Flight Test *Safety* Fact

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In This Issue

A Brief History of Flight Test Orange

Mark Jones Jr., Editor

Embedded deep in the lore and legend of flight test is a uniquely colored fiber woven into the fabric of who we are and what we do. The color of that fiber is flight test orange. It appears on our patches and in our logos—like the FTSC logo pictured above—but it also shows up in our aircraft, as flight test instrumentation, orange wire, and emergency equipment.

The origin of this color tradition is largely unknown, but an easily recognizable, early example is the Bell X-1. Anecdotal evidence suggests that engineers painted the X-1 its bright orange color to enhance its discernibility. From a purely theoretical standpoint, orange is the color that contrasts most vividly with sky blue, but empirical results did not match the theory. Later paint schemes included color patterns that provided contrast on the aircraft itself. For example, early on, NASA used it in the unmanned X-9 paint scheme, including black and white contrast with "day-glo orange" around the national insignia, as described in Monograph 31, American X-Vehicles.

The continued evolution of the actual paint schemes is not clear, but evidence of the use of standardized orange also dates back to the World War II timeframe. In that era, the War Department issued a color standard, known as FS-595, to assist vendors in meeting paint requirements for the booming aviation industry. "The Federal Standard color system provides a means of comparing colors visually. It has its origin in the US Military complex and is still used there as the primary source of color reference… The widespread application of the standard in the military is the reason for the prevalence of the FS-595B despite its apparent obsolescence as compared to more modern color designation systems. FS-595B has also become a de-facto standard in many non-military applications such as historical color research or the modeling industry worldwide" (FED-STD-595, http://www.colorserver.net/history/history-description-of-tt-c-595-josa.htm, Sep 25, 2015). In the documentation for the standard, we find Aviation Surface Orange as No. 1205, a color previously denoted Army-Navy Aircraft Standard 508.

A multitude of orange shades also appear inside the aircraft on which we fly even today. A host of orange wires run every which way, to and from orange boxes inside and outside our aircraft. Flight test equipment installations historically use this orange wire, hardware, and markings, but the earliest appearance of this practice is unknown.

Finally, bright orange flight suits are also a common sight, but the emergence of this fashion statement is also of unknown origin. Though we can easily ascertain its purpose as a method to assist in finding aircrew members wherever their aircraft inadvertently land or unfortunately crash.

In the anecdotes above we find several curious links with the month of October. In the milder parts of the Northern Hemisphere, October brings

with it a color palette based largely in orange, as autumn paints the trees, and the setting sun casts its hues on the early evening skies. The color permeates almost everything we do, as hot drinks turn orange, and the scent of pumpkin spice fills the air. October also brings its companion, Halloween, a holiday which brings a wide array of ghoulish costumes, jack-o-lanterns, and orange-and-black-themed decorations filling store shelves. The makeover that the occasion brings may only remain for a short season, but in the world of flight test, the Frankenstein-like contraptions last year-round in our flying test beds, prototypes, and other experimental aircraft.

