

WEBVTT

1

00:10:31.825 --> 00:10:33.745
Greetings everybody, and welcome

2

00:10:34.125 --> 00:10:36.905
to our virtual flight test safety workshop, day two.

3

00:10:37.965 --> 00:10:40.265
Um, welcome back to those that joined us yesterday.

4

00:10:40.685 --> 00:10:42.345
Uh, I think we had a good day yesterday,

5

00:10:42.525 --> 00:10:45.025
and we've got a lot in store for you today.

6

00:10:46.825 --> 00:10:49.185
I realized yesterday that I, I failed to introduce myself.

7

00:10:49.205 --> 00:10:50.305
I'm Tom, I'm the chairman

8

00:10:50.305 --> 00:10:51.545
of the Flight Test Safety Committee.

9

00:10:52.065 --> 00:10:54.425
I and the other flight test safety committees, uh,

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00:10:54.425 --> 00:10:55.945
safety committee members serve you.

11

00:10:56.725 --> 00:10:58.465
If you have any questions at all, um,

12

00:10:58.645 --> 00:11:02.225
or you want to see different things on our website

13

00:11:02.685 --> 00:11:05.705
or on the podcast or in the newsletter, feel free

14

00:11:05.705 --> 00:11:08.345
to reach out to us Again, we're here to, uh,

15

00:11:08.365 --> 00:11:10.225
to help you in your flight test endeavors.

16

00:11:11.205 --> 00:11:13.825
Um, I do want to thank you all for your patience.

17

00:11:14.125 --> 00:11:18.505
Um, you know, we're not experts on these webinar platforms.

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00:11:18.695 --> 00:11:23.135
There's a bit of time latency issues we have to remember

19

00:11:23.135 --> 00:11:25.815
to unmute and mute ourselves, um, et cetera.

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00:11:25.835 --> 00:11:28.935
So we appreciate that, um, you give us that consideration.

21

00:11:29.675 --> 00:11:32.055
Um, we're gonna dive right into it here in the

22

00:11:32.175 --> 00:11:33.215
homework assignment momentarily.

23

00:11:33.635 --> 00:11:35.615
And, uh, so for those that weren't able

24

00:11:35.615 --> 00:11:38.295
to join us yesterday, um, you,

25

00:11:38.315 --> 00:11:40.295
you may feel like you're a little bit behind the eight ball,

26

00:11:40.395 --> 00:11:41.975
so, uh, just bear with us.

27

00:11:42.235 --> 00:11:44.895

Uh, things will come clear as the day goes on.

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00:11:45.435 --> 00:11:48.855

Uh, and again, the intent of all this is really to, to, uh,

29

00:11:49.215 --> 00:11:52.015

increase your interest in learning more about systems

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00:11:52.125 --> 00:11:53.725

theoretic process analysis.

31

00:11:55.045 --> 00:11:56.225

We appreciate your engagement.

32

00:11:56.365 --> 00:11:59.305

So, um, again, just a quick reminder over there on

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00:11:59.305 --> 00:12:01.665

that control panel, there is a question tab.

34

00:12:02.525 --> 00:12:03.985

Use that to interface with us.

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00:12:03.985 --> 00:12:05.425

Unfortunately, you're not gonna be able

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00:12:05.425 --> 00:12:09.785

to see all the attendees inputs, uh, but we see those, uh,

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00:12:09.805 --> 00:12:11.705

and we will be looking at those

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00:12:11.845 --> 00:12:14.425

and posing those questions as we can to the presenters.

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00:12:15.485 --> 00:12:17.345

Um, and then lastly, uh, we,

40

00:12:17.365 --> 00:12:20.665

we did appreciate the feedback on, uh, the q

41

00:12:20.665 --> 00:12:21.705
and a yesterday.

42

00:12:22.045 --> 00:12:25.745
It, it, it's heartwarming to get that feedback that, uh, uh,

43

00:12:25.755 --> 00:12:27.425
we're doing a halfway decent job here for you

44

00:12:27.425 --> 00:12:29.865
and trying to deliver some content that's, that's useful

45

00:12:30.065 --> 00:12:33.105
and relevant to what we do here in, uh, flight testing.

46

00:12:34.365 --> 00:12:36.905
So, with that, um, I want to, uh,

47

00:12:36.905 --> 00:12:40.585
welcome back on stage our virtual stage, if you will.

48

00:12:41.045 --> 00:12:44.665
Uh, Ben Luther from Gulfstream, who has graciously agreed

49

00:12:44.665 --> 00:12:47.065
to continue his co-hosting duties with me today.

50

00:12:47.245 --> 00:12:49.105
So you'll see him interact.

51

00:12:49.185 --> 00:12:50.665
He's the one with a funny accent.

52

00:12:51.165 --> 00:12:52.265
Um, and,

53

00:12:52.265 --> 00:12:53.945
and helping me run the, the, uh,

54

00:12:54.605 --> 00:12:56.385

the workshop throughout the day to day.

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00:12:56.925 --> 00:13:00.135

Um, we're, we're going to, like I said, review this,

56

00:13:00.235 --> 00:13:01.255

uh, homework assignment.

57

00:13:01.355 --> 00:13:03.975

But before we do, uh, I do want to thank those

58

00:13:04.005 --> 00:13:06.735

that submitted, uh, responses to the homework.

59

00:13:07.405 --> 00:13:10.295

When I, uh, closed up shop last night, there was about 15,

60

00:13:10.355 --> 00:13:13.535

and that doubled, uh, as we kicked off this morning.

61

00:13:13.955 --> 00:13:16.335

And as I promised, we, we put a carrot out there

62

00:13:16.335 --> 00:13:19.775

that we would give away a \$20 Starbucks e-gift certificate.

63

00:13:20.235 --> 00:13:23.335

And I'm happy to say that that lucky winner that was drawn

64

00:13:23.335 --> 00:13:25.975

by Susan this morning is Jeff can clean.

65

00:13:26.875 --> 00:13:28.055

So, Jeff, congratulations.

66

00:13:28.155 --> 00:13:31.215

We hope that you enjoy Starbucks and staying caffeinated.

67

00:13:31.275 --> 00:13:33.735

So we'll get that emailed to you shortly.

68

00:13:34.905 --> 00:13:37.295

We're pleased to welcome back, uh, Dr. John Thomas,

69

00:13:37.395 --> 00:13:40.415

the Executive Director of Engineering Systems Lab at MIT

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00:13:40.515 --> 00:13:43.655

and a renowned expert on systems

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00:13:43.965 --> 00:13:45.695

theoretic process analysis.

72

00:13:45.835 --> 00:13:49.615

Uh, so, uh, he's going to be reviewing some of the homework,

73

00:13:49.875 --> 00:13:50.975

but I wanted to take a moment

74

00:13:51.075 --> 00:13:53.935

to introduce his partner in crime captain.

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00:13:54.355 --> 00:13:55.535

She Quist.

76

00:13:56.635 --> 00:14:00.775

Uh, sheem is currently a triple seven captain operating on

77

00:14:00.775 --> 00:14:01.895

international route.

78

00:14:02.195 --> 00:14:04.935

And, uh, he also is an aviation

79

00:14:05.615 --> 00:14:08.055

enthusiast in instructing in a broad array of aircraft

80

00:14:08.075 --> 00:14:10.375

to include providing aerobatic instruction.

81

00:14:11.125 --> 00:14:13.175

Shem is deeply involved in academic research

82

00:14:13.515 --> 00:14:15.335

and air safety invest investigation.

83

00:14:15.535 --> 00:14:18.535

I believe the first time I met Shem was at an International

84

00:14:18.535 --> 00:14:20.775

Society of Air Safety Investigators Conference.

85

00:14:20.775 --> 00:14:23.855

And we've established a relationship and a friendship,

86

00:14:23.875 --> 00:14:25.775

and I, and I appreciate him agreeing

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00:14:25.775 --> 00:14:26.935

to participate with us today.

88

00:14:27.485 --> 00:14:30.695

He's very, very knowledgeable about STPA

89

00:14:31.585 --> 00:14:34.445

and the Ality model, uh, stamp

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00:14:34.445 --> 00:14:36.525

that you're gonna hear more about, uh, later on.

91

00:14:37.105 --> 00:14:40.325

Um, he holds master's degree in human factors, um,

92

00:14:40.945 --> 00:14:43.285

and aeronautics from the Florida Institute of Technology.

93

00:14:43.305 --> 00:14:45.805

And I think he's actually doing some, some, uh,

94

00:14:46.075 --> 00:14:49.445

adjunct professing there as well, uh, which is fantastic.

95

00:14:49.625 --> 00:14:52.325

So he's teaching our seedcorn more about, uh,

96

00:14:52.735 --> 00:14:55.925

these different methodologies to make our industry safer.

97

00:14:56.425 --> 00:14:58.965

She is also a fellow of the Royal Aeronautical Society

98

00:14:58.965 --> 00:15:01.645

and a full member of visas e that International Society

99

00:15:01.645 --> 00:15:03.765

of Air Safety Investigators that I mentioned previously,

100

00:15:04.105 --> 00:15:05.885

and many other professional societies

101

00:15:05.945 --> 00:15:08.205

and committees, uh, that he's involved with.

102

00:15:08.305 --> 00:15:13.085

So, uh, John Shem, welcome back, uh, and welcome Shem.

103

00:15:13.565 --> 00:15:16.485

I appreciate, uh, you all participating in our workshop.

104

00:15:16.705 --> 00:15:18.445

And with that, I'm gonna step aside so

105

00:15:18.445 --> 00:15:20.005

that we can get right into the meat of the matter

106

00:15:20.225 --> 00:15:21.565

and discuss some of these, um,

107

00:15:21.965 --> 00:15:23.525

homework assignments that, uh, we got in.

108

00:15:27.515 --> 00:15:31.125

Okay. I need, uh, permission, I think, to share my screen.

109

00:15:43.725 --> 00:15:45.705

All right. Good morning, everyone.

110

00:15:46.905 --> 00:15:48.445

And, uh, just a clarification,

111

00:15:48.445 --> 00:15:51.045

I'm actually a visiting professor at, uh, Florida Institute.

112

00:15:51.505 --> 00:15:52.525

So, uh, which screen?

113

00:15:59.445 --> 00:16:00.445

Can you see my screen?

114

00:16:03.895 --> 00:16:08.835

Not yet, John. You

115

00:16:08.835 --> 00:16:10.435

should just have to click that approved John.

116

00:16:18.975 --> 00:16:21.345

Well, John's doing that. I just, I do wanna point out

117

00:16:21.375 --> 00:16:25.985

that also in your control panel, um, in the handouts tab,

118

00:16:26.715 --> 00:16:28.265

there is reference material.

119

00:16:28.895 --> 00:16:31.825

There's also, uh, the copy of the, the homework assignment.

120

00:16:31.845 --> 00:16:33.385

If you hadn't had a chance to take a look at that,

121

00:16:33.385 --> 00:16:34.465

maybe you didn't join us yesterday.

122

00:16:34.925 --> 00:16:39.265

Um, and the slide deck that John briefed yesterday as well.

123

00:16:39.725 --> 00:16:40.725

So that's all there.

124

00:16:42.845 --> 00:16:47.785

Can you see my screen? Nope.

125

00:16:47.785 --> 00:16:49.185

We're still not there yet, John.

126

00:16:49.565 --> 00:16:51.705

It says on air showing screen, uh,

127

00:16:55.255 --> 00:16:56.255

There we go.

128

00:16:56.815 --> 00:16:57.815

Yeah, we got it.

129

00:16:59.315 --> 00:17:01.175

Ah, just had to wait. Okay.

130

00:17:01.875 --> 00:17:04.015

Yep. We do not have a webcam on you yet, though.

131

00:17:04.405 --> 00:17:07.455

Yeah, I've, it is cutting in and out for me, the internet.

132

00:17:07.455 --> 00:17:08.895

Okay. So I don't want to stress it too much.

133

00:17:09.555 --> 00:17:11.375

Uh, I just wanna start with a quick note.

134

00:17:11.375 --> 00:17:13.055

We've got a bunch of questions about, uh,

135

00:17:13.055 --> 00:17:14.655

using SDPA to accidents.

136

00:17:14.915 --> 00:17:18.575

Uh, there are some, uh, uh, people wondering, uh,

137

00:17:19.155 --> 00:17:21.615

how SDPA would be applied before an accident.

138

00:17:21.685 --> 00:17:23.335

It's exactly what we've been going through.

139

00:17:23.835 --> 00:17:26.695

Um, now here, there's kind of a gotcha here.

140

00:17:27.075 --> 00:17:28.895

Uh, we cheated a little bit yesterday

141

00:17:28.895 --> 00:17:31.695

because I started with an accident, uh, a couple times,

142

00:17:31.795 --> 00:17:34.055

and then I showed you how STPA could be applied.

143

00:17:34.555 --> 00:17:37.215

Um, but that's not really how you do SDPA.

144

00:17:37.215 --> 00:17:39.295

That was a shortcut I took so

145

00:17:39.295 --> 00:17:41.415

that I could demonstrate SDPA very quickly.

146

00:17:41.915 --> 00:17:44.935

Um, accidents, when you review them, have a way

147

00:17:44.935 --> 00:17:47.655

of sifting out, uh, certain information that's very,

148

00:17:47.655 --> 00:17:48.975

very important, um,

149

00:17:49.185 --> 00:17:51.125

and get us right to the heart of the matter quickly.

150

00:17:51.225 --> 00:17:53.925

So I, so I use that. So I could cover SDPA in an hour,

151

00:17:54.305 --> 00:17:57.165

but of course, in a real project, we would do this

152

00:17:57.165 --> 00:17:58.605

before an accident occurs,

153

00:17:58.665 --> 00:18:01.005

we would apply a DPA based on whatever

154

00:18:01.005 --> 00:18:02.085

information is available.

155

00:18:02.505 --> 00:18:04.445

And the output of SDPA would be

156

00:18:04.585 --> 00:18:06.085

the accident before it happens.

157

00:18:06.785 --> 00:18:11.405

An hour is not enough time, uh, to convince skeptics,

158

00:18:11.745 --> 00:18:14.485

uh, that that works really well sometimes.

159

00:18:14.945 --> 00:18:17.845

Um, but if you gimme about four hours sometime,

160

00:18:18.445 --> 00:18:20.325

I can convince you we can do it together.

161

00:18:20.705 --> 00:18:23.725

Uh, so that was just a shortcut that I, uh, that I took.

162

00:18:23.785 --> 00:18:26.525

You usually wouldn't wait for an accident to apply SDPA.

163

00:18:27.505 --> 00:18:29.885

So, uh, we've been going through the homework, uh,

164

00:18:29.935 --> 00:18:32.205

we've had excellent submissions.

165

00:18:32.605 --> 00:18:35.125

I, we don't have enough time to go through all

166

00:18:35.125 --> 00:18:38.245

of the submissions that I would like to, uh, in fact,

167

00:18:38.285 --> 00:18:40.845

I might follow up with some of you later to, to,

168

00:19:09.065 --> 00:19:10.065

I think we've lost you, John

169

00:19:20.845 --> 00:19:22.095

Sham, are you able to hear John?

170

00:19:25.695 --> 00:19:27.685

Let's, no, it's, uh, he's off.

171

00:19:27.945 --> 00:19:29.365

I'm now landing,

172

00:19:29.365 --> 00:19:31.165

but let me just check. Can you guys hear me okay?

173

00:19:31.825 --> 00:19:33.355

Okay. We've just got you back now, John,

174

00:19:45.395 --> 00:19:46.655

and he is dropped off again.

175

00:19:54.105 --> 00:19:55.105

She, you?

176

00:19:56.715 --> 00:19:58.125

Yeah. No, I can't hear hear Jim did,

177

00:19:58.185 --> 00:20:00.125

Did you have other comments on some of the homework?

178

00:20:00.235 --> 00:20:02.045

Unfortunately, I think we're gonna, um,

179

00:20:02.535 --> 00:20:03.725

we're gonna miss most of it.

180

00:20:03.905 --> 00:20:05.605

No, it looked really good. I think, you know, we need

181

00:20:05.605 --> 00:20:09.085

to kind probably get John on.

182

00:20:09.585 --> 00:20:11.995

Um, you know, the,

183

00:20:14.985 --> 00:20:18.085

you know, the, the most challenging part I think for a lot

184

00:20:18.085 --> 00:20:21.605

of people is the difference between, well,

185

00:20:23.125 --> 00:20:25.325

I don't know if we really got into looking at the hazards,

186

00:20:25.545 --> 00:20:26.725

you know, specifically,

187

00:20:27.185 --> 00:20:29.325

but the control structure really is a kind

188

00:20:29.325 --> 00:20:32.005

of a different animal, you know, that people are used to.

189

00:20:32.785 --> 00:20:35.565

And I think that that takes a little bit of getting used to.

190

00:20:36.425 --> 00:20:39.385

Uh, I found on a couple of the projects

191

00:20:39.385 --> 00:20:40.585

that's starting really simple,

192

00:20:41.045 --> 00:20:42.985

and I saw some of them. John, are you back?

193

00:20:43.805 --> 00:20:45.825

Yes, I'm on the phone now. Hopefully this will work.

194

00:20:48.325 --> 00:20:51.475

Sorry about that. Alright, so, uh,

195

00:20:51.495 --> 00:20:53.595

here's the next four autonomous aircraft.

196

00:20:53.815 --> 00:20:56.195

The intent in here is to be, uh,

197

00:20:56.515 --> 00:20:58.555

a fully autonomous, uh, aircraft.

198

00:20:58.615 --> 00:21:00.795

It can even land on an aircraft carrier.

199

00:21:01.455 --> 00:21:04.155

One example of the automation is a cross wind limits.

200

00:21:05.185 --> 00:21:09.515

This aircraft uses calculated wind, uh, at altitude

201

00:21:09.655 --> 00:21:12.115

to determine if side slip limits would

202

00:21:12.115 --> 00:21:13.315

be exceeded on touchdown.

203

00:21:13.855 --> 00:21:16.875

It can automatically wave itself off if needed,

204

00:21:16.965 --> 00:21:18.235

based on that calculation.

205

00:21:18.615 --> 00:21:19.635

Uh, of course it's not perfect

206

00:21:19.635 --> 00:21:21.835

because the aircraft doesn't have sensors on the ground

207

00:21:22.095 --> 00:21:23.955

to figure out exactly what it's going to be.

208

00:21:24.015 --> 00:21:26.395

So there's some, uh, calculation going on there.

209

00:21:26.815 --> 00:21:29.795

Um, now that's what the aircraft does, uh,

210

00:21:29.825 --> 00:21:30.915

part, just a part of it.

211

00:21:31.015 --> 00:21:34.475

And what flight testers, uh, could do, uh,

212

00:21:34.495 --> 00:21:35.875

is a little more flexible.

213

00:21:36.055 --> 00:21:39.155

Flight test testers, uh, could deal with a situation

214

00:21:39.155 --> 00:21:42.595

where a pilot may see stronger winds at altitude,

215

00:21:42.905 --> 00:21:44.235

even it's a thousand feet.

216

00:21:44.295 --> 00:21:45.675

But then on landing

217

00:21:45.805 --> 00:21:47.555
where the cross wind limits actually

218

00:21:47.555 --> 00:21:48.955
matter, it might be fine.

219

00:21:49.295 --> 00:21:52.795
So what flight testers could do is receive surface wind info

220

00:21:52.795 --> 00:21:55.075
from the tower, assess the potential

221

00:21:55.095 --> 00:21:57.275
for cross wind exceedance on landing,

222

00:21:57.775 --> 00:22:00.115
and they can override the automation and say,

223

00:22:00.315 --> 00:22:01.795
although you're seeing high winds are now,

224

00:22:01.955 --> 00:22:03.115
I want you to land anyway.

225

00:22:03.145 --> 00:22:04.795
It's gonna be okay when you get down there.

226

00:22:05.575 --> 00:22:07.755
Uh, lemme just do a quick check.

227

00:22:07.975 --> 00:22:09.355
Are you, can you still hear me okay?

228

00:22:09.745 --> 00:22:11.475
Yeah, we can, John. Thank you.

229

00:22:11.545 --> 00:22:13.915
Perfect. Thank you for that. Alright.

230

00:22:14.175 --> 00:22:18.955

Uh, this is a chart that was given to the flight testers,

231

00:22:19.535 --> 00:22:22.915

uh, showing the logic gates during a carrier approach.

