

# Flight Test Safety Fact



Published for the Flight Test Safety Committee

## FTSW Hotwash

**Tom Huff**

We completed the 2019 edition of the North American Flight Test Safety Workshop (FTSW) in Charleston, SC, with an attendance of 170, the second highest attendance on record! The theme was Safety Assurance in Flight Test and specifically, how a robust Safety Management System can—and should—yield higher safety performance and prevent needless accidents. We kicked off the tutorial with an emergency response scenario designed to “get inside your head, stir your soul, and touch your heart.” Presenters affirmed the critical importance of a well-developed and practiced crisis response program. The second half of the tutorial took a closer look at Safety Assurance and how the current commercial/business aviation methods and standards apply to flight test. Technical presentations were excellent and the Boeing Dreamliner tour capped off a successful conference. The Flight Test Safety Committee (FTSC) reviewed the critiques: the feedback was very positive and the comments helpful. Our goal is to continually improve the quality and relevancy of the Workshops so your input and suggestions are paramount. Unfortunately, *less than half* of the attendees submitted feedback: This is another area to target improvement. The polling questions revealed a lack of understanding and/or adoption of SMS recommended practices. We encouraged attendees (and readers of FTSTF!) to leverage the resources on the FTSC web site: [flighttestsafety.org](http://flighttestsafety.org). The FTSC is always eager to assist and contact information is available on the web site. We are already planning for 2020 FTSW in Denver (4-7 May) and the European edition in London (TBD Oct).

*Tom Huff, Chairman*

## Two from USN TPS earn LeVier Award

The accomplishments of Mark Hargrove, LT (USN) and Ms. Barbara Gordon, both from US Navy TPS earned them the 2019 Tony LeVier Flight Test Safety Award. According to CDR Glenn Rioux, “USNTPS flight test education is a multi-faceted effort and the Aviation Safety Officer and Safety Officer serve a critical and enduring role in that total-immersion training of critical thinking and risk assessment. Ms. Gordon and LT Hargrove have taken safety promotion to the next level by fostering and maintaining a positive safety climate, safety communication, and safety training into flight test safety education.” This included over 6500 flight hours in 43 aircraft.

## Flight Test Safety Committee

Tom Huff, Chairman [chairman@flighttestsafety.org](mailto:chairman@flighttestsafety.org)

Society of Flight Test Engineers [edir@sfte.org](mailto:edir@sfte.org)

Society of Experimental Test Pilots [setp@setp.org](mailto:setp@setp.org)

Contact *Flight Test Safety Fact*

Mark Jones Jr, [mark@flighttestfact.com](mailto:mark@flighttestfact.com) 

## Limitations of the 2D Matrix **Ben Luther**

At the Workshop panel session in Charleston, a member of the audience asked the panel a question; the subject of 2D risk matrices had featured in earlier presentations. What I understood the premise from the audience member to be was: “The 2D matrix has served the flight test community well; there isn’t anything else. Stop bashing it, since we should encourage its use.” In providing a response to this question, I want to illustrate the limitations of the 2D matrix, provide references to contrasting alternatives, and encourage considered use of the 2D matrix *when* it is an appropriate tool.

As a junior aircrew member, I was not trained in use of the 2D risk assessment matrix, just provided with OJT: “It’s simple—two variables, work them out, assign the colour (red, yellow or green), and move on.” Since then, I’ve observed its ubiquitous implementation, to the point where it is mistaken for risk management. The terms used in the field of risk science are important since application of the correct taxonomy leads the user to a clear understanding and better risk management. First note that the 2D matrix is a risk *assessment* tool; hazard identification precedes a risk assessment, and risk *management* is the broader application of tools and resources to the problem.