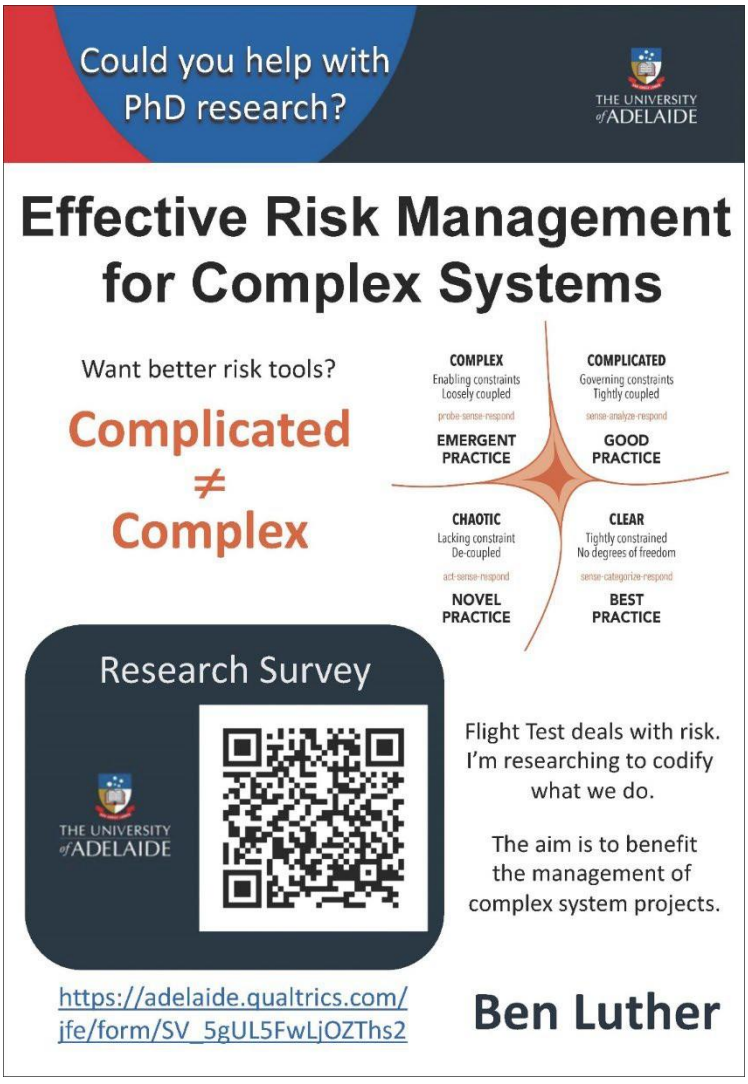
Finally, October is the month that Chuck Yeager broke the sound barrier in an orange-colored rocket aircraft, the X-1. As I close my observations about orange, I would like to raise one small line of questions. History tells us that Yeager made his flight with a broken rib, and he used a broom handle to close the door of the aircraft that he, otherwise, would not have been able to close. Is this anecdote evidence of virtue or vice? Did he accept risk he should have avoided? Did the people on the test team have processes which promoted a safety culture?

It's worth pondering while you sip your pumpkin spice.

Special Request

Ben Luther

Editor's Note: Ben Luther is the 2021 LeVier Award winner, multiple -FTSW presenter, and a long time SFTE member and flight test safety professional. He asked the FTSF to publish this special request in support of his research. Please feel free to hang these posters in your workspace to get the word out about Ben's research.



In my university research team, we are seeking to develop management practices for complex systems - particularly looking for effective risk management frameworks for use with complex systems. The research is being conducted at the University of Adelaide, away from specific flight test practice. For my part, I think that the Flight Test community are particularly adept at handling risk in complex systems, as we are one of the few disciplines (only??) that routinely deal with all three system-intricacy classifications in the Cynefin model: Clear, Complicated and Complex. A lot of what we do is dealt with culturally in lore and stories from senior and experienced practitioners, and my objective in the research is to codify flight test lore as it relates to complex systems. If we can codify the principles with some academic rigour (not just leaving it as, "The moral of the story is that there-be-dragons"), we can teach people quicker than via OJT, with some assurance of educational scope. Just as importantly, we can argue our point in management circles, to win the resourcing we need to undertake our work. For my wider research team, I will abstract the knowledge for application across industries as management theory. This is where I think that flight test can add value as we already do some of this well. We can influence management practice outside of flight test.

Unlike our usual flight test physical sciences, this research is being conducted within the social sciences. So, rather than a single test point to determine the answer, I need a lot of data from individual responses. Hence my appeal to Safety Fact. The data collection is being conducted via survey to gather practitioner experiences. For your readers, please do not underestimate the value of your response. What we think is normal in flight test is not a given in other disciplines. It is not enough for me to think that I can report flight test experience. I need to gather the evidence. Hence the value in individual responses. Given how small the flight test community is, I need everybody in flight test to be providing their thoughts on

complex risk management. The survey is taking respondents about 8 minutes, and it is system agnostic. It does not ask about commercial or security sensitive topics, just the way complex system risk was managed in an individuals' experience. I can't say that it will impact any individual's work. But I am working toward providing us with better risk management tools.