232

00:22:23.615 --> 00:22:26.355

Can we unmute Alan Jespersion for a second

233

00:22:26.415 --> 00:22:28.115

and see if he has anything to add?

234

00:22:28.765 --> 00:22:30.435

Who's involved in this, uh, project?

235

00:22:32.435 --> 00:22:34.695

So, hi everybody. Uh, my name's Alan Jespersion.

236

00:22:34.935 --> 00:22:37.495

I was the, uh, project officer

237

00:22:37.755 --> 00:22:40.055

during the first carrier landings of X 47.

238

00:22:40.555 --> 00:22:41.735

Uh, everything that you see

239

00:22:41.735 --> 00:22:45.415

below the glide slope are essentially autonomy triggers

240

00:22:45.445 --> 00:22:50.355

that would engage in a wave off sequence for the aircraft.

241

00:22:50.375 --> 00:22:52.395

So the aircraft would power up, it would clean up

242

00:22:52.395 --> 00:22:53.915

and raise the gear, raise the flaps,

243

00:22:54.255 --> 00:22:57.995

and it would proceed on an autonomous route, uh, to downwind

244

00:22:58.135 --> 00:22:59.515
to attempt another landing.

245

00:23:00.095 --> 00:23:03.315
And what's telling about this is any, anything in red

246

00:23:03.315 --> 00:23:06.355
that you see there, what's missing, what's it's,

247

00:23:06.695 --> 00:23:08.195
what's telling, uh, compared

248

00:23:08.195 --> 00:23:11.795
to the last slide is this side slip, uh, trigger

249

00:23:11.935 --> 00:23:14.235
for the wave off is not captured on there at all.

250

00:23:14.935 --> 00:23:17.435
And of course, at an aircraft carrier

251

00:23:17.625 --> 00:23:18.835
that moves in the ocean

252

00:23:18.935 --> 00:23:21.475
and can always align the wind, it makes sense

253

00:23:21.475 --> 00:23:23.795
that you wouldn't necessarily think of side slip

254

00:23:23.795 --> 00:23:24.995
as wave off criteria.

255

00:23:25.615 --> 00:23:29.355
But when you're testing and doing buildup at the airfield,

256

00:23:29.455 --> 00:23:31.835
and you don't have the benefit of just moving the airfield

257

00:23:31.835 --> 00:23:34.795
to align the, the wind, uh,

258

00:23:34.935 --> 00:23:37.795
you would create this additional autonomy trigger.

259

00:23:38.015 --> 00:23:42.155
And so what this created for us was an issue of, uh,

260

00:23:42.315 --> 00:23:44.875
experiencing multiple wave

261

00:23:44.945 --> 00:23:45.945
Off. Let me, let

262

00:23:45.945 --> 00:23:47.205
me maybe pause you right there.

263

00:23:47.745 --> 00:23:49.285
Uh, if I could, uh,

264

00:23:49.285 --> 00:23:53.725
before we get too far, uh, uh, I, I, I wanna

265

00:23:54.235 --> 00:23:55.805
save some of the information for,

266

00:23:55.945 --> 00:23:57.445
for a little bit later if I could.

267

00:24:02.295 --> 00:24:04.185
Alright, let's, let's continue.

268

00:24:04.325 --> 00:24:06.825
Uh, and I, and I'll pull you back in in just a minute.

269

00:24:07.365 --> 00:24:11.665
Um, let's go through an STPA analysis, uh,

270

00:24:11.955 --> 00:24:13.585

given the information we have now,

271

00:24:13.585 --> 00:24:14.625
which is very, very limited.

272

00:24:15.285 --> 00:24:17.585
Now I have to ask you, uh, all

273

00:24:17.585 --> 00:24:19.905
of the attendees kind of bear with me a little bit.

274

00:24:20.145 --> 00:24:23.945
I literally prepared these slides within the last hour, uh,

275

00:24:23.945 --> 00:24:26.345
which I don't like to do with such a large audience,

276

00:24:26.445 --> 00:24:28.905
but we're, we're gonna see how this goes.

277

00:24:29.445 --> 00:24:32.145
Um, so this is kind of a little bit rough,

278

00:24:32.285 --> 00:24:33.825
but, uh, let's talk about losses.

279

00:24:34.045 --> 00:24:36.745
You might have a loss of life in this system, uh,

280

00:24:36.745 --> 00:24:38.425
potentially, although it's unmanned.

281

00:24:38.645 --> 00:24:40.505
Uh, maybe there are folks on the aircraft

282

00:24:40.765 --> 00:24:44.065
or when we're testing, uh, we may be in a different, uh,

283

00:24:44.145 --> 00:24:45.265
environment when we're testing

284

00:24:45.325 --> 00:24:48.185

and we may, uh, hurt some people potentially, of course,

285

00:24:48.185 --> 00:24:50.785

we could lose the aircraft, that's a another loss.

286

00:24:51.085 --> 00:24:53.865

Or if we are unable to perform the flight testing

287

00:24:53.965 --> 00:24:56.985

or if we're, we can only flight test half of what we want it

288

00:24:56.985 --> 00:24:58.865

to today, uh, that's a mission loss,

289

00:24:59.005 --> 00:25:00.105

uh, that we might want include.

290

00:25:00.105 --> 00:25:02.865

And there could be others. But let's start with these three.

291

00:25:03.435 --> 00:25:06.505

Let's go on to a control structure now, based on

292

00:25:07.085 --> 00:25:09.945

the information that you've seen, uh, maybe here

293

00:25:09.965 --> 00:25:11.825

and on these two slides, uh,

294

00:25:12.015 --> 00:25:14.345

pull up the questions pane if you could.

295

00:25:14.345 --> 00:25:15.985

We're gonna use that as a chat window

296

00:25:16.565 --> 00:25:18.865

and type into the question pane, what you think some

297

00:25:18.865 --> 00:25:22.545

of the boxes might be in, in this control structure.

298

00:25:23.005 --> 00:25:26.025

I'm shooting for maybe four or five boxes.

299

00:25:26.645 --> 00:25:28.825

Um, but, but type it up as a question.

300

00:25:29.285 --> 00:25:31.385

Uh, just because the chat window doesn't work for us,

301

00:25:31.415 --> 00:25:32.905

what do you think the boxes might be?

302

00:25:32.905 --> 00:25:34.425

What are the controllers in this system?

303

00:25:57.605 --> 00:25:59.895

Fantastic. Are some of the answers.

304

00:26:00.135 --> 00:26:01.775

I realize you can't see all the questions.

305

00:26:02.195 --> 00:26:04.615

Uh, we do have some software automation for sure

306

00:26:04.615 --> 00:26:06.455

that includes flight director and things like that.

307

00:26:06.955 --> 00:26:09.975

Uh, of course we have the flight tester, right?

308

00:26:09.975 --> 00:26:12.055

That's a, uh, or the, the remote pilot

309

00:26:12.315 --> 00:26:13.655

or supervisor, if you will.

310

00:26:14.235 --> 00:26:17.015

Um, now there's something in this text

311

00:26:17.365 --> 00:26:21.535
that mentions a tower, uh, which could provide some,

312

00:26:21.765 --> 00:26:23.215
some surface wind information

313

00:26:23.445 --> 00:26:24.735
that might be a starting point.

314

00:26:25.115 --> 00:26:29.615
Now, of course, uh, this, this slide is very incomplete.

315

00:26:29.615 --> 00:26:31.455
There's a lot more to it, but I, I'm just trying

316

00:26:31.455 --> 00:26:34.215
to scope this that we can do this in a couple minutes.

317

00:26:34.915 --> 00:26:37.175
Um, so here's an example of

318

00:26:37.175 --> 00:26:38.775
what the control structure might look like.

319

00:26:38.885 --> 00:26:40.095
It's just a very quick sketch,

320

00:26:40.155 --> 00:26:41.815
but we've got some automation.

321

00:26:41.835 --> 00:26:43.325
The automation can land

322

00:26:43.505 --> 00:26:47.445
or wave off on its own, uh, the, the fiscal UAV to either

323

00:26:48.405 --> 00:26:49.885
continue with the landing or, or not.

324

00:26:50.265 --> 00:26:51.565

But we've got the flight tester.

325

00:26:51.745 --> 00:26:54.765

The flight tester can set us up maybe to request a,

326

00:26:54.845 --> 00:26:58.205

a landing initially, or they could override, you know,

327

00:26:58.205 --> 00:27:00.565

request landing might be by way of a way point

328

00:27:00.585 --> 00:27:02.365

or by defining the mission,

329

00:27:02.665 --> 00:27:05.965

but they can also override the automation and landing

330

00:27:06.025 --> 00:27:08.245

and say whatever criteria you're looking at

331

00:27:08.245 --> 00:27:09.845

internally, do it anyway.

332

00:27:09.995 --> 00:27:11.845

Land, land this thing, um,

333

00:27:12.105 --> 00:27:14.165

the flight tester can communicate with the tower course.

334

00:27:14.165 --> 00:27:16.285

The tower gives them clearance to land, which is important.

335

00:27:16.545 --> 00:27:18.925

And they may also provide some surface wind

336

00:27:18.925 --> 00:27:20.285

conditions to flight tested or not.

337

00:27:20.285 --> 00:27:22.045

It's interesting that that doesn't actually get down

338

00:27:22.045 --> 00:27:23.365
to the UAV automation.

339

00:27:23.665 --> 00:27:26.805
The only information that the UAV automation can get is from

340

00:27:26.825 --> 00:27:28.525
the sensors on the UAV itself.

341

00:27:28.655 --> 00:27:31.325
Which slide slip at altitude.

342

00:27:31.765 --> 00:27:33.805
I, now, I have to apologize a bit to Alan.

343

00:27:33.885 --> 00:27:36.085
I don't know that this is 100% correct.

344

00:27:36.115 --> 00:27:37.165
This is my understanding.

345

00:27:37.785 --> 00:27:41.365
We are just gonna go with this, uh, rather than take time,

346

00:27:41.825 --> 00:27:43.605
uh, to make this crisp and precise.

347

00:27:43.625 --> 00:27:45.325
But, but hopefully this is pretty close.

348

00:27:45.705 --> 00:27:48.085
Um, let's, let's assume this is accurate

349

00:27:48.505 --> 00:27:50.485
and let's continue with an analysis.

350

00:27:50.485 --> 00:27:52.485
Let's see what can go wrong in this control structure?

351

00:27:52.825 --> 00:27:55.925

The next step is to identify unsafe control actions.

352

00:27:55.925 --> 00:27:57.365

These are the downward arrows.

353

00:27:57.635 --> 00:28:00.325

What unsafe control action do you think we should analyze?

354

00:28:00.355 --> 00:28:01.925

Type it up into the question pane.

355

00:28:03.335 --> 00:28:05.545

What action, which would be a downward arrow?

356

00:28:05.575 --> 00:28:08.785

What label for a downward arrow do you think might be a good

357

00:28:08.785 --> 00:28:09.865

place to, to analyze?

358

00:28:09.925 --> 00:28:10.745

Any one of them are fine,

359

00:28:10.745 --> 00:28:11.705

but I'm just curious what you think.

360

00:28:21.565 --> 00:28:25.615

Fantastic. We, yeah, that wave off command looks fantastic.

361

00:28:25.975 --> 00:28:27.415

I don't have slides prepared for that,

362

00:28:27.595 --> 00:28:30.415

but we could almost discuss that, discuss that ourselves

363

00:28:30.675 --> 00:28:33.495

and, and we'd find something like you provide the wave off

364

00:28:33.495 --> 00:28:35.135

command when you don't really need to

365
00:28:35.135 --> 00:28:37.135
because surface wind is actually fine.

366
00:28:37.555 --> 00:28:39.215
Um, why would the UAV do that?

367
00:28:39.215 --> 00:28:40.775
Because its process model is

368
00:28:40.775 --> 00:28:43.935
that the side flip is too high for a landing.

369
00:28:44.275 --> 00:28:47.295
Uh, when in reality maybe the surface condition is just

370
00:28:47.295 --> 00:28:48.735
fine, why would it have that belief?

371
00:28:48.735 --> 00:28:52.015
Because the feedback it has is maybe not the,

372
00:28:52.195 --> 00:28:55.255
the real feedback that we would like to see or,

373
00:28:55.355 --> 00:28:58.135
or the most accurate feedback, uh, to make that decision.

374
00:28:58.195 --> 00:28:59.655
And we could anticipate that scenario.

375
00:28:59.715 --> 00:29:04.415
And, and, uh, you may not even need SDPA to anticipate

376
00:29:04.415 --> 00:29:05.895
that scenario, but it would come out

377
00:29:05.895 --> 00:29:07.535
of this process very systematically.

378
00:29:07.785 --> 00:29:08.815

Let's do it. Another one.

379

00:29:09.105 --> 00:29:12.255

Let's look at overriding the automation from the flight

380

00:29:12.255 --> 00:29:14.055

tester, this command to override.

381

00:29:14.235 --> 00:29:16.095

And let's do this a little more systematically.

382

00:29:16.395 --> 00:29:19.655

So let's go to step three. I've prepared a table here.

383

00:29:19.655 --> 00:29:22.495

Here's a very simplified, uh, control loop at the top.

384

00:29:22.495 --> 00:29:23.775

Just to give us a reminder.

385

00:29:24.025 --> 00:29:26.015

We're talking about actions from the flight tester.

386

00:29:26.405 --> 00:29:28.815

This table, everything in it would be populated

387

00:29:28.815 --> 00:29:31.935

automatically by STPA at this point in the process,

388

00:29:32.235 --> 00:29:33.655

we just have to fill in the blank.

389

00:29:33.875 --> 00:29:36.735

And I'm gonna skip the additional criteria, uh,

390

00:29:36.735 --> 00:29:37.975

that would help you fill in the blank.

391

00:29:37.975 --> 00:29:40.255

We're just gonna brainstorm, uh, which is a,

392

00:29:40.335 --> 00:29:41.845
a little less systematic than

393

00:29:42.085 --> 00:29:43.445
SDBA would actually have us do.

394

00:29:43.465 --> 00:29:47.125
But, um, it works. Let's try it. Let's the first one.

395

00:29:47.125 --> 00:29:48.285
So the first case is,

396

00:29:48.555 --> 00:29:51.045
suppose the flight tester does not provide a

397

00:29:51.045 --> 00:29:52.205
force landing command.

398

00:29:52.665 --> 00:29:55.325
Do we care? Is this ever gonna cause one of our losses?

399

00:29:55.425 --> 00:29:58.245
And remember, our losses, not just loss of life,

400

00:29:58.305 --> 00:30:00.285
but if we lose the aircraft somehow,

401

00:30:00.785 --> 00:30:04.765
or if we, uh, lose our flight test mission somehow

402

00:30:04.945 --> 00:30:06.125
by this, uh, we care.

403

00:30:06.465 --> 00:30:11.445
So when would this be very critical to not provide the, the,

404

00:30:11.885 --> 00:30:13.445
i, maybe I shouldn't say very critical,

405

00:30:13.505 --> 00:30:17.565

but in terms of our losses, when do we care about, uh,

406

00:30:17.585 --> 00:30:20.125

not providing a force landing command?

407

00:30:20.125 --> 00:30:23.005

When could that get us into trouble in terms of our losses?

408

00:30:27.385 --> 00:30:29.605

If you do not provide the force landing command,

409

00:30:32.425 --> 00:30:33.995

type it into the question box.

410

00:30:54.765 --> 00:30:56.745

I'm not, are, can you still hear me?

411

00:31:13.495 --> 00:31:14.955

Can someone confirm if you can hear me?

412

00:31:16.835 --> 00:31:19.615

Yep. You're still loud and clear. I'm not hearing Ben.

413

00:31:24.835 --> 00:31:27.565

Okay, so one of the rea one

414

00:31:27.565 --> 00:31:30.725

of the cases in which providing a force landing command

415

00:31:30.815 --> 00:31:34.405

might be an issue is what if we're low on fuel?

416

00:31:35.915 --> 00:31:36.935

Uh, here we go. I had a,

417

00:31:37.015 --> 00:31:38.735

I think I had a bad internet connection here.

418

00:31:39.315 --> 00:31:42.175

Uh, I wasn't seeing the, the responses for a minute.

419

00:31:42.715 --> 00:31:44.655
Um, you, you guys have got it.

420

00:31:44.715 --> 00:31:48.675
If, if we, if we get a, uh,

421

00:31:49.375 --> 00:31:51.995
if we get a situation where we're maybe lower fuel, we have

422

00:31:51.995 --> 00:31:54.755
to land and maybe the surface wind is telling us it's okay,

423

00:31:55.855 --> 00:31:59.355
but the altitude side slip is a problem, uh,

424

00:31:59.935 --> 00:32:02.715
we really should be providing the forced landing command.

425

00:32:02.855 --> 00:32:04.755
And if we don't, we could lose the

426

00:32:04.915 --> 00:32:05.955
aircraft in the worst case.

427

00:32:06.415 --> 00:32:10.875
Or maybe in the better case, we lose part of the mission

428

00:32:10.875 --> 00:32:14.955
because we experience a, a go around or a wave off.

429

00:32:15.455 --> 00:32:17.515
Um, what about providing that command?

430

00:32:17.855 --> 00:32:21.475
Is there any situation where providing the command, uh,

431

00:32:21.475 --> 00:32:23.955
from the flight tester could get us into trouble

432

00:32:34.605 --> 00:32:36.655

Exactly when the surface winds are too high?

433

00:32:36.655 --> 00:32:39.565

So we wanna make sure that we bake this into the flight

434

00:32:39.565 --> 00:32:41.485

testing procedure, make sure that they know,

435

00:32:41.825 --> 00:32:43.485

or when they force landing command

436

00:32:43.485 --> 00:32:45.165

that they check these things and so on.

437

00:32:45.265 --> 00:32:47.765

And we'd go through this table. But let's move on.

438

00:32:48.015 --> 00:32:50.805

Let's do the last part of TPA a and wrap this up.

439

00:32:51.225 --> 00:32:53.405

Um, let's, the last part is build a scenario.

440

00:32:53.465 --> 00:32:54.725

So we would, this is step forward.

441

00:32:54.725 --> 00:32:56.245

We take one of those unsafe control

442

00:32:56.345 --> 00:32:57.925

and we figure out how it could actually happen.

443

00:32:57.985 --> 00:32:59.725

So let's take the first one we came up with.

444

00:33:00.145 --> 00:33:02.565

If you do not provide this force landing command

445

00:33:02.565 --> 00:33:04.965

that's overriding the wave off, that's autonomous.

446

00:33:05.425 --> 00:33:07.245

If you don't provide that command when,

447

00:33:07.415 --> 00:33:11.125

let's say fuel is low, if winds are just fine, um, that,

448

00:33:11.125 --> 00:33:13.605

that could be maybe one of the most critical cases.

449

00:33:13.745 --> 00:33:15.925

You could also say maybe the fuel is just fine,

450

00:33:16.225 --> 00:33:17.685

but surface winds are acceptable.

451

00:33:17.795 --> 00:33:19.205

That won't get you all three losses,

452

00:33:19.305 --> 00:33:20.365

but it'll get you L three.

453

00:33:20.365 --> 00:33:24.325

It'll get you, uh, uh, limits on the, uh, mission

454

00:33:24.325 --> 00:33:25.645

that we can accomplish in terms

455

00:33:25.645 --> 00:33:27.485

of testing if we just have unintended

456

00:33:27.825 --> 00:33:29.405

and unexpected wave offs.

457

00:33:29.545 --> 00:33:31.685

Um, so why in the world would this happen?

458

00:33:31.945 --> 00:33:34.165

Why in the world would a flight tester

459

00:33:34.825 --> 00:33:37.005

not provide the force landing committee

460

00:33:37.515 --> 00:33:40.085

When these things are happening, when the fuel is low,

461

00:33:40.215 --> 00:33:41.605

we're coming in for landing and the

462

00:33:41.605 --> 00:33:42.765

surface winds are acceptable.

463

00:33:42.795 --> 00:33:45.125

What kinds of beliefs might the flight adjuster have

464

00:33:45.355 --> 00:33:47.445

that make them think we don't need this force landing?

465

00:34:02.975 --> 00:34:05.065

Exactly. You guys have got it.