Presentations about the 2D risk assessment matrix were made to the Flight Test Safety Workshop in 2015 (<http://flighttestsafety.org/2015-scottsdale>), and the paper was subsequently published in SETP’s Cockpit (January 2017). More recently, in February 2019, MIT’s Prof. Leveson, weighed in on the issue with the first part of a promised two-part paper, Improving the Standard Risk Matrix: Part I (<http://sunnyday.mit.edu/Risk-Matrix.pdf>). Without repeating all the detail in the above references, pertinent points follow:

1. The 2D matrix is a risk assessment tool. It serves two purposes: the relative ranking of risks or the assessment of a risk against a subjective baseline. The first is useful if you have constrained resources and must leave a risk element unmitigated, deciding which one goes unaddressed. The other is useful to access pre-authorized risk acceptance thresholds. These typically appears as “risks assessed below a certain level don’t go to SRB.” It is not a hazard identification tool.

2. There are mathematical limitations to a risk model with two dimensions that applies multiplication to the ordinal variables representing those dimensions. The 2D matrix is particularly susceptible to cognitive bias as users attempt to coerce their real-world problem into the model.

3. Other risk models exist. I like one that implements three variables (exposure, consequence and likelihood) to address problems of independence in the 2D matrix (consequence and

*(continued next page)*

**Limitations of the 2D Matrix** (continued) and likelihood. I like it because its existence highlights differences. Other tools are available that use other models.

**A standard risk matrix from MIL-STD-882E**

RISK ASSESSMENT MATRIX				
SEVERITY \ PROBABILITY	Catastrophic (1)	Critical (2)	Marginal (3)	Negligible (4)
Frequent (A)	High	High	Serious	Medium
Probable (B)	High	High	Serious	Medium
Occasional (C)	High	Serious	Medium	Low
Remote (D)	Serious	Medium	Medium	Low
Improbable (E)	Medium	Medium	Medium	Low
Eliminated (F)	Eliminated			

(image credit: <http://sunnyday.mit.edu/Risk-Matrix.pdf>)

In 1976, George Box quipped, “All models are wrong; some are useful.” When undertaking my OJT in risk assessment, I did not realise I was implementing a model upon risk, or, the difference between identification, assessment and management. I did not see the limitations. When I learned of other tools in the toolbox, comparisons between those tools illustrated the limitations of each. I am not advocating that we dump the 2D matrix. It has a place. It is a small place, after we implement hazard identification tools, in order to access pre-authorized risk acceptance processes. I aim to reduce the amount of time I waste trying to bestow unachievable accuracy, since the desired output is classification either above or below the threshold that would direct me to the SRB. I am careful not to mistake the 2D matrix risk assessment for hazard identification tools, or wider risk management efforts. *Ben Luther*

**Gulfstream Trio wins Best Paper**

The Workshop’s best paper award went to *Takeoff Field Performance at Gulfstream*, Todd Ablor, Clay Harden & Ben Luther of Gulfstream Aerospace. The paper and video will not be available, but the authors have shared the slides of their presentation as an attachment to this newsletter.



**An example of the swag for Workshop attendees**



(picture credit: [@David\\_Kern](#))

**FTSC Reopens Workshop Feedback**

If you attended the 2019 Flight Test Safety Workshop in Charleston, please take the survey provided by the Committee. <https://www.surveymonkey.com/r/FTSW2019>. Your feedback is very important, and the more feedback received, the better vector the Committee can provide to make future Workshops better. Please consider completing it ASAP. Though not part of the survey, consider sending an email with suggestions for how to improve the survey as well.

The critiques from the Workshop pointed to a desire to understand more practical application of tools, particularly STPA. Organizers believe this applies to Risk Matrices, as discussed above. This will also inform the workgroup activities at future workshops. Attendees at the conference represented more than sixty-two organizations from Europe, Canada, and the United States.

Videos from the Workshops (for those presenters who agreed to be recorded) should be available before next month. You can find videos for all workshops at <http://www.flighttestsafety.org/workshops>. Click on the previous workshop link in the sidebar to see videos from that workshop. Not all presentations are recorded.