Toward gathering data, I've produced a couple of posters and flyers (attached) that contain a link to the survey (text link and QR code). The survey is hosted within Qualtrics (fancy, academic SurveyMonkey). The survey can be completed anonymously, or individuals can elect to provide their contact details to give me the option of a follow up question if they raise something of particular interest. The survey has human ethics approval in accordance with Australian academic requirements. **Ben Luther**

Where did the (Orange) Wire Come From?

By Bob Piwarzyk, Society of Flight Test Engineers. Reprinted from Flight Test News, January 1977.

Why Orange?

Curious about the origins of an industry-wide tradition, I began asking several old timers: "Why orange?" The path led to my old friend, Bob Cundiff, who a couple of sources said, "Had something to do with it," and I obtained the following story:

In the late summer of 1949, we at Douglas Aircraft finished a demonstration at Pax River with the first Douglas XF3D-1 Sky Knight. The airplane returned to El Segundo before the crew got back. They wanted the airplane out of Flight Test ASAP, so someone issued the paper to remove the instrumentation. A temporary crew did the work, and they enthusiastically removed the instrumentation, all the test wiring, and some ship's wiring, too!

It really took a long time to rewire that airplane and as a result I was assigned the job of color-coding future instrumentation wiring. I selected a fluorescent orange, got approval, and ordered enough to instrument about fifteen airplanes. The wire room at Santa Monica refused to store it due to lack of space, so it was shipped to the El Segundo hangar. It was almost all used when I was instructed not to order any more, since it proved to be an expensive specialty.

About that time, a contract was negotiated to instrument two additional F3D-1s for Westinghouse for engine development. Their engineers saw the orange wire in our test airplanes and called for it in their contract. Sometime later Douglas got a contract from North American to instrument a B-45 as a flying test bed with an engine that retracted into the bomb bay, and orange wire was again specified. Finally, we hit upon the idea of stamping regular wires with orange numbers to reduce the cost. I believe Bob Clink was the first to use the color brackets and such. From then on it was essential, so I guess I really left my mark. Those early days of flight testing the first jet engines were really fun!

Bob Clink added modestly, "Bob Cundiff's story may be true, but the real clincher was due to Pax, the F9F, and a Mil Spec requiring all flight test wiring, brackets, etc., to be orange. Many years later, a Douglas change required refurbish papers be written against flight test installations, and it was felt that color coding was no longer needed. However, this argument lost, as the precedent had been well set."

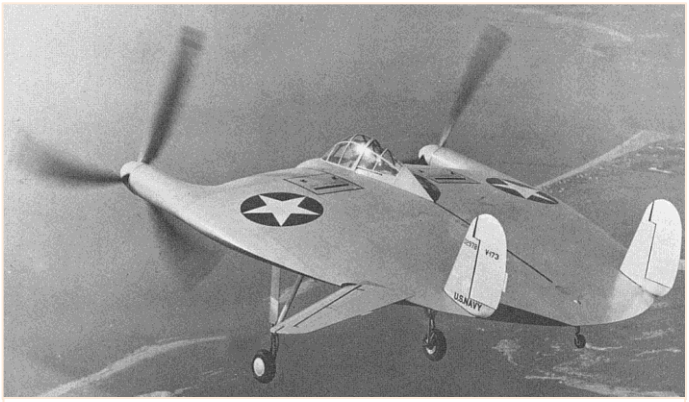
(While on the subject of orange wires and such, the following anecdote was told by Walt Gibson, Experimental Flight Test Manager for DeHavilland Aircraft Ltd., during last year's [1976] SFTE Symposium.)

Before getting into a description of our DASH-7 instrumentation, I would like to tell you about an incident concerning the installation of instrumentation in the aircraft which backfired on me. In our effort to achieve the perfect instrumentation installation in the aircraft we of course used orange wire and painted all transducer installations the "classic" flight test orange. However, when components of the first aircraft, which was itself to be painted blue and white, were being painted during build, the salesmen got to the paint shop people and had them paint over our transducers so that they wouldn't be so obvious. This naturally annoyed me somewhat, so the day before the entire aircraft was to be painted, I went over to the paint shop and had a two-hour hassle with the foreman convincing him that our drawings showed the instrumentation installations were painted orange and that was the way it was going to be. He finally conceded, and we parted friends. Would you believe my amazement, when I came in the next day and the whole aircraft was painted orange! Unknown to me the Marketing people had changed their minds at the last minute about the paint scheme for the aircraft and there it was; the whole aircraft painted orange like my instrumentation! Did I win or lose?