466

00:34:05.565 --> 00:34:08.985

Um, now in ft PA, we don't have to think off the top

467

00:34:08.985 --> 00:34:11.105

of our heads, uh, from a blank slate on,

468

00:34:11.105 --> 00:34:13.465

on this question like I just made you, uh, do,

469

00:34:13.595 --> 00:34:15.665

there are places we can look to get the answer,

470

00:34:15.725 --> 00:34:18.265

but you actually did it without any additional guidance.

471

00:34:19.555 --> 00:34:22.505

Three that come to mind are, you don't know the fuel is low.

472

00:34:22.505 --> 00:34:23.785

That comes from the context here.

473

00:34:23.785 --> 00:34:25.585

If you don't know the fuel is low, you think it is fine.

474

00:34:25.585 --> 00:34:26.985

We don't, we don't have any urgency.

475

00:34:26.985 --> 00:34:28.105

We don't need to force landing.

476

00:34:28.255 --> 00:34:31.385

Another belief is if you believe the surface winds are not

477

00:34:31.385 --> 00:34:33.905

acceptable, if you think that they're too high,

478

00:34:33.965 --> 00:34:36.425

of course we're not gonna force a landing if we think it's

479

00:34:36.425 --> 00:34:38.225

gonna result in a, in a collision or,

480

00:34:38.245 --> 00:34:41.265

or, uh, override, uh, uh, exceeding the limit we have.

481

00:34:41.765 --> 00:34:45.465

Um, and, and another belief if we don't think

482

00:34:45.465 --> 00:34:48.265

that the thing is going to wave off,

483

00:34:48.365 --> 00:34:50.785

if we think it's gonna land, if we think everything is fine.

484

00:34:51.085 --> 00:34:52.585

Uh, so we'd fill in those beliefs.

485

00:34:52.925 --> 00:34:54.345

Now somebody tell me what kind

486

00:34:54.345 --> 00:34:56.505

of inputs could cause those beliefs.

487

00:34:56.765 --> 00:34:58.585

Now, to narrow it down, let's pick one belief.

488

00:34:58.795 --> 00:35:02.065

Let's say the flight tested beliefs, it's going

489

00:35:02.065 --> 00:35:03.305

to land normally.

490

00:35:03.325 --> 00:35:05.465

It has no idea that the thing is going to wave off.

491

00:35:05.925 --> 00:35:09.625

Um, what kind of inputs that may exist

492

00:35:09.685 --> 00:35:12.705

or may not exist will cause a, a flight tester

493

00:35:12.705 --> 00:35:14.745

to think it's, it's okay when it's not.

494

00:35:15.095 --> 00:35:17.545

What kind of inputs might be missing or,

495

00:35:17.605 --> 00:35:19.025

or might be misleading

496

00:35:19.205 --> 00:35:21.665

to the flight tester to make them think?

497

00:35:21.765 --> 00:35:22.765

Uh, it's

498

00:35:54.255 --> 00:35:55.435

You seeing those answers, John?

499

00:36:05.025 --> 00:36:07.975

We're getting answers about tower winds not receiving

500
00:36:07.975 --> 00:36:09.015
the wave off information.

501
00:36:11.255 --> 00:36:15.725
Lack of accurate wins, belief

502
00:36:15.725 --> 00:36:16.925
that the side slip is okay,

503
00:36:21.115 --> 00:36:23.845
sensors giving low wind, low wind readings.

504
00:36:33.265 --> 00:36:34.595
Okay, sounds like we lost John again.

505
00:36:36.355 --> 00:36:37.785
Shane, do you wanna pick it up from there?

506
00:36:39.215 --> 00:36:41.985
Well, I think that these are again, oh,

507
00:36:41.985 --> 00:36:43.065
they're back. Perfect. Back

508
00:36:43.065 --> 00:36:44.065
Again.

509
00:36:44.205 --> 00:36:46.865
Oh man, I'm really sorry everybody. Uh, that's alright.

510
00:36:46.965 --> 00:36:49.305
My second backup sticking with is going down.

511
00:36:51.325 --> 00:36:53.345
But anyway, uh, you've got it.

512
00:36:53.455 --> 00:36:58.185
This is a fantastic, we, uh, we, uh, kind

513
00:36:58.185 --> 00:36:59.185

of cut some cores.

514

00:36:59.185 --> 00:37:00.785

We did a very rushed analysis.

515

00:37:00.845 --> 00:37:03.305

We didn't this up right with the right experts on the phone

516

00:37:03.305 --> 00:37:05.865

and so on, but you all got it exactly right.

517

00:37:06.085 --> 00:37:08.825

Um, as you saw in the other, other, in the questions,

518

00:37:09.005 --> 00:37:12.585

if the flight tester does not know that the, uh,

519

00:37:13.005 --> 00:37:16.705

the wind flip it altitude is, uh, exceeding the threshold,

520

00:37:16.775 --> 00:37:18.345

then it's gonna, they're not gonna know

521

00:37:18.345 --> 00:37:19.705

that the thing is gonna wave off.

522

00:37:19.925 --> 00:37:23.225

If there's no indication that the thing is going to wave off

523

00:37:23.805 --> 00:37:26.065

before it happens, it's gonna surprise them.

524

00:37:26.365 --> 00:37:29.105

Uh, if they have an indication that fuel is low, of course,

525

00:37:29.105 --> 00:37:30.985

that's, that's another one that that would come up.

526

00:37:30.985 --> 00:37:32.465

And we wanna make sure

527

00:37:32.565 --> 00:37:34.905
before we go into flight testing that all

528

00:37:34.905 --> 00:37:36.865
of these things are there, uh,

529

00:37:36.925 --> 00:37:38.425
for the flight test to do their job.

530

00:37:39.015 --> 00:37:42.945
Okay, at this point I would like to, I'm done.

531

00:37:43.325 --> 00:37:46.025
Uh, we've done SDBA very rushed very quickly,

532

00:37:46.045 --> 00:37:48.545
but you saw another demonstration of kind of how

533

00:37:48.545 --> 00:37:50.185
to think about the problem at least,

534

00:37:50.195 --> 00:37:51.465
which is really my point.

535

00:37:52.045 --> 00:37:55.305
Um, let me hand it off to Alan Jespersen,

536

00:37:55.485 --> 00:37:57.025
if we can unmute his mic again

537

00:37:57.365 --> 00:38:01.665
and let him explain, uh, his experience with this system,

538

00:38:01.755 --> 00:38:03.345
which is, which is what, uh,

539

00:38:03.645 --> 00:38:05.825
he explained in the homework assignment.

540

00:38:08.995 --> 00:38:11.495

Uh, great, thanks John. That was really, uh, useful

541

00:38:11.495 --> 00:38:13.135
to see it from a different perspective.

542

00:38:13.795 --> 00:38:17.495
So I think the, the one thing that hasn't been mentioned is,

543

00:38:17.835 --> 00:38:21.375
you know, site slip and winded altitude were not displayed

544

00:38:21.375 --> 00:38:24.535
to the operator, nor did any engineer in the control

545

00:38:24.535 --> 00:38:25.695
room were.

546

00:38:25.765 --> 00:38:27.055
They were not monitoring that.

547

00:38:27.595 --> 00:38:30.095
Uh, we also didn't have awareness that, that

548

00:38:30.095 --> 00:38:31.415
that was an autonomy trigger.

549

00:38:32.275 --> 00:38:35.245
And so the forecasting, uh,

550

00:38:35.275 --> 00:38:37.365
when the wave off happened did not tell us

551

00:38:37.505 --> 00:38:38.725
why it was waiving off.

552

00:38:39.105 --> 00:38:42.685
And it was only through multiple wave offs when we were

553

00:38:42.685 --> 00:38:45.165
trying to figure out why it was doing what it was doing,

554

00:38:45.675 --> 00:38:49.925

that we noodled through that, that problem to figure out

555

00:38:49.925 --> 00:38:52.965

that it was waiving off for that specific criteria.

556

00:38:53.385 --> 00:38:55.485

So, um, that was the challenge

557

00:38:55.865 --> 00:38:59.315

and the lesson learned, I think, um, out of that program

558

00:38:59.535 --> 00:39:02.655

for me is that, you know, as a flight tester,

559

00:39:02.655 --> 00:39:05.015

you wanna not be surprised by automation.

560

00:39:05.155 --> 00:39:08.495

And you want to have, uh, really good understanding of

561

00:39:08.495 --> 00:39:11.975

that in that entire model that's in the software, uh,

562

00:39:12.315 --> 00:39:14.135

to especially be attentive

563

00:39:14.155 --> 00:39:16.695

to those autonomy triggers at specific times.

564

00:39:17.435 --> 00:39:19.175

And even more so the,

565

00:39:20.055 --> 00:39:23.375

I think the final point I would make is that the displays

566

00:39:23.375 --> 00:39:25.055

that enable flight test

567

00:39:25.795 --> 00:39:28.375

and in order in order for us to flight test a machine like

568

00:39:28.375 --> 00:39:33.255

that, uh, are very, very different than a regular cockpit

569

00:39:33.255 --> 00:39:34.815

that a end user might use.

570

00:39:34.815 --> 00:39:35.855

Where the test pilot

571

00:39:36.035 --> 00:39:39.415

and the future operator are in a common cockpit here

572

00:39:39.445 --> 00:39:43.495

that the test interface for X 47 didn't suit flight test.

573

00:39:43.555 --> 00:39:45.975

It would also not suit the end operator.

574

00:39:46.235 --> 00:39:48.575

And so there were lots of decisions made in the design

575

00:39:49.475 --> 00:39:52.375

to not display, uh, certain things

576

00:39:52.475 --> 00:39:55.775

and to not forecast autonomy, you know,

577

00:39:55.775 --> 00:39:57.295

impending autonomy triggers

578

00:39:57.315 --> 00:40:00.295

to potentially override an undesired outcome.

579

00:40:00.395 --> 00:40:04.495

And so those were, you know, uh, you know, I think the, the,

580

00:40:04.495 --> 00:40:06.615

the lesson learned, I think for all the flight testers

581
00:40:06.615 --> 00:40:10.615
that are online is you need to be much more involved earlier

582
00:40:11.275 --> 00:40:13.095
as the software is being designed

583
00:40:13.715 --> 00:40:18.295
to enable flight test inputs, um, into the software

584
00:40:18.295 --> 00:40:21.335
that needs to be baked in so that, uh,

585
00:40:21.435 --> 00:40:22.695
you can flight test the machine

586
00:40:22.715 --> 00:40:25.135
and then also realize that the end user might have a

587
00:40:25.135 --> 00:40:28.775
completely different interface, uh, to enable that autonomy

588
00:40:28.955 --> 00:40:31.695
and to enable the, uh, behavior that you want.

589
00:40:32.275 --> 00:40:35.455
And so those are, are competing needs, competing interfaces,

590
00:40:35.585 --> 00:40:37.695
which is not something that we normally see in,

591
00:40:37.995 --> 00:40:39.055
in manned flight test.

592
00:40:39.355 --> 00:40:41.735
Uh, with that, thanks John. And, uh, I'll go back on mute.

593
00:40:43.995 --> 00:40:46.425
Perfect. Alright.

594
00:40:46.645 --> 00:40:50.145

So e essentially what what we just identified

595

00:40:50.665 --> 00:40:51.745
happened, it was less serious.

596

00:40:51.775 --> 00:40:54.945
They weren't, uh, out of fuel for the first time, uh,

597

00:40:54.945 --> 00:40:57.785
but it happened about three, three or four times, uh,

598

00:40:57.785 --> 00:40:59.385
before they were able to get it on the ground.

599

00:40:59.405 --> 00:41:00.985
It kept a boarding, uh,

600

00:41:01.085 --> 00:41:04.985
or waving off at altitude, even though surface winds were,

601

00:41:05.325 --> 00:41:08.265
and the flight tester had checked with the tower

602

00:41:08.365 --> 00:41:10.705
to confirm the surface winds were fine,

603

00:41:10.855 --> 00:41:12.225
this thing kept waving off.

604

00:41:12.485 --> 00:41:15.065
Um, and, and it was a surprise, uh,

605

00:41:15.065 --> 00:41:17.625
because they didn't have an indication that it was going

606

00:41:17.625 --> 00:41:20.305
to wave off or an indication of the slide slip to be able

607

00:41:20.305 --> 00:41:22.225
to predict if it was going to wave off.

608

00:41:22.605 --> 00:41:25.385

And I, if I recall correctly, I think on, on the third

609

00:41:25.605 --> 00:41:28.225

or fourth attempt, they finally were low on fuel

610

00:41:28.285 --> 00:41:31.065

and they had the force of the landing, uh, to get it down.

611

00:41:31.135 --> 00:41:33.605

Another interesting thing is that my understanding is

612

00:41:33.605 --> 00:41:36.565

that someone else actually did have an indication

613

00:41:37.105 --> 00:41:39.285

of the side flip and what was going on,

614

00:41:39.345 --> 00:41:42.045

but that info information was not, uh,

615

00:41:42.145 --> 00:41:44.085

on the interface, the flight tester.

616

00:41:44.745 --> 00:41:48.205

Um, and in hindsight it would be a good thing to be added.

617

00:41:48.305 --> 00:41:51.805

So the point that, uh, Alan made

618

00:41:52.035 --> 00:41:54.005

that flight testers really need

619

00:41:54.005 --> 00:41:57.445

to be involved much earlier in the program, uh,

620

00:41:57.505 --> 00:41:58.525

and in the development,

621

00:41:58.845 --> 00:42:01.245

I think we can all appreciate with that.

622

00:42:01.365 --> 00:42:05.005

I think I will hand it off to the, to the organizer.

623

00:42:15.425 --> 00:42:17.465

Excellent. Thank you John. And, uh,

624

00:42:17.485 --> 00:42:21.185

as Susan is bringing my webcam back up, uh, again,

625

00:42:21.185 --> 00:42:22.185

wanna thank Ben and,

626

00:42:22.185 --> 00:42:24.385

and Sheem for kind of, uh, moderating this session.

627

00:42:25.085 --> 00:42:28.585

Um, and I wanna put Sheem on the spot if I could

628

00:42:28.695 --> 00:42:30.505

with, with a question.

629

00:42:30.845 --> 00:42:35.545

Um, because admittedly I am an advocate of, uh,

630

00:42:37.565 --> 00:42:38.725

STPA and stamp.

631

00:42:39.005 --> 00:42:42.525

I am by no means competent in using it. I'm still learning.

632

00:42:43.145 --> 00:42:46.565

And I wanted to maybe get a feel from Shem, um,

633

00:42:46.865 --> 00:42:49.405

as an active line pilot, you know, what kind

634

00:42:49.405 --> 00:42:53.045

of time investment is required to get to a level of

635
00:42:53.845 --> 00:42:57.325
familiarity and comfort in using STPA if you are going

636
00:42:57.325 --> 00:42:59.365
to embark on a journey of analyzing a system.

637
00:43:01.765 --> 00:43:03.335
Well, you know, I've, of course, I

638
00:43:03.945 --> 00:43:05.475
been working on it as a live pod.

639
00:43:05.495 --> 00:43:10.075
I'm also been implementing it, uh, in, uh,

640
00:43:10.335 --> 00:43:11.915
in my role as a visiting professor

641
00:43:12.135 --> 00:43:13.635
for institute technology as well.

642
00:43:14.505 --> 00:43:17.155
It's, um, it takes some time, uh,

643
00:43:17.575 --> 00:43:19.475
at first it takes a while to get your head around.

644
00:43:19.535 --> 00:43:21.315
One thing that I found really helped me

645
00:43:22.055 --> 00:43:24.355
and uh, that was working with, uh, Dr.

646
00:43:24.645 --> 00:43:27.795
Nancy Levison was starting

647
00:43:28.255 --> 00:43:30.115
by simplifying the control structure.

648
00:43:30.375 --> 00:43:31.955

You know, at first I was trying

649

00:43:31.955 --> 00:43:34.035
to make it too complicated too quickly,

650

00:43:34.175 --> 00:43:36.235
and that sort of overwhelmed me.

651

00:43:37.095 --> 00:43:41.485
And so what we got down to, we're starting out with really,

652

00:43:41.485 --> 00:43:43.285
really simple control structures.

653

00:43:43.305 --> 00:43:47.005
For example, you know, looking at, at aircraft, we just had

654

00:43:47.885 --> 00:43:49.545
the, uh, pilots

655

00:43:49.925 --> 00:43:54.185
and then the el we just said electronics, you know, for the,

656

00:43:54.365 --> 00:43:58.025
all the other systems and then then the aircraft,

657

00:43:58.165 --> 00:43:59.905
and then you can, of course,

658

00:43:59.905 --> 00:44:02.225
the pilots could bypass the electronic systems on

659

00:44:02.225 --> 00:44:03.545
some airplanes, not on others.

660

00:44:04.325 --> 00:44:07.665
And then they were having feedback either

661

00:44:07.665 --> 00:44:10.225
through the systems, some airplanes, that's all you have is,

662

00:44:10.245 --> 00:44:14.815

you know, and other times you have feedback, you know,

663

00:44:15.735 --> 00:44:18.815

directly, um, you know, that you can get, uh,

664

00:44:18.815 --> 00:44:20.415

certainly acceleration cues

665

00:44:20.415 --> 00:44:22.695

or whatnot if you're flying the airplane, all of

666

00:44:22.695 --> 00:44:23.855

that goes out the window with

667

00:44:23.855 --> 00:44:25.295

autonomous vehicles, obviously.

668

00:44:26.685 --> 00:44:28.305

So we start out very simple.

669

00:44:28.365 --> 00:44:32.925

And then the other thing that we did was, was we separated

670

00:44:34.015 --> 00:44:35.065

control structures.

671

00:44:35.085 --> 00:44:37.265

For example, in one example, looking at

672

00:44:37.885 --> 00:44:39.785

the UPS accident in Birmingham,

673

00:44:39.785 --> 00:44:42.305

and this was using not an SDPA,

674

00:44:42.305 --> 00:44:47.065

which is course a perspective method and extremely powerful,

675

00:44:47.685 --> 00:44:50.305

but we were looking at an accident after the fa

676

00:44:50.435 --> 00:44:55.355

after the fact, and we independently modeled the control

677

00:44:55.355 --> 00:44:56.835

of what was going on at the airport

678

00:44:56.835 --> 00:44:59.035

and why they decided to close the runways

679

00:44:59.695 --> 00:45:01.115

and how that happened.

680

00:45:01.655 --> 00:45:04.155

And then once we had that done,

681

00:45:04.265 --> 00:45:06.795

then we could put those together separately if we tried

682

00:45:06.795 --> 00:45:08.475

to put a map it all together.

683

00:45:09.255 --> 00:45:12.275

But, but it just really made it a lot more complicated.

684

00:45:12.375 --> 00:45:14.005

And, and I guess the,

685

00:45:14.225 --> 00:45:18.445

the other aspect is I find the control structure, uh,

686

00:45:18.585 --> 00:45:21.165

you know, we haven't talked about it like using it,

687

00:45:21.225 --> 00:45:23.565

but you know, if you look at the control structure,

688

00:45:24.025 --> 00:45:27.445

it really helps you identify some of the gaps

689

00:45:27.475 --> 00:45:29.445
that you need to analyze.

690

00:45:30.265 --> 00:45:34.165
And I think when I first went through it, we kind of,

691

00:45:34.185 --> 00:45:36.005
we looked at the control structure and built it,

692

00:45:36.005 --> 00:45:40.325
but then we moved right on to, you know, the next section

693

00:45:40.345 --> 00:45:41.805
of identifying ucas.

694

00:45:42.505 --> 00:45:46.565
And initially I didn't really use the control structure

695

00:45:47.035 --> 00:45:49.045
that much in developing the ucas.

696

00:45:49.045 --> 00:45:52.805
And after a time, I found it a really useful way

697

00:45:52.805 --> 00:45:56.245
to say this is, uh, you know, this is what we're controlling

698

00:45:56.305 --> 00:46:00.395
as well as these are the, um, uh, you know,

699

00:46:00.395 --> 00:46:03.995
then identifying the feedback or lack of feedback and,

700

00:46:04.735 --> 00:46:08.895
and listing it out, uh, at each level

701

00:46:09.355 --> 00:46:10.735
of the control structure.

702

00:46:11.515 --> 00:46:14.495

So it's, it took a little while to get your head around

703

00:46:14.515 --> 00:46:17.575

and also it's really not a, you know, system diagram

704

00:46:17.915 --> 00:46:18.895

or, you know, any of

705

00:46:18.895 --> 00:46:19.975

the other things that I was more used to.

