

Tutorial Flight Test Crew Resource Management Part 2

1

00:00:01.200 --> 00:00:04.780

Back where we left off, making sure I'm not going to get feedback here.

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00:00:06.240 --> 00:00:09.959

All right. So we started off with a couple of good stories already.

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00:00:11.300 --> 00:00:11.780

Tom, I'm going to

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00:00:12.600 --> 00:00:14.990

steal something you were talking about during the break.

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00:00:16.281 --> 00:00:19.490

On top of safety significant events, or

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00:00:20.220 --> 00:00:20.750

almost,

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00:00:21.960 --> 00:00:25.490

how about external pressures and how that

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00:00:25.520 --> 00:00:28.880

affects your train of thought, how you're approaching different

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00:00:28.920 --> 00:00:29.550

projects,

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00:00:30.480 --> 00:00:32.080

even logistical pressures.

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00:00:32.960 --> 00:00:36.949

"Hey, my hotel reservation is up in two days, and we've

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00:00:37.000 --> 00:00:38.300

got four days of work left,

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00:00:40.000 --> 00:00:43.580

and there's no more rooms at this hotel because we're off in a remote site."

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00:00:45.720 --> 00:00:46.200

Now what?

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00:00:47.520 --> 00:00:50.810

So all those different types of pressures and how they play into this are really

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00:00:50.860 --> 00:00:52.260

interesting as well. All right.

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00:00:53.340 --> 00:00:57.240

More stories, or do I need to give another one? Please, somebody else.

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00:00:57.600 --> 00:00:58.540

Good. Dave's got one.

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00:01:00.460 --> 00:01:01.200

So this was

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00:01:02.480 --> 00:01:05.200

two tests, two different airplanes, same kind of test.

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00:01:05.261 --> 00:01:06.860

It was a contaminated leading edge.

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00:01:07.400 --> 00:01:08.980

And so one was on a

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00:01:09.880 --> 00:01:13.340

CJ4 and the other one's on a Challenger, but two different cert agencies.

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00:01:13.370 --> 00:01:15.020

So on the CJ4,

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00:01:16.500 --> 00:01:19.680

we flew all the maneuvers, and it's on the tape.

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00:01:20.280 --> 00:01:23.890

I told the FAA pilot, "You agree we're completely done with all the certification

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00:01:23.960 --> 00:01:26.660

testing, all the points we had to do?" "Yep." "I just want to look at this one more

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00:01:26.700 --> 00:01:26.880

time."

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00:01:27.780 --> 00:01:31.130

And so did one more stall, turned the airplane upside down, and home we

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00:01:31.200 --> 00:01:34.980

went. Alternatively, flying something similar on a

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00:01:35.080 --> 00:01:37.220

Challenger with a different agency pilot,

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00:01:38.780 --> 00:01:40.860

it was contaminated leading edge, and

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00:01:41.760 --> 00:01:45.280

the plane had a roll off coincident with pusher, but it was

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00:01:45.320 --> 00:01:47.660

controllable. And so he did get a roll-off.

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00:01:47.820 --> 00:01:51.280

It was highly variable when it would happen, but it rolled off,

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00:01:51.600 --> 00:01:54.840

and he didn't hold it within 20. It went a little bit past that.

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00:01:54.860 --> 00:01:56.650

I don't remember how much. I don't think we got to 30,

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00:01:57.460 --> 00:02:01.240

but it was outside of the limits. But he came back, and he said, "Yeah, I

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00:02:01.320 --> 00:02:04.380

don't think I got the aileron in quick enough." And he said, "I know I had more

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00:02:04.420 --> 00:02:07.680

left," and TM confirmed that. And then he turned to me, and he said, "You got

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00:02:07.720 --> 00:02:10.350

company data for this?" And I said, "Yeah." He said, "Okay, I'm done.

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00:02:10.741 --> 00:02:13.780

I've looked at enough." So two different outcomes from two different people.

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00:02:18.540 --> 00:02:22.480

No, and that'll be true, and you especially see it when we start, at

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00:02:22.520 --> 00:02:26.140

least I've seen and heard feedback, when you start involving not only

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00:02:26.660 --> 00:02:30.220

FAA, but when you start involving other foreign authorities coming in for

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00:02:30.260 --> 00:02:34.120

validation work and so on. We see a lot of variability there, especially

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00:02:34.180 --> 00:02:37.320

how they interact with the applicants and the crews.

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00:02:39.680 --> 00:02:41.010

I see a hand somewhere. Oh, there. I got you.

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00:02:41.010 --> 00:02:44.920

Yep. So Captain Carson, flight test engineer with the Royal Canadian

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00:02:44.960 --> 00:02:48.180

Air Force, and my story is a little bit about crew resource management when the

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00:02:48.240 --> 00:02:49.820

crew is outside of the aircraft.

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00:02:50.040 --> 00:02:50.200

Okay.

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00:02:50.300 --> 00:02:53.920

We were down in China Lake, testing the CF-18 Hornet

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00:02:54.340 --> 00:02:58.130

and the F-18 Charlie for the US Marine Corps, and

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00:02:58.180 --> 00:03:00.890

we had an event on the range where

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00:03:01.720 --> 00:03:05.380

another aircraft ejected just outside of our

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00:03:05.420 --> 00:03:09.310

airspace. And the so what was immediately transmitted to us in

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00:03:09.420 --> 00:03:13.360

the TM room that, okay, you no longer have SAR

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00:03:13.400 --> 00:03:16.420

or emergency response at your airfield.

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00:03:16.810 --> 00:03:20.620

And so that turns into a really quick discussion in the TM room

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00:03:20.680 --> 00:03:23.100

about, okay, what's the so what? What is our divert?

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00:03:23.850 --> 00:03:27.360

Do we still have a workable plan in case things start going wrong?

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00:03:27.440 --> 00:03:31.380

We've had no no-go items so far. Everything is green across the board,

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00:03:31.460 --> 00:03:35.310

but what if something happens? And then we come to a decision, okay, we can

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00:03:35.340 --> 00:03:38.400

divert. Edwards is still green. Everything's up and running.

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00:03:38.660 --> 00:03:41.260

We don't have any high-risk test points remaining on the dance card.

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00:03:41.970 --> 00:03:45.920

And then we key in the pilot after a quick standby, one minute to sort

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00:03:45.940 --> 00:03:49.380

out our thoughts, and we just really briefly give them the so what.

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00:03:50.120 --> 00:03:53.670

We don't say all of the details about the emergency that's happening outside of his

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00:03:53.700 --> 00:03:57.560

airspace, just the so what. You no longer have emergency response at the

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00:03:57.600 --> 00:04:01.480

home airfield. Are you comfortable, given all of these considerations, to continue

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00:04:01.500 --> 00:04:05.260

with the test point? Because he's in control of the aircraft, ultimately, safety is

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00:04:05.280 --> 00:04:09.060

his call. And so we tiered

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00:04:09.360 --> 00:04:13.140

our communications through the various channels until we got

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00:04:13.220 --> 00:04:13.520

to

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00:04:14.340 --> 00:04:18.240

the razor's edge of decision making with the pilot in the cockpit, and

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00:04:18.340 --> 00:04:21.981

I think that was a really good example of comms flow, discipline, and

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00:04:22.101 --> 00:04:25.560

pre-planning all coming together to make a very quick

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00:04:25.600 --> 00:04:26.900

decision with

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00:04:27.980 --> 00:04:31.099

the right amount, but not too much communication

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00:04:31.580 --> 00:04:34.820

bogging down the decision that needed to be made then.

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00:04:36.360 --> 00:04:37.860

So in situations like that,

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00:04:39.840 --> 00:04:43.340

did you guys end up, after the fact-- Sorry, I'm

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00:04:43.680 --> 00:04:45.040

pitching a question back at you.

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00:04:47.160 --> 00:04:50.160

Did you end up, after the fact, changing any of your

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00:04:50.720 --> 00:04:54.360

processes, procedures, briefing guides, anything, to try to account for that in the

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00:04:54.400 --> 00:04:57.340

future? So it's a thought on the ground in advance

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00:04:57.400 --> 00:04:59.680

before on the spot in flight.

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00:04:59.740 --> 00:05:03.160

Yeah, absolutely. So we reviewed that comms flow after the fact to

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00:05:03.200 --> 00:05:06.900

identify any efficiencies we could have had, any circular

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00:05:06.940 --> 00:05:10.850

conversations that were happening in the TM room, so that we knew

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00:05:10.880 --> 00:05:14.840

the comms flow in a similar situation for the future, so that the comms flow could

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00:05:14.860 --> 00:05:18.490

be more of a straight line rather than the eddies and flows that

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00:05:18.540 --> 00:05:22.200

happened in the moment. But I still think in the moment, we made the right

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00:05:22.360 --> 00:05:24.940

call, but we made it more efficient if that happens in the future.

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00:05:24.960 --> 00:05:28.920

Yeah. No, and I think that feedback loop, that safety assurance loop,

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00:05:29.060 --> 00:05:31.420

from an SMS perspective, is super important.

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00:05:32.620 --> 00:05:36.380

Addison and our safety team has started to do that very

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00:05:36.440 --> 00:05:40.320

earnestly with any of our safety reports that we get in, lessons learned, things

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00:05:40.360 --> 00:05:44.300

like that, that come out of those. How do we feed back that into

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00:05:44.380 --> 00:05:47.260

any of our processes? Does our ops manual need to change?

102

00:05:47.340 --> 00:05:48.960

Does our briefing guides need to change?

103

00:05:49.720 --> 00:05:53.100

How do we make that institutionalized so that we

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00:05:53.220 --> 00:05:57.070

actually learn the lesson? We talk a lot about, in this industry, about

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00:05:57.080 --> 00:06:00.270

lessons learned, right? We have lots of meetings and activities about

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00:06:00.300 --> 00:06:03.696

it. Until you actually drag that

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00:06:03.756 --> 00:06:07.556

information back into your processes, you're not really learning it.

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00:06:07.616 --> 00:06:11.316

You're doing a great job talking about it, but how are you going to act on

109

00:06:11.356 --> 00:06:13.356

it to really institutionalize it?

110

00:06:13.436 --> 00:06:16.096

So I'm glad to hear that that got baked back in. That's great.

111

00:06:18.736 --> 00:06:19.556

I got one here in the back.

112

00:06:19.616 --> 00:06:20.256

Yeah.

113

00:06:20.296 --> 00:06:24.036

So we were doing, a few years back, in a development test, so all

114

00:06:24.096 --> 00:06:27.456

OEM crew doing a offset landing back at

115

00:06:27.476 --> 00:06:30.476

Savannah with some hydraulics turned off.

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00:06:30.516 --> 00:06:34.376

So we're in a failure mode, and normally we'll try to do

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00:06:34.416 --> 00:06:37.616

those at outlying sites where things are a little quieter, not as busy, but we're

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00:06:37.656 --> 00:06:40.336

back in Savannah. So the procedures will have us, we're turning off all the

119

00:06:40.356 --> 00:06:42.476

hydraulics, doing an offset landing.

120

00:06:42.556 --> 00:06:44.896

So as soon as you're lined up at the runway, the test point's done, but then you

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00:06:44.936 --> 00:06:48.785

got to land, right? So part of the procedures will have us, about a minute prior to

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00:06:48.836 --> 00:06:52.756

landing, turn on a auxiliary hyd pump to

123

00:06:52.796 --> 00:06:55.586

continue to pressurize our brake accumulators to help us stop, because that's

124

00:06:55.616 --> 00:06:59.426

always a good thing. So long and the short of it, we're doing the test, busy

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00:07:00.956 --> 00:07:03.436

airport, and we forget to get the aux hyd pump on.

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00:07:04.076 --> 00:07:07.956

So the guys land, and then as the brakes go to the floor, they realize it,

127

00:07:07.996 --> 00:07:11.636

and turn the hyd back on, and nothing really big happened.

128

00:07:11.676 --> 00:07:14.936

But we went back and looked at the CRM, right? There's four people in the airplane.

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00:07:15.416 --> 00:07:18.596

How did we miss that? And in the front, it was just missed.

130

00:07:18.796 --> 00:07:21.916

It was a procedural miss, and they were just busy doing a bunch of things.

131

00:07:22.456 --> 00:07:26.116

And in the back, it was interesting. One of the FTEs was like, "I knew it.

132

00:07:26.196 --> 00:07:29.016

I knew that it wasn't turned on." But he didn't say anything.

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00:07:29.376 --> 00:07:31.596

And this was a pretty good FTE, very strong FTE.

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00:07:32.396 --> 00:07:32.836

He was about

135

00:07:33.916 --> 00:07:35.016

27, 28

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00:07:36.156 --> 00:07:40.136

on the aero per side. And just when you think about the comm cadence

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00:07:40.256 --> 00:07:43.586

in a very busy towered environment, it's

138

00:07:43.656 --> 00:07:46.816

hard to get some words in edgewise.

139

00:07:46.876 --> 00:07:47.056

Yeah.

140

00:07:47.086 --> 00:07:50.716

And now you're landing, you're giving an HQR, you're

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00:07:50.736 --> 00:07:54.526

verifying configuration, and there's a whole bunch of comm going on, and he needed

142

00:07:54.556 --> 00:07:56.716
to say either go around or turn the aux pump on.

143
00:07:56.756 --> 00:07:56.916
Yeah.

144
00:07:56.936 --> 00:08:00.756
And he just didn't say it. So it's one of those things, as we've gone and

145
00:08:01.496 --> 00:08:05.376
dissected that incident, thinking about, "Okay, hey, if we

146
00:08:05.516 --> 00:08:08.896
do need to make a comm call in a very busy environment, what is it going to be?

147
00:08:09.396 --> 00:08:12.495
And who's going to make it, and who's empowered to make it?" And so it's just one

148
00:08:12.536 --> 00:08:15.565
of those things that you wouldn't think that somebody would've actually seen it and

149
00:08:15.616 --> 00:08:18.476
not said anything, but that was the reality that we saw that day.

150
00:08:19.596 --> 00:08:23.476
Interesting. Yeah. That crew concept, we talk

151
00:08:23.516 --> 00:08:26.496
about it all the time, right? We've talked about it today already.

152
00:08:26.536 --> 00:08:30.516
We've talked about it in our classes that we do, and it's

153
00:08:30.526 --> 00:08:33.836
always emphasized that everybody has a voice, right?

154
00:08:34.817 --> 00:08:35.196
And

155

00:08:36.596 --> 00:08:40.396

it's interesting how often that type of situation

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00:08:40.496 --> 00:08:41.177

still comes up,

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00:08:42.116 --> 00:08:45.896

and we still have to emphasize it. So all we can do is continue to preach that

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00:08:45.936 --> 00:08:46.276

lesson,

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00:08:47.416 --> 00:08:51.366

but learning that one is a tough one, especially in organizations where you're

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00:08:51.376 --> 00:08:54.796

bringing up what I'll call-- You said an experienced FTE,

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00:08:54.896 --> 00:08:58.516

but it becomes even more of a challenge when you start trying to do

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00:08:58.526 --> 00:09:02.056

on-the-job training, and training up the next

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00:09:02.116 --> 00:09:04.005

generation, right? Because

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00:09:04.056 --> 00:09:07.896

we've all been there, we've all

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00:09:07.936 --> 00:09:11.856

sat in that seat, and it's all running in our heads. "They must see that.

166

00:09:12.446 --> 00:09:15.996

They must know that. We've talked about that. They know they need to do that.

167

00:09:16.256 --> 00:09:17.606

I don't need to say anything."

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00:09:18.636 --> 00:09:21.576
So teaching that ability, that

169

00:09:22.036 --> 00:09:25.366
desire to speak up and say something.

170

00:09:25.476 --> 00:09:27.856
And the worst thing that's going to happen is, "Yep, I got that.

171

00:09:27.896 --> 00:09:28.706
Yeah, I remember that."

172

00:09:29.816 --> 00:09:33.696
But the best thing that's going to happen, potentially, is, "Oh, wow,
good

173

00:09:33.816 --> 00:09:35.476
catch. Thanks, I forgot."

174

00:09:37.096 --> 00:09:38.276
Right. So no, that's a great one.

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00:09:39.856 --> 00:09:41.616
Who else? I saw somebody walking for a mic. There you go.

176

00:09:42.616 --> 00:09:42.836
Yeah.

