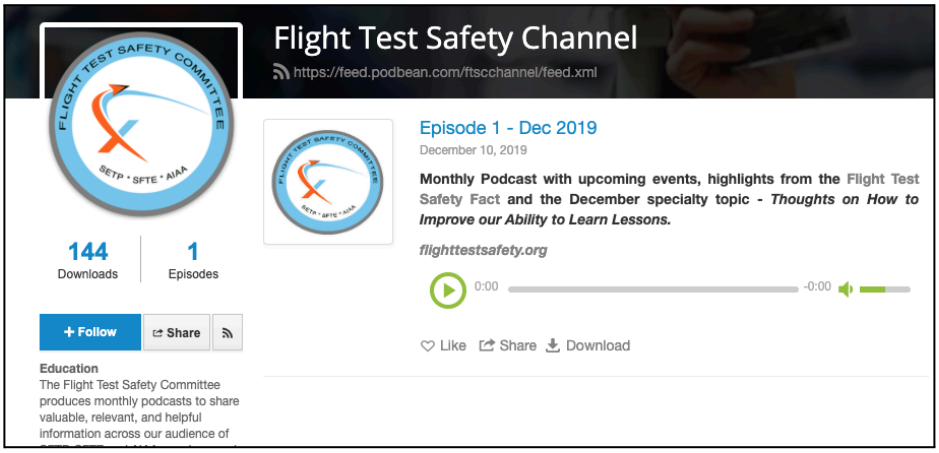
I looked for our group photo from that visit but could not find it. But I found this one which shows basically the same thing, me in multiple layers of cold weather gear, still freezing, but smiling like this Floridian is enjoying himself. This is from my command tour at VX-23 on a ski trip with my pilots. I actually learned to ski on this trip, and this is my third time down the slope. No one explained the slope symbols to me but it seemed a lot higher than the first two. There is another lesson here about knowing your own limits, but we will save that for another time.

Until next time be Safe, Be Smart and Be Ready (even when its 65 below with the windchill)!

Turbo

Latest Podcast

In December, the Flight Test Safety Channel turned FOUR. Below is a tabular summary of episodes from 2023, a tradition for this month's podcast column. You can subscribe to the Flight Test Safety Channel podcast in iTunes, Spotify, Podbean, Google, and Amazon Music's FTSCChannel. You can also share the link below with colleagues and friends who may not know about Turbo's monthly recording: https://flighttestsafety.org/ftsc-news/flight-test-safety-podcast-channel.



2023 Podcast Episodes	
January	Test Teams Today
February	What If?
March	This is the Way: Applying Safety Every Day
April	B-1 Flight Test Lessons Learned (Part 1)
May	B-1 Flight Test Lessons Learned (Part 2)
June	Signs of Danger
July	Battle of the X Pilots - Part 1
August	Are you Ready for the Bad Day - Part 1
September	Are you Ready for the Bad Day - Part 2
October	The Tale of Aircraft 163666
November	Battle of the X Pilots - Part 2
December	Battle of the X Pilots - Part 3

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Website: flighttestsafety.org

Report

Editor

The **FTSF** turns five years old this month. The first edition went to press in January 2019, and for the first two years attempted to maintain a monthly schedule. Starting in 2021, the readers provided input that once every other month was a better rhythm. It turns out that "bi-monthly" means two different things: "twice a month" and "once every two months." During that time, we've changed the format, but we've never changed our commitment to Reach Everyone, even if we mention it less frequently. In December 2019, we reached 3539 people with email distribution of the newsletter, which was, at the time, 103% of the membership of SETP and SFTE. As of November 2023, distribution between SETP, SFTE, and FTSC has reached 4000 people, which is an estimate based on the fact that there may be duplicate names in some of these distribution contact lists. Susan reported that she adds people monthly by special requests sent directly to her. The podcast also provided some quantitative data: We have 39.9k all time downloads. Episode 18 (Interview with Justin Paines - Thoughts on Commercial Electric Aircraft on May 13, 2021) tops the charts with 1,332 downloads. From the FTSC website, there is some data we can also report. Issue 19-02 has 502 downloads, the most of any other issue, but the newsletter webpage (which links to all the newsletters) has 17,060 hits. In closing, we'd like to ask you to share the newsletter: forward your email copy to a coworker, print a copy for the lunch room counter, or post a link on social media. We can add ANYONE to the FTSF email list! If there's someone new in your office, just have them send an email to susan@setp.org or mark@flighttestfact.com.

Year	Number of issues
2019	11
2020	9
2021	6
2022	5
2023	6