706

00:46:20.035 --> 00:46:23.655

So, you know, it took a few times to get past trying

707

00:46:23.655 --> 00:46:24.775

to draw it that way as well.

708

00:46:26.415 --> 00:46:28.145

Yeah, good comment, sham, I, and,

709

00:46:28.245 --> 00:46:30.385

and, uh, I like that approach as well.

710

00:46:30.925 --> 00:46:33.945

So I think that that's a good takeaway for the attendees

711

00:46:33.945 --> 00:46:36.145

that are tuning in today, that, uh,

712

00:46:36.145 --> 00:46:38.625

you don't necessarily have to build the, the level

713

00:46:38.625 --> 00:46:40.745

of complexity within the control structure right out

714

00:46:40.745 --> 00:46:42.625

of the gate that as you're learning this,

715

00:46:42.665 --> 00:46:44.305

maybe just take it in bite-sized chunks.

716
00:46:44.695 --> 00:46:47.145
Yeah. And, and in fact, it's better not to,

717
00:46:47.365 --> 00:46:49.065
and I think as John will say,

718
00:46:49.125 --> 00:46:52.225
and you know, we did some of the top talks is

719
00:46:52.225 --> 00:46:54.585
that you can start with a very basic one, one,

720
00:46:54.585 --> 00:46:58.225
and then you can zoom in and do another one for that section

721
00:46:58.325 --> 00:47:00.465
and then zoom out and look at the larger one

722
00:47:01.365 --> 00:47:05.935
because not lost on all of this is that as you zoom out,

723
00:47:06.115 --> 00:47:08.325
you also need to look at, you know,

724
00:47:08.385 --> 00:47:10.125
how the training was done.

725
00:47:10.125 --> 00:47:11.125
What were the policies

726
00:47:11.125 --> 00:47:14.085
and procedures put in place, what were the rules, you know,

727
00:47:14.085 --> 00:47:16.405
put in place by the program managers

728
00:47:16.625 --> 00:47:18.965
or above them, you know, what restrictions

729
00:47:19.065 --> 00:47:21.965

and constraints that they have that may have limited

730

00:47:22.225 --> 00:47:23.565

how you're designing the whole process.

731

00:47:23.865 --> 00:47:26.465

So, so it's really important to zoom out,

732

00:47:26.565 --> 00:47:27.825

you know, on something short like this.

733

00:47:27.825 --> 00:47:30.725

We can't get into those aspects, but that becomes very,

734

00:47:30.725 --> 00:47:31.725

Very interesting.

735

00:47:32.065 --> 00:47:35.085

Yep. Fantastic. Well, thanks again, she, I appreciate it.

736

00:47:35.185 --> 00:47:37.245

And, uh, I know you're gonna be with us throughout the day

737

00:47:37.545 --> 00:47:39.565

and we'll hear more from you later this afternoon.

738

00:47:40.105 --> 00:47:43.725

Um, I'm looking over here at, uh, our number of attendees

739

00:47:43.725 --> 00:47:45.245

and I'm seeing 340,

740

00:47:45.345 --> 00:47:47.245

and I think we got to a high watermark yesterday

741

00:47:47.245 --> 00:47:48.965

of just over 390.

742

00:47:49.665 --> 00:47:52.205

Um, that's very encouraging, so that's great.

743

00:47:52.225 --> 00:47:54.645

And we thank you for, uh, for tuning in

744

00:47:54.905 --> 00:47:57.045

and, uh, trying to learn more about STPA.

745

00:47:57.505 --> 00:48:01.005

Um, this, uh, our next presenter, you,

746

00:48:01.085 --> 00:48:05.075

I think you're really gonna enjoy, um, Fred George.

747

00:48:05.295 --> 00:48:07.315

Uh, I, I saw his presentation

748

00:48:07.935 --> 00:48:10.675

at the National Business Aviation Association conference,

749

00:48:11.215 --> 00:48:13.875

uh, at the Business aviation, uh, convention,

750

00:48:14.215 --> 00:48:15.715

uh, and exposition.

751

00:48:16.055 --> 00:48:18.755

And that was an excellent presentation on, on this topic.

752

00:48:18.855 --> 00:48:20.675

And I thought that, uh, we'd invite him in.

753

00:48:21.095 --> 00:48:24.235

Um, Fred is coming from his command bunker up

754

00:48:24.235 --> 00:48:25.395

in Redmond, Oregon.

755

00:48:25.815 --> 00:48:27.035

So welcome Fred.

756

00:48:27.135 --> 00:48:29.515

And that, uh, anybody that's read any

757

00:48:29.535 --> 00:48:32.235
of the more prominent aviation periodicals

758

00:48:32.455 --> 00:48:35.955
or consume online content, including LinkedIn

759

00:48:35.955 --> 00:48:37.955
or Facebook, has probably read some of Fred's work.

760

00:48:38.785 --> 00:48:40.875
He's a senior editor and chief pilot for Business

761

00:48:40.875 --> 00:48:42.355
and Commercial Aviation Magazine.

762

00:48:43.025 --> 00:48:45.555
He's chief evaluation aircraft evaluation pilot

763

00:48:45.615 --> 00:48:48.915
for Aviation Weekend Space Technology, and he's chief pilot

764

00:48:48.975 --> 00:48:50.675
and senior writer for Show news.

765

00:48:51.305 --> 00:48:52.435
Fred is an a TP.

766

00:48:52.615 --> 00:48:55.035
He carries type ratings in several different aircraft,

767

00:48:55.375 --> 00:48:57.995
but over his 7,700 plus hours of flight time,

768

00:48:57.995 --> 00:49:00.795
he's flown over 220 different aircraft.

769

00:49:01.555 --> 00:49:03.795
I think that's right up there with probably one, some

770
00:49:03.795 --> 00:49:05.995
of our most experienced test pilots in the Society

771
00:49:05.995 --> 00:49:08.315
of Experimental Test pilots, Fred.

772
00:49:08.575 --> 00:49:11.115
Um, and, and these include everything from Cubs

773
00:49:11.115 --> 00:49:12.675
Streamliners, a three fifties.

774
00:49:12.825 --> 00:49:16.515
He's got even got airship time, um, to include takeoffs

775
00:49:16.515 --> 00:49:17.835
and landings, which is pretty impressive.

776
00:49:18.145 --> 00:49:21.795
He's a former part 1 35, uh, charter captain as well

777
00:49:21.795 --> 00:49:25.475
as certified flight instructor Instrument FA designated

778
00:49:25.475 --> 00:49:26.475
pilot examiner.

779
00:49:27.135 --> 00:49:30.315
Fred's call sign is charts, as you can see behind him, his,

780
00:49:30.535 --> 00:49:33.985
uh, wings of Gold, a former Navy fighter pilot.

781
00:49:34.175 --> 00:49:37.905
He's got a thousand hour patch in the Mighty F four Phantom.

782
00:49:38.685 --> 00:49:41.425
He conducted Western Pacific deployments on the iconic,

783
00:49:41.425 --> 00:49:43.705

conventionally powered aircraft carriers,

784

00:49:43.705 --> 00:49:45.625
constellation and Coral Sea.

785

00:49:46.525 --> 00:49:48.845
I had zero traps on either of those boats, Fred,

786

00:49:49.385 --> 00:49:50.805
so I'm, I'm jealous.

787

00:49:50.945 --> 00:49:54.245
The Kitty Hawk was the, the, the, the legacy carrier

788

00:49:54.245 --> 00:49:55.925
that I ended up, uh, doing a, uh,

789

00:49:56.565 --> 00:49:59.805
a certification on when I was at VX 23 at P River.

790

00:50:00.545 --> 00:50:02.485
Uh, Fred has been recognized numerous times

791

00:50:02.625 --> 00:50:04.125
for his excellence in journalism

792

00:50:04.705 --> 00:50:07.525
and his extraordinary technical and instructional content.

793

00:50:08.245 --> 00:50:10.165
I enjoy Fred's product flight reports

794

00:50:10.385 --> 00:50:13.975
as they do indeed sound more like a thorough qual further,

795

00:50:14.075 --> 00:50:15.095
he is fair and balanced

796

00:50:15.155 --> 00:50:17.255
and many times tempers the marketing hype.

797

00:50:18.275 --> 00:50:20.655

One piece of Fred's background I wasn't aware of was

798

00:50:20.655 --> 00:50:21.775

that he was the former director

799

00:50:21.775 --> 00:50:24.015

of the San Diego Aerospace Museum,

800

00:50:24.825 --> 00:50:25.965

and this is really kind

801

00:50:25.965 --> 00:50:27.445

of a treasure out there in San Diego.

802

00:50:27.635 --> 00:50:30.565

It's a nice museum, a really impressive collection,

803

00:50:31.145 --> 00:50:33.605

and I think the secret was to get with a docent so

804

00:50:33.605 --> 00:50:34.725

that you go down to the basement

805

00:50:34.725 --> 00:50:36.205

and see the artifacts down there,

806

00:50:36.415 --> 00:50:38.645

which are really cool charts.

807

00:50:38.645 --> 00:50:40.645

Thanks so much for joining us today, uh,

808

00:50:40.645 --> 00:50:41.725

and spending some time with us,

809

00:50:41.865 --> 00:50:44.165

and we really look forward to your presentation on systems

810

00:50:44.595 --> 00:50:47.965

theoretic accident model and processes, or stamp.

811

00:50:48.315 --> 00:50:49.315

Over to you, sir.

812

00:50:50.145 --> 00:50:51.725

Thanks, fer. Appreciate it.

813

00:50:51.825 --> 00:50:54.005

Let me see if I can get this up on screen here.

814

00:50:54.395 --> 00:50:57.285

It's, um, I'm trying to figure out how

815

00:50:57.285 --> 00:50:59.645

to get my slides up here right now, uh,

816

00:51:00.115 --> 00:51:04.245

because right now, uh, I'm having a couple

817

00:51:04.245 --> 00:51:05.565

of technical difficulties.

818

00:51:05.905 --> 00:51:07.165

I'm glad you folks can hear me,

819

00:51:07.185 --> 00:51:09.485

but I've gotta try to get the presentation up here.

820

00:51:10.495 --> 00:51:12.875

Uh, let's see if I can find out how to do that.

821

00:51:18.145 --> 00:51:21.125

I'm trying to get my slides up here.

822

00:51:21.465 --> 00:51:24.765

Now, give me just a second here.

823

00:51:26.535 --> 00:51:28.795

You don't need to see all the garbage on screen,

824

00:51:28.795 --> 00:51:30.035
which you really need to see.

825

00:51:30.415 --> 00:51:34.115
Is the, uh, can you see that slide, uh,

826

00:51:34.215 --> 00:51:36.075
the PowerPoint presentation in the background?

827

00:51:36.155 --> 00:51:37.355
I, I, I can't hear anybody,

828

00:51:37.455 --> 00:51:39.675
but, uh, can somebody gimme a little feedback on that?

829

00:51:39.815 --> 00:51:41.355
I'm trying to get this thing to blow up.

830

00:51:42.575 --> 00:51:44.395
That's the button there, Fred. That's the one you want.

831

00:51:45.085 --> 00:51:47.875
There we go, we got it. We fine. Okay. Thanks so much.

832

00:51:48.935 --> 00:51:50.115
Uh, now all's have

833

00:51:50.115 --> 00:51:51.515
to do is figure out how to split the screen.

834

00:51:52.445 --> 00:51:56.705
Uh, but anyway, um, you know,

835

00:51:58.265 --> 00:52:01.955
when the MCA tobacco really started going down, I said,

836

00:52:01.955 --> 00:52:03.475
you know, we gotta get to the bottom of this thing.

837

00:52:03.475 --> 00:52:05.235

And I had the opportunity to go up

838

00:52:05.375 --> 00:52:09.875

and get into, uh, the max engineering cab in Seattle

839

00:52:10.495 --> 00:52:12.955

and go through a lot of the scenarios.

840

00:52:13.575 --> 00:52:17.555

And I think there were a lot of aha moments there.

841

00:52:17.735 --> 00:52:20.355

And when you do that, you begin to see

842

00:52:20.355 --> 00:52:21.915

that this is a pretty complex problem.

843

00:52:21.915 --> 00:52:24.795

It's not just, uh, a software

844

00:52:25.665 --> 00:52:27.555

anomaly in a flight control computer.

845

00:52:28.055 --> 00:52:29.715

But let's start out here

846

00:52:29.735 --> 00:52:33.075

and go to the most basic of, um,

847

00:52:34.295 --> 00:52:35.475

our tasks here.

848

00:52:35.475 --> 00:52:39.115

And that is, you know, the basic control loop.

849

00:52:39.135 --> 00:52:40.995

You know, we as pilots are controllers.

850

00:52:41.335 --> 00:52:43.195

Our mission here is to

851
00:52:43.865 --> 00:52:46.315
control the process within the boundaries

852
00:52:46.575 --> 00:52:48.275
of the flight control envelope.

853
00:52:48.375 --> 00:52:51.795
So as the blue arrow over there on the left hand side shows,

854
00:52:51.895 --> 00:52:55.715
we make control inputs to the actuators, the actuators,

855
00:52:55.735 --> 00:52:59.715
the flight controls, and the throttles then create, uh,

856
00:52:59.935 --> 00:53:01.515
our ability to control the process.

857
00:53:01.685 --> 00:53:03.595
Pitch plus power equals performance.

858
00:53:03.615 --> 00:53:04.955
And then our feedback,

859
00:53:05.135 --> 00:53:07.395
as you can see over there on the lower right process

860
00:53:07.875 --> 00:53:11.635
feedback gives us feedback to our sensors, eyes, ears,

861
00:53:11.645 --> 00:53:13.155
touch, seat of the pants, and

862
00:53:13.155 --> 00:53:16.355
therefore we make adjustments all the way back to

863
00:53:16.355 --> 00:53:17.955
what we're doing with the control process.

864
00:53:18.425 --> 00:53:20.515

Well, that's flying. If you're flying the cub

865

00:53:20.515 --> 00:53:21.515
or something like that

866

00:53:21.515 --> 00:53:24.955
because you're flying in non-compressible air, uh,

867

00:53:25.065 --> 00:53:28.125
you pull the stick back, the air speed slows down, you have

868

00:53:28.125 --> 00:53:30.685
to pull it back farther as the speed goes down and so forth.

869

00:53:30.705 --> 00:53:32.565
And finally, you get to the stall.

870

00:53:33.025 --> 00:53:35.845
And similarly, as the speed increases, you push the,

871

00:53:35.905 --> 00:53:37.885
the stick forward, keep going harder

872

00:53:37.905 --> 00:53:39.485
and harder, the speed increases, you have

873

00:53:39.485 --> 00:53:40.565
to push the stick forward.

874

00:53:41.195 --> 00:53:42.925
Well, the problem is that

875

00:53:43.025 --> 00:53:45.445
as you get into more sophisticated aircraft,

876

00:53:45.675 --> 00:53:47.605
they don't necessarily behave that way.

877

00:53:47.745 --> 00:53:49.885
Whoops, I went to the wrong slide there.

878
00:53:50.185 --> 00:53:54.285
And so, as shown in the third slide, uh, now

879
00:53:55.575 --> 00:53:57.205
we've introduced some automation

880
00:53:57.345 --> 00:54:00.455
or some computer help

881
00:54:00.555 --> 00:54:03.495
to help us make the airplane easier to fly.

882
00:54:03.595 --> 00:54:05.815
So we make partial control inputs,

883
00:54:06.315 --> 00:54:09.895
and then a flight control computer is going

884
00:54:09.895 --> 00:54:12.895
to help this process, make it feel more natural,

885
00:54:13.115 --> 00:54:14.535
reduce our pilot workload.

886
00:54:14.635 --> 00:54:16.695
So for example, let's say

887
00:54:16.695 --> 00:54:18.375
that you have a flight control computer

888
00:54:18.485 --> 00:54:20.135
with speed trim functions,

889
00:54:20.835 --> 00:54:24.135
and one of those speed trim functions is mock trim.

890
00:54:24.515 --> 00:54:26.175
And as the aircraft goes faster

891
00:54:26.235 --> 00:54:28.535

and faster, you'd like to be able to push and push

892

00:54:28.535 --> 00:54:30.095

and push as the aircraft goes faster.

893

00:54:30.235 --> 00:54:33.095

But then because of a shock wave

894

00:54:33.715 --> 00:54:37.015

coming down the surface of the wing, the center

895

00:54:37.075 --> 00:54:39.495

of pressure moves aft

896

00:54:40.115 --> 00:54:43.015

and now perhaps the nose wants

897

00:54:43.075 --> 00:54:44.735

to start going down on its own.

898

00:54:44.875 --> 00:54:48.855

We might have to actually pull back as the speed increases.

899

00:54:49.315 --> 00:54:52.495

So we introduced mock trim as the speed trim function,

900

00:54:52.755 --> 00:54:55.415

and what that does is that's going to roll in

901

00:54:56.285 --> 00:55:00.135

some nose up trim as the speed increases

902

00:55:00.635 --> 00:55:04.055

to give us the feel all the way up to red line

903

00:55:04.395 --> 00:55:08.575

and beyond, uh, that as speed increases, we have

904

00:55:08.575 --> 00:55:11.575

to keep pushing and pushing and pushing a very natural feel.

905
00:55:12.085 --> 00:55:14.855
Similarly, we have a speed trim function at the bottom.

906
00:55:14.915 --> 00:55:16.295
And let's say we're going around

907
00:55:17.235 --> 00:55:21.655
and as you cob the power lightweights, uh, F cg,

908
00:55:21.655 --> 00:55:24.495
the nose really wants to pitch up if you have engines

909
00:55:24.495 --> 00:55:26.055
that are under slung under the wings.

910
00:55:26.355 --> 00:55:30.295
And so a speed trim function can be introduced down there so

911
00:55:30.295 --> 00:55:31.455
that as you cob the power

912
00:55:31.555 --> 00:55:33.855
and the aircraft starts to accelerate,

913
00:55:34.195 --> 00:55:36.255
you're gonna roll in some nose down trim

914
00:55:36.635 --> 00:55:39.135
and give the aircraft a much more natural feel

915
00:55:39.195 --> 00:55:44.015
so you don't have as much of this pitch thrust coupling

916
00:55:44.165 --> 00:55:47.295
that makes the airplane feel very unboard to fly.

917
00:55:47.755 --> 00:55:50.015
Now let's go over here to this next slide,

918
00:55:50.015 --> 00:55:51.335

which is the MCAT slide.

919

00:55:52.035 --> 00:55:56.335

Uh, always, uh, good until we got into, uh,

920

00:55:56.555 --> 00:56:00.855

the max and put on these big old honking one B engines.

921

00:56:01.315 --> 00:56:03.615

And what happened with them is they were mounted farther

922

00:56:03.645 --> 00:56:08.135

forward and they were mounted, uh, higher up than the, uh,

923

00:56:08.415 --> 00:56:10.095

c FM 56 dash sevens.

924

00:56:11.565 --> 00:56:15.505

And, uh, during flight tests, what was determined was

925

00:56:15.615 --> 00:56:17.665

that at high angles of attack,

926

00:56:17.915 --> 00:56:21.305

these big old honking the cells would create vortex lift,

927

00:56:21.685 --> 00:56:24.525

and that would cause the nose to start

928

00:56:25.935 --> 00:56:27.335

catching up a little bit.

929

00:56:27.915 --> 00:56:29.695

Now, when you go on a fly,

930

00:56:29.695 --> 00:56:32.095

this thing in the sim it's really interesting

931

00:56:32.095 --> 00:56:34.775

because if you are at mid-range CG

932
00:56:35.875 --> 00:56:39.215
and you, uh, have

933
00:56:39.855 --> 00:56:44.745
MCA disconnected as the aircraft slows down, you start

934
00:56:44.745 --> 00:56:47.505
to get a little bit of rumble, uh, you get stick shaker,

935
00:56:47.505 --> 00:56:50.145
you get elevator field shift and finally get into buffet.

936
00:56:50.805 --> 00:56:53.025
And there someplace in here,

937
00:56:53.025 --> 00:56:55.465
there's just a very slight relaxation

938
00:56:55.605 --> 00:56:57.065
of the amount of back pressure.

939
00:56:57.305 --> 00:56:58.665
I mean, it's almost imperceptible.