177

00:09:44.256 --> 00:09:48.116
Yeah. So Cody Ailey here with Electra, and I'm going to ask James to

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00:09:48.156 --> 00:09:52.136
grab a mic, if we could get James. So we're doing a hybrid

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00:09:52.176 --> 00:09:53.616
electric airplane up in Manassas.

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00:09:54.376 --> 00:09:56.516
I was the test pilot for this particular event.

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00:09:56.976 --> 00:10:00.776

James was lead test director/FTE for this, so he's back in TM

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00:10:00.836 --> 00:10:03.986

monitoring. And at the time, we were using Starlink.

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00:10:04.036 --> 00:10:06.336

So if you haven't tried Starlink for TM, it's pretty phenomenal.

184

00:10:06.896 --> 00:10:10.576

We rely on Starlink pretty much for our primary TM source.

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00:10:10.596 --> 00:10:14.236

But James has got basically all the data that I've got in the cockpit back.

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00:10:14.256 --> 00:10:16.676

He can see the same systems display and information that I've got.

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00:10:17.216 --> 00:10:21.176

But one of the things with CRM that at least I

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00:10:21.196 --> 00:10:24.556

like to say is you've got to share your awareness, and this is a failing on my part

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00:10:24.676 --> 00:10:28.416

of sharing my awareness. But we head out on a test mission, hybrid

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00:10:28.716 --> 00:10:32.616

system, so we've got a turbine turning the generator, and we get a hot

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00:10:32.636 --> 00:10:34.216

bearing temperature in the generator.

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00:10:34.296 --> 00:10:37.526

So on the way out, we make the decision, and

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00:10:38.316 --> 00:10:42.166

so I'm going to ask James to chime in here, but at the time, my assumption is

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00:10:42.176 --> 00:10:45.386

that we've got something degrading in the generator, and

195

00:10:45.876 --> 00:10:48.856

obviously that's resulting in a high bearing temperature.

196

00:10:48.916 --> 00:10:50.536

So what was your thoughts on the way out?

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00:10:51.036 --> 00:10:54.936

Yeah. So on the way out, we saw the high bearing temperature, and that immediately

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00:10:55.056 --> 00:10:57.196

prompted a discussion in the telemetry room.

199

00:10:57.356 --> 00:11:01.016

I let Cody know that we were busy looking at it, and the discussion

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00:11:01.096 --> 00:11:04.316

ultimately came back to the SMEs saying, "You know what?"

201

00:11:05.116 --> 00:11:07.196

It's not a problem. We can continue flying like this.

202

00:11:07.356 --> 00:11:08.016

Not a big deal."

203

00:11:09.536 --> 00:11:09.856

But

204

00:11:10.696 --> 00:11:14.376

after giving it a little bit more thought, I wasn't really comfortable

205

00:11:14.436 --> 00:11:18.096

doing the mission that we were planning to do. So I said, "You know what, Cody?"

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00:11:18.356 --> 00:11:21.136

Let's come back, take a look at it, and do it another day."

207

00:11:21.616 --> 00:11:23.376

Yeah. So that's communicated, right?

208

00:11:23.456 --> 00:11:26.536

So we're up and we've got hot mic via comms as well.

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00:11:26.616 --> 00:11:30.156

So we're talking pretty continuously and make the decision to abort and start

210

00:11:30.176 --> 00:11:34.046

heading home. So as we start heading home, then now I

211

00:11:34.136 --> 00:11:37.786

am still seeing a high bearing temperature, although we've reduced power so that

212

00:11:37.796 --> 00:11:41.196

we're not pulling as much torque. So the temperature starts coming down a little

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00:11:41.276 --> 00:11:45.216

bit, and I'm thinking we probably are in at least stable

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00:11:45.296 --> 00:11:49.236

condition, so we can make it home. As I turn back, I hear an odd

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00:11:49.256 --> 00:11:51.876

frequency of vibration that certainly I haven't heard before.

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00:11:51.956 --> 00:11:55.296

So at that point, it is my

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00:11:55.356 --> 00:11:57.616

understanding that we've had a high bearing temperature, right?

218

00:11:57.676 --> 00:11:59.916

Would be an indication of a failing bearing.

219

00:11:59.996 --> 00:12:03.814

And my thought is thatAll right. Now I've got a weird frequency that's

220

00:12:03.844 --> 00:12:05.884
never really been present in prior flights.

221

00:12:05.944 --> 00:12:08.044
So yeah, the bearing's probably starting to go.

222

00:12:08.144 --> 00:12:09.653
Interestingly, I lower my visor,

223

00:12:10.464 --> 00:12:12.664
but I don't say anything to James at this point.

224

00:12:12.984 --> 00:12:16.864
So I'm thinking, "Great, the bearing's about to let go, so I probably should

225

00:12:16.904 --> 00:12:20.164
make sure that any FOD that comes through the firewall is not in my

226

00:12:20.224 --> 00:12:22.844
eyeball." But I don't share my awareness.

227

00:12:22.964 --> 00:12:26.724
I don't call James up and go, "All right, I just picked up a level of

228

00:12:26.784 --> 00:12:29.184
vibe that I've never seen before." It's not big.

229

00:12:29.284 --> 00:12:31.624
It's not like it's about to rattle itself apart.

230

00:12:32.084 --> 00:12:36.004
It's just a frequency that's new, and I know it's unusual, but I don't share that.

231

00:12:36.104 --> 00:12:39.964
So as we turn back, do you have any awareness at that point that

232

00:12:40.044 --> 00:12:42.644

obviously I am starting to see some anomalous indications?

233

00:12:42.724 --> 00:12:46.224

Now, it's there in the data. If you look at the data traces, you'll see torque,

234

00:12:46.304 --> 00:12:49.344

fuel flow, they all start to fluctuate as this bearing is degrading.

235

00:12:49.864 --> 00:12:52.224

But at this time, I don't tell James.

236

00:12:52.284 --> 00:12:54.544

So what was your thought as we turned for home?

237

00:12:55.064 --> 00:12:58.204

We weren't too concerned. Everything else looked nice and smooth.

238

00:12:58.244 --> 00:13:01.664

There had been no real changes since we first saw the initial

239

00:13:01.724 --> 00:13:05.264

indication. We'd lowered the load on the generator, and

240

00:13:06.904 --> 00:13:10.724

temperatures had started to come down just a little bit, so we were feeling a

241

00:13:10.744 --> 00:13:14.704

little bit more comfortable that things were going to be fine during the

242

00:13:14.764 --> 00:13:15.164

RTB.

243

00:13:15.664 --> 00:13:19.544

Yeah, right. Okay, so here's the really interesting part. Completely unrelated.

244

00:13:19.704 --> 00:13:22.064

We've actually had a FOD in the oil system.

245

00:13:22.224 --> 00:13:25.614

I don't know how this happens because we've got a filter, but we ended up with a

246

00:13:25.664 --> 00:13:29.104

small piece of FOD that clogged an injector nozzle in the turbine, not in the

247

00:13:29.144 --> 00:13:32.604

generator. And so now the turbine is being starved of oil.

248

00:13:32.664 --> 00:13:35.954

So the frequency that I hear is actually the bearings in the turbine eating

249

00:13:35.964 --> 00:13:39.624

themselves. The generator looks okay, but in the meanwhile now, we're

250

00:13:39.984 --> 00:13:43.464

servicing out all the bearings in the turbine, or at least on the compressor side.

251

00:13:43.564 --> 00:13:46.484

And that is what I'm hearing. So

252

00:13:47.284 --> 00:13:50.854

again, I have not shared this. Had I, then I probably would've

253

00:13:50.854 --> 00:13:54.554

prompted James to start taking a much harder look at what the actual

254

00:13:55.044 --> 00:13:57.984

entire sum total picture was looking like.

255

00:13:58.444 --> 00:14:01.064

But eventually, the bearings started to clearance themselves to the point that we

256

00:14:01.104 --> 00:14:04.784

get a case rub out of it. And so now we've got fan and turbine blades

257

00:14:04.904 --> 00:14:08.044

rubbing against the case, and obviously the vibe picks up considerably.

258

00:14:08.064 --> 00:14:10.464

So any awareness that that's going on up to this point?

259

00:14:10.784 --> 00:14:11.204

Negative.

260

00:14:11.924 --> 00:14:15.604

Yeah. So it starts sounding very ugly for me, but before I even have a chance to

261

00:14:15.624 --> 00:14:19.064

say anything at that point, the turbine's running with an ECU that's trying to

262

00:14:19.104 --> 00:14:22.824

maintain RPM, and so it just starts dumping fuel in, trying to keep the

263

00:14:22.864 --> 00:14:26.544

turbine speed up, over temps itself, and then automatically shuts itself down.

264

00:14:26.604 --> 00:14:30.464

So not a big deal. It shut itself down in self-protect mode,

265

00:14:30.624 --> 00:14:34.124

but now the turbine has just failed. That is very clear to all of us at that point.

266

00:14:34.184 --> 00:14:34.324

So

267

00:14:36.784 --> 00:14:39.794

at that point, I think we're now suddenly all brought back into a very

268

00:14:40.724 --> 00:14:42.304

cohesive state of situational awareness.

269

00:14:42.984 --> 00:14:46.404

But had I shared that, that was about a minute between when that odd frequency

270

00:14:46.464 --> 00:14:48.314

started as the bearings had clearanced themselves,

271

00:14:49.144 --> 00:14:52.344

and the case rub started before the turbine finally ended up shutting itself off.

272

00:14:52.404 --> 00:14:55.844

So there's about a minute there that I could have actually brought the situational

273

00:14:55.864 --> 00:14:59.854

awareness of the team up and had made sure that we were all prepped for

274

00:14:59.904 --> 00:15:01.654

some significant anomalous event,

275

00:15:02.544 --> 00:15:05.184

which happened then a few seconds later.

276

00:15:05.224 --> 00:15:08.704

Now, being hybrid, we just kept going on battery and landed safely back at the

277

00:15:08.764 --> 00:15:09.024

field.

278

00:15:09.924 --> 00:15:13.874

But postmortem, of course, we pull out a one millimeter chunk of-- We're

279

00:15:13.904 --> 00:15:16.224

waiting for spectral analysis to tell us what it was.

280

00:15:16.244 --> 00:15:20.094

But an incredibly tiny piece of FOD in the oil system, but

281

00:15:20.104 --> 00:15:23.684

completely unrelated. That's the really wild part, is they just happened to happen

282

00:15:23.704 --> 00:15:27.444
at the same time. We had turned for home, so we were in a good position
to get back

283
00:15:27.544 --> 00:15:31.424
safely. But they were, at the time, completely unrelated, and it was a
failure

284
00:15:31.464 --> 00:15:35.404
on my part to share the awareness that I had to bring the team up and get
the team

285
00:15:35.444 --> 00:15:37.173
aware of what was actually happening with the aircraft.

286
00:15:37.754 --> 00:15:41.344
What Cody didn't know was that I'd already pulled up the EPs for the

287
00:15:41.384 --> 00:15:42.164
TG failure.

288
00:15:42.904 --> 00:15:46.144
Which, again, was extremely helpful, and so from a CRM standpoint, from
that point

289
00:15:46.204 --> 00:15:48.644
on, it ran pretty smooth because, of course, we briefed that.

290
00:15:48.684 --> 00:15:52.604
And so James was ready, had looked up the procedure, which is great,

291
00:15:52.644 --> 00:15:55.104
and was spring-loaded, ready to go with the TG fail.

292
00:15:55.164 --> 00:15:59.124
So at that point, lowers my workload, and we're able to run the EP

293
00:15:59.224 --> 00:16:01.964
and bring the aircraft home in accordance with procedures.

294
00:16:02.044 --> 00:16:03.864
So that was a very positive outcome.

295

00:16:04.604 --> 00:16:07.044

And one more thing I'd like to share from the telemetry room.

296

00:16:07.164 --> 00:16:10.924

We've got a lot of really sharp engineers in there, and immediately after the

297

00:16:10.964 --> 00:16:14.744

TG failed, they took that personally and immediately went into root

298

00:16:14.864 --> 00:16:17.884

cause analysis. We're still in the middle of the RTB.

299

00:16:17.924 --> 00:16:19.964

The aircraft's not on the ground yet.

300

00:16:20.004 --> 00:16:23.264

But they were all so enthusiastic to figure out what happened.

301

00:16:23.324 --> 00:16:26.184

It took, "Hey, guys, we need to focus.

302

00:16:26.474 --> 00:16:28.444

It's not over till the aircraft's back on the ground."

303

00:16:28.744 --> 00:16:28.864

Yeah.

304

00:16:28.964 --> 00:16:30.904

And suddenly, the team was back,

305

00:16:31.784 --> 00:16:35.684

monitoring everything they needed to look at and ensured a good outcome, even if

306

00:16:35.744 --> 00:16:36.644

something else had come up.

307

00:16:37.204 --> 00:16:38.783

Yeah, indeed. And that's where leadership comes in.

308

00:16:38.804 --> 00:16:41.904

You talk about the skills, but leadership being a big one, and that's getting the

309

00:16:41.924 --> 00:16:45.884

team refocused on making sure that you stay on task until

310

00:16:45.924 --> 00:16:47.704

that task is done. So thanks, Eric.

311

00:16:47.884 --> 00:16:51.224

Awesome. No, I appreciate it. You guys are a great plant, and I didn't even plan

312

00:16:51.284 --> 00:16:51.524

that.

313

00:16:56.764 --> 00:16:57.364

Go time.

314

00:16:57.424 --> 00:16:57.944

I'm just following.

315

00:16:57.964 --> 00:16:58.464

Yeah, it's all good.

316

00:17:00.604 --> 00:17:00.754

All right.

317

00:17:00.754 --> 00:17:04.184

All right, Barbara Gordon. I'm an instructor pilot at Navy Test Pilot

318

00:17:04.244 --> 00:17:06.904

School. I also am the CRM instructor.

319

00:17:06.964 --> 00:17:10.644

We teach threat and error management, and I get to teach risk management and

320

00:17:10.684 --> 00:17:13.404

THAs to the student, and so this event, kind of the

321

00:17:13.484 --> 00:17:17.464
culmination of training. So, yes,

322

00:17:17.565 --> 00:17:21.434
we teach to anticipate and mitigate and detect and correct and recover
and

323

00:17:21.484 --> 00:17:24.244
resolve. So basic threat and error management principles.

324

00:17:25.624 --> 00:17:28.924
This was about 10 years ago. I was in a Black Hawk helicopter.

325

00:17:29.024 --> 00:17:32.804
It was a procedure, so got to give you guys a rotorcraft,

326

00:17:32.924 --> 00:17:36.844
have to be the token rotorcraft person here, maybe besides Tom Curry.

327

00:17:36.854 --> 00:17:37.164
But

328

00:17:38.164 --> 00:17:42.114
there's a procedure we do for engine performance called running lines,

329

00:17:42.304 --> 00:17:46.024
and so we take one engine to idle, the other

330

00:17:46.064 --> 00:17:49.444
one, we start adding power to try to get up to those higher limits.

331

00:17:49.564 --> 00:17:53.484
It is a procedure that is done in Black Hawks and

332

00:17:53.584 --> 00:17:57.124
Seahawks to check topping power post-maintenance, so it's not

333

00:17:57.164 --> 00:18:00.844
uncommon to use this procedure. It's a great way to collect a lot of

334

00:18:00.864 --> 00:18:04.584
data very quickly in some higher-end and middle-end

335

00:18:04.744 --> 00:18:08.124
power settings. So I'm flying with a-

336

00:18:08.884 --> 00:18:12.364
Army warrant officer, 47 pilot, that I have to remind her which way

337

00:18:12.424 --> 00:18:14.364
helicopters rotate if tail rotor fails.

338

00:18:15.024 --> 00:18:18.964
And who also doesn't have a lot of experience doing autorotations because
in

339

00:18:19.004 --> 00:18:22.764
a Chinook, they just don't do autorotations unless you're a maintenance

340

00:18:22.844 --> 00:18:23.484
test pilot.

341

00:18:24.504 --> 00:18:27.664
So we go through all of the things,

342

00:18:28.544 --> 00:18:31.324
the THAs. We go through test planning.

343

00:18:31.404 --> 00:18:34.784
This is their first event of soup to nuts.

344

00:18:36.064 --> 00:18:39.984
We brief. We're in the middle of this flight, so we have procedures in
place over

345

00:18:40.004 --> 00:18:43.224
southern Maryland where we do these running lines, and of course, it's
like you set

346

00:18:43.264 --> 00:18:46.684

yourself up so if something happens, you got a place to land in southern Maryland,

347

00:18:47.524 --> 00:18:49.804

so on and so forth. We go through the prompts, limits.