Turbo Talk – Chairman's Corner

Art "Turbo" Tomassetti

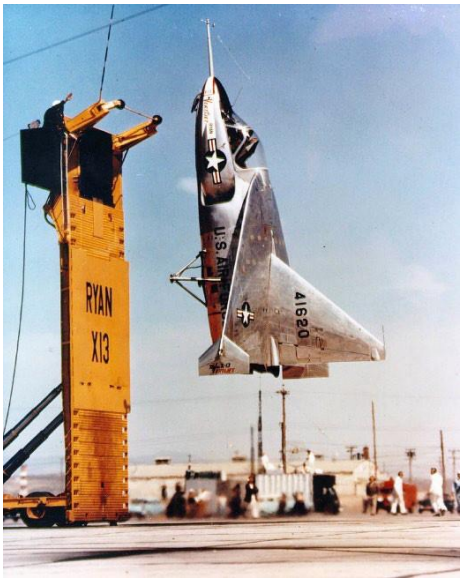
When Mark told me he wanted to do a special Halloween edition of the Flight Test Safety Fact I was excited. Afterall, it is the time of orange pumpkins, frightening looking things and scary stories. Just like flight test, right? Now, I know we don't have pumpkins, but we have orange as Mark points out in his articles. We also have some frightening and strange looking flight test aircraft and of course we have scary stories.



Vought V-173

In the strange aircraft category, there are plenty to choose from. Being a V/STOL pilot I am partial to the strange ones in that category. One is the Vought V-173 better known as the flying pancake. The prototype performed very well, and the US Navy funded an upgrade to increase the max speed to 425 mph. Unfortunately, excessive engine bay vibrations occurred and by the time this issue was resolved World War 2 had ended and the focus turned from props to jets.

But there were a few strange looking test jets in this category (no I am not going to mention the X-32). My favorite in the jet age would be the Ryan X-13 Vertijet. The picture shows the Vertijet about to moor itself to a dual-role flatbed transport/launch trailer. Now I am betting even the most junior Flight Tester can come up with one or two possible deficiencies just looking at the picture.



Ryan X-13 Vertijet

But here is the thing when you think about all the strange looking flight test and prototype aircraft we have seen over the years. They were usually developed to meet a requirement; they often pushed the boundaries of design and manufacture not to mention aerodynamics. They were likely born out of some one somewhere asking, "What if?" We talk a lot in this newsletter, in our podcast, and at our symposia about the risk culture we operate in today, and I wonder sometimes if that impacts what we do after asking "What if?"

Finally, in the scary stories category of this Halloween edition. I thought about sharing one of my scary stories and then trying to extract some lessons to share. I thought about just grabbing someone else's lesson from their scary story we have in our resources. (If you are ever looking from some interesting reading on this topic, check out the Dave Houle Flight Test Accident Archive in our resources page.) Instead, I decided just to ask a question. How many flight test scary stories start with:

Aircrew: "Hmm that's strange. Control did you see that?

Test Conductor: "Stand by."

Aircrew: "It seems like every time I make this input the aircraft does this unexpected thing."

Now, if this was a horror movie, you know what happens next. They open the door to the basement, the go into the eerie house, or they walk towards the strange sound. But this isn't a horror movie. This is flight test. So of course, we…

Until next time: Be Safe, Be Smart and Be Ready. **Turbo**

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Effective Risk Management for Complex Systems

Research Survey

THE UNIVERSITY of ADELAIDE

Flight Test deals with risk. I'm researching to codify what we do.

The aim is to benefit the management of complex system projects.

https://adelaide.qualtrics.com/jfe/form/SV_5gUL5FwLjOZThs2

Ben Luther

The survey gathers your thoughts and experiences working with risk management in complex systems.

It is system agnostic. You are not asked any details that could be commercially or security sensitive.

The subject of research is management practices that remain effective with complex systems.

https://adelaide.qualtrics.com/jfe/form/SV_5gUL5FwLjOZThs2

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