940
00:56:58.665 --> 00:57:00.065
You almost have to be warned.

941
00:57:00.885 --> 00:57:04.785
The problem is that if you are flying at very lightweights

942
00:57:04.815 --> 00:57:07.185
with extreme apt cg,

943
00:57:07.885 --> 00:57:10.065
now if you take a look at what's at the bottom here,

944
00:57:10.285 --> 00:57:12.345
you see the separation between the center

945
00:57:12.345 --> 00:57:13.745

of pressure and the center of gravity.

946

00:57:14.125 --> 00:57:15.825

And as you pitch up, the

947

00:57:16.695 --> 00:57:21.345

cell vortex lift causes the CP to get so close to the center

948

00:57:21.345 --> 00:57:23.305

of gravity that the airplane starts

949

00:57:23.325 --> 00:57:24.945

to get very soft in your hands

950

00:57:25.125 --> 00:57:26.985

as you get into very high angles of attack.

951

00:57:27.405 --> 00:57:28.505

And well, what the heck,

952

00:57:28.855 --> 00:57:32.225

what we can do here when we found this out, is to

953

00:57:32.815 --> 00:57:37.385

introduce a new speed trim wrinkle,

954

00:57:37.485 --> 00:57:39.945

and we're gonna call it the maneuvering characteristics

955

00:57:40.385 --> 00:57:41.625

augmentation system.

956

00:57:47.465 --> 00:57:51.525

Now, the original P 11.1 software

957

00:57:52.675 --> 00:57:56.325

used one angle of attack sensor

958

00:57:56.585 --> 00:58:01.205

and one light control computer to actuate

959

00:58:01.305 --> 00:58:02.525
and MCA function.

960

00:58:02.825 --> 00:58:04.965
So let's take off the first flight of the day,

961

00:58:05.215 --> 00:58:07.405
let's say it's gonna be the left hand angle of attack,

962

00:58:07.405 --> 00:58:09.005
the left hand flight control computer,

963

00:58:09.065 --> 00:58:12.125
and that's going to host, if you will, all

964

00:58:12.125 --> 00:58:14.645
of these flight control functions including MAS.

965

00:58:15.115 --> 00:58:17.805
Then on the second flight of the day, we'll turn it over

966

00:58:17.805 --> 00:58:21.165
to the right hand angle of attack, uh, sensor vein.

967

00:58:21.265 --> 00:58:22.805
Uh, we will turn it over to the right

968

00:58:22.805 --> 00:58:24.005
hand flight control computer.

969

00:58:24.745 --> 00:58:27.365
It will host it. So basically it's like pilot flying

970

00:58:27.365 --> 00:58:28.965
and not pilot, pilot not flying.

971

00:58:28.965 --> 00:58:30.165
We're just gonna alternate legs.

972

00:58:30.905 --> 00:58:34.925

Uh, so what happens here is that with MCAS is

973

00:58:35.065 --> 00:58:39.045

as the Ang attack increases to a particular point, uh,

974

00:58:39.045 --> 00:58:40.925

that's sensed with the angle of attack sensor,

975

00:58:41.315 --> 00:58:42.485

just one sensor now,

976

00:58:43.065 --> 00:58:47.805

and at a certain point, it's going to dial in as much

977

00:58:48.265 --> 00:58:51.805

as not a full, but as much as two

978

00:58:51.805 --> 00:58:54.685

and a half degree nose down trim so that we

979

00:58:55.465 --> 00:58:58.365

can meet the 25.1 73

980

00:58:58.385 --> 00:59:03.205

and 1 75 positive pitch stability requirements.

981

00:59:03.305 --> 00:59:07.165

Now, this is not a stall prevention device.

982

00:59:07.355 --> 00:59:10.365

What it is, is it's an augmentation device

983

00:59:10.365 --> 00:59:13.085

to give you positive pitch stability

984

00:59:13.305 --> 00:59:16.765

to meet 21, 1 73, and 1 75.

985

00:59:17.505 --> 00:59:20.045

So now the, uh, aircraft comes up,

986
00:59:20.105 --> 00:59:21.740
you have all the stall warning things

987
00:59:21.745 --> 00:59:24.805
and transparent to you, something like my trim.

988
00:59:25.065 --> 00:59:28.405
But at the other end of the spectrum is dialing in some nose

989
00:59:28.435 --> 00:59:32.125
down trim in this case so that the airplane feels very,

990
00:59:32.125 --> 00:59:34.845
very, very natural, right up to the aero stall.

991
00:59:34.935 --> 00:59:38.765
Feels just like a, a garden variety docile guppy.

992
00:59:39.705 --> 00:59:42.005
And now as you reduce the angle of attack,

993
00:59:42.065 --> 00:59:45.205
you dump the nose, you get out of elevator field shift,

994
00:59:45.205 --> 00:59:49.365
you get out of stall shaker and so forth, fine MCAS reverses

995
00:59:49.585 --> 00:59:53.165
and takes out all of the nose down trim that had dialed in.

996
00:59:53.745 --> 00:59:56.265
Now, you never wanna trim one

997
00:59:56.265 --> 00:59:57.505
of these things into the stall,

998
00:59:57.605 --> 01:00:01.625
but if you do, if you trim the airplane into the stall

999
01:00:02.485 --> 01:00:05.025

and then release and MCAST is already fired,

1000

01:00:05.245 --> 01:00:07.625

it waits five seconds and then it says, oh,

1001

01:00:08.045 --> 01:00:09.705

you did something really onward there,

1002

01:00:09.805 --> 01:00:11.345

and I'm gonna have to get the nose down

1003

01:00:11.345 --> 01:00:13.265

before this thing gets a little too pinky.

1004

01:00:13.525 --> 01:00:17.625

So it dials in and additional as much as two

1005

01:00:17.625 --> 01:00:18.905

and a half degrees nose down,

1006

01:00:19.205 --> 01:00:22.585

and now the airplane really starts down well, okay, fine,

1007

01:00:22.605 --> 01:00:26.545

as long as the anum attack recovers, uh, MCAS dials out all

1008

01:00:26.545 --> 01:00:29.065

of that nose down trim and we're back to normal.

1009

01:00:29.725 --> 01:00:31.665

That's all well and good.

1010

01:00:32.895 --> 01:00:37.515

But the original am CA function relied on

1011

01:00:38.345 --> 01:00:40.835

only a single angle of attack sensor.

1012

01:00:41.775 --> 01:00:46.635

And actually compounding this in the original F comms

1013

01:00:46.655 --> 01:00:48.035
and the other publications,

1014

01:00:48.125 --> 01:00:50.555
there was no information on MCAS.

1015

01:00:50.965 --> 01:00:54.315
There was no differences there telling you

1016

01:00:54.555 --> 01:00:58.395
that a new speed trim wrinkle had been added to

1017

01:00:59.175 --> 01:01:01.275
the flight control computer software.

1018

01:01:02.045 --> 01:01:05.995
There were no warnings at the time about reliance on a

1019

01:01:05.995 --> 01:01:10.835
single angle of attack sensor that wrist

1020

01:01:11.755 --> 01:01:13.275
a false positive.

1021

01:01:13.735 --> 01:01:16.885
If the angle of attack goes bad, what's it do?

1022

01:01:17.075 --> 01:01:18.365
What are the failure modes?

1023

01:01:18.365 --> 01:01:21.005
Nobody knew this wasn't told the pilots.

1024

01:01:21.705 --> 01:01:25.585
So there was also no warning about

1025

01:01:26.325 --> 01:01:31.025
the fact that the stick force transducer doesn't work to

1026

01:01:31.605 --> 01:01:36.555

arrest, um, speed trim functions

1027

01:01:37.095 --> 01:01:39.515

or a runaway stab as it would normally.

1028

01:01:39.815 --> 01:01:42.475

So, you know, all you folks that have been flying guppies,

1029

01:01:42.855 --> 01:01:45.115

you know, for example, if you have runaway trim,

1030

01:01:45.175 --> 01:01:47.275

if you force the oak in the opposite direction,

1031

01:01:47.275 --> 01:01:50.035

it'll operate the, uh, actuate the trim brake

1032

01:01:50.095 --> 01:01:52.675

and disable the speed trim that buys you enough time

1033

01:01:52.675 --> 01:01:57.475

to go ahead and turn off the twin trim cutout switches over

1034

01:01:57.475 --> 01:01:59.315

here on the console and go ahead

1035

01:01:59.315 --> 01:02:02.075

and use the Frisbee to manually trim the airplane,

1036

01:02:02.095 --> 01:02:03.515

get it back in into shape.

1037

01:02:04.135 --> 01:02:08.955

Now also, as you know, on the max, uh, the angle

1038

01:02:08.955 --> 01:02:12.795

of attack indicator on the PFD was an option, was an option.

1039

01:02:13.375 --> 01:02:17.715

And also on the max, if you didn't, uh,

1040
01:02:17.805 --> 01:02:21.605
originally opt for the optional angle of attack indicator,

1041
01:02:21.915 --> 01:02:25.845
then you didn't get the PFD angle of attack.

1042
01:02:26.285 --> 01:02:31.245
Disagree annunciation, which then might give you a hint

1043
01:02:31.385 --> 01:02:33.085
as to what might be going wrong.

1044
01:02:34.285 --> 01:02:36.275
Let's take a look at, uh,

1045
01:02:36.275 --> 01:02:38.075
just a quick look at the checklist here,

1046
01:02:38.575 --> 01:02:40.515
and, uh, uh, this is, you know,

1047
01:02:40.515 --> 01:02:43.235
garden variety guffy checklist, uh, runaway stab.

1048
01:02:43.425 --> 01:02:46.115
Okay, fine. Hold the control com column.

1049
01:02:46.215 --> 01:02:47.955
Firmly disengage the autopilot.

1050
01:02:48.175 --> 01:02:51.275
By the way, autopilot has nothing to do with MCM a s

1051
01:02:51.275 --> 01:02:52.555
because if the autopilot's engaged,

1052
01:02:53.065 --> 01:02:56.075
then you'll never see the MCM A, it's transparent to you

1053
01:02:56.425 --> 01:02:58.675

because MCAS only fires if

1054

01:02:58.675 --> 01:03:00.115
you're manually flying the airplane.

1055

01:03:00.615 --> 01:03:02.315
Uh, auto throttle, turn that off.

1056

01:03:02.735 --> 01:03:05.035
If the trim runaway stops, hey, that's it.

1057

01:03:05.575 --> 01:03:08.915
Now if it doesn't, uh, now you're gonna go for over here,

1058

01:03:08.915 --> 01:03:10.955
reach down the console, turn down the, uh,

1059

01:03:11.105 --> 01:03:14.035
trim cutout switches and follow the checklist.

1060

01:03:16.645 --> 01:03:19.625
Now here's what it looks like on rotation,

1061

01:03:20.645 --> 01:03:22.065
uh, on a, on a max.

1062

01:03:22.285 --> 01:03:24.745
If you're taking a look at the PFD window on that, uh,

1063

01:03:24.745 --> 01:03:26.185
number one and number four, display.

1064

01:03:26.605 --> 01:03:27.905
Uh, you're rolling down the runway.

1065

01:03:28.115 --> 01:03:29.945
Let's say that you got 10 knots of headwind.

1066

01:03:30.095 --> 01:03:31.785
Okay, B one rotate. Off we go.

1067

01:03:32.705 --> 01:03:34.905

14 degrees positive rate gear comes up.

1068

01:03:36.465 --> 01:03:39.085

So if you look at the left hand side over there, uh,

1069

01:03:39.085 --> 01:03:41.965

we're looking at 149 knots, a little green, uh,

1070

01:03:41.965 --> 01:03:43.685

trend vector says we're accelerating.

1071

01:03:44.265 --> 01:03:47.965

Um, the, uh, right hand side says we're climbing coming

1072

01:03:47.965 --> 01:03:50.565

through 185 feet, and off we go.

1073

01:03:50.875 --> 01:03:52.525

Same indication left to right.

1074

01:03:53.505 --> 01:03:57.325

Now, let's say that you have

1075

01:03:58.245 --> 01:04:00.885

a left hand angle of attack failure

1076

01:04:01.345 --> 01:04:05.165

and at rotation, the damn thing just pegs.

1077

01:04:05.825 --> 01:04:06.925

Here's what you see.

1078

01:04:07.945 --> 01:04:10.365

All of a sudden, here comes the zipper, that red

1079

01:04:10.365 --> 01:04:12.765

and white stall warning tape, it comes right

1080

01:04:12.765 --> 01:04:14.365

through your indicated airspeed.

1081

01:04:14.505 --> 01:04:16.245

The stall shaker's going off like this.

1082

01:04:16.305 --> 01:04:17.965

You know, this is, you know, startling.

1083

01:04:18.065 --> 01:04:19.765

What's going on here? What's going on here?

1084

01:04:19.805 --> 01:04:20.885

I mean, the airplane's flying,

1085

01:04:21.065 --> 01:04:22.205

it feels like it's pretty good,

1086

01:04:22.225 --> 01:04:24.485

but I mean, this is very distracting now.

1087

01:04:24.745 --> 01:04:26.525

But now here's another thing.

1088

01:04:26.585 --> 01:04:27.765

If you take a look down here,

1089

01:04:28.075 --> 01:04:30.965

look at the difference in the airspeed indications

1090

01:04:30.995 --> 01:04:32.085

from left to right.

1091

01:04:32.555 --> 01:04:36.005

What is not clearly explained to a lot of pilots

1092

01:04:36.005 --> 01:04:40.235

during flight training is that if you have angle of attack,

1093

01:04:40.775 --> 01:04:45.595

uh, excuse me, uh, angle of attack is used to normalize out

1094
01:04:46.415 --> 01:04:50.075
PTO and static source errors so that

1095
01:04:50.295 --> 01:04:51.435
as you rotate

1096
01:04:51.535 --> 01:04:55.355
and you have these errors induced around the PTO tubes

1097
01:04:55.355 --> 01:04:57.075
and the static ports, the angle

1098
01:04:57.075 --> 01:04:59.715
of attack normalizes the indications.

1099
01:05:00.215 --> 01:05:03.795
So that 149 knots indicated is really

1100
01:05:03.875 --> 01:05:05.355
149 knots indicated.

1101
01:05:05.355 --> 01:05:09.115
But if the angle of attack goes to bluey, it goes off scale.

1102
01:05:09.505 --> 01:05:14.345
That can induce large scale errors into your

1103
01:05:14.465 --> 01:05:17.805
airspeed indication, say 169 as opposed

1104
01:05:17.805 --> 01:05:19.685
to 149 is shown over here.

1105
01:05:19.985 --> 01:05:21.845
As you take a look at the left hand slide of

1106
01:05:21.845 --> 01:05:23.885
that should let say left hand slide of this.

1107
01:05:24.505 --> 01:05:27.805

And that's what can be very confusing.

1108

01:05:28.505 --> 01:05:31.325

Now, you can see down here that at the bottom

1109

01:05:31.545 --> 01:05:34.125

of the airspeed tape, it does say, uh,

1110

01:05:34.125 --> 01:05:35.805

indicated airspeed disagree.

1111

01:05:35.985 --> 01:05:39.645

And on the bottom of the altitude, tape altitude disagree,

1112

01:05:39.645 --> 01:05:42.845

meaning that you have left to right disagreements.

1113

01:05:43.185 --> 01:05:47.365

But what is not clear to a lot of pilots is this angle

1114

01:05:47.365 --> 01:05:50.245

of attack and normalization functions that is used to

1115

01:05:50.835 --> 01:05:55.045

correct for PO source errors and static source errors.

1116

01:05:55.395 --> 01:05:56.725

Okay, let's go to the next one.

1117

01:05:58.365 --> 01:06:02.785

Uh, now let's say that you did have

1118

01:06:03.825 --> 01:06:05.685

the optional angle of attack indicator.

1119

01:06:06.455 --> 01:06:09.745

Take a look up there at that upper right hand corner right

1120

01:06:09.745 --> 01:06:12.825

below where it says, uh, to gun D nav armed,

1121

01:06:13.725 --> 01:06:15.505
you have an angle of attack indication

1122

01:06:16.405 --> 01:06:20.185
and it's pegged, it's pegged at say 26.4 units.

1123

01:06:20.695 --> 01:06:24.425
Alright? Obviously, you would have to be trained to know how

1124

01:06:24.425 --> 01:06:27.745
to use angle of attack, uh, huffer, I mean, I think you

1125

01:06:27.745 --> 01:06:30.065
and I used angle of attack for a number of years as did, uh,

1126

01:06:30.445 --> 01:06:34.705
uh, uh, Allen, uh, you know, to get on and off the boat.

1127

01:06:35.245 --> 01:06:37.545
Uh, and so, uh, we're used to using angle

1128

01:06:37.545 --> 01:06:38.825
of attack, but that's just us.

1129

01:06:39.535 --> 01:06:41.755
If you compare the left hand angle of attack,

1130

01:06:41.755 --> 01:06:44.115
which is an option over here to the right hand angle

1131

01:06:44.115 --> 01:06:47.395
of attack should be pointing the opposite direction.

1132

01:06:47.735 --> 01:06:49.795
Uh, you can see that the right hand angle

1133

01:06:49.795 --> 01:06:53.235
of attack is relatively normal at say 6.2 units.

1134

01:06:54.525 --> 01:06:58.915

Now, with the optional angle of attack indicator

1135

01:06:59.055 --> 01:07:02.155

or indication on the PFD comes the angle of attack,

1136

01:07:03.075 --> 01:07:04.515

disagree annunciation.

1137

01:07:04.855 --> 01:07:06.235

And in this case, you know,

1138

01:07:06.235 --> 01:07:08.395

you've got the shaker going off and so forth and so on.

1139

01:07:08.395 --> 01:07:09.675

But there's a clue down here.

1140

01:07:09.935 --> 01:07:13.595

And you can see down here it says, angle attack, disagree.

1141

01:07:13.975 --> 01:07:16.515

And now at least if you have the proper training,

1142

01:07:16.895 --> 01:07:19.795

you have some clue as to what's going on

1143

01:07:20.175 --> 01:07:22.955

and what can come next.

1144

01:07:23.065 --> 01:07:27.275

Because what's going on here is bump,

1145

01:07:32.195 --> 01:07:35.065

startle factor, startle factor.

1146

01:07:36.285 --> 01:07:39.705

Now this angle attack problem with a stick shaker going off

1147

01:07:39.725 --> 01:07:42.705

as you've taken off on takeoff, is very distracting

1148

01:07:42.965 --> 01:07:47.705

and it's going to blind you as to what's coming next.

1149

01:07:48.445 --> 01:07:52.505

Now, if you take a look at the latest version of the max QRH

1150

01:07:52.505 --> 01:07:54.825

and the non-normal checklist, 10.8,

1151

01:07:55.405 --> 01:07:58.585

it talks a little bit about erroneous angle of attack

1152

01:07:58.605 --> 01:08:01.025

and its effect on air data indications.

1153

01:08:01.295 --> 01:08:05.425

Okay, that's good. But ask your friends who are flying

1154

01:08:05.445 --> 01:08:09.145

for the majors, how many of them have seen

1155

01:08:09.935 --> 01:08:11.825

this scenario in the sim

1156

01:08:12.275 --> 01:08:15.365

where you have gross angle attack error

1157

01:08:16.245 --> 01:08:18.225

and on, on takeoff rotation,

1158

01:08:18.525 --> 01:08:23.025

and it causes those, uh, indications

1159

01:08:23.025 --> 01:08:26.545

that we saw in the previous slides where here's the zipper

1160

01:08:26.645 --> 01:08:29.585

and uh, and the stick shaker and so forth and so on.

1161

01:08:29.845 --> 01:08:32.825

And I'm willing to bet you that you'll find very few

1162

01:08:33.705 --> 01:08:35.545
mainline 1 21 guffy drivers

1163

01:08:35.655 --> 01:08:37.545
that have ever seen this during SIM training.

1164

01:08:39.685 --> 01:08:41.745
Now, what are you gonna do if you

1165

01:08:41.745 --> 01:08:42.785
take off when this happens?

1166

01:08:43.205 --> 01:08:46.785
Uh, one of the memory items is you immediately wanna say,

1167

01:08:46.845 --> 01:08:49.185
oh, wait a minute, turn the flight director off,

1168

01:08:49.185 --> 01:08:50.785
turn the autopilot off, uh,

1169

01:08:51.205 --> 01:08:53.225
and, uh, turn the auto throttles off,

1170

01:08:53.325 --> 01:08:55.025
get the thrust back to 80%.