348

00:18:49.904 --> 00:18:51.574

We talk about review of the safety.

349

00:18:51.664 --> 00:18:55.264

Remember, okay, if the engine that is driving the

350

00:18:55.284 --> 00:18:59.244

rotor fails, this is what we have to do as a crew to

351

00:18:59.284 --> 00:19:02.804

not end up in a field in southern Maryland.

352

00:19:02.844 --> 00:19:06.044

And so, part of that is

353

00:19:06.604 --> 00:19:09.744

detecting. So we have the mitigations in place.

354

00:19:09.824 --> 00:19:12.104

We have the detection. We have an engine out.

355

00:19:12.584 --> 00:19:16.184

We're probably going to have some yaw or some sort of

356

00:19:16.364 --> 00:19:20.334

little gyration in the aircraft. So we go through all these procedures,

357

00:19:20.384 --> 00:19:22.824

and I remind her, "You have to lower the collective.

358

00:19:22.924 --> 00:19:26.764

You have to slow us down to enter the auto." I push the good engine

359

00:19:27.064 --> 00:19:30.624

back to fly, and then, Bob's your uncle, we go home. Right?

360

00:19:30.824 --> 00:19:31.044

So

361

00:19:33.104 --> 00:19:36.714

then it happened. So the engine driving the

362

00:19:36.784 --> 00:19:39.664

rotor, it actually exploded internally.

363

00:19:41.484 --> 00:19:41.644

She

364

00:19:43.424 --> 00:19:47.064

has 10 hours in a Black Hawk. She did exactly what we

365

00:19:47.124 --> 00:19:49.424

briefed. She lowered that collective to the floor.

366

00:19:49.504 --> 00:19:53.444

Unfortunately, our rotor speed was already down at 80, and so

367

00:19:53.504 --> 00:19:56.364

it did not recover. So me getting the engine in fly.

368

00:19:57.264 --> 00:20:00.964

So the story is what

369

00:20:01.044 --> 00:20:04.324

you talk about in recovery is incredibly

370

00:20:04.364 --> 00:20:08.294

important because we talk about how to lower the

371

00:20:08.364 --> 00:20:10.864

collective, slow to 80 knots, enter the auto,

372

00:20:12.364 --> 00:20:15.964

instructor advances the lever to fly, but we don't talk about the

373

00:20:16.004 --> 00:20:19.964
details of it like you can't slam that engine in fly because you could
compress

374
00:20:20.004 --> 00:20:20.544
or stall in

375
00:20:21.424 --> 00:20:23.734
a high-rated ascent. Well, how high?

376
00:20:23.764 --> 00:20:26.024
Well, they had us at greater than 8,000.

377
00:20:26.524 --> 00:20:30.384
So vertical speed indicator is pegged, so we have no idea.

378
00:20:31.344 --> 00:20:33.884
She also, because the rotor speed is so low,

379
00:20:35.044 --> 00:20:38.984
I actually stopped looking at it when it went through 85, and so I

380
00:20:39.024 --> 00:20:42.784
realized that her rate of deceleration could be problematic getting

381
00:20:42.824 --> 00:20:46.004
those blades flapping, and I'm like, "Oh, we're going to hit the tail,
and then it

382
00:20:46.044 --> 00:20:49.044
doesn't matter." So I had to block her at the same time.

383
00:20:49.064 --> 00:20:52.973
And so these nuanced things about the recovery, I'm like, you talked

384
00:20:53.024 --> 00:20:54.944
about the recovery is what gets you.

385
00:20:55.504 --> 00:20:59.484
It was the details of how to recover, the intimate details,

386

00:20:59.964 --> 00:21:01.894
and what could happen if

387

00:21:03.304 --> 00:21:06.504
she doesn't do this, and I don't do exactly this.

388

00:21:06.534 --> 00:21:10.514
And so we've changed how we do that exercise, what

389

00:21:10.544 --> 00:21:14.394
we brief, how we train to, and talk about your recovery procedures

390

00:21:14.444 --> 00:21:18.064
are as important as the detailed method of test of a test

391

00:21:18.074 --> 00:21:21.234
technique because those nuances

392

00:21:21.264 --> 00:21:23.824
can what get you in trouble on the recovery.

393

00:21:23.864 --> 00:21:26.564
So the good news is we recovered at 600 feet.

394

00:21:27.664 --> 00:21:29.764
Made it home to PAX. Declared the emergency.

395

00:21:29.824 --> 00:21:33.484
They shut down the entire airfield for a helicopter, which was pretty funny.

396

00:21:33.824 --> 00:21:34.684
Awesome.

397

00:21:35.264 --> 00:21:36.064
Yeah.

398

00:21:37.344 --> 00:21:39.404
Closed all runways at PAX so we could land.

399

00:21:39.464 --> 00:21:39.664

So,

400

00:21:40.704 --> 00:21:43.744

the good news is I think it was a valuable lesson for all of us,

401

00:21:44.344 --> 00:21:46.844

from the details of what you teach,

402

00:21:47.904 --> 00:21:50.714

but also how important students are like, "Eh,

403

00:21:51.664 --> 00:21:54.524

what could possibly happen?" I'm like, "Death."

404

00:21:55.784 --> 00:21:55.924

So.

405

00:21:55.944 --> 00:21:56.084

Yeah.

406

00:21:59.284 --> 00:22:01.964

No, I appreciate that, and I'm glad to hear

407

00:22:03.324 --> 00:22:07.004

those shifts that you made after the fact, for

408

00:22:07.424 --> 00:22:09.744

when you do those type of maneuvers in the future.

409

00:22:11.344 --> 00:22:15.084

I really feel strongly that that's a super important part,

410

00:22:15.164 --> 00:22:15.884

and

411

00:22:17.404 --> 00:22:20.644

we can argue what the most important parts of SMS are, right?

412

00:22:21.704 --> 00:22:25.663

But for me, that safety assurance loop is so key, and that feedback

413

00:22:25.673 --> 00:22:29.564

and bringing these lessons back into how you're operating

414

00:22:29.584 --> 00:22:33.254

on a day-to-day basis is so crucial so that the next

415

00:22:33.284 --> 00:22:36.924

person doesn't have to go through the same thing again and maybe not have

416

00:22:36.984 --> 00:22:38.984

that positive outcome.

417

00:22:40.244 --> 00:22:44.064

I'll

418

00:22:44.484 --> 00:22:46.884

try not to get on my SMS soapbox for a minute here.

419

00:22:48.124 --> 00:22:52.004

Do we have any others? Otherwise, I have one personal one I

420

00:22:52.044 --> 00:22:53.044

was going to do. Go ahead. Yeah.

421

00:22:53.264 --> 00:22:54.264

Do you want one more CRM?

422

00:22:54.324 --> 00:22:54.424

Yeah.

423

00:22:55.504 --> 00:22:55.724

So,

424

00:22:56.664 --> 00:23:00.014

a long time ago at a test pilot school far, far away,

425

00:23:02.184 --> 00:23:03.764

was going to give a launch

426

00:23:03.774 --> 00:23:07.684

student stability progress check to a student.

427

00:23:08.944 --> 00:23:12.764

This guy was a heavy airplane dude, and we were out flying in a T-2,

428

00:23:13.764 --> 00:23:15.404

and the brief was pretty

429

00:23:16.384 --> 00:23:20.104

exceptional. It was really, really good, and he mentioned one thing in the brief

430

00:23:20.164 --> 00:23:23.824

that ended up being a factor later on, which was he didn't

431

00:23:23.864 --> 00:23:26.624

intend on exceeding 350 knots that particular day.

432

00:23:27.984 --> 00:23:31.764

So we go out, and the kid flew the absolute most

433

00:23:31.904 --> 00:23:32.304

stellar

434

00:23:33.424 --> 00:23:36.964

long stab prog check that I'd ever seen. He's nailing his fuel points.

435

00:23:37.144 --> 00:23:39.824

He's nailing his data tolerances.

436

00:23:39.924 --> 00:23:42.364

He's just walking through the thing perfectly.

437

00:23:43.204 --> 00:23:46.284

So into the back of my mind kind of creeps some of that

438

00:23:46.844 --> 00:23:50.804

cockpit hierarchy and cultural of, man, this

439

00:23:50.844 --> 00:23:52.664

kid is just doing fantastic.

440

00:23:53.664 --> 00:23:57.424

And so we went in, we were about 13,000 feet, and the

441

00:23:57.484 --> 00:24:01.454

next step was to do the negative G cockpit check, and then

442

00:24:01.484 --> 00:24:02.284

the next step was a

443

00:24:03.244 --> 00:24:06.044

few negative G pushes for stick force per G.

444

00:24:07.104 --> 00:24:10.944

So we're up at 13,000, and he rolls inverted,

445

00:24:11.624 --> 00:24:14.904

and I'm thinking, okay, he's going to roll inverted and do a little push,
and we'll

446

00:24:15.104 --> 00:24:18.932

check that out. But instead, he kind of just continues the nose

447

00:24:18.972 --> 00:24:22.012

tracking down, and the negative G points are at 10,000 feet.

448

00:24:22.072 --> 00:24:23.132

So I'm thinking, "Wow.

449

00:24:23.972 --> 00:24:27.412

Man, is this kid on it. He's going to let our nose gently come down.

450

00:24:27.452 --> 00:24:29.372

He's going to do a little bit of a 1G scoop.

451

00:24:29.412 --> 00:24:32.012

He's going to roll out, and we're going to knock this thing out of the
park.

452

00:24:32.032 --> 00:24:35.212

This kid's amazing." And then the nose kind of keeps on falling.

453

00:24:35.912 --> 00:24:36.372

And then

454

00:24:37.272 --> 00:24:40.842

it gets to 350, and per the brief, I'm like, "Hey,

455

00:24:41.152 --> 00:24:43.752

350 knots." And I hear something to the effect of,

456

00:24:45.192 --> 00:24:48.792

and the G increases, and I'm like, "Do you have it?"

457

00:24:49.372 --> 00:24:51.132

And then the stick kind of comes back in my lap.

458

00:24:52.072 --> 00:24:55.952

So by the point I've yelled out three times, "I got it," we're at

459

00:24:55.992 --> 00:24:58.592

80 degrees nose low, going through about 420,

460

00:24:59.512 --> 00:25:03.412

and at about 8,000 or 6,000 feet. And I'm thinking, "Well, maybe we

461

00:25:03.452 --> 00:25:06.562

should eject." And I thought, "No, that'd just shred us.

462

00:25:06.602 --> 00:25:09.012

So I'm going to take it right to the G limit.

463

00:25:09.032 --> 00:25:11.252

If that doesn't work, I'm going to go a little bit over, and we'll recover."

464

00:25:12.392 --> 00:25:15.192

So we bottomed out at about 1,500 feet,

465

00:25:16.472 --> 00:25:17.492

cleaned ourselves up, and

466

00:25:18.772 --> 00:25:22.732

went back to the house. Well, the postmortem was that he was a

467

00:25:22.772 --> 00:25:26.132

heavy guy, so he'd always done his G checks as a push.

468

00:25:26.832 --> 00:25:29.792

And the recovery for that, of course, would be a pull.

469

00:25:30.252 --> 00:25:34.152

So when I asked him if he had it, his recovery was to pull harder

470

00:25:34.532 --> 00:25:36.772

because he had lost SA of where the horizon was.

471

00:25:37.512 --> 00:25:41.212

So two things CRM wise that played in that.

472

00:25:41.272 --> 00:25:45.132

One, that 350 knot call. If he hadn't have done that, I probably would've been

473

00:25:45.232 --> 00:25:48.672

late on taking the airplane and probably wouldn't be talking with you today.

474

00:25:49.232 --> 00:25:53.192

And the second was that kind of cultural halo

475

00:25:53.272 --> 00:25:56.972

bias that I had put on the kid because he was doing so incredibly

476

00:25:57.012 --> 00:26:00.892

well that I didn't question. In fact, I made up a reason for how he was going

477

00:26:00.932 --> 00:26:02.712

from one altitude to the next.

478

00:26:04.112 --> 00:26:04.812

That's a great one.

479

00:26:06.832 --> 00:26:10.312

So I'll give you a personal story, and Dave

480

00:26:10.352 --> 00:26:11.632

Lewandowski can help me here.

481

00:26:13.332 --> 00:26:15.752

How many people were airborne on 9/11?

482

00:26:18.112 --> 00:26:20.872

Yeah, there was a few. I don't think I was flying with you, Dave.

483

00:26:20.992 --> 00:26:22.312

I think I was flying with somebody else.

484

00:26:22.412 --> 00:26:22.542

But

485

00:26:24.452 --> 00:26:28.332

we were out in West Kansas, and the call comes in,

486

00:26:28.972 --> 00:26:31.432

citation test, whatever, I forget what I was

487

00:26:32.412 --> 00:26:32.942

in that day,

488

00:26:34.052 --> 00:26:34.731

return to base.

489

00:26:36.932 --> 00:26:39.172

We're not done. Why am I returning to base?

490

00:26:40.552 --> 00:26:44.352

So the pilot I was flying with at that point, I was in the right seat, said, "Hey,

491

00:26:44.432 --> 00:26:47.432

reach back out to TM, see what's going on."

492

00:26:48.452 --> 00:26:49.712
So I called back in, and

493

00:26:50.712 --> 00:26:54.192
they said, "Yeah, you guys come home." "Well, what's going on?"

494

00:26:54.272 --> 00:26:55.792
Can you say what's going on?" "Just get home."

495

00:26:57.112 --> 00:27:00.442
They didn't want to say anything because they knew that

496

00:27:02.032 --> 00:27:05.912
my mom was a state employee for the state of New York,

497

00:27:06.122 --> 00:27:07.652
and they didn't know if she was in one of the buildings.

498

00:27:09.272 --> 00:27:10.672
So from a CRM perspective,

499

00:27:11.772 --> 00:27:15.692
they didn't want to contaminate us coming back because they didn't know

500

00:27:15.732 --> 00:27:17.172
what my mental state was going to be.

501

00:27:18.512 --> 00:27:22.072
So little simple things like that, forming those relationships, those bonds with

502

00:27:22.092 --> 00:27:25.412
the people you're working with, can have a big impact on that as well.

503

00:27:26.172 --> 00:27:27.912
So fortunately, she wasn't. She was

504

00:27:29.212 --> 00:27:29.472
different

505

00:27:30.612 --> 00:27:34.572
part of the state that day. But yeah, those little personal things, those

506

00:27:34.692 --> 00:27:38.412
cultural things, can have a big impact when it comes to CRM.

507

00:27:39.452 --> 00:27:39.712
All right.

508

00:27:41.932 --> 00:27:44.412
It was actually a great lead in to a next slide.

509

00:27:44.452 --> 00:27:48.252
We can tell more stories, so don't hold back on me if you think of

510

00:27:48.292 --> 00:27:51.892
one. But I am going to move on. So

511

00:27:51.912 --> 00:27:52.552
preparing.

512

00:27:54.592 --> 00:27:57.952
This one always gets some energy in our conversation.

513

00:27:58.052 --> 00:28:01.792
So we'll go down this path a little bit and see what you guys have to

514

00:28:01.832 --> 00:28:04.252
say. So it comes back to the

515

00:28:05.352 --> 00:28:08.252
train like you fight, right? Fly like you brief.

516

00:28:10.932 --> 00:28:14.382
So making sure test plans are in place, TIA, the conformity,

517

00:28:14.832 --> 00:28:18.212
all these things that we were talking about, getting all that in place,

518

00:28:18.812 --> 00:28:22.152
reviewing the ACs, getting your

519

00:28:22.192 --> 00:28:25.962

THAs and your mitigations outlined so you make sure you have all that in

520

00:28:26.052 --> 00:28:27.932

place appropriately for each flight.

521

00:28:28.452 --> 00:28:32.272

The briefings, hitting those hazard levels, and the mitigations are

522

00:28:32.352 --> 00:28:32.951

super key.

523

00:28:34.612 --> 00:28:37.712

I will get on my safety assurance soapbox a little bit.

524

00:28:38.072 --> 00:28:39.592

How many people after a flight

525

00:28:40.412 --> 00:28:44.132

come back, and in the post-flight briefing, pull the THAs back up?

526

00:28:46.752 --> 00:28:48.132

Did you do this one?