1171

01:08:55.125 --> 01:08:58.825
And one, uh, let's pitch down to about 10 degrees, nice

1172

01:08:58.825 --> 01:09:02.945
and slow, no fast hands, and let's climb to a safe altitude

1173

01:09:03.085 --> 01:09:04.585
and get this thing sorted out.

1174

01:09:05.545 --> 01:09:09.845
But there are, there were no warnings about

1175

01:09:10.445 --> 01:09:12.125
MCA being activated

1176

01:09:12.545 --> 01:09:16.805
or could be activated when you suck up the flaps

1177

01:09:16.805 --> 01:09:20.685
and the slats and you're manually flying the airplane.

1178

01:09:21.385 --> 01:09:24.285
And because of that, all of this is coming

1179

01:09:24.345 --> 01:09:25.845
as a big nasty surprise.

1180

01:09:26.845 --> 01:09:30.185
Um, now what can we count on at this point?

1181

01:09:30.235 --> 01:09:32.625
Going back to pitch plus power performance.

1182

01:09:32.625 --> 01:09:34.745
Just, hey, if we're trained,

1183

01:09:34.885 --> 01:09:36.785
if we know about this MCAST function

1184

01:09:36.785 --> 01:09:37.825
and its failure modes,

1185

01:09:38.085 --> 01:09:42.465
we can fly this thing out at 10 degrees, nose up 80% N one,

1186

01:09:42.765 --> 01:09:45.745
fly it up to a safe altitude and clean it up up.

1187

01:09:46.125 --> 01:09:47.545
But we're gonna know what's coming next

1188

01:09:48.285 --> 01:09:52.025

and what's coming next, uh, here

1189

01:09:54.035 --> 01:09:56.095

Is this MCA runaway?

1190

01:09:58.415 --> 01:10:00.275

Now again, going back to the checklist,

1191

01:10:00.985 --> 01:10:02.195

hold the control column,

1192

01:10:02.695 --> 01:10:05.315

but now the trim break is not gonna work.

1193

01:10:05.535 --> 01:10:07.435

If you know the trim break's not gonna work.

1194

01:10:08.135 --> 01:10:09.395

You are forewarned and

1195

01:10:09.595 --> 01:10:12.195

therefore forearmed to deal with the emergency.

1196

01:10:12.535 --> 01:10:15.685

Nobody knew. So the autopilot's off the

1197

01:10:15.685 --> 01:10:16.765

auto throttles are off.

1198

01:10:16.905 --> 01:10:19.605

Now we're cleaning the airplane up four degrees,

1199

01:10:19.715 --> 01:10:23.925

nose up 75% in what, why is this important?

1200

01:10:24.275 --> 01:10:28.125

Because if the airplane accelerates more than about, nah,

1201

01:10:28.285 --> 01:10:30.365

a hundred eighty, a hundred ninety two, a hundred ten

1202

01:10:30.375 --> 01:10:31.165
knots right in there.

1203

01:10:31.905 --> 01:10:35.885
Now there is so much friction on the trim jack screw

1204

01:10:36.115 --> 01:10:39.765
that it's virtually impossible to use the Frisbee

1205

01:10:39.985 --> 01:10:41.365
to retrim the airplane.

1206

01:10:41.705 --> 01:10:44.605
You have to keep the air speed under control.

1207

01:10:44.865 --> 01:10:45.885
And if you take a look at

1208

01:10:45.885 --> 01:10:48.845
what happened in the Ethiopian accident with a, you know,

1209

01:10:48.845 --> 01:10:50.125
thrust clobbered up here

1210

01:10:50.125 --> 01:10:51.405
and so forth, man,

1211

01:10:51.435 --> 01:10:53.245
that they were their own worst enemy enemy there.

1212

01:10:53.245 --> 01:10:57.085
Because you have to control the air speed, you have

1213

01:10:57.085 --> 01:10:58.245
to keep the airspeed down

1214

01:10:58.665 --> 01:11:00.925
and say, I'm the adult in, in the room here.

1215

01:11:01.265 --> 01:11:03.285

And I don't know what's going on with the automation,

1216

01:11:03.945 --> 01:11:05.965

but it's up to me to control it.

1217

01:11:06.305 --> 01:11:08.805

So now we're gonna pull this thrust back if we haven't

1218

01:11:08.805 --> 01:11:12.205

already had four degrees nose up wings, level four degrees,

1219

01:11:12.505 --> 01:11:14.565

uh, you know, 75% N one,

1220

01:11:14.985 --> 01:11:17.285

and we'll deal with the emergency as we're going.

1221

01:11:18.975 --> 01:11:21.155

Now, here's another thing that's really interesting.

1222

01:11:21.155 --> 01:11:22.395

If you take a look at the next slide.

1223

01:11:22.775 --> 01:11:26.315

You know, when I flew this, um, MCAS runaway scenario

1224

01:11:26.615 --> 01:11:30.195

and we followed the checklist, I, I was very lucky

1225

01:11:30.195 --> 01:11:31.475

because I knew what to expect.

1226

01:11:31.835 --> 01:11:36.195

I was forewarned that if we had an angle attack,

1227

01:11:36.275 --> 01:11:39.915

a gross angle attack failure, it was going to cause

1228

01:11:40.455 --> 01:11:41.755

an mc a s runaway.

1229

01:11:41.815 --> 01:11:43.315
So I was forewarned.

1230

01:11:43.655 --> 01:11:45.595
So in other words, it's not just the system

1231

01:11:45.595 --> 01:11:47.355
that's wrong here, there were some really

1232

01:11:47.415 --> 01:11:48.755
big chins in drain.

1233

01:11:49.535 --> 01:11:54.225
So now if we follow the checklist,

1234

01:11:54.755 --> 01:11:56.945
we've turned off the trim switches down here.

1235

01:11:57.525 --> 01:12:01.145
Uh, we are flying 75%, uh,

1236

01:12:01.445 --> 01:12:04.385
and with four degrees nose up, uh, and we're manually trim.

1237

01:12:04.385 --> 01:12:05.745
You take all the pressure out of this thing.

1238

01:12:06.025 --> 01:12:10.905
I talked to my buddies at Southwest and uh, American

1239

01:12:11.205 --> 01:12:12.665
and Alaska and I said,

1240

01:12:13.295 --> 01:12:15.345
when you have a trim runaway in the sim,

1241

01:12:15.695 --> 01:12:16.905
what happens at this point?

1242

01:12:17.285 --> 01:12:21.985

And they all said, to a person, well, you solve the trim

1243

01:12:22.895 --> 01:12:26.465

runaway, and therefore let's move on to the next emergency.

1244

01:12:27.295 --> 01:12:31.505

Well, what I said to my sim partner up in Seattle is, uh,

1245

01:12:31.605 --> 01:12:35.545

no, our task now is

1246

01:12:35.545 --> 01:12:39.305

to fly the sim, as you know, train to fly,

1247

01:12:39.605 --> 01:12:41.025

uh, the real airplane.

1248

01:12:41.485 --> 01:12:42.665

That's the only way you can do it.

1249

01:12:42.665 --> 01:12:45.905

We're gonna fly to sim all the way back to touchdown

1250

01:12:46.525 --> 01:12:48.865

at Boeing King Field using manual trim.

1251

01:12:48.895 --> 01:12:50.025

This is not negotiable.

1252

01:12:50.265 --> 01:12:51.185

I know it's gonna take time,

1253

01:12:51.185 --> 01:12:52.345

but we don't have time in the sim.

1254

01:12:52.885 --> 01:12:56.105

The sim is there for proficiency.

1255

01:12:56.405 --> 01:12:59.585

You need to train to proficiency, not just train to cost.

1256

01:12:59.645 --> 01:13:02.385

And people say, well, you have so many required maneuvers.

1257

01:13:02.425 --> 01:13:03.905

I mean, there just isn't time to do that.

1258

01:13:04.375 --> 01:13:08.045

Well, maybe we have to make time to do that. Alright?

1259

01:13:08.105 --> 01:13:09.445

So that's what we did.

1260

01:13:09.745 --> 01:13:11.805

We manually trimmed the aircraft, uh,

1261

01:13:12.205 --> 01:13:14.485

reconfigured the landing, fortunately with the Cabo

1262

01:13:14.485 --> 01:13:15.605

of the moon back at, uh,

1263

01:13:15.665 --> 01:13:17.245

boy King Field, at least in the sim.

1264

01:13:17.465 --> 01:13:20.285

And I went back there and landed the aircraft at Seattle.

1265

01:13:20.465 --> 01:13:21.885

And that was the end of the emergency,

1266

01:13:22.345 --> 01:13:23.965

uh, like it should have been.

1267

01:13:26.435 --> 01:13:30.495

Now, uh, let's take a look at what was done to fix this.

1268

01:13:30.755 --> 01:13:35.655

In P 12.1 control law,

1269

01:13:38.385 --> 01:13:41.565

the single point failure modes were eliminated

1270

01:13:41.625 --> 01:13:44.445

and there were some checks and balances put into this thing.

1271

01:13:44.535 --> 01:13:49.445

First. The whole thing is inspired by the KC 46 a Pegasus

1272

01:13:50.085 --> 01:13:51.125

MCAS architecture.

1273

01:13:51.585 --> 01:13:55.315

And there both angle attack sensors are used.

1274

01:13:55.545 --> 01:13:57.795

It's kinda like pilot flying, pilot monitoring.

1275

01:13:57.815 --> 01:13:59.355

You seeing the same thing I am? Yeah.

1276

01:13:59.375 --> 01:14:00.555

I'm seeing the same thing you are.

1277

01:14:00.625 --> 01:14:01.675

Okay, we can agree on that.

1278

01:14:01.945 --> 01:14:05.185

Well, if we have as much as a five

1279

01:14:05.285 --> 01:14:08.585

and a half degree variation between left

1280

01:14:08.605 --> 01:14:10.905

and right angle back, all

1281

01:14:10.905 --> 01:14:13.045

of a sudden we're saying, Hey, wait a minute.

1282

01:14:13.145 --> 01:14:15.405

We got a disagreement here. We have no tie breaker.

1283
01:14:15.465 --> 01:14:17.405
But I'll tell you one thing for you, were gonna share.

1284
01:14:17.415 --> 01:14:20.405
We're not gonna use any digital fast hands

1285
01:14:20.505 --> 01:14:24.865
to make hasty maneuvers like actuating an MCA function

1286
01:14:24.885 --> 01:14:27.025
or any of these other things that can get you into trouble.

1287
01:14:27.645 --> 01:14:29.425
So first, we're gonna look at left

1288
01:14:29.525 --> 01:14:31.875
and right, uh, angle of attack

1289
01:14:32.055 --> 01:14:36.835
and come up with a mutually acceptable sensor reading.

1290
01:14:37.215 --> 01:14:39.715
Uh, the second thing is we are gonna put in an angle

1291
01:14:39.715 --> 01:14:43.075
of attack disagree annunciation on the PFD, so

1292
01:14:43.075 --> 01:14:44.875
that if we do have such a function

1293
01:14:45.135 --> 01:14:48.555
and we start seeing some anomalies in air airspeed

1294
01:14:48.575 --> 01:14:51.915
and altitude from left to right, at least we know

1295
01:14:52.145 --> 01:14:54.355
that perhaps they're angle attack related.

1296
01:14:54.505 --> 01:14:55.835

It's not as though we're having a problem

1297

01:14:55.835 --> 01:14:58.515

with an air data computer or a plug PTO tube

1298

01:14:58.535 --> 01:14:59.715

or a plug static port.

1299

01:14:59.965 --> 01:15:01.835

We're seeing ang attack disagree.

1300

01:15:02.415 --> 01:15:05.675

Uh, the next thing besides several different functions,

1301

01:15:05.695 --> 01:15:07.915

and I'll let you read those things in terms of

1302

01:15:08.535 --> 01:15:12.915

the triple A OA checks, uh, things like, uh,

1303

01:15:13.275 --> 01:15:16.475

absolute angle attack, uh, mean value select.

1304

01:15:16.475 --> 01:15:17.955

We'll go into that at a later time.

1305

01:15:17.955 --> 01:15:18.995

We have time and of course,

1306

01:15:19.185 --> 01:15:22.795

left right differences is we are going to limit

1307

01:15:24.045 --> 01:15:25.625

the amount of trim

1308

01:15:26.255 --> 01:15:31.145

that the MCAS can put into the stab one, limited

1309

01:15:31.655 --> 01:15:34.585

stab trim command as much as,

1310
01:15:34.725 --> 01:15:38.625
but not fully of two and a half degrees nose down if needed.

1311
01:15:39.085 --> 01:15:42.785
But our goal here is to always make sure

1312
01:15:43.455 --> 01:15:47.985
that in a pitch control struggle between the elevators

1313
01:15:48.245 --> 01:15:52.385
and the stab, the elevators always win.

1314
01:15:52.725 --> 01:15:56.625
The pilot always maintains at least 1.2 Gs

1315
01:15:56.625 --> 01:15:57.905
of positive pitch control

1316
01:15:57.935 --> 01:16:02.345
because we've limited the amount of stab, trim,

1317
01:16:03.165 --> 01:16:07.145
uh, authority if you will, uh, of the MCA to make sure

1318
01:16:07.145 --> 01:16:10.505
that the pilot and the elevators always win.

1319
01:16:10.965 --> 01:16:12.785
That's kind of an important one.

1320
01:16:13.985 --> 01:16:17.395
Uh, next, uh, MCA,

1321
01:16:18.825 --> 01:16:23.765
at least from what we could find out by flying the, uh,

1322
01:16:24.825 --> 01:16:26.685
sim in Seattle is really kind

1323
01:16:26.685 --> 01:16:28.765

of the canary in the coal mine.

1324

01:16:29.345 --> 01:16:33.605

And it points to a much larger set of

1325

01:16:34.235 --> 01:16:38.205

control loop issues than just the design,

1326

01:16:38.665 --> 01:16:41.365

the software design of a flight control computer.

1327

01:16:41.985 --> 01:16:44.605

And I think it's very important to see

1328

01:16:44.605 --> 01:16:46.405

that MCAS is a wake up call

1329

01:16:46.945 --> 01:16:49.205

for not just the seven thirty seven max,

1330

01:16:49.305 --> 01:16:53.725

but for how we design, certify, train, maintain

1331

01:16:54.905 --> 01:16:58.485

all kinds of aircraft in the air transport industry.

1332

01:16:58.985 --> 01:17:01.725

And if you take a look at the big picture here, you know,

1333

01:17:01.745 --> 01:17:04.765

the control loop that started out just as the pilot

1334

01:17:05.305 --> 01:17:08.805

and you know, the pilot over here with a, a control input.

1335

01:17:08.825 --> 01:17:11.525

The control input to an actuator, the actuator

1336

01:17:11.585 --> 01:17:14.685

to a control process, and the process feedbacks

1337

01:17:14.685 --> 01:17:15.685
and coming back to the pilot

1338

01:17:15.905 --> 01:17:18.805
and make changes so that you can control the whole thing.

1339

01:17:19.075 --> 01:17:21.845
What really goes on the canary in the coal mine tells us

1340

01:17:21.845 --> 01:17:26.725
that this control loop is a holistic, uh,

1341

01:17:26.955 --> 01:17:30.845
control loop that actually starts with the legislators,

1342

01:17:30.855 --> 01:17:32.125
which with government.

1343

01:17:32.425 --> 01:17:36.685
And then the government has to make control inputs,

1344

01:17:36.705 --> 01:17:40.525
if you will, to FAA ia, uh,

1345

01:17:40.705 --> 01:17:41.925
and so forth and so on.

1346

01:17:41.945 --> 01:17:43.045
All kinds of inputs.

1347

01:17:43.415 --> 01:17:47.085
Those associations in make inputs

1348

01:17:47.105 --> 01:17:48.725
to the manufacturer.

1349

01:17:49.105 --> 01:17:52.365
The manufacturer makes inputs to the project management.

1350

01:17:52.665 --> 01:17:55.525

The project management make makes inputs into design

1351

01:17:55.545 --> 01:17:57.965

and documentation and so forth and so on.

1352

01:17:58.105 --> 01:18:00.125

And as we find out what goes right

1353

01:18:00.125 --> 01:18:02.645

and what goes wrong, we get down here to maintenance

1354

01:18:02.645 --> 01:18:03.765

and evolution.

1355

01:18:04.065 --> 01:18:08.605

And now we evolve this whole control loop going right up

1356

01:18:08.605 --> 01:18:12.285

back to the top and say, alright, how do we have to change

1357

01:18:12.825 --> 01:18:16.805

our control inputs at each step in the control loop

1358

01:18:17.225 --> 01:18:21.205

to create the desired outputs and outcomes?

1359

01:18:21.315 --> 01:18:23.685

Down here, and I'll let you read the rest of this thing,

1360

01:18:23.745 --> 01:18:25.885

but basically one of the things

1361

01:18:25.885 --> 01:18:29.085

that we found out here, excuse me.

1362

01:18:29.385 --> 01:18:33.325

If you take a look over here at, uh, some of those

1363

01:18:34.325 --> 01:18:36.485

pressures on the company, here's a company.

1364

01:18:36.705 --> 01:18:38.685

Any company is gonna fill these kinds of pressures.

1365

01:18:38.685 --> 01:18:42.365

But in the case of the max, these pressures were acute.

1366

01:18:43.105 --> 01:18:45.445

We have time pressure, we have cost pressure,

1367

01:18:45.665 --> 01:18:48.125

we have outsourcing to keep our costs under control.

1368

01:18:48.145 --> 01:18:49.165

We have profit goals.

1369

01:18:49.425 --> 01:18:50.485

And then the question is,

1370

01:18:50.745 --> 01:18:52.525

do we have a business oriented culture

1371

01:18:52.705 --> 01:18:55.045

or do we have an engineering oriented culture?

1372

01:18:55.505 --> 01:18:56.685

Um, one

1373

01:18:56.685 --> 01:18:58.965

of the things about an engineering culture is you can get

1374

01:18:58.965 --> 01:19:00.365

things absolutely right,

1375

01:19:01.395 --> 01:19:04.935

but the big risk there is you can bankrupt the company in

1376

01:19:04.935 --> 01:19:06.495

the process and then you can't put out the product.

1377

01:19:06.835 --> 01:19:09.135

So there has to be a balance between the business goals

1378

01:19:09.135 --> 01:19:12.095

and the engineering goals to make sure that all

1379

01:19:12.435 --> 01:19:15.135

of those critical engineering needs are met,

1380

01:19:15.315 --> 01:19:17.055

but you don't bankrupt the company in the process.

1381

01:19:17.915 --> 01:19:21.705

Now, this brings us to deck Chris Hart.

1382

01:19:22.005 --> 01:19:23.345

Hey, uh, by show of hands,

1383

01:19:23.445 --> 01:19:24.705

of course I can't see you out there,

1384

01:19:24.725 --> 01:19:28.385

but by show of hands, how many people read Chris Hart's, uh,

1385

01:19:28.395 --> 01:19:31.265

joint, uh, authority's technical review, uh,

1386

01:19:31.265 --> 01:19:32.705

this little gem right over here,

1387

01:19:33.185 --> 01:19:34.305

I keep this thing on my desk.

1388

01:19:34.495 --> 01:19:37.585

This thing is, I mean, an incredible document.

1389

01:19:37.975 --> 01:19:42.865

71 pages really gives you a big picture approach

1390

01:19:42.925 --> 01:19:45.905

to not just the max, but what goes on

1391

01:19:45.905 --> 01:19:48.865

and what has gone wrong and what could go much better.

1392

01:19:48.975 --> 01:19:51.065

What are the opportunities for improvement

1393

01:19:51.135 --> 01:19:55.425

through all those levels that we described back in

1394

01:19:55.425 --> 01:19:58.625

that previous slide where we show all the different levels

1395

01:19:58.965 --> 01:20:01.265

in the entire holistic control loop.

1396

01:20:01.685 --> 01:20:04.785

And then, um, bulk. There we go.

1397

01:20:04.805 --> 01:20:05.945

Uh, here's just a little bit

1398

01:20:05.945 --> 01:20:07.445

of basic background on this thing.

1399

01:20:07.745 --> 01:20:09.685

Uh, I'm not gonna go through each one of those things,

1400

01:20:09.785 --> 01:20:11.885

but the holistic approach that, uh,

1401

01:20:11.885 --> 01:20:15.005

Chris Hart's team came up with is you gotta take a look at

1402

01:20:15.005 --> 01:20:17.445

how you basically certify the airplanes.

1403

01:20:17.465 --> 01:20:19.205

Uh, you have to take a look at, you know,

1404

01:20:19.205 --> 01:20:21.085

reasonable user interface

1405

01:20:21.105 --> 01:20:23.765

and reaction times, realistic reaction times,

1406

01:20:24.545 --> 01:20:26.845

how you're gonna get through stall demos

1407

01:20:27.225 --> 01:20:28.645

and so forth and so on.

1408

01:20:28.705 --> 01:20:31.325

And, you know, there's some very important things here.

1409

01:20:31.625 --> 01:20:33.045

One of the things they said is, you know,

1410

01:20:33.045 --> 01:20:35.805

if you take a look at the Boeing Aviation Safety Oversight,

1411

01:20:36.105 --> 01:20:39.845

uh, ODA, that needs deeper broader engineering expertise,

1412

01:20:40.035 --> 01:20:41.165

well, that's gonna take money.

1413

01:20:41.785 --> 01:20:44.965

And, you know, f has been challenged for budgets.

1414

01:20:45.025 --> 01:20:46.605

How in the heck are you gonna come up with the money?

1415

01:20:47.245 --> 01:20:48.805

Somebody's gonna have to say, oh, by the way,

1416

01:20:48.985 --> 01:20:51.805

if you want a much richer, broader,

1417

01:20:51.825 --> 01:20:53.165

and deeper ODA process,

1418

01:20:53.595 --> 01:20:55.165
then somebody's gonna have to fund it.

1419

01:20:55.785 --> 01:20:58.905
And so where the, where's the money gonna come from?

1420

01:20:58.905 --> 01:21:00.065
That's one of those things we have

1421

01:21:00.065 --> 01:21:01.505
to decide what's important.

1422

01:21:03.115 --> 01:21:05.935
Uh, human factors, uh, human factors need

1423

01:21:05.935 --> 01:21:08.855
to be back integrated into the control process

1424

01:21:09.235 --> 01:21:10.535
as you're designing the airplane.

1425

01:21:10.755 --> 01:21:14.765
You know, imagine if MCAS were all its flaws.

1426

01:21:14.775 --> 01:21:17.685
Originally in the P one 11 dash one software,

1427

01:21:17.785 --> 01:21:19.525
one had just one angle attack.

1428

01:21:19.955 --> 01:21:23.925
What if operators and crews have been told about it?

1429

01:21:23.985 --> 01:21:26.605
Hey folks, uh, we've introduced this new stability

1430

01:21:26.605 --> 01:21:27.685
augmentation system.

1431

01:21:28.145 --> 01:21:29.925

Uh, it joins speed, trim,

1432

01:21:29.925 --> 01:21:32.285

and mock trim as one of the speed trim functions.

1433

01:21:32.545 --> 01:21:34.845

Uh, and over here on the overhead panel here, you know

1434

01:21:34.845 --> 01:21:36.325

where the lights are for the flight control stuff.

1435

01:21:36.325 --> 01:21:38.885

Up here, you see where it says, uh, speed trim

1436

01:21:39.585 --> 01:21:40.885

and, uh, mock trim warning.

1437

01:21:40.885 --> 01:21:44.565

What if there's an MA fail warning up there too? You know?

1438

01:21:44.665 --> 01:21:49.565

So there were some real opportunities to, uh, incorporate,

1439

01:21:49.985 --> 01:21:54.125

uh, human interface and bring the pilots

1440

01:21:54.125 --> 01:21:57.485

and the operators into the process so that they would know

1441

01:21:57.995 --> 01:22:01.285

that this is a single point failure system.

1442

01:22:02.505 --> 01:22:05.005

Not a big deal if you know what happens.

1443

01:22:05.675 --> 01:22:08.485

What if also you had said, alright,

1444

01:22:10.035 --> 01:22:11.095

here's what goes on.

1445

01:22:11.195 --> 01:22:12.935

If you have an angle of attack that failed,

1446

01:22:13.255 --> 01:22:15.655

I know we've all been told over the years, anger

1447

01:22:15.655 --> 01:22:16.975

of attack just cannot fail.

1448

01:22:17.165 --> 01:22:20.135

Well, actually it can. I mean, a bird can hit it.

1449

01:22:20.315 --> 01:22:22.855

You can have damage from GSE like a jet way.

1450

01:22:23.155 --> 01:22:24.695

Uh, you can have a lightning strike.

1451

01:22:24.895 --> 01:22:26.375

I think that happened early in the seven

1452

01:22:26.475 --> 01:22:27.895

two, uh, test cycle.

1453

01:22:27.995 --> 01:22:29.455

It actually got hit by lightning

1454

01:22:29.675 --> 01:22:31.295

and closed one of the angle tag things.

1455

01:22:31.835 --> 01:22:34.335

But it is not in an infallible system,

1456

01:22:35.035 --> 01:22:38.215

but it's okay if it's not fallible.

1457

01:22:38.355 --> 01:22:40.935

If everybody knows from day one, Hey,

1458

01:22:40.985 --> 01:22:43.015

we've got a single point failure system here.

1459

01:22:43.515 --> 01:22:46.255

Here's the first warnings you're gonna have.

1460

01:22:46.595 --> 01:22:50.095

Uh, when you rotate, if the thing is failed at that point

1461

01:22:50.235 --> 01:22:52.455

and it failed through the high a OA mode,

1462

01:22:52.455 --> 01:22:53.855

you're gonna get stick shaker.

1463

01:22:53.855 --> 01:22:55.415

You're gonna get the zipper that comes

1464

01:22:55.415 --> 01:22:56.575

through your air speed tape.

1465

01:22:56.995 --> 01:22:59.015

Um, you have all these indications

1466

01:23:00.075 --> 01:23:04.565

and that it may blind you to the onset

1467

01:23:04.585 --> 01:23:08.525

of an MCAS runaway when you suck up the gear in the flaps if

1468

01:23:08.525 --> 01:23:10.565

you're hand flying the airplane, which most of us would be.

1469

01:23:10.945 --> 01:23:15.245

So I think it's important to know that mc CA in itself

1470

01:23:15.865 --> 01:23:19.755

was not so much, uh, uh,

1471

01:23:19.895 --> 01:23:20.995

hugely flawed system,

1472

01:23:21.415 --> 01:23:24.835

but it was hugely flawed not to tell the operators

1473

01:23:25.025 --> 01:23:26.955

that had been incorporated in the system.

1474

01:23:27.415 --> 01:23:30.515

And here are the normal modes. Here are the failure modes.

1475

01:23:30.825 --> 01:23:32.675

Here are the first things that can happen

1476

01:23:32.705 --> 01:23:35.795

with a failed angle of attack that can blind you

1477

01:23:36.175 --> 01:23:38.515

to the onset of an MCAS runaway

1478

01:23:38.515 --> 01:23:40.035

as you suck up the gear in the flaps.

1479

01:23:41.005 --> 01:23:45.905

Now, uh, next slide here is an optimum, uh,

1480

01:23:46.605 --> 01:23:49.065

uh, a simplified shot of what I showed you

1481

01:23:49.065 --> 01:23:52.665

before here in the ideal world.

1482

01:23:53.535 --> 01:23:55.275

And of course, as she will tell you,

1483

01:23:55.275 --> 01:23:57.315

it's hardly an ideal world when you have all kinds

1484

01:23:57.315 --> 01:24:00.715

of external pressures, uh, working on the various phases

1485

01:24:00.715 --> 01:24:01.795

of the control loops.

1486

01:24:02.295 --> 01:24:05.875

But, you know, FAA makes the regulations, the manufacturer

1487

01:24:06.395 --> 01:24:09.675

interests with ODA then manages the project.

1488

01:24:10.375 --> 01:24:13.515

Uh, you have, uh, a max project management

1489

01:24:13.515 --> 01:24:14.555

and so forth and so on.

1490

01:24:14.655 --> 01:24:17.955

And the whole idea is that when you get over here back

1491

01:24:17.955 --> 01:24:21.075

to the basic, uh, human computer control loop,

1492

01:24:21.335 --> 01:24:24.995

the airplane is easy and predictable to fly.

1493

01:24:25.535 --> 01:24:28.075

And it frees up enough of your spare time

1494

01:24:28.075 --> 01:24:30.355

because everything is relatively routine.

1495

01:24:30.615 --> 01:24:34.915

You know, pilots are very poor at dealing with unknowns,

1496

01:24:35.295 --> 01:24:38.915

but if you tell them exactly what's going on, explain

1497

01:24:38.915 --> 01:24:41.955

to them, here are all the failure modes they can go, yeah,

1498

01:24:41.955 --> 01:24:45.075

I've been there, done that in the sim, I've seen it before.

1499

01:24:45.495 --> 01:24:47.915

And if you introduce just a little bit of a new wrinkle at

1500

01:24:47.915 --> 01:24:49.595

that point, they go, can handle that

1501

01:24:49.595 --> 01:24:51.355

because I've been trained to do everything else.

1502

01:24:52.015 --> 01:24:54.835

So eliminate as many surprises as you possibly can,

1503

01:24:55.255 --> 01:24:57.995

and you make it a whole lot easier to fly the airplane.

1504

01:24:59.015 --> 01:25:02.835

Here's something that I know is probably going to, um, uh,

1505

01:25:04.035 --> 01:25:06.615

uh, not please, uh, John Thomas and Nancy.

1506

01:25:07.075 --> 01:25:10.535

And so as I click to this one, excuse me, well, I, uh,

1507

01:25:10.725 --> 01:25:11.735

duck out for the flack.

1508

01:25:12.905 --> 01:25:15.755

Alright? Now, I know that all

1509

01:25:15.755 --> 01:25:17.955

of you in the STPA community

1510

01:25:17.955 --> 01:25:19.875

and stamp community hate the James

1511

01:25:19.985 --> 01:25:21.555

reasons Swiss cheese model.

1512

01:25:21.855 --> 01:25:23.995

But the reason I throw it up there is

1513

01:25:23.995 --> 01:25:26.555
that 346 people lost their lives

1514

01:25:26.785 --> 01:25:28.355
because all

1515

01:25:28.535 --> 01:25:31.355
of the holes in the reasons Swiss cheese model lined up.

1516

01:25:31.705 --> 01:25:35.515
Something was flawed in the way

1517

01:25:35.745 --> 01:25:39.955
that the legislatures oversaw the airworthiness authorities

1518

01:25:40.305 --> 01:25:44.275
that oversaw the associations and the manufacturer

1519

01:25:44.615 --> 01:25:47.195
and the operator, and finally the pilots

1520

01:25:47.255 --> 01:25:48.795
and bang the air went

1521

01:25:48.795 --> 01:25:50.435
through all those holes in the Swiss cheese

1522

01:25:50.855 --> 01:25:52.235
and everybody lost their lives.

1523

01:25:52.815 --> 01:25:56.395
And that's just kind of a reminder that

1524

01:25:57.025 --> 01:25:58.595
what we're doing here really counts

1525

01:25:58.945 --> 01:26:01.995
because people have entrusted

1526

01:26:01.995 --> 01:26:04.305
us with their lives.

1527

01:26:05.005 --> 01:26:06.225
And that's a sacred trust.

1528

01:26:06.285 --> 01:26:09.545
You know, um, you all remember the late Gene Cerin?

1529

01:26:11.245 --> 01:26:13.385
Uh, does anybody remember Jerry Berlin?

1530

01:26:14.285 --> 01:26:16.785
Uh, he was a noted aviation psychologist.

1531

01:26:17.315 --> 01:26:19.585
Jerry would put everybody up on stage

1532

01:26:20.665 --> 01:26:24.645
and say, alright, I'm gonna put you into an accident model.

1533

01:26:25.265 --> 01:26:27.965
Uh, you just told everybody on the airplane,

1534

01:26:27.965 --> 01:26:29.045
including yourself.

1535

01:26:29.935 --> 01:26:31.115
Now what I want you to do

1536

01:26:31.655 --> 01:26:32.955
is we're gonna have some other people

1537

01:26:32.955 --> 01:26:34.835
that are gonna play who's closest to you.

1538

01:26:35.535 --> 01:26:38.515
And for Gene Cernan, the closest person

1539

01:26:38.515 --> 01:26:40.515

to him in this live force is daughter Terry.

1540

01:26:41.785 --> 01:26:43.805

And Terry got up,

1541

01:26:44.105 --> 01:26:47.645

and all of the people who are role playing, the

1542

01:26:48.155 --> 01:26:50.405

crew on the airplane and, uh, Dr.

1543

01:26:50.675 --> 01:26:53.255

Jerry's model are ghosts.

1544

01:26:53.915 --> 01:26:57.325

And they have to answer to the people

1545

01:26:57.595 --> 01:26:59.645

that mattered most in their lives.

1546

01:27:00.775 --> 01:27:05.535

And Terry said, dad, how could you do this to me?

1547

01:27:07.465 --> 01:27:09.115

Gene was almost brought to tears.

1548

01:27:09.615 --> 01:27:11.555

I'd never seen CERN so emotional.

1549

01:27:12.095 --> 01:27:15.315

And that really hammered this whole thing home for me.

1550

01:27:15.315 --> 01:27:18.995

And I said, this is why I feel so strongly about all

1551

01:27:19.055 --> 01:27:21.715

of these safety issues

1552

01:27:21.715 --> 01:27:26.705

because my wife, the wives of the passengers,

1553

01:27:28.125 --> 01:27:29.215
what about all of them?

1554

01:27:29.775 --> 01:27:34.035
I can see my wife saying, Fred, how could you do this to me?

1555

01:27:36.295 --> 01:27:37.665
That really hammered it home,

1556

01:27:37.665 --> 01:27:39.265
because at the end of the day,

1557

01:27:39.645 --> 01:27:42.505
it isn't about hardware, it's about people.

1558

01:27:43.415 --> 01:27:47.785
And that's our most awesome and sake of responsibility.

1559

01:27:49.565 --> 01:27:52.295
Well, thank you. I'd like to open it up now to, uh,

1560

01:27:52.305 --> 01:27:54.015
discussion questions and answers.

1561

01:27:54.115 --> 01:27:55.695
And you guys are gonna have to kind of feed me

1562

01:27:55.695 --> 01:27:58.455
because I can't see anything other than just, uh, you know,

1563

01:27:58.455 --> 01:28:00.335
my screen and, uh, the presentation.

1564

01:28:00.355 --> 01:28:01.655
So, hey, Shem

1565

01:28:01.675 --> 01:28:03.495
and Ben, can you help me out as to

1566

01:28:03.495 --> 01:28:05.095

what people are talking about out there?

1567

01:28:05.995 --> 01:28:06.995

Tom,

1568

01:28:07.485 --> 01:28:10.055

Fred, uh, as usual, great presentation.

1569

01:28:10.235 --> 01:28:13.215

Thanks so much. And, uh, you know, the, the,

1570

01:28:13.435 --> 01:28:15.815

I'm encouraging, uh, attendees to go ahead and,

1571

01:28:15.815 --> 01:28:18.535

and type into that question tab, uh,

1572

01:28:18.535 --> 01:28:19.775

if you've got a question for Fred,

1573

01:28:19.835 --> 01:28:21.935

but I noticed that people really appreciated your,

1574

01:28:22.325 --> 01:28:23.455

your duck there.

1575

01:28:24.035 --> 01:28:26.095

Um, and I always love the animation

1576

01:28:26.095 --> 01:28:27.495

that you include in your presentations.

1577

01:28:27.555 --> 01:28:31.295

It, it just, uh, number one, uh, holds, uh, attention.

1578

01:28:31.395 --> 01:28:33.875

So why people are typing in, uh,

1579

01:28:33.875 --> 01:28:35.555

their questions if they have any.

1580
01:28:36.215 --> 01:28:40.355
Um, you and I, uh, prior to this event had talked about,

1581
01:28:41.065 --> 01:28:42.555
yeah, philosophically speaking,

1582
01:28:42.775 --> 01:28:44.995
and I'm gonna about to bring this back to, uh,

1583
01:28:45.435 --> 01:28:46.715
STPA here hopefully.

1584
01:28:47.135 --> 01:28:51.475
Um, but about the ability to restore manual control

1585
01:28:52.215 --> 01:28:54.085
to the aircr, right?

1586
01:28:54.265 --> 01:28:56.445
The, uh, uh, the autopilot disconnect button.

1587
01:28:56.505 --> 01:29:00.865
So if you got a big red button, should we perhaps

1588
01:29:01.405 --> 01:29:05.645
standardize across all different type model series aircraft?

1589
01:29:06.755 --> 01:29:09.525
Just when you're on brainstorm and you have startle

1590
01:29:09.525 --> 01:29:11.045
or surprise, you push

1591
01:29:11.105 --> 01:29:14.045
and hold that button, you've restored normal manual flight

1592
01:29:14.045 --> 01:29:16.885
control to the air crew, and now we can go ahead

1593
01:29:17.065 --> 01:29:19.325

and, uh, do some forensics

1594

01:29:19.705 --> 01:29:23.085

and some, uh, specific discrete actions to disable systems

1595

01:29:23.235 --> 01:29:25.285

that, um, are obviously

1596

01:29:25.825 --> 01:29:27.525

not performing the way we want them to.

1597

01:29:28.505 --> 01:29:29.845

Oh, absolutely. But you know,

1598

01:29:29.845 --> 01:29:32.325

if you take a look at the evolution of this airplane

1599

01:29:32.325 --> 01:29:34.085

that's been around since what, 1969

1600

01:29:34.225 --> 01:29:35.965

or something like that, help me, Boeing guys,

1601

01:29:36.385 --> 01:29:41.205

are we now into the, what is this, the, uh, 51st year of,

1602

01:29:41.305 --> 01:29:43.925

of, uh, the evolutions,

1603

01:29:43.945 --> 01:29:45.765

the various evolutions, the seven three.

1604

01:29:45.985 --> 01:29:48.445

So many of those systems are carried over from those days

1605

01:29:48.795 --> 01:29:50.565

when the airplane was a whole lot simpler.

1606

01:29:51.065 --> 01:29:54.885

But you know, as you know, uh, on this airplane, you have,

1607

01:29:55.385 --> 01:29:59.445

um, an autopilot disconnect button under your, uh, well,

1608

01:29:59.445 --> 01:30:01.365

it should be under my left hand thumb over here, you know,

1609

01:30:01.365 --> 01:30:03.445

right below the trim switches on the yolk.

1610

01:30:03.785 --> 01:30:06.485

And so you can disconnect the autopilot like that.

1611

01:30:06.945 --> 01:30:10.565

But, uh, I don't believe that that has any function in terms

1612

01:30:10.705 --> 01:30:12.325

of disconnecting any

1613

01:30:12.325 --> 01:30:14.805

of those flight control computer functions.

1614

01:30:15.305 --> 01:30:17.325

And, uh, perhaps that's an opportunity

1615

01:30:17.505 --> 01:30:21.845

to improve the airplane or perhaps add a second red button.

1616

01:30:21.985 --> 01:30:24.565

But the whole object is to have a common pipe rating.

1617

01:30:24.705 --> 01:30:27.085

So as we add new functions, uh,

1618

01:30:27.425 --> 01:30:32.045

and uh, uh, maybe even a new hardware to the cockpit,

1619

01:30:32.395 --> 01:30:35.365

then you get into much more complex differences training.

1620

01:30:35.625 --> 01:30:39.085

The whole idea with the original airplane was you take a 45

1621

01:30:39.085 --> 01:30:42.205
minute, two hour, uh, laptop training course

1622

01:30:42.265 --> 01:30:43.605
and you're ready to go fly.

1623

01:30:44.145 --> 01:30:46.925
But we found out that it's a whole lot more complex than

1624

01:30:46.925 --> 01:30:49.125
that, and perhaps it's, uh, time to go back

1625

01:30:49.125 --> 01:30:50.685
and say, Hey, do we need some sort

1626

01:30:50.685 --> 01:30:54.525
of a flight control computer interrupt function here,

1627

01:30:54.785 --> 01:30:59.525
or limited interrupt function to, uh, disable some

1628

01:30:59.525 --> 01:31:01.085
of these higher order functions

1629

01:31:01.395 --> 01:31:03.165
that might have runaway modes?