527

00:28:49.212 --> 00:28:52.032

Did you hit that mitigation? Did this one work?

528

00:28:52.212 --> 00:28:54.952

Are there others that you did that should be on this list?

529

00:28:55.882 --> 00:28:57.612

That's part of that safety assurance loop, too.

530

00:28:57.712 --> 00:28:59.172

You want to really learn some lessons.

531

00:28:59.232 --> 00:29:01.452

You want to really ingrain that into your process.

532

00:29:02.512 --> 00:29:04.401
That's a key one. Now,

533
00:29:06.092 --> 00:29:09.972
after a six, eight, 10-hour mission day, and

534
00:29:10.032 --> 00:29:13.932
it's the last post-flight brief, and the last thing anybody wants to do

535
00:29:13.992 --> 00:29:17.852
is sit in that post-flight brief longer than they have to because they

536
00:29:17.872 --> 00:29:21.052
want to get home, back to the hotel, get a shower, something.

537
00:29:22.652 --> 00:29:26.592
It can be a big ask some days. But the value can

538
00:29:26.632 --> 00:29:29.792
be there as well. So I just ask that you guys consider that. All right.

539
00:29:32.632 --> 00:29:35.352
So the mitigations, test limitations, terminology.

540
00:29:36.352 --> 00:29:37.572
Here's my favorite one.

541
00:29:38.472 --> 00:29:39.852
Knock it off, terminate, abort.

542
00:29:40.692 --> 00:29:41.492
Do they mean the same thing?

543
00:29:43.332 --> 00:29:43.452
No.

544
00:29:44.612 --> 00:29:48.332
Does abort mean the same thing to you that it does to me, that it

545
00:29:48.342 --> 00:29:50.082
does to Tom, that it does...

546

00:29:51.732 --> 00:29:52.302

Do you know?

547

00:29:54.132 --> 00:29:57.952

Now, are we going to sit there in a pre-flight brief and tear apart every possible

548

00:29:58.032 --> 00:30:00.452

word we're going to say? Probably not.

549

00:30:01.332 --> 00:30:04.052

Are there some key ones that we should maybe highlight in on?

550

00:30:04.992 --> 00:30:08.022

Yeah, maybe. Especially depending on the different tests you're going to be doing

551

00:30:08.022 --> 00:30:11.452

that day. At least having a common understanding of

552

00:30:11.492 --> 00:30:14.732

what knock it off versus terminate means, something like that.

553

00:30:15.772 --> 00:30:17.112

I see the mic over to you, Pete. What you got?

554

00:30:20.676 --> 00:30:22.876

You got to factor in under pressure,

555

00:30:23.996 --> 00:30:27.716

somebody may revert to their primary call from a

556

00:30:27.796 --> 00:30:28.556

past life.

557

00:30:28.676 --> 00:30:28.996

Of course.

558

00:30:29.296 --> 00:30:33.116

Because for me, it's always knock it off and abort, and also from

559

00:30:33.216 --> 00:30:36.855

having some missile background, terminate means push the red button and blow the

560

00:30:36.916 --> 00:30:37.416

thing up.

561

00:30:38.976 --> 00:30:42.856

And one day during a ground test, the other flight test

562

00:30:42.916 --> 00:30:43.516

engineer said

563

00:30:44.476 --> 00:30:48.256

the word that I shall not repeat, basically because we did

564

00:30:48.296 --> 00:30:52.226

not want personnel around the asset or

565

00:30:52.276 --> 00:30:55.986

anything like that. So the terminology call-outs is

566

00:30:56.036 --> 00:30:59.096

something the stress of in the moment, people may

567

00:31:00.656 --> 00:31:03.936

agree to what the calls are going to be, but when they revert to

568

00:31:03.996 --> 00:31:07.976

their childhood state, they may go back to what they're used

569

00:31:08.016 --> 00:31:09.316

to from a past life.

570

00:31:09.756 --> 00:31:09.956

Yeah, for sure.

571

00:31:10.006 --> 00:31:13.876

So that's just a consideration, and you talk about, okay, if we hear these

572

00:31:13.976 --> 00:31:16.436
other calls, what we're going to do.

573

00:31:16.756 --> 00:31:19.816
Yeah. No, 100% agree. And I would like to think

574

00:31:20.616 --> 00:31:22.736
that if I was charging down the runway

575

00:31:23.616 --> 00:31:27.316
and in the middle of a takeoff run and somebody yelled terminate versus

576

00:31:27.356 --> 00:31:30.996
abort versus stop, that I would stop the plane.

577

00:31:32.256 --> 00:31:32.416
Right?

578

00:31:33.536 --> 00:31:37.376
But you're 100% right. You have to be prepared for what

579

00:31:37.416 --> 00:31:38.136
primacy is.

580

00:31:40.176 --> 00:31:40.356
Yeah.

581

00:31:40.916 --> 00:31:44.816
For the terminology, I think it kind of depends on the

582

00:31:44.896 --> 00:31:46.176
test content as well.

583

00:31:46.516 --> 00:31:46.656
Yeah.

584

00:31:47.376 --> 00:31:49.076
For example, you said the takeoff run.

585

00:31:49.156 --> 00:31:52.756

For the maximum energy brake tests, for example, our

586

00:31:52.816 --> 00:31:53.936

internal agreement,

587

00:31:55.356 --> 00:31:59.116

as flight test engineers, we will not call knock it off or abort

588

00:31:59.316 --> 00:32:01.596

because there is a runway end coming.

589

00:32:02.236 --> 00:32:05.976

If you say abort, then you may kick on the brakes harder,

590

00:32:06.076 --> 00:32:10.036

that we need test pilots to release

591

00:32:10.076 --> 00:32:14.056

the brakes. So our internal agreement for the

592

00:32:15.356 --> 00:32:18.716

knock it off call, it's the release, release, release, basically,

593

00:32:19.376 --> 00:32:21.896

because one of the mitigation is the long runway.

594

00:32:22.216 --> 00:32:22.596

Yeah.

595

00:32:22.636 --> 00:32:25.556

Yeah. From the perception point of view that the end is coming,

596

00:32:26.316 --> 00:32:29.136

but we know we have enough distance to stop.

597

00:32:30.175 --> 00:32:33.876

No, that's a great point. Yeah, I say this one always generates some

598

00:32:33.916 --> 00:32:34.896

energy in the class. We

599

00:32:36.416 --> 00:32:40.406

had two of our pilots that had conflicting definitions of some of

600

00:32:40.456 --> 00:32:44.076

these, and it was no joke, a 15-minute knock-down,

601

00:32:44.096 --> 00:32:45.956

drag-out about how the other guy was stupid.

602

00:32:47.376 --> 00:32:50.916

So it was pretty entertaining. But terminology is a

603

00:32:51.436 --> 00:32:52.056

huge

604

00:32:52.896 --> 00:32:54.216

factor in what we do.

605

00:32:56.996 --> 00:33:00.036

In your example that you were talking about, you made the statement of,
"Do you

606

00:33:00.076 --> 00:33:01.436

have it?" Right? Do you have it?

607

00:33:03.076 --> 00:33:06.216

What's your interpretation of do you have it?

608

00:33:07.376 --> 00:33:08.096

What does that mean?

609

00:33:09.196 --> 00:33:10.076

So

610

00:33:11.736 --> 00:33:14.636

the example I gave with the

611

00:33:15.896 --> 00:33:16.356

departure,

612

00:33:17.716 --> 00:33:17.936
right?

613

00:33:19.656 --> 00:33:21.296
It didn't matter what he was saying to me.

614

00:33:21.456 --> 00:33:24.576
It wouldn't matter if he said, "I've got it." I was waiting for that

615

00:33:24.636 --> 00:33:26.525
secondary, right?

616

00:33:27.716 --> 00:33:28.106
And

617

00:33:29.196 --> 00:33:31.196
so just setting those expectations.

618

00:33:31.216 --> 00:33:32.956
But to your point, Pete, heat of the moment,

619

00:33:34.156 --> 00:33:37.076
the primacy of what you're going to say,

620

00:33:37.896 --> 00:33:41.776
who knows what's going to come out, right? Depending on how deep you are
into it.

621

00:33:42.776 --> 00:33:46.496
All right. Yeah, I covered all those.

622

00:33:47.696 --> 00:33:48.616
Let's see what we got here.

623

00:33:51.296 --> 00:33:54.716
All right. This is another terminology one that I'll hit on real quick
before we

624

00:33:54.756 --> 00:33:58.556
keep going. When you start bringing TM into the loop now,

625

00:34:00.276 --> 00:34:03.916

and that's part of our class exercise, is we have that TM

626

00:34:03.936 --> 00:34:06.796

ability with our ground station outside the sim.

627

00:34:08.156 --> 00:34:11.127

We actually had a crew that briefed how they were going to interact with TM.

628

00:34:12.377 --> 00:34:16.326

What was going to happen, who was going to be responsible for recording what

629

00:34:16.357 --> 00:34:18.846

data. It was a wonderful briefing,

630

00:34:20.036 --> 00:34:21.857

but there was one thing that wasn't talked about,

631

00:34:22.796 --> 00:34:24.836

and that is when you finish a test point,

632

00:34:25.756 --> 00:34:27.136

how does the pilot know

633

00:34:28.216 --> 00:34:30.776

to proceed to the next condition, right?

634

00:34:32.357 --> 00:34:34.676

And the pilot had an expectation in his head.

635

00:34:34.877 --> 00:34:38.495

The expectation was he was waiting to hear, "Good data,

636

00:34:38.917 --> 00:34:42.607

clear to proceed." And if he didn't hear that, he was

637

00:34:42.656 --> 00:34:43.107

just, psst,

638

00:34:44.236 --> 00:34:45.397

going to keep doing what he was doing.

639

00:34:46.397 --> 00:34:50.116

Stable aircraft under control, straight and level. Pause. Wait.

640

00:34:51.736 --> 00:34:55.576

And it was a really uncomfortable kind

641

00:34:55.616 --> 00:34:56.696

of pregnant pause.

642

00:34:57.996 --> 00:35:01.226

Right? The plane was just flying, and he was sitting there silent,

643

00:35:02.366 --> 00:35:06.076

and the test conductor was kind of looking around, and we had all this on video.

644

00:35:06.226 --> 00:35:08.156

It was really pretty interesting to watch.

645

00:35:08.756 --> 00:35:10.216

The test conductor looks down at his paper.

646

00:35:10.236 --> 00:35:11.916

He's looking around like, "What's going on?"

647

00:35:11.996 --> 00:35:12.516

Why aren't we

648

00:35:13.496 --> 00:35:16.316

setting up for the next point?" And finally, the

649

00:35:17.236 --> 00:35:21.096

pilot monitoring turned to the pilot flying and said, "Are you going to move

650

00:35:21.176 --> 00:35:25.136

on to the next setup?" And he said, "I'm waiting to hear

651

00:35:25.176 --> 00:35:27.736

that we had good data, and we're cleared to proceed to the next."

652

00:35:29.436 --> 00:35:31.456

He never communicated that expectation.

653

00:35:33.576 --> 00:35:37.506

So now the expectation was made, and the rest of the flight was

654

00:35:37.556 --> 00:35:39.066

off and running and flawless.

655

00:35:40.336 --> 00:35:44.116

But setting those key expectations in that brief, in that moment

656

00:35:44.216 --> 00:35:48.196

is super important as well. If you have an expectation like that, you have to

657

00:35:48.216 --> 00:35:48.836

communicate it.

658

00:35:50.876 --> 00:35:54.256

All right. So standard procedures. We talked a lot about checklists.

659

00:35:54.296 --> 00:35:58.236

We talked about QRHs. Anybody here have what I call an in-flight

660

00:35:58.276 --> 00:35:58.576

guide?

661

00:36:00.316 --> 00:36:03.256

I know some manufacturers have them. I know Textron did.

662

00:36:03.296 --> 00:36:05.336

That's where I learned the practice from.

663

00:36:06.516 --> 00:36:08.016

They're a great resource.

664

00:36:09.896 --> 00:36:10.316
Go ahead, Rory.

665
00:36:10.576 --> 00:36:13.996
Yeah, I came across something recently with respect to flight

666
00:36:14.076 --> 00:36:16.596
manuals and QRHs on a training event.

667
00:36:17.016 --> 00:36:20.736
And so just for the people in the room, the FAA approves flight manuals,
but we

668
00:36:20.776 --> 00:36:22.856
don't always necessarily dig into the QRH.

669
00:36:23.456 --> 00:36:27.016
Interesting thing I found in this flight manual in one of the emergency
procedure

670
00:36:27.136 --> 00:36:30.228
section is it saidGo to QRH step

671
00:36:30.828 --> 00:36:33.748
XXX. And I thought, isn't that interesting?

672
00:36:33.788 --> 00:36:35.268
We have never actually looked at that.

673
00:36:35.348 --> 00:36:39.128
So how did we as the FAA allow this kind of potential

674
00:36:39.138 --> 00:36:42.968
area for divergence of approved data and/or information

675
00:36:43.028 --> 00:36:43.288
to

676
00:36:44.168 --> 00:36:47.908
get in there, right? And when you take a look at these, I'm very proud of
the

677

00:36:48.008 --> 00:36:51.378

level of eloquence of my fixed-wing brethren and the amount of manuals and

678

00:36:51.408 --> 00:36:54.088

checklists that they can write. It's quite prodigious.

679

00:36:54.128 --> 00:36:56.068

You should give yourselves a round of applause.

680

00:36:56.268 --> 00:36:59.748

And I was like: How do I ever even remember all of that in flight in the heat of

681

00:36:59.788 --> 00:37:03.648

the moment? But that is one thing I would maybe stress to the

682

00:37:03.668 --> 00:37:07.308

manufacturers. Think about who the line pilot is, whether that's a

683

00:37:07.408 --> 00:37:10.628

135 operator or a 121 operator or even a 91

684

00:37:10.688 --> 00:37:14.518

operator. From an engineering perspective, it makes a lot of

685

00:37:14.548 --> 00:37:18.388

sense to us to have that level of detail, and then you still

686

00:37:18.428 --> 00:37:22.108

have to put the operational envelope over the top of it. What does that look like?

687

00:37:22.148 --> 00:37:25.948

What am I actually telling the end user reader when they break this open

688

00:37:26.008 --> 00:37:29.758

in-flight, right? Now, I think a lot of them use a QRH, and I

689

00:37:30.048 --> 00:37:33.128

could not ever imagine opening up a flight manual in-flight.

690

00:37:33.368 --> 00:37:35.028

I don't think I'd be strong enough to lift the book.

691

00:37:36.968 --> 00:37:40.788

And that's an FAA problem, right? We have driven the industry to

692

00:37:40.828 --> 00:37:42.008

write volumes

693

00:37:43.368 --> 00:37:46.868

that may never be read. And in this case, it clearly wasn't.

694

00:37:46.888 --> 00:37:50.738

But just something to think about in terms of where information with good

695

00:37:50.788 --> 00:37:54.428

intent has diverged on what is FAA

696

00:37:54.488 --> 00:37:57.868

approved versus what is going to be used in the industry. Thanks.

697

00:38:02.948 --> 00:38:05.928

All right. When using checklists, QRHs,

698

00:38:06.848 --> 00:38:10.428

everybody pretty much in the challenge-response ballpark,

699

00:38:10.848 --> 00:38:11.948

somewhere in that realm.

700

00:38:13.048 --> 00:38:13.988

What about with,

701

00:38:14.908 --> 00:38:16.508

how do you tie the FTEs into that?

702

00:38:17.648 --> 00:38:18.208

Or do you?

703

00:38:20.588 --> 00:38:24.358

Right? Because I've flown with a whole bunch of people in this room, and I know in

704

00:38:24.408 --> 00:38:28.248

a bunch of the checklists, especially on the experimental aircraft and even in your

705

00:38:28.288 --> 00:38:32.228

digital checklists, you've tied in on the digital checklist some

706

00:38:32.268 --> 00:38:34.968

of those checks that involve the folks in the back.

707

00:38:35.708 --> 00:38:35.968

If you

708

00:38:36.948 --> 00:38:39.908

make that challenge and you don't get that response, do you stop?

709

00:38:39.968 --> 00:38:41.528

Do you pause, or do you

710

00:38:42.488 --> 00:38:43.448

skip that step

711

00:38:44.468 --> 00:38:45.468

and come back to it?

712

00:38:48.208 --> 00:38:52.188

From an FTE perspective, I want to see the QRH repeated

713

00:38:52.328 --> 00:38:56.288

or at least referenced in the flight cards, especially if that's going to become

714

00:38:56.328 --> 00:38:59.908

a compliance document for the certification, or in the

715

00:38:59.948 --> 00:39:03.228

military parlance, a qualification of the asset.

716

00:39:04.408 --> 00:39:07.848

And Rick and I were also talking, to Rory's point,

717

00:39:08.368 --> 00:39:12.328

I'd prefer to see the QRH become

718

00:39:12.468 --> 00:39:16.298

an appendix to the flight manual so that it does get

719

00:39:16.328 --> 00:39:16.848

approved,

720

00:39:17.648 --> 00:39:21.238

whether it's by us in flight test or the aircraft evaluation

721

00:39:21.288 --> 00:39:23.468

division, so.

722

00:39:26.288 --> 00:39:27.848

Yeah. So I do think it's a key point.

723

00:39:27.948 --> 00:39:31.648

If you're going to take the time and effort to tie experimental stuff into your

724

00:39:31.688 --> 00:39:33.568

checklists, into your QRHs,

725

00:39:34.628 --> 00:39:38.148

if you put that step in a certain position, it's there probably for a reason.

726

00:39:39.028 --> 00:39:42.168

So, I encourage you from a

727

00:39:44.008 --> 00:39:44.488

operate

728

00:39:45.348 --> 00:39:49.048

as planned to stick to those procedures, and if it means a

729

00:39:49.108 --> 00:39:50.908
pause, so be it. It's a pause.

730

00:39:53.868 --> 00:39:54.188
All right.

731

00:39:55.988 --> 00:39:59.788
I'm actually nearing the end of my slides already, so this is going to be another

732

00:39:59.888 --> 00:40:00.888
conversation slide.

733

00:40:03.148 --> 00:40:06.388
Danger zones. Any people here know Ron McElroy?

734

00:40:07.488 --> 00:40:10.748
Raise of hands, other than the FAA guys. Yeah. All right.

735

00:40:11.368 --> 00:40:14.727
So Ron was a FAA test pilot with us for a while.

736

00:40:14.788 --> 00:40:15.808
He was actually one of the

737

00:40:16.668 --> 00:40:19.008
creators and founders of this with our team.

738

00:40:20.308 --> 00:40:24.108
He loves to drop his little-- We left a lot of his

739

00:40:24.148 --> 00:40:26.168
imprints on our course material here.

740

00:40:26.228 --> 00:40:30.008
The danger zones is a Ron-ism, and on one of the previous

741

00:40:30.068 --> 00:40:34.028
slides, if you saw the little clips of Donald Duck and tailspins and all that

742

00:40:34.048 --> 00:40:34.508
good stuff.

743

00:40:36.288 --> 00:40:37.348
But he brought this one in,

744

00:40:38.308 --> 00:40:39.248
and it's actually

745

00:40:41.228 --> 00:40:44.888
very timely and a good discussion point.

746

00:40:47.508 --> 00:40:51.388
To say danger zones may be a little bit of a misnomer, but we'll

747

00:40:51.428 --> 00:40:54.528
call them attention zones, things that need to be paid attention to.

748

00:40:55.668 --> 00:40:59.617
We talked a lot about unfamiliar aircraft and/or other unfamiliar

749

00:40:59.708 --> 00:41:00.298
crew members.

750

00:41:01.188 --> 00:41:02.588
That happens to us quite a bit,

751

00:41:03.728 --> 00:41:07.628
so learning that adaptability is certainly important, but at the same

752

00:41:07.668 --> 00:41:11.208
time, it does take sometimes slowing down

753

00:41:11.688 --> 00:41:12.848
of the process a little bit,

754

00:41:13.748 --> 00:41:16.428
so that we do and can build a little bit of comfort.

755

00:41:16.508 --> 00:41:20.288

Whether it's a, "Hey, before we go out and do this test mission, I could really

756

00:41:20.448 --> 00:41:20.848

use

757

00:41:22.068 --> 00:41:25.828

just a 30-minute fam flight, couple trips around the pattern just to get the feel

758

00:41:25.888 --> 00:41:28.788

for this thing again before we start yanking and banking."

759

00:41:30.948 --> 00:41:34.788

Or beyond that, certain deliberate build-up events.

760

00:41:36.728 --> 00:41:39.628

Risk levels, transition between test points.

761

00:41:40.048 --> 00:41:43.808

I cannot tell you how many safety events I've read through, whether it's

762

00:41:43.868 --> 00:41:47.708

internal to us or NTSB safety reports, whatever the case

763

00:41:47.808 --> 00:41:48.268

may be.

764

00:41:49.348 --> 00:41:52.948

It's last event, returning to base, on

765

00:41:52.968 --> 00:41:55.028

approach to landing after a long flight.

766

00:41:55.148 --> 00:41:57.648

It's all these little transition things.

767

00:41:59.328 --> 00:42:01.388

Configuration changes is a huge one.

768

00:42:02.648 --> 00:42:04.328

Unplanned weather malfunctions.

769

00:42:05.088 --> 00:42:08.988

The list goes on and on, and where I'd love to hear some

770

00:42:09.088 --> 00:42:12.868

stories is how has one of these things

771

00:42:12.908 --> 00:42:16.688

affected a test event that you guys have had, where it

772

00:42:16.748 --> 00:42:20.668

either generated a test result you weren't expecting,

773

00:42:21.888 --> 00:42:22.888

you aborted a flight,

774

00:42:24.188 --> 00:42:28.088

you were out and about on a long test mission, say out in a test area,
and by

775

00:42:28.128 --> 00:42:32.116

the time you got the weather was garbage and maybe had to go somewhere
else,

776

00:42:32.816 --> 00:42:36.116

or maybe made a not great return-to-base decision.

777

00:42:36.696 --> 00:42:40.096

And I'll kick it off and give you one.

778

00:42:40.506 --> 00:42:43.116

I was out on a test mission at a different airport.

779

00:42:43.196 --> 00:42:45.266

We were returning to base where the aircraft lived,

780

00:42:46.316 --> 00:42:47.996

and on the way back in,

781

00:42:49.006 --> 00:42:52.836

noticed on the weather radar that an unforecasted, imagine

782

00:42:52.896 --> 00:42:56.596

that, afternoon thunderstorm in Texas was coming into the

783

00:42:56.616 --> 00:42:57.716

airport we were targeting.

784

00:42:58.836 --> 00:42:59.216

So we were

785

00:43:00.076 --> 00:43:03.316

in a race to the airport to try to beat the storm to the airport.

786

00:43:04.996 --> 00:43:08.676

Was that the right decision? Should we have just gone to an alternate,

787

00:43:08.816 --> 00:43:12.526

waited it out? Because per most cases in Texas,

788

00:43:12.616 --> 00:43:14.076

thunderstorms roll through pretty quick,

789

00:43:14.936 --> 00:43:17.236

and you could then proceed after that.

790

00:43:17.476 --> 00:43:20.816

But we made the decision, we were going to try to beat the storm back into the

791

00:43:20.836 --> 00:43:21.296

airport.

792

00:43:22.816 --> 00:43:26.736

The winds had shifted, so it shifted in our favor, and we were able

793

00:43:26.776 --> 00:43:30.416

to proceed straight in from the course we were on to the landing runway.

794

00:43:31.106 --> 00:43:34.536

The storm was at the opposite end of the field as we were at the approach end of

795

00:43:34.576 --> 00:43:34.976
the field.

796

00:43:36.276 --> 00:43:37.896
It was a pretty good storm

797

00:43:38.916 --> 00:43:40.466
with lots of wind and activity.

798

00:43:41.656 --> 00:43:44.676
When we got into the flare and the mains touched

799

00:43:44.716 --> 00:43:48.586
down, this aircraft in particular, when the mains touch,

800

00:43:49.736 --> 00:43:53.496
the standard procedure is to deploy the spoilers.

801

00:43:54.276 --> 00:43:57.996
In this airplane, with the flaps extended and the spoilers deployed, it's about

802

00:43:58.096 --> 00:44:01.916
a three-foot by one-foot hole in the wing now underneath

803

00:44:01.976 --> 00:44:02.756
those spoilers.

804

00:44:04.276 --> 00:44:07.276
So now the mains are on the ground, the spoilers are up, this big hole is in the

805

00:44:07.296 --> 00:44:10.016
middle of my wing, and the winds shift.

806

00:44:10.806 --> 00:44:14.696
Microburst rolls right across the field, and about

807

00:44:14.716 --> 00:44:18.416
15 knots below stall speed, the aircraft becomes airborne

808
00:44:18.436 --> 00:44:18.736
again.

809
00:44:21.356 --> 00:44:25.296
Yeah. I see all the "Ugh" in the room, and yes, that's

810
00:44:25.336 --> 00:44:26.716
exactly what we were doing.

811
00:44:27.896 --> 00:44:30.756
So a quick advance of the throttle stows the spoilers.

812
00:44:30.856 --> 00:44:34.756
We got a little bit of boost underneath us, and it was a firm landing,
but not

813
00:44:35.096 --> 00:44:36.736
anything abnormal.

814
00:44:38.076 --> 00:44:39.536
We've seen landings of that

815
00:44:40.776 --> 00:44:41.836
strength several times.

816
00:44:44.136 --> 00:44:46.936
But every time I think about it, it makes me question,

817
00:44:48.776 --> 00:44:52.086
I could've just taken 30 minutes and gone somewhere else and sat on the
ground and

818
00:44:52.096 --> 00:44:53.896
let it pass, and then jumped in.

819
00:44:55.296 --> 00:44:59.066
So those unexpected things that happen, having that

820

00:44:59.076 --> 00:45:02.976
CRM conversation, which we did, and we can question the decision all

821
00:45:03.016 --> 00:45:04.896
we want now after the fact.

822
00:45:07.396 --> 00:45:09.156
I think it's a super important component.

823
00:45:09.196 --> 00:45:11.276
So does anybody have an example like that?

824
00:45:12.336 --> 00:45:15.986
Doesn't have to be specifically to that, but something that an external

825
00:45:16.076 --> 00:45:19.696
force has come in, and something unexpected happened,

826
00:45:19.796 --> 00:45:21.576
something you hadn't planned for.

827
00:45:22.556 --> 00:45:24.816
I saw something. I saw a hand back there. There we go.

828
00:45:25.916 --> 00:45:26.516
Don't be shy.

829
00:45:28.176 --> 00:45:28.616
So,

830
00:45:29.716 --> 00:45:32.856
this was an MD test, so we were up at altitude,

831
00:45:33.616 --> 00:45:37.396
and we were busy setting up to

832
00:45:37.456 --> 00:45:39.996
hit MD, so design dive speed.

833
00:45:40.956 --> 00:45:44.856
And there was a lot of traffic underneath us.

834
00:45:44.936 --> 00:45:48.736
ATC said, "You guys are going to be waiting for at least an hour." And

835
00:45:48.856 --> 00:45:51.956
so we just hung out there, and everybody

836
00:45:53.056 --> 00:45:55.476
let their guard down, relaxed. It was lunchtime.

837
00:45:55.536 --> 00:45:58.556
We'd been up there for a long time, so people started eating their lunch,

838
00:45:59.856 --> 00:46:01.876
myself included, as TD.

839
00:46:02.776 --> 00:46:05.096
Well, during the hour we were waiting,

840
00:46:05.916 --> 00:46:07.025
there were some comms that

841
00:46:08.536 --> 00:46:12.396
made it to the cockpit that I didn't hear, which was that the aircraft

842
00:46:12.616 --> 00:46:14.836
had climbed an additional 2,000 feet.

843
00:46:14.896 --> 00:46:17.316
So we were already up near our ceiling,

844
00:46:18.116 --> 00:46:21.996
so I didn't think we were going any higher, but in order to

845
00:46:22.576 --> 00:46:26.316
reduce the amount of airspace below us that we needed to consume, the
pilots had

846
00:46:26.376 --> 00:46:30.356
climbed. So, there's been a couple really

847

00:46:30.396 --> 00:46:33.556

good talks over the years about all the things you need to worry about when hitting

848

00:46:33.576 --> 00:46:34.736

one of these MD points.

849

00:46:35.776 --> 00:46:37.976

And one of them is doing an atmospheric survey.

850

00:46:38.336 --> 00:46:40.876

So I had watched the atmosphere the whole way up.

851

00:46:41.356 --> 00:46:42.696

It was perfect

852

00:46:43.696 --> 00:46:44.606

conditions for this.

853

00:46:45.456 --> 00:46:49.435

But as we finally got cleared to do the point, we started our

854

00:46:49.556 --> 00:46:53.536

dive. I immediately saw that we were going to go way over speed,

855

00:46:53.576 --> 00:46:56.076

and I called abort, but it was already too late.

856

00:46:56.136 --> 00:46:59.296

And what had happened in that last 2,000 feet when I wasn't paying

857

00:46:59.336 --> 00:47:02.116

attention, there was horrible wind shear.

858

00:47:02.336 --> 00:47:02.496

So,

859

00:47:03.696 --> 00:47:07.656

all that to say, never, ever let your guard down, even when you're between

860
00:47:07.776 --> 00:47:10.216
tests, eating your lunch. Somebody's always got to

861
00:47:11.576 --> 00:47:14.036
ensure they've got eyes on critical parameters.

862
00:47:14.976 --> 00:47:16.356
So that's my story.

863
00:47:16.756 --> 00:47:17.656
No, appreciate that.

864
00:47:22.276 --> 00:47:25.996
Yeah, I think this one is probably the trifecta because we got all in the

865
00:47:26.076 --> 00:47:29.436
same point, the transition between points, a configuration change, and it
was a

866
00:47:29.496 --> 00:47:32.676
last flight before RTB.

867
00:47:33.836 --> 00:47:37.636
So it was a six-hour flight test, long day, fatigue was in

868
00:47:37.696 --> 00:47:41.676
there. But we had one of those once

869
00:47:41.736 --> 00:47:45.556
in a million days where we had completed every point on the test card, on
the

870
00:47:45.596 --> 00:47:48.436
dance card. Usually, we over-plan.

871
00:47:48.476 --> 00:47:50.856
We put more points on the dance card than we think we're going to be able
to

872
00:47:50.876 --> 00:47:52.676
achieve in a day, and that's just kind of our culture.

873

00:47:52.876 --> 00:47:53.026

Mm-hmm.

874

00:47:53.516 --> 00:47:57.096

This thing created some discussion about whether that was a good idea or not, but

875

00:47:57.856 --> 00:48:01.656

anyway, so we were on this last point, and we had about five, 10

876

00:48:01.796 --> 00:48:05.536

minutes of fuel left in the weight band before RTB, and

877

00:48:05.856 --> 00:48:09.746

we were all thinking, the external pressure, all of us were sensing it, "Hey, we're

878

00:48:09.816 --> 00:48:12.716

going to go home and we're going to be heroes because we completed this huge deck

879

00:48:12.796 --> 00:48:14.016

flawlessly," kind of thing there.

880

00:48:14.116 --> 00:48:18.016

So we're all pushing to get this last point done in this last five, 10 minutes we

881

00:48:18.056 --> 00:48:21.756

had left. So, as we're briefing up in between test

882

00:48:21.856 --> 00:48:25.696

points, where new conditions, we brief a quick DMOT brief there just to

883

00:48:25.736 --> 00:48:26.956

make sure everybody's on the same

884

00:48:27.816 --> 00:48:31.516

page regarding limits and speeds and all that. So we are making that

885

00:48:31.556 --> 00:48:35.476

transition that last point, and that speed at the last point puts

886

00:48:35.536 --> 00:48:39.036

us below our trailing cone speed. And this last point, we had to extend a trailing

887

00:48:39.056 --> 00:48:39.606

cone for it.

888

00:48:40.416 --> 00:48:42.616

So we get on condition, we call on condition. It was like, "Oh, crap.

889

00:48:42.676 --> 00:48:45.786

Yeah, we got to get the trailing cone out." And we're on the speed below the

890

00:48:45.836 --> 00:48:48.316

trailing cone speed. And if you're not familiar what I'm talking about, it's a

891

00:48:48.336 --> 00:48:51.556

squirrel cage back there that lets the-- You need to have enough drag on the

892

00:48:52.236 --> 00:48:55.476

drogue chute to pull it out. Well, there wasn't enough drag on the drogue chute, so

893

00:48:55.536 --> 00:48:59.456

that thing started wrapping up and rats nesting back there, and kinked the

894

00:48:59.516 --> 00:49:02.435

trailing cone tube, and turned into a big nest until we heard someone at the back

895

00:49:02.475 --> 00:49:03.896

of the airplane screaming, "Stop."