1630

01:31:04.815 --> 01:31:06.455
I don't know. Yeah. And yeah,

1631

01:31:06.515 --> 01:31:08.895
and this, um, um, I don't think you'll mind me saying

1632

01:31:08.895 --> 01:31:10.855
because he, uh, one

1633

01:31:10.855 --> 01:31:12.335
of our flight test safety committee members,

1634

01:31:12.355 --> 01:31:16.875

but Jim Richmond, uh, submitted a homework last night

1635

01:31:17.145 --> 01:31:20.155

that, uh, discussed the EEC 1 35 mishap,

1636

01:31:20.425 --> 01:31:21.675

that that was fatal.

1637

01:31:22.065 --> 01:31:26.215

Very tragic story here where the autopilot was actually,

1638

01:31:26.955 --> 01:31:29.375

uh, fighting the trim.

1639

01:31:30.115 --> 01:31:31.815

So the, the fab was being trimmed

1640

01:31:31.815 --> 01:31:33.335

and the autopilot was compensating

1641

01:31:33.345 --> 01:31:34.775

until it could no longer do so.

1642

01:31:35.195 --> 01:31:37.975

And then when it disconnected the airplane, uh,

1643

01:31:37.975 --> 01:31:40.135

took an unrecoverable dive at that point,

1644

01:31:40.135 --> 01:31:41.415

as I understand it in simple terms.

1645

01:31:41.445 --> 01:31:43.455

Yeah. Uh, maybe this gets back to your point

1646

01:31:43.455 --> 01:31:46.015

that thou shall never overpower the elevators.

1647

01:31:46.635 --> 01:31:48.935

Uh, but again, it,

1648

01:31:49.075 --> 01:31:52.015

it seems like maybe there could be a level of sophistication

1649

01:31:52.085 --> 01:31:56.855

that an STPA analysis might suggest that go, you know,

1650

01:31:56.915 --> 01:32:01.565

we don't want to leave this go that long until

1651

01:32:02.105 --> 01:32:04.285

the autopilot can just throw its hands up in the air

1652

01:32:04.285 --> 01:32:06.005

and say, I can't handle this anymore,

1653

01:32:06.345 --> 01:32:09.125

and then provide the annunciation when now we're gonna

1654

01:32:09.125 --> 01:32:11.285

induce more startle and surprise

1655

01:32:11.585 --> 01:32:14.165

and perhaps, um, even though it's alerted at that point,

1656

01:32:14.865 --> 01:32:16.445

and we have elevator control power,

1657

01:32:16.465 --> 01:32:19.245

but maybe the airplane's in a condition where we,

1658

01:32:19.265 --> 01:32:21.045

we simply can't recover too low to the ground.

1659

01:32:21.475 --> 01:32:23.885

Yeah. Well, we know that there's two different ways,

1660

01:32:24.105 --> 01:32:26.165

or at least two different ways of this three.

1661
01:32:26.685 --> 01:32:28.925
I mean, first of all, you can use the glare shield control

1662
01:32:28.925 --> 01:32:30.845
panel to disconnect the autopilot here.

1663
01:32:31.185 --> 01:32:32.485
You can use the red button on the oak,

1664
01:32:32.485 --> 01:32:33.645
or if you trim the airplane,

1665
01:32:33.645 --> 01:32:36.205
that'll obviously disconnect the autopilot like it does.

1666
01:32:36.225 --> 01:32:37.445
And most things that you

1667
01:32:37.445 --> 01:32:39.325
and I have flown over the years, uh,

1668
01:32:39.545 --> 01:32:42.085
but, um, I think in terms of some

1669
01:32:42.085 --> 01:32:44.365
of these higher order functions, that's an opportunity

1670
01:32:44.425 --> 01:32:47.725
to study and find out if we press down on the red, uh,

1671
01:32:47.725 --> 01:32:50.525
autopilot disconnect button, should that also maybe

1672
01:32:50.525 --> 01:32:53.085
with a second push or a prolonged push

1673
01:32:53.105 --> 01:32:55.445
or something like that, disable some

1674
01:32:55.445 --> 01:32:58.045

of these tire order flight control computer functions.

1675

01:32:58.205 --> 01:33:00.725

I don't know, because I don't know enough about the design

1676

01:33:00.725 --> 01:33:04.205

of the airplane to, uh, describe that.

1677

01:33:04.305 --> 01:33:07.605

But one thing that's I think troubling, Hey, uh, Tom,

1678

01:33:07.925 --> 01:33:10.605

I mean, I'm sure a lot of you out there know, um, Richard

1679

01:33:11.165 --> 01:33:14.845

Champion decrepit, you know, Qantas 32, the A three 80

1680

01:33:14.875 --> 01:33:17.845

that had that left hand engine that, uh, blew up

1681

01:33:17.865 --> 01:33:19.565

and, uh, damn near took the airplane down.

1682

01:33:19.705 --> 01:33:21.325

It was a Singapore to Sydney plight.

1683

01:33:21.795 --> 01:33:25.525

Rich told me that he studies all of the maintenance manuals

1684

01:33:25.525 --> 01:33:28.245

of the airplane two hours a day every day.

1685

01:33:28.665 --> 01:33:32.485

And he credits that plus some very sharp crew members

1686

01:33:32.905 --> 01:33:36.205

and a whole lot of crew resource management

1687

01:33:36.205 --> 01:33:37.685

for getting the airplane back on the ground

1688

01:33:37.685 --> 01:33:38.765
safely in Singapore.

1689

01:33:39.105 --> 01:33:40.765
But as you know, Tom, one

1690

01:33:40.765 --> 01:33:43.005
of the things we've done over the years is

1691

01:33:43.705 --> 01:33:44.885
we dumbed down flight training.

1692

01:33:45.145 --> 01:33:47.165
We don't want people to be mechanics, right?

1693

01:33:47.165 --> 01:33:49.325
Look, if, if you can't control it,

1694

01:33:49.325 --> 01:33:51.125
if you can't see it in the cockpit,

1695

01:33:51.125 --> 01:33:52.365
you don't need to know about it.

1696

01:33:52.935 --> 01:33:57.125
Maybe there's a balance there of providing pilots

1697

01:33:57.125 --> 01:33:59.525
with a better in-depth technical knowledge

1698

01:33:59.525 --> 01:34:01.965
of the airplane without turning them into bonafide

1699

01:34:02.025 --> 01:34:03.845
or quasi A and ps.

1700

01:34:03.985 --> 01:34:06.485
But I think that's an opportunity for discussion here too.

1701

01:34:07.625 --> 01:34:10.805

Excuse me. How much technical knowledge do these people need

1702

01:34:11.185 --> 01:34:13.725
to really do their jobs, uh, thoroughly?

1703

01:34:13.725 --> 01:34:16.485
Because, you know, one thing that comes out

1704

01:34:16.485 --> 01:34:19.925
with things like, for instance, your, um, what is it,

1705

01:34:19.925 --> 01:34:23.575
the XB 47, the drone? Is that what that was?

1706

01:34:24.275 --> 01:34:25.575
Uh, X 47? Yeah.

1707

01:34:25.805 --> 01:34:27.015
Yeah. I mean, one of the things that you

1708

01:34:27.015 --> 01:34:29.415
and I were thinking about, I'm sure it was, oh,

1709

01:34:29.415 --> 01:34:33.095
you're coming down here and you're getting close to the deck

1710

01:34:33.515 --> 01:34:35.655
and you're looking at, well, what about winds on the deck?

1711

01:34:35.655 --> 01:34:38.415
What about low fuel? Well, what about, hey, one

1712

01:34:38.415 --> 01:34:40.975
of the cross deck pennants is so worn, we gotta change it.

1713

01:34:40.975 --> 01:34:42.575
So if FO deck because of that,

1714

01:34:42.595 --> 01:34:45.295
or maybe we couldn't, we had a, an air plane

1715

01:34:45.295 --> 01:34:47.295
that landed previously in a blew with tire,

1716

01:34:47.365 --> 01:34:48.895
it's gonna take a while to get out of there.

1717

01:34:49.135 --> 01:34:51.055
I mean, it's a whole systems analysis,

1718

01:34:51.395 --> 01:34:54.575
not just what's going on without one UAV

1719

01:34:54.755 --> 01:34:56.095
and one aircraft carrier.

1720

01:34:56.095 --> 01:34:58.325
There's a whole lot of things in play here,

1721

01:34:58.585 --> 01:35:00.045
but I mean, that's the sort of thing

1722

01:35:00.045 --> 01:35:01.205
that humans can think of.

1723

01:35:01.465 --> 01:35:04.325
And getting back to how that relevance for the seven three,

1724

01:35:04.705 --> 01:35:07.525
you know, or other airplanes, you know, perhaps we need

1725

01:35:07.525 --> 01:35:10.565
to train pilots to a much deeper technical level

1726

01:35:11.195 --> 01:35:14.765
without saying, oh, by the way, uh, you don't need

1727

01:35:14.765 --> 01:35:16.125
to get your a and p this week,

1728

01:35:16.425 --> 01:35:19.045

but you do need to have some advanced tools so

1729

01:35:19.045 --> 01:35:23.335

that when things go wrong, you go, aha, I bet you that

1730

01:35:24.165 --> 01:35:28.415

this is connected to a particular system on the airplane.

1731

01:35:29.225 --> 01:35:32.895

Maybe we need to call maintenance or call dispatch

1732

01:35:32.915 --> 01:35:35.215

and say, here's what we're experiencing.

1733

01:35:35.685 --> 01:35:38.055

Give us a hand. I bet you we can solve this

1734

01:35:38.245 --> 01:35:39.415

with your help on the ground.

1735

01:35:41.015 --> 01:35:45.545

Yeah, good points. Um, getting to Chris Hart's, uh,

1736

01:35:45.795 --> 01:35:47.385

joint authorities technical report.

1737

01:35:47.455 --> 01:35:50.745

Yeah. One of the things that I noted in, in the report

1738

01:35:50.745 --> 01:35:55.225

that was pretty prominent was perhaps the,

1739

01:35:55.285 --> 01:35:58.305

the suggestion that we need to pay greater attention

1740

01:35:58.525 --> 01:36:00.785

to the variance in pilot response.

1741

01:36:01.335 --> 01:36:04.305

Yeah. That not all pilots are created equal.

1742

01:36:04.325 --> 01:36:07.425

And maybe it was unfair to throw the pilots under the bus,

1743

01:36:07.515 --> 01:36:09.265

which seemed to be pretty typical these days,

1744

01:36:09.925 --> 01:36:11.025

uh, right out of the gate.

1745

01:36:11.325 --> 01:36:12.825

But the difference between training

1746

01:36:13.335 --> 01:36:15.505

schemes overseas versus us

1747

01:36:15.565 --> 01:36:18.745

and Oh yeah, US pilot would never react in that way.

1748

01:36:19.125 --> 01:36:21.865

But the bottom line is, is that our products are flown

1749

01:36:21.965 --> 01:36:25.705

by a wide variance in, in pilot competency.

1750

01:36:26.055 --> 01:36:27.745

Yeah. I think that's just fact of life.

1751

01:36:28.085 --> 01:36:31.225

And so the question from that I was really kind

1752

01:36:31.225 --> 01:36:33.065

of mulling over is, well, gosh,

1753

01:36:33.405 --> 01:36:35.665

how do you accommodate every combination

1754

01:36:35.665 --> 01:36:39.945

and permutation of pilot response against all

1755

01:36:39.945 --> 01:36:43.985

of the plausible scenarios that, that you could conceive,

1756

01:36:44.095 --> 01:36:46.225

perhaps going through an STPA analysis,

1757

01:36:46.885 --> 01:36:49.065

and then, okay, now what are we going to do?

1758

01:36:49.085 --> 01:36:50.905

But perhaps the exercise is valid.

1759

01:36:50.985 --> 01:36:52.785

I just wanted to get your comments on how,

1760

01:36:52.805 --> 01:36:54.385

how would we get our arms

1761

01:36:54.385 --> 01:36:57.225

around this from a certification basis standpoint?

1762

01:36:58.055 --> 01:37:00.825

Well, you know, one of my concerns is, look, Tom, uh,

1763

01:37:00.885 --> 01:37:02.785

how many hours did you have before you hit the boat?

1764

01:37:05.365 --> 01:37:06.825

Oh, I guess maybe two 50

1765

01:37:07.465 --> 01:37:08.465

Ish, maybe.

1766

01:37:09.305 --> 01:37:11.625

I mean, you know, and I think when I got my Mach two pin,

1767

01:37:11.705 --> 01:37:13.865

I had 275 hours in my logbook.

1768

01:37:14.485 --> 01:37:18.985

But the luxury the military has is that it has very

1769

01:37:19.555 --> 01:37:22.555
tight pilot candidate screening.

1770

01:37:22.815 --> 01:37:24.955
You know, do you remember the a q team and the FAR test?

1771

01:37:24.975 --> 01:37:26.555
We took years and years and years ago,

1772

01:37:26.735 --> 01:37:29.155
or each young to have gone through that stuff.

1773

01:37:32.395 --> 01:37:33.695
Yes, Right.

1774

01:37:33.995 --> 01:37:36.935
My point is that, uh, Terry bla talked

1775

01:37:36.935 --> 01:37:38.055
to a fellow at Airbus,

1776

01:37:38.055 --> 01:37:39.495
and I can't remember his name right now,

1777

01:37:39.555 --> 01:37:41.015
but, uh, at AB week.

1778

01:37:41.155 --> 01:37:44.055
And the Airbus guy said, look, the military has the luxury

1779

01:37:44.635 --> 01:37:46.215
of screening people

1780

01:37:46.315 --> 01:37:48.615
and training people to

1781

01:37:49.135 --> 01:37:51.055
a much higher standard than the airlines.

1782

01:37:51.115 --> 01:37:53.815

The airlines, they have to accommodate lots of people.

1783

01:37:54.445 --> 01:37:56.725

They have a huge need for pilots,

1784

01:37:56.725 --> 01:37:59.005

and they just basically have to get the job done.

1785

01:37:59.585 --> 01:38:01.365

Now, one of the things you see, I think

1786

01:38:01.365 --> 01:38:03.565

with the US airlines, first of all,

1787

01:38:05.285 --> 01:38:08.085

I think maintenance standards, uh, if somebody

1788

01:38:08.595 --> 01:38:11.005

runs into an angle of attack probe, this happened

1789

01:38:11.005 --> 01:38:12.805

to a friend of mine who now works for flight safety

1790

01:38:12.865 --> 01:38:14.525

as an instructor, and he was flying buses,

1791

01:38:14.985 --> 01:38:17.085

and he said, Hey, I had a, a, a, uh,

1792

01:38:17.205 --> 01:38:19.325

a ground guy one day he ran into an angle

1793

01:38:19.325 --> 01:38:21.805

of attack robe on the side of my bus, and he damaged it.

1794

01:38:21.985 --> 01:38:26.125

And he said, you're grounded. You're not leaving. That's it.

1795

01:38:26.485 --> 01:38:28.245

I broke the angle of attack and you can't go.

1796

01:38:28.745 --> 01:38:33.165

He said, what about overseas? Are there pressures on people?

1797

01:38:33.355 --> 01:38:36.845

They're so poor that if you damage something on an airplane,

1798

01:38:36.845 --> 01:38:39.085

you're afraid to tell your boss because you might get fired?

1799

01:38:39.805 --> 01:38:44.085

I don't know. But those kinds of distortions in

1800

01:38:44.085 --> 01:38:46.205

that control loop process we talked about, you know,

1801

01:38:46.205 --> 01:38:47.365

that started with the regulators

1802

01:38:47.365 --> 01:38:49.765

and moves all the way down to the pilots, you know,

1803

01:38:49.765 --> 01:38:52.765

with all the various loops in there, if you have those kinds

1804

01:38:52.765 --> 01:38:56.165

of distortions that can really have a bearing on safety.

1805

01:38:56.665 --> 01:39:00.885

And one of my concerns there is that, uh, here,

1806

01:39:01.625 --> 01:39:06.245

you know, that the airlines are pretty good about vetting

1807

01:39:06.245 --> 01:39:09.245

pilots and their qualifications in the time, oh, you have,

1808

01:39:09.585 --> 01:39:10.805

uh, \$1,500

1809

01:39:10.905 --> 01:39:13.165

and we're gonna take a real close look at your log book.

1810

01:39:13.915 --> 01:39:17.665

Maybe we have to have the same sort of

1811

01:39:18.935 --> 01:39:21.495

bonafide vetting crosscheck process so

1812

01:39:21.495 --> 01:39:23.935

that if you say you have \$200 in your log book,

1813

01:39:24.195 --> 01:39:26.575

you really do have \$200 in your log book.

1814

01:39:26.755 --> 01:39:30.175

And it's not just pencil whipped to make, uh,

1815

01:39:30.205 --> 01:39:31.695

meet a basic requirement.

1816

01:39:32.235 --> 01:39:36.295

So I think there has to be some, uh, vetting, if you will,

1817

01:39:36.435 --> 01:39:40.175

in terms of pilot, uh, prequel and also pilot training.

1818

01:39:40.485 --> 01:39:42.575

Another fellow said he was, uh,

1819

01:39:42.815 --> 01:39:44.055

training some folks overseas,

1820

01:39:44.795 --> 01:39:48.775

and he saw, uh, six people crowded into the back of the sim.

1821

01:39:49.755 --> 01:39:53.455

Excuse me. They all got sim time as observers.

1822

01:39:53.455 --> 01:39:54.775

They didn't actually have to fly it,

1823

01:39:54.955 --> 01:39:56.615
but the operator said, uh,

1824

01:39:56.615 --> 01:39:58.175
we don't have the money, we don't have the time.

1825

01:39:58.595 --> 01:40:00.775
Uh, we need to get these people signed off from just

1826

01:40:01.005 --> 01:40:03.455
observing for riding around on the back of the sim.

1827

01:40:03.915 --> 01:40:06.415
So again, another distortion in the process,

1828

01:40:06.995 --> 01:40:10.255
and there has to be some honesty in vetting so that, uh,

1829

01:40:10.255 --> 01:40:12.695
everybody trains for the same standard around the world.

1830

01:40:14.975 --> 01:40:16.735
Excellent. Yeah. And sorry, my about my

1831

01:40:16.735 --> 01:40:18.175
hesitation in answering your question.

1832

01:40:18.255 --> 01:40:20.095
I had an eyeball down here in the question pain.

1833

01:40:20.475 --> 01:40:22.655
Um, hey, in the last 30 seconds that we have,

1834

01:40:22.835 --> 01:40:26.815
can you just briefly describe your journey with, uh,

1835

01:40:27.375 --> 01:40:31.015
STPA and stamp, you know, how you became familiar with it,

1836

01:40:31.195 --> 01:40:33.175

why you chose to do a stamp

1837

01:40:33.495 --> 01:40:34.695
analysis on this particular event?

1838

01:40:35.195 --> 01:40:37.135
Oh, well, blame it on Nancy Levison.

1839

01:40:37.735 --> 01:40:41.815
I mean, uh, I am so, uh,

1840

01:40:42.855 --> 01:40:47.415
I think in awe of this person who

1841

01:40:48.515 --> 01:40:52.035
has devoted her whole life to safety

1842

01:40:52.855 --> 01:40:54.965
and eliminating error.

1843

01:40:55.505 --> 01:40:59.045
And I love it when Nancy says, um, you know,

1844

01:40:59.215 --> 01:41:02.565
pilot error is more symptomatic than it is problematic.

1845

01:41:02.755 --> 01:41:06.045
It's symptomatic of problems in the control structure.

1846

01:41:06.435 --> 01:41:07.965
It's more than it's problematic.

1847

01:41:08.025 --> 01:41:10.485
And, you know, I think, uh,

1848

01:41:10.785 --> 01:41:13.925
was it the com air crash in Lexington a while back

1849

01:41:14.255 --> 01:41:15.725
where they took off with the wrong runway?

1850

01:41:17.485 --> 01:41:18.825

That's correct, yes. Yeah.

1851

01:41:18.925 --> 01:41:21.265

And I think that's the first time that I chatted with her,

1852

01:41:21.285 --> 01:41:24.745

and it was this big wake up call, like, aha, you know,

1853

01:41:24.745 --> 01:41:26.345

we are so into blaming the pilots.

1854

01:41:26.345 --> 01:41:27.745

You know, we've seen that in accident report

1855

01:41:27.