896

00:49:05.456 --> 00:49:07.346

And obviously, we didn't get that last point.

897

00:49:08.176 --> 00:49:11.716

After we thought we were going to be heroes, we were chumps because now the

898

00:49:11.756 --> 00:49:15.696

system's broken in the back, and it's about a few days to replace that

899

00:49:15.706 --> 00:49:17.336

poly tubing and all that kind of thing there.

900

00:49:17.376 --> 00:49:21.156

So obviously, created a lot of discussion, and we went from heroes

901

00:49:21.236 --> 00:49:23.516

to chumps in a matter of milliseconds there.

902

00:49:23.576 --> 00:49:27.476

So again, a lot of discussion about sometimes that old adage, the

903

00:49:27.516 --> 00:49:29.256

hurrier you go, the behinder you get.

904

00:49:29.356 --> 00:49:29.636

Yeah.

905

00:49:29.676 --> 00:49:33.556

But it created a lot of those kind of discussions about do you overplan

906

00:49:33.596 --> 00:49:36.576

a flight every time? I think most people probably do, but it certainly created

907

00:49:36.586 --> 00:49:40.496

discussion about that kind of culture that we had there at the time.

908

00:49:40.506 --> 00:49:42.816

No, I appreciate that. That's a great example.

909

00:49:42.876 --> 00:49:43.656

And I--

910
00:49:44.996 --> 00:49:46.316
Oh, I'm sorry, did somebody else...

911
00:49:48.636 --> 00:49:48.876
Okay.

912
00:49:51.016 --> 00:49:52.616
No, it's

913
00:49:53.696 --> 00:49:57.616
astonishing to me how often it comes up, transition between

914
00:49:57.656 --> 00:50:00.256
conditions, last condition of the day.

915
00:50:01.976 --> 00:50:02.196
So

916
00:50:03.036 --> 00:50:06.556
I appreciate your comment of is it the right decision to

917
00:50:06.636 --> 00:50:07.616
overplan a flight?

918
00:50:08.936 --> 00:50:10.036
So many of us do that.

919
00:50:11.596 --> 00:50:14.216
You're not unique in it. I see it all over the place.

920
00:50:15.076 --> 00:50:18.576
And it's great in concept, right? "Hey, when we get

921
00:50:18.636 --> 00:50:22.436
tired, when we run out of this weight band, when we run out of

922
00:50:22.496 --> 00:50:24.196
that, then we'll just stop."

923
00:50:25.676 --> 00:50:29.136

It's a lot harder to pull that trigger to just stop, right?

924

00:50:29.246 --> 00:50:29.436

"Oh, well,

925

00:50:30.256 --> 00:50:31.596

there's just one more.

926

00:50:32.556 --> 00:50:35.196

There's just this one other one," right?

927

00:50:35.916 --> 00:50:39.215

So that becomes a pressure on yourself.

928

00:50:39.336 --> 00:50:42.856

Necessary or not, it is a pressure that you've put on yourself,

929

00:50:43.996 --> 00:50:47.076

that can drive you into potentially a bad situation.

930

00:50:47.156 --> 00:50:49.536

So I appreciate that example. Anybody else?

931

00:50:53.096 --> 00:50:53.776

Chirp, chirp.

932

00:50:56.476 --> 00:50:57.036

I got two.

933

00:50:59.196 --> 00:51:00.256

Well, let Stu go first.

934

00:51:04.176 --> 00:51:05.416

How are you doing, Keith?

935

00:51:06.696 --> 00:51:07.596

Second flight TM.

936

00:51:09.276 --> 00:51:09.725

All right.

937

00:51:12.276 --> 00:51:16.156

All right. So, second flight of an airplane,

938

00:51:16.256 --> 00:51:19.176

oh, about five, seven years ago.

939

00:51:21.716 --> 00:51:25.016

And of course, second flight, we're still running two TM rooms,

940

00:51:26.316 --> 00:51:28.186

with chase video.

941

00:51:29.036 --> 00:51:32.856

We got a great nice video screen up in the corner that's beaming

942

00:51:32.896 --> 00:51:36.056

down the chase video, so we can all see the airplane in all its glory.

943

00:51:37.636 --> 00:51:41.076

Not only flight test in there supporting, but also the

944

00:51:41.736 --> 00:51:42.866

various engineering SMEs,

945

00:51:43.976 --> 00:51:47.536

watching their systems, who are only ever in

946

00:51:47.596 --> 00:51:49.856

TM for about three flights,

947

00:51:50.956 --> 00:51:53.166

maybe in their career, maybe every

948

00:51:54.156 --> 00:51:54.636

program.

949

00:51:57.276 --> 00:52:00.796

So there's a lot of attempting to manage

950

00:52:00.856 --> 00:52:04.456

CRM with that group and getting them to give you the

951

00:52:04.496 --> 00:52:06.886
feedback they need. Regardless,

952

00:52:07.736 --> 00:52:11.566
we're up flying, and the crew started talking about

953

00:52:11.576 --> 00:52:13.556
the tail was shaking.

954

00:52:14.396 --> 00:52:16.616
They didn't understand why the tail was shaking.

955

00:52:18.036 --> 00:52:21.896
So our chase crew very dutifully zoomed

956

00:52:21.936 --> 00:52:24.836
their camera in on the tail, and sure enough, our tail's shaking.

957

00:52:24.896 --> 00:52:27.445
We're all looking at this pretty picture on the video of, "Hey, the
tail's

958

00:52:27.456 --> 00:52:27.776
shaking."

959

00:52:28.656 --> 00:52:32.456
Not great, so let's slow down a little bit and start working on

960

00:52:32.496 --> 00:52:33.836
coming around, coming back to base.

961

00:52:33.876 --> 00:52:37.556
And we're sitting there trying to troubleshoot, we're between

962

00:52:37.576 --> 00:52:39.256
maneuvers trying to figure out what's going on.

963

00:52:41.356 --> 00:52:45.026
The safety officer conveniently walks into the room at that point and

964
00:52:45.396 --> 00:52:48.916
says, "Hey, can we zoom out and look at the rest of the airplane?"

965
00:52:50.876 --> 00:52:54.836
At which point we realized that the tail shaking was just a

966
00:52:54.876 --> 00:52:58.616
symptom of the actual problem. Fairly

967
00:52:58.796 --> 00:52:59.716
late in the

968
00:53:01.716 --> 00:53:05.356
build of the airplane, right before first flight, we added some heat
shields,

969
00:53:06.296 --> 00:53:10.266
because of engine exhaust. We thought that how the engines were going

970
00:53:10.276 --> 00:53:14.156
to exhaust onto the wing was going to do bad things to the leading edge,
added some

971
00:53:14.196 --> 00:53:17.596
heat shields. Turns out, as we zoomed out, we saw the heat

972
00:53:17.676 --> 00:53:18.776
shield on one

973
00:53:19.656 --> 00:53:23.496
side started to peel up, and that was throwing a wake back over the wing.

974
00:53:24.456 --> 00:53:27.566
So this changed the entire dynamic, and

975
00:53:28.396 --> 00:53:32.256
not only are we now talking to chase saying, "Hey, by the way, when you

976
00:53:32.296 --> 00:53:36.145
cross back over, don't cross behind the airplane, because if that heat

977

00:53:36.196 --> 00:53:39.736

shield goes, it's a really bad day for multiple aircraft now."

978

00:53:41.816 --> 00:53:45.656

But it was also a big exercise in the TM room of you can't just sit

979

00:53:45.716 --> 00:53:49.296

there and watch this pretty picture of a heat shield kind of flapping around the

980

00:53:49.316 --> 00:53:53.096

airplane, trying to come back in. I need the engineers to continue

981

00:53:53.106 --> 00:53:57.016

watching their screens because the pilots are fixated on

982

00:53:57.036 --> 00:54:00.226

getting the airplane home. They're not fixated on making sure all the additional

983

00:54:00.256 --> 00:54:02.736

systems are up and running and working.

984

00:54:03.176 --> 00:54:03.536

And

985

00:54:05.076 --> 00:54:08.956

trying to bring that training into subsequent first, second,

986

00:54:09.016 --> 00:54:12.876

third flights is just really, really difficult.

987

00:54:13.116 --> 00:54:16.916

Because while you might have the same FT,

988

00:54:17.536 --> 00:54:17.976

flight test

989

00:54:18.816 --> 00:54:21.376

groups in there, and you can pass along those lessons learned,

990
00:54:22.296 --> 00:54:26.216
you're definitely not dealing with the same systems engineers.

991
00:54:26.836 --> 00:54:27.236
And

992
00:54:28.636 --> 00:54:28.736
yeah,

993
00:54:29.616 --> 00:54:32.476
how you teach that, how you pass those lessons along to the SMEs is

994
00:54:32.536 --> 00:54:35.032
just I don't know how to do and don't know how to

995
00:54:36.212 --> 00:54:36.832
carry that forward.

996
00:54:37.532 --> 00:54:41.192
Yeah. It's a super complicated issue, and especially with a lot of the

997
00:54:41.232 --> 00:54:45.132
systems work that we do, where as part of the test, you're turning

998
00:54:45.192 --> 00:54:48.312
stuff off, you're putting it in a switch in an abnormal

999
00:54:48.352 --> 00:54:52.292
position. You're using this instead of that.

1000
00:54:52.332 --> 00:54:55.852
Right? And we talk about, in that threat error

1001
00:54:55.912 --> 00:54:59.852
management, identify and then recover, and recover is just getting the
aircraft

1002
00:54:59.892 --> 00:55:03.732
back to a good stable spot. Well, sometimes that good stable spot

1003
00:55:03.952 --> 00:55:07.922
you can't do without flipping some of those switches back or turning

1004
00:55:07.972 --> 00:55:11.942
that system back on. So incorporating that into

1005
00:55:11.992 --> 00:55:15.912
your SOPs, into your processes, how to drive that home, how to

1006
00:55:16.252 --> 00:55:20.092
bake that in, because some of those tests are so non-standard,

1007
00:55:20.172 --> 00:55:24.052
becomes really challenging. I wish I had the magic answer for everybody,
but I

1008
00:55:24.092 --> 00:55:24.332
don't.

1009
00:55:26.452 --> 00:55:26.692
Yes, sir.

1010
00:55:28.012 --> 00:55:29.532
Or Stu, you had the mic next.

1011
00:55:29.692 --> 00:55:33.612
Yeah, sure. Yeah, it was a great example of everyone's

1012
00:55:33.652 --> 00:55:34.901
looking at the shiny thing that was wrong-

1013
00:55:34.912 --> 00:55:35.012
Yeah

1014
00:55:35.032 --> 00:55:38.022
... and missing the fact that they still had to go do their primary job
because it

1015
00:55:38.032 --> 00:55:41.932
was only the second flight. I 100% agree with, majority of the incidents
I

1016

00:55:41.952 --> 00:55:45.732

look into at our company have nothing to do with the

1017

00:55:45.752 --> 00:55:46.492

system under test,

1018

00:55:47.432 --> 00:55:51.382

but the system under test and what we're doing for it complicates things
a

1019

00:55:51.472 --> 00:55:54.652

lot, and that's really where the risks come in, or between that.

1020

00:55:54.712 --> 00:55:58.472

Take an example on one of our large cabin business jets a while

1021

00:55:58.692 --> 00:55:59.292

ago.

1022

00:56:00.912 --> 00:56:04.752

In between a low speed pushover with a inner cycle shape on the tail

1023

00:56:04.772 --> 00:56:08.652

looking for force lightening or tail stall, and transitioning to

1024

00:56:08.692 --> 00:56:12.472

the high speed point, because we only need to check the low and high
speed on the

1025

00:56:12.512 --> 00:56:15.312

transition, that's when they get a tail stall. So, totally caught.

1026

00:56:15.572 --> 00:56:19.422

The crew was in the tail stall mindset, but they weren't looking for it
at the

1027

00:56:19.452 --> 00:56:23.272

time and ended up with an aero change to the aircraft for that.

1028

00:56:24.432 --> 00:56:28.242

Things like single bleed source, very common, where we've had

1029

00:56:28.272 --> 00:56:29.972
single bleed sources that fail.

1030

00:56:31.232 --> 00:56:32.892
You're taking away your redundancy.

1031

00:56:32.912 --> 00:56:36.872
So we do a lot of work with system safety to show

1032

00:56:36.932 --> 00:56:40.632
the redundancy of the aircraft, and then we smart flight testers turn off
the other

1033

00:56:40.652 --> 00:56:44.572
engine and take away all that redundancy that's built into those numbers,
and

1034

00:56:44.912 --> 00:56:45.712
that's a common one. We

1035

00:56:46.832 --> 00:56:50.792
had a completely unrelated system fail because we're doing a single bleed
source.

1036

00:56:51.732 --> 00:56:55.452
Something else fails that's unrelated to the test, and then another
failure

1037

00:56:55.472 --> 00:56:58.852
occurs with a, we had a check valve on our escape hatch that then caused
the

1038

00:56:58.872 --> 00:57:01.892
aircraft to depressurize up to past 25,000 feet.

1039

00:57:01.962 --> 00:57:02.172
And

1040

00:57:03.512 --> 00:57:07.092
the crew had to deal with that. And that created a whole bunch of CRM

1041
00:57:07.152 --> 00:57:09.582
issues. We had at least two incidents with

1042
00:57:10.872 --> 00:57:12.082
single engine aircraft where

1043
00:57:13.232 --> 00:57:14.792
the test condition complicated it.

1044
00:57:14.872 --> 00:57:18.212
One of them was we had to have a extremely heavy fuel imbalance on the
aircraft to

1045
00:57:18.252 --> 00:57:21.452
try and get a stagnation point on the wing, collecting some aero data,

1046
00:57:22.072 --> 00:57:25.332
and they had an engine failure due to a FOD event.

1047
00:57:25.412 --> 00:57:27.812
Absolutely nothing to do with the test, but now they got this massive
fuel

1048
00:57:27.852 --> 00:57:30.982
imbalance, dead sticking the aircraft in

1049
00:57:31.052 --> 00:57:35.032
without the ability to transfer because they've

1050
00:57:35.072 --> 00:57:38.492
lost generator power. So there's all those kind of things that always
seem to add

1051
00:57:38.552 --> 00:57:39.692
up. It's always those transitions.

1052
00:57:39.732 --> 00:57:40.952
We had another one that had an oil loss,

1053
00:57:42.152 --> 00:57:44.402

which eventually results in the propeller feathering.

1054

00:57:45.232 --> 00:57:45.572

And

1055

00:57:47.112 --> 00:57:51.012

so they've got a good profile coming in for high key, but we have ice

1056

00:57:51.032 --> 00:57:53.452

shapes in the aircraft, unknown drag configuration.

1057

00:57:54.092 --> 00:57:55.412

First time flying with those ice shapes.

1058

00:57:55.452 --> 00:57:59.692

Occasionally

1059

00:57:59.752 --> 00:58:03.702

it is the system fails, but rarely, it just cause complications is what it normally

1060

00:58:03.752 --> 00:58:06.312

does. It's what I find in pretty well all the time.

1061

00:58:06.442 --> 00:58:06.442

Yeah.

1062

00:58:06.452 --> 00:58:06.552

And

1063

00:58:08.572 --> 00:58:12.142

I try to brief our crews, and when we talk about this is how do you put

1064

00:58:12.152 --> 00:58:16.052

margin to deal with the unknown? We get

1065

00:58:16.092 --> 00:58:19.432

too many folks who will be like, "I got my THAs for all my risks." But how often do

1066

00:58:19.472 --> 00:58:22.492

we actually have an incident occurs that is actually directly related to a risk you

1067

00:58:22.512 --> 00:58:26.332

identified in the THA? Because you probably mitigated that with what you did.

1068

00:58:26.382 --> 00:58:29.072

It's these surprises that you need to be able to

1069

00:58:29.892 --> 00:58:31.012

really have the margin to handle.

1070

00:58:31.852 --> 00:58:35.352

Yeah, and that goes back to an earlier slide or earlier statement that I made

1071

00:58:35.412 --> 00:58:39.372

about threat error management, using it to build the safety buffer.

1072

00:58:39.652 --> 00:58:43.392

Right? Because we can't eliminate all these things from ever

1073

00:58:43.452 --> 00:58:47.112

happening, but if we can build a big enough buffer in everything else that we do,

1074

00:58:47.732 --> 00:58:51.232

when they do, hopefully it provides us the time

1075

00:58:51.252 --> 00:58:55.172

and altitude and speed we need to detect

1076

00:58:55.212 --> 00:58:56.712

and get to that recovery state.

1077

00:59:02.372 --> 00:59:04.852

I see one hand back there, Jason. I see another one over here.

1078

00:59:06.292 --> 00:59:06.432

Yeah.

1079
00:59:06.732 --> 00:59:06.872
Right.

1080
00:59:06.892 --> 00:59:07.912
You already got the mic. Go for it.

1081
00:59:08.132 --> 00:59:10.402
Yeah. On the what else on the bottom is-

1082
00:59:10.472 --> 00:59:10.572
Yeah

1083
00:59:10.872 --> 00:59:11.932
... why are we doing

1084
00:59:12.852 --> 00:59:14.712
this test point that's on the plan?

1085
00:59:15.532 --> 00:59:15.712
And

1086
00:59:16.992 --> 00:59:19.802
a long time ago, during Super Hornet development,

1087
00:59:21.572 --> 00:59:24.462
they were working on VMC, and so they're alternating.

1088
00:59:24.532 --> 00:59:28.512
The test technique is you slow down one throttle into max AB, one goes to

1089
00:59:28.612 --> 00:59:31.892
idle, two second delay, and then pedal input to

1090
00:59:31.912 --> 00:59:35.792
fix. So they're working down on each side, right test

1091
00:59:35.872 --> 00:59:39.032
point, left test point, et cetera. Let's make up a number.

1092
00:59:39.072 --> 00:59:42.732

They get down to 140 knots, and they meet their knock it off criteria

1093

00:59:42.772 --> 00:59:44.652
for the point to the right,

1094

00:59:45.472 --> 00:59:49.372
and then they do another point at 138

1095

00:59:49.412 --> 00:59:51.112
knots to the left

1096

00:59:51.972 --> 00:59:55.252
and departs control flight, and we should have lost the airplane.

1097

00:59:56.412 --> 01:00:00.312
What was super interesting from the test CRM point of view is, why

1098

01:00:00.332 --> 01:00:01.392
were you doing that point?

1099

01:00:01.432 --> 01:00:01.602
Mm-hmm.

1100

01:00:01.912 --> 01:00:05.632
You've already got the answer, but it wasn't until the postmortem

1101

01:00:06.032 --> 01:00:08.212
when they started looking around at each other and going, "Wait a minute.

1102

01:00:08.252 --> 01:00:11.992
Well, why did we fly that?" You don't need to know

1103

01:00:12.052 --> 01:00:15.892
that. It was just an engineering question, and it's on the test

1104

01:00:15.952 --> 01:00:19.372
card. Right? Cleared to proceed to the next one, reduce two knots, two
knots, two

1105

01:00:19.412 --> 01:00:19.632
knots.

1106

01:00:20.532 --> 01:00:24.072

All of the THA was there, but the common sense,

1107

01:00:24.612 --> 01:00:28.592

take a minute, pause, think about why are you actually doing that test point,

1108

01:00:28.612 --> 01:00:29.632

nearly lost an air vehicle.

1109

01:00:31.692 --> 01:00:35.492

No, that's an excellent point. And we should be asking those questions

1110

01:00:35.612 --> 01:00:38.932

even right back to the test plan development stages, right?

1111

01:00:39.552 --> 01:00:42.542

As we're building the test plans out and we're building out the envelope we're

1112

01:00:42.572 --> 01:00:43.472

trying to explore,

1113

01:00:45.272 --> 01:00:46.792

by rule, do we have to go there?

1114

01:00:48.032 --> 01:00:50.352

What are the configurations that are required?

1115

01:00:50.412 --> 01:00:53.012

Should we be looking at other configurations first?

1116

01:00:54.112 --> 01:00:57.872

So yeah, right from the test planning standpoint, asking those questions is

1117

01:00:57.952 --> 01:01:00.492

super important. I agree with that completely.

1118

01:01:01.872 --> 01:01:02.612

Yeah. Yes, sir.

1119

01:01:02.832 --> 01:01:04.232

Eric, I'm not going to share a story.

1120

01:01:04.292 --> 01:01:07.092

I'll be happy to share some of my stories at the bar later on.

1121

01:01:07.212 --> 01:01:09.892

I just want to throw something out there that'll bake everybody's noodle.

1122

01:01:10.852 --> 01:01:14.632

At SFTE 2009, so a lot of years ago,

1123

01:01:14.752 --> 01:01:17.712

Sidney Decker was talking human factors with us,

1124

01:01:18.532 --> 01:01:21.752

and he said something that has stuck with me for a long, long

1125

01:01:21.812 --> 01:01:25.492

time. He says he thinks Murphy's Law, what can go wrong will go wrong,

1126

01:01:25.772 --> 01:01:29.512

needs to be inverted. Sometimes things

1127

01:01:29.552 --> 01:01:30.712

don't go wrong

1128

01:01:31.552 --> 01:01:34.952

when they should have gone wrong, and we draw the wrong conclusion.

1129

01:01:35.692 --> 01:01:39.452

So that prompts us all to do a hot wash-

1130

01:01:39.852 --> 01:01:39.862

Sure

1131

01:01:39.872 --> 01:01:41.372

... even when we've had a good flight.

1132

01:01:42.112 --> 01:01:45.212

So put that into the process in the SMS.

1133

01:01:45.252 --> 01:01:46.252

So over to Rick.

1134

01:01:48.152 --> 01:01:52.032

Yeah. One of the things we have to be careful, you talked about earlier

1135

01:01:52.112 --> 01:01:54.972

about the OEMs versus the little shops.

1136

01:01:56.272 --> 01:01:59.792

Was doing a project a long time ago on an early

1137

01:01:59.852 --> 01:02:03.012

Citation with a re-engineering project.

1138

01:02:03.652 --> 01:02:04.431

Okay?

1139

01:02:05.352 --> 01:02:08.012

Whoever could that be with? I wouldn't know what applicant you're talking about,

1140

01:02:08.072 --> 01:02:08.252

Rick.

1141

01:02:09.912 --> 01:02:10.432

No names.

1142

01:02:11.712 --> 01:02:13.532

But we were doing a project, and I was doing the

1143

01:02:14.472 --> 01:02:17.612

restart envelope. All right? And one of the hard points to get

1144

01:02:17.692 --> 01:02:21.652

on a straight wing Citation is the high

1145

01:02:21.672 --> 01:02:24.812
end, high speed, high altitude. So I was going up to get the

1146
01:02:25.752 --> 01:02:26.292
end up,

1147
01:02:27.292 --> 01:02:30.872
and you got the live engine almost at full power

1148
01:02:31.492 --> 01:02:35.432
to get the test point. As I went to start the engine, the one I

1149
01:02:35.472 --> 01:02:38.912
was starting was rapidly increasing to max temp.

1150
01:02:39.792 --> 01:02:43.392
I shut it down, and barely stopped at about five degrees below the red
line.

1151
01:02:45.692 --> 01:02:49.472
And thought, okay, maybe it was slow procedure, so we're going to do it

1152
01:02:49.512 --> 01:02:49.952
again.

1153
01:02:50.852 --> 01:02:54.112
Checked everything, let everything cool, let it set a little while, we're
going to

1154
01:02:54.172 --> 01:02:57.212
redo it. Redid it again, exact same thing.

1155
01:02:57.752 --> 01:03:01.741
Very high acceleration. Got it stopped about 10 degrees before it crossed

1156
01:03:01.752 --> 01:03:04.152
the limit. Then the

1157
01:03:05.292 --> 01:03:09.192
test director was on the ground, communicated, said, "Could you just let

1158

01:03:09.232 --> 01:03:11.072
it go ahead and go through the transit?

1159
01:03:11.132 --> 01:03:13.632
You got 10 seconds or something above the limit.

1160
01:03:14.152 --> 01:03:17.272
Let it go ahead into the transit. We're almost positive it'll cool down."

1161
01:03:18.532 --> 01:03:20.552
I said, "Not on my watch."

1162
01:03:21.992 --> 01:03:25.792
"Okay, we're going home." And of course, at this point, I only got one running, so

1163
01:03:25.812 --> 01:03:29.292
we dropped down to the bottom of the limit, got the other one started, and

1164
01:03:29.352 --> 01:03:33.212
landed. And it was under TIA, so

1165
01:03:33.252 --> 01:03:35.832
those familiar, I did a discontinuance right on the spot.

1166
01:03:35.962 --> 01:03:36.102
Said,

1167
01:03:36.902 --> 01:03:40.762
"Test is over, okay? If you want to go up and do what you want to do..."
Because

1168
01:03:40.792 --> 01:03:44.331
they wanted to go back up and do it, try this last start.

1169
01:03:44.732 --> 01:03:48.092
Said, "No. Discontinuance. You're on your own."

1170
01:03:48.992 --> 01:03:51.572
The two company pilots got in the airplane, went up,

1171
01:03:52.712 --> 01:03:56.652
tried their procedure. When it hit the limit, then they shut her down,

1172
01:03:56.732 --> 01:04:00.372
and it went, I don't know, 100 degrees above the max limit for...

1173
01:04:01.112 --> 01:04:02.612
Stayed up there about 30 seconds.

1174
01:04:03.872 --> 01:04:07.812
Torched the engine, obviously. So the decision there is you got

1175
01:04:07.832 --> 01:04:08.832
to be careful what you

1176
01:04:09.692 --> 01:04:13.452
decide to do and what you don't do. It goes right back to what was talked

1177
01:04:13.492 --> 01:04:16.652
about earlier. It was the system, not part of the test,

1178
01:04:17.332 --> 01:04:21.092
because when they got on the ground to find the problem, there's a
crossover valve

1179
01:04:21.132 --> 01:04:23.972
that's got a check valve. The check valve had failed.

1180
01:04:24.012 --> 01:04:27.912
So that engine running at max power was putting all that temp right into
the

1181
01:04:27.932 --> 01:04:29.132
engine I was trying to start.

1182
01:04:30.652 --> 01:04:34.532
All right? So on the older aircraft, there's things that you have to

1183
01:04:34.572 --> 01:04:38.232
be careful about, unintended failures that may

1184
01:04:38.272 --> 01:04:40.292
affect the test you're doing. So

1185
01:04:41.372 --> 01:04:43.712
there's a lot of other crossovers.

1186
01:04:43.752 --> 01:04:46.632
The older the airplane, you got to be more careful about the other systems

1187
01:04:46.672 --> 01:04:47.152
involved.

1188
01:04:48.292 --> 01:04:52.252
Oh, thanks for that. Yeah, and a lot of this is the focus areas

1189
01:04:52.292 --> 01:04:52.651
that we

1190
01:04:53.651 --> 01:04:56.912
use when we develop the scenarios for our sim events.

1191
01:04:57.652 --> 01:05:01.332
Right? It's on some of those systems, whether they're part of the test or

1192
01:05:01.392 --> 01:05:01.732
not,

1193
01:05:02.772 --> 01:05:06.212
doing engine operating characteristics with

1194
01:05:06.732 --> 01:05:10.452
test engine bleed on versus bleed off. That's a pretty common test.

1195
01:05:10.512 --> 01:05:11.732
Nothing special about that.

1196
01:05:13.012 --> 01:05:16.692
Well, I'll give you a little peek behind the curtain on this one, since I think

1197

01:05:16.702 --> 01:05:20.312

pretty much everybody in the room here from the FAA side has seen this one

1198

01:05:20.372 --> 01:05:21.382

already.

1199

01:05:23.432 --> 01:05:27.312

We set up the conditions so that the altitude requirements for

1200

01:05:27.372 --> 01:05:30.992

this specific test are around 18,000 feet-ish or so.

1201

01:05:31.572 --> 01:05:35.472

So now you're dealing with airspace, and you're dealing with the test events

1202

01:05:35.512 --> 01:05:39.212

and maintaining speed and configuration, and all at the same time, we

1203

01:05:39.272 --> 01:05:43.052

say, "All right, these four points in a row are going to be with the test engine

1204

01:05:43.112 --> 01:05:43.612

bleed off."

1205

01:05:45.312 --> 01:05:46.492

Okay? Easy enough.

1206

01:05:47.522 --> 01:05:51.352

And then immediately following that is a bunch of conditions with both

1207

01:05:51.372 --> 01:05:51.952

bleeds off.

1208

01:05:53.692 --> 01:05:53.992

All right?

1209

01:05:54.812 --> 01:05:58.052

Well, now we're in the teens. We're not super high, but we're high enough

1210
01:05:58.912 --> 01:06:02.892
that with both bleeds off over the course of the next 20 to 30 minutes,
that

1211
01:06:02.932 --> 01:06:06.652
cabin altitude just starts to creep. Right?

1212
01:06:06.912 --> 01:06:10.762
And it's nothing overt in either of the aircraft, in either of

1213
01:06:10.812 --> 01:06:14.642
the sims that we have. The little cabin altitude meter just

1214
01:06:14.732 --> 01:06:16.342
starts ticking up little by little,

1215
01:06:17.512 --> 01:06:21.492
and then all of a sudden, inevitably, you're right in the middle of a

1216
01:06:21.552 --> 01:06:24.162
test condition, and there's red everywhere.

1217
01:06:25.872 --> 01:06:29.552
Right? And it's what happened, what's wrong with the engine?

1218
01:06:29.652 --> 01:06:30.832
There's nothing wrong with the engine.

1219
01:06:31.452 --> 01:06:34.052
It has nothing to do with the engine that you're testing. The engine's
fine.

1220
01:06:34.892 --> 01:06:38.636
You have a cabin altitude warning So we've

1221
01:06:38.696 --> 01:06:42.676
built things like that into all these different scenarios, so

1222
01:06:42.716 --> 01:06:45.716

that depending on what you're doing and how you're doing it, and the order of

1223

01:06:45.776 --> 01:06:46.816
everything that's happening,

1224

01:06:47.896 --> 01:06:49.536
you might get something you might not.

1225

01:06:49.896 --> 01:06:53.216
We've had about 50% of our crews run into that.

1226

01:06:53.246 --> 01:06:56.336
The other 50%, it's like a trigger for them.

1227

01:06:56.446 --> 01:06:57.736
As soon as you hear

1228

01:06:58.656 --> 01:07:00.956
dual bleed off, I need to start the APU.

1229

01:07:02.196 --> 01:07:05.136
I want that alternate source of air in this aircraft.

1230

01:07:06.036 --> 01:07:06.216
Right?

1231

01:07:07.246 --> 01:07:07.556
So,

1232

01:07:09.696 --> 01:07:13.256
we've made very deliberate efforts in building out this course and these

1233

01:07:13.316 --> 01:07:17.156
simulator profiles to tie stuff like that in so that we don't have to

1234

01:07:17.196 --> 01:07:20.866
role play. And quite frankly, I don't care if you run into anything

1235

01:07:20.956 --> 01:07:24.676
abnormal or not. If you don't, it means your CRM

1236

01:07:24.716 --> 01:07:27.176

level, the bar you've set is really high.

1237

01:07:27.636 --> 01:07:30.396

It means you're interacting well. It means you've planned things out well.

1238

01:07:30.536 --> 01:07:33.576

You're speaking well and working efficiently as a team.

1239

01:07:35.456 --> 01:07:38.116

At that point, I don't care if you run into anything abnormal.

1240

01:07:38.516 --> 01:07:41.676

You guys are getting some good practice in and some test technique practice to

1241

01:07:41.715 --> 01:07:43.696

boot. Right? It's all good stuff.

1242

01:07:45.236 --> 01:07:46.896

All right. I am running a little bit ahead.

1243

01:07:47.276 --> 01:07:50.896

This is

1244

01:07:50.976 --> 01:07:54.756

actually the last slide before my closing, so if there's any go back

1245

01:07:54.856 --> 01:07:58.836

stories, safety event stories, CRM stories, anything that we

1246

01:07:58.876 --> 01:08:00.126

want to learn from as a group,

1247

01:08:01.156 --> 01:08:05.096

we can entertain that now. Or I can close out

1248

01:08:05.156 --> 01:08:07.476

and just open up for questions from you guys.

1249

01:08:08.616 --> 01:08:10.416

Or I can take questions now, I really don't care.

1250

01:08:12.256 --> 01:08:16.016

Any other stories to share? I'm running 15, 20 minutes

1251

01:08:16.036 --> 01:08:16.556

ahead.

1252

01:08:19.116 --> 01:08:23.036

I did purposefully decide to not be the guy that holds you up

1253

01:08:23.096 --> 01:08:26.696

from lunch. I didn't plan on being this early, but it's

1254

01:08:26.736 --> 01:08:27.096

okay.

1255

01:08:28.776 --> 01:08:29.116

All right.

1256

01:08:30.257 --> 01:08:33.316

We'll proceed on, and then we'll open up for some questions.

1257

01:08:33.396 --> 01:08:36.217

So does CRM really help in flight test?

1258

01:08:37.556 --> 01:08:39.896

Of course it does, but it's a choice. Right?

1259

01:08:41.016 --> 01:08:43.837

You have to choose to do all the upfront planning.

1260

01:08:43.896 --> 01:08:47.257

You have to choose your communication style and how you're going to interact with

1261

01:08:47.276 --> 01:08:47.906

your crew member.

1262

01:08:49.536 --> 01:08:53.335

The execution of the test, the briefings, it's all choices.

1263

01:08:54.456 --> 01:08:55.337

So if we

1264

01:08:56.236 --> 01:08:58.056

said no, just as an example.

1265

01:08:59.677 --> 01:09:00.556

See if this works.

1266

01:09:02.416 --> 01:09:03.016

Come on.

1267

01:09:06.056 --> 01:09:08.116

I wanted to make you guys laugh a little bit. There we go.

1268

01:09:09.936 --> 01:09:10.776

Who knows this clip?

1269

01:09:14.876 --> 01:09:16.436

What you just said

1270

01:09:17.696 --> 01:09:20.837

is one of the most insanely idiotic things I have ever heard.

1271

01:09:21.916 --> 01:09:25.837

At no point in your rambling, incoherent response

1272

01:09:26.536 --> 01:09:30.396

were you even close to anything that could be considered a rational

1273

01:09:30.476 --> 01:09:30.837

thought.

1274

01:09:31.876 --> 01:09:35.837

Everyone in this room is now dumber for having listened to it.

1275

01:09:36.936 --> 01:09:38.196

I award you no points,

1276

01:09:39.276 --> 01:09:40.936
and may God have mercy on your soul.

1277

01:09:43.376 --> 01:09:46.257
Now, hopefully you guys aren't thinking that right now.

1278

01:09:50.976 --> 01:09:54.116
We'll go out for pineapple, my little bobbly-headed booply-boo.

1279

01:09:54.416 --> 01:09:55.136
Skipper, look.

1280

01:09:56.536 --> 01:09:59.936
Analysis. It looks like a small incandescent bulb designed to indicate something

1281

01:09:59.956 --> 01:10:01.776
out of the ordinary, like a malfunction.

1282

01:10:01.916 --> 01:10:04.196
I find it pretty and somewhat hypnotic.

1283

01:10:04.316 --> 01:10:06.936
That too, sir. Right. Rico, manual.

1284

01:10:08.296 --> 01:10:08.556
Mm-hmm.

1285

01:10:10.136 --> 01:10:11.196
Problemo solved.

1286

01:10:11.496 --> 01:10:15.016
Sir, we may be out of fuel. What makes you think that? We've lost engine one.

1287

01:10:17.276 --> 01:10:20.516
And engine two is no longer on fire. Buckle up, boys.

1288

01:10:21.656 --> 01:10:22.416

Don't look, doll.

1289

01:10:22.696 --> 01:10:23.935

This might get hairy.

1290

01:10:28.476 --> 01:10:30.436

I had to inject a little bit of levity.

1291

01:10:30.546 --> 01:10:33.256

I appreciate the interaction you guys have had this morning.

1292

01:10:34.016 --> 01:10:37.626

Hopefully, you got a little bit out of it and got a little peek behind what we've

1293

01:10:37.656 --> 01:10:39.336

been doing in developing this course.

1294

01:10:39.886 --> 01:10:43.386

And, if you're interested, I'm happy to provide contact information.

1295

01:10:43.456 --> 01:10:43.746

We can

1296

01:10:44.556 --> 01:10:48.116

chat some more and hopefully share some more lessons, but I'll

1297

01:10:48.496 --> 01:10:51.736

welcome any questions or any other stories you guys want to give at this point.

1298

01:10:57.336 --> 01:10:57.636

All right.

1299

01:10:59.236 --> 01:10:59.596

There we go.

1300

01:11:02.956 --> 01:11:04.316

Thanks, Eric. Really appreciate it.

1301

01:11:05.216 --> 01:11:05.416

So

1302

01:11:07.276 --> 01:11:11.216

recent trends, not everyone has access to simulators or TM capability,

1303

01:11:11.376 --> 01:11:15.296

and so it gets hard to find scenarios that

1304

01:11:15.496 --> 01:11:18.076

allow them to exercise CRM practically.

1305

01:11:18.836 --> 01:11:21.936

I haven't had a chance to experience myself, but I heard great things.

1306

01:11:22.136 --> 01:11:24.266

SFTs been using escape rooms-

1307

01:11:24.756 --> 01:11:24.896

Okay

1308

01:11:25.036 --> 01:11:28.716

... as a surrogate for CRM to try and get folks together.

1309

01:11:28.816 --> 01:11:32.356

Just wondered if you had any thoughts on that or any other feedback from the crowd

1310

01:11:32.396 --> 01:11:36.276

on how that's been, because not everyone has access to a simulator

1311

01:11:36.316 --> 01:11:40.236

capability that allows them to really create those realistic scenarios.

1312

01:11:40.316 --> 01:11:43.496

Sure. No, that's a great idea. Very creative.

1313

01:11:44.676 --> 01:11:47.826

And really it comes back to, and I see where they're going with it, it comes back

1314

01:11:47.836 --> 01:11:49.136

to the communication side, right?

1315

01:11:49.296 --> 01:11:53.236

So you can have an escape room, and if you have 10 people in that room

1316

01:11:53.316 --> 01:11:55.596

all running in 10 different directions, you're never getting out.

1317

01:11:56.536 --> 01:11:59.616

Right? So it does come back down to that teamwork piece.

1318

01:12:00.656 --> 01:12:03.156

So yeah, I can see how there's value in that for sure.

1319

01:12:03.236 --> 01:12:04.696

Absolutely.

1320

01:12:04.756 --> 01:12:08.456

Just out of interest for yourself or the audience, has other folks found surrogates

1321

01:12:08.496 --> 01:12:09.416

they could use to

1322

01:12:10.656 --> 01:12:14.076

get away from the PowerPoint brief, but they didn't have access to a full sim to

1323

01:12:14.096 --> 01:12:17.396

really create flight scenarios? Just anything from the crowd.

1324

01:12:20.616 --> 01:12:24.576

We do a Lego exercise, a reader, a builder, a QA

1325

01:12:24.876 --> 01:12:28.596

kind of thing. It's a communication, and lack of communication, and barrier to

1326

01:12:28.616 --> 01:12:31.356

communication at the National Test Pilot School. It's a puzzle.

1327

01:12:31.396 --> 01:12:32.016
That's fun.

1328
01:12:37.236 --> 01:12:37.836
Anybody else?

1329
01:12:42.256 --> 01:12:44.116
I have a question. My son is

1330
01:12:44.176 --> 01:12:48.056
a Navy helicopter pilot, and

1331
01:12:48.716 --> 01:12:52.216
he was telling me there is a company called

1332
01:12:52.296 --> 01:12:55.096
CTI out of San Diego,

1333
01:12:56.036 --> 01:13:00.006
former aviators, and they have a product that

1334
01:13:00.036 --> 01:13:03.836
produces CRM video games. And I had never

1335
01:13:04.016 --> 01:13:04.536
heard of it,

1336
01:13:05.336 --> 01:13:05.656
and

1337
01:13:07.316 --> 01:13:08.536
I actually have a personal reason.

1338
01:13:08.556 --> 01:13:10.016
He says, "I think I might go work for them,"

1339
01:13:11.176 --> 01:13:15.156
when he gets out. But has anyone heard of this company and

1340
01:13:15.196 --> 01:13:16.916
the CRM games that they play?

1341

01:13:17.676 --> 01:13:18.156

I have not.

1342

01:13:19.576 --> 01:13:20.956

I'm willing to play games, though.

1343

01:13:24.936 --> 01:13:27.836

We work for the government, we're not allowed to play for them.

1344

01:13:29.096 --> 01:13:30.256

Yes. All right.

1345

01:13:31.116 --> 01:13:31.836

Oh, one more.

1346

01:13:31.956 --> 01:13:33.376

We don't use proprietary data.

1347

01:13:33.796 --> 01:13:37.676

Oh, yeah. So that's an important point. Thanks, Pete, for the reminder.

1348

01:13:39.436 --> 01:13:42.556

In developing these scenarios, in all of our discussions in the classroom,

1349

01:13:43.356 --> 01:13:44.376

it's a very

1350

01:13:46.236 --> 01:13:50.056

dedicated effort to not pull proprietary data in

1351

01:13:50.156 --> 01:13:52.956

from, whether it's any of the applicants here in this room or others.

1352

01:13:53.936 --> 01:13:54.416

We do our

1353

01:13:55.396 --> 01:13:59.136

very best to sanitize all that when we start

1354

01:13:59.176 --> 01:14:02.076
talking about events. And at the same time,

1355

01:14:03.076 --> 01:14:06.816
still try to glean the lessons learned that we can from any events that we've been

1356

01:14:06.856 --> 01:14:09.976
a part of or heard of. So yeah, thanks for that reminder, Pete.

1357

01:14:09.986 --> 01:14:10.956
Feel free to share.

1358

01:14:10.996 --> 01:14:11.196
Yeah.

1359

01:14:14.036 --> 01:14:14.616
Anybody else?

1360

01:14:15.516 --> 01:14:15.776
All right.

1361

01:14:16.876 --> 01:14:18.596
Thank you very much, guys. Appreciate the time.

1362

01:14:26.616 --> 01:14:30.376
All right, we've got 15 minutes. I won't take more than about a

1363

01:14:30.416 --> 01:14:31.476
minute here.

1364

01:14:33.656 --> 01:14:37.356
SFTE, SETP, the Flight Test Safety Committee, we all

1365

01:14:37.456 --> 01:14:41.036
have repositories of documents,

1366

01:14:41.256 --> 01:14:44.106
and lessons learned, and briefings that

1367

01:14:45.536 --> 01:14:49.216
are available to testers. I've got a couple

1368
01:14:49.296 --> 01:14:50.736
papers that I've pulled

1369
01:14:51.676 --> 01:14:55.596
in times past, and if you work for me, you've read them, because I send

1370
01:14:55.636 --> 01:14:57.316
them out about every couple of years.

1371
01:14:58.156 --> 01:15:01.846
But one of them is called "A Different Perspective: Why Flight

1372
01:15:02.036 --> 01:15:05.696
Test is Distinctively Complex." It's by

1373
01:15:05.796 --> 01:15:08.956
Robert Barham from Lockheed and Star Hughes.

1374
01:15:10.076 --> 01:15:13.696
And their hypothesis is that flight test

1375
01:15:13.836 --> 01:15:17.696
is complex. If you know about the four

1376
01:15:19.836 --> 01:15:20.596
areas of

1377
01:15:23.056 --> 01:15:25.066
domains, there's simple,

1378
01:15:25.876 --> 01:15:29.136
there's complicated, there's complex, and there's chaos.

1379
01:15:30.136 --> 01:15:33.746
And the argument and the hypothesis in this

1380
01:15:34.396 --> 01:15:37.496
paper is that flight test is complex.

1381

01:15:38.456 --> 01:15:40.576

And I encourage you to read the paper.

1382

01:15:41.176 --> 01:15:44.716

It's called "A Different Perspective: Why Flight Test is

1383

01:15:44.956 --> 01:15:48.616

Distinctively Complex." They make the argument that we

1384

01:15:48.756 --> 01:15:51.856

live in a complex environment when we're doing flight test.

1385

01:15:52.296 --> 01:15:53.416

And I'm going to read this to you.

1386

01:15:54.556 --> 01:15:57.916

"As such," being in this complex domain, "it should be

1387

01:15:58.016 --> 01:16:01.576

recognized that flight test interactions and problems are best viewed

1388

01:16:01.976 --> 01:16:04.536

from a pattern recognition perspective.

1389

01:16:05.156 --> 01:16:09.016

Experiences and storytelling are extremely important to

1390

01:16:09.036 --> 01:16:13.026

the building of a personal library of favorable and

1391

01:16:13.096 --> 01:16:16.856

unfavorable patterns with which to compare with

1392

01:16:16.916 --> 01:16:20.526

current patterns to make decisions that result in a favorable

1393

01:16:20.616 --> 01:16:21.096

outcome."

1394

01:16:22.106 --> 01:16:25.966
So what we've been doing here, and what Eric encourages us to do, is

1395
01:16:26.076 --> 01:16:26.846
storytelling,

1396
01:16:27.696 --> 01:16:29.836
because storytelling is how we all learn.

1397
01:16:30.336 --> 01:16:34.176
It's how we all can have this background that we haven't

1398
01:16:34.236 --> 01:16:37.496
maybe experienced personally, but we've got this background now of

1399
01:16:37.676 --> 01:16:41.586
storytelling, that we can apply those patterns to something else that

1400
01:16:41.596 --> 01:16:45.326
we're going to see in the future. So what we did

1401
01:16:45.396 --> 01:16:49.116
here today, the CRM training, the CRM ideas, is great,

1402
01:16:49.736 --> 01:16:52.716
and the storytelling that we did on top of it was excellent.

1403
01:16:52.796 --> 01:16:56.636
So thank you very much. Eric, thank you again for your workshop.

1404
01:16:56.796 --> 01:16:59.846
I appreciate the effort you put into this, and

1405
01:17:01.036 --> 01:17:03.146
for the great morning. So with that,

1406
01:17:04.055 --> 01:17:07.556
lunch hopefully is ready. It's in the back room there at

1407
01:17:07.576 --> 01:17:11.536
12:00 to 1:00. Bus is at 1:15. Any

1408

01:17:11.636 --> 01:17:13.736

questions before we dismiss?

1409

01:17:14.976 --> 01:17:16.516

Do you have the guidance for the tour?

1410

01:17:16.676 --> 01:17:18.456

Is there stuff we should bring, not bring,

1411

01:17:19.396 --> 01:17:19.446

et cetera?

1412

01:17:19.446 --> 01:17:20.956

Closed-toed shoes.

1413

01:17:22.196 --> 01:17:25.416

Any tips for your guides?

1414

01:17:26.616 --> 01:17:28.836

Oh, tips for the guides, John says.

1415

01:17:29.396 --> 01:17:29.516

No,

1416

01:17:30.656 --> 01:17:33.176

you really don't need to bring anything.

1417

01:17:33.716 --> 01:17:35.956

If you bring it, you'll just carry it with you.

1418

01:17:35.976 --> 01:17:38.626

Cell phones are okay to bring, or do they stay in our pockets?

1419

01:17:38.626 --> 01:17:40.916

What? Phones? Yes. Yeah, phones are fine. Yeah.

1420

01:17:42.156 --> 01:17:45.256

So closed-toed shoes and no skirts.

1421

01:17:45.516 --> 01:17:49.436
That's the two things we always harp on,

1422
01:17:49.496 --> 01:17:51.916
because when you get up on stands, it's not a good thing.

1423
01:17:52.476 --> 01:17:53.936
So no skirts for you.

1424
01:17:55.176 --> 01:17:56.776
ID too, probably.

1425
01:17:56.836 --> 01:17:57.336
What's that?

1426
01:17:59.016 --> 01:17:59.026
You actually need an ID to get through security.

1427
01:17:59.026 --> 01:18:01.136
Oh, that's right. ID to get in the gate. Yeah.

1428
01:18:02.636 --> 01:18:04.806
Unrelated, I wondered if you had an update on the

1429
01:18:05.076 --> 01:18:08.736
flight test safety

1430
01:18:08.836 --> 01:18:09.436
database?

1431
01:18:09.646 --> 01:18:09.646
Flight test safety database.

1432
01:18:09.676 --> 01:18:10.636
I'll take care of that before tomorrow.

1433
01:18:11.156 --> 01:18:11.886
Oh, thank you.

1434
01:18:11.886 --> 01:18:12.036
Yep.

1435

01:18:15.336 --> 01:18:16.416

All right. Enjoy your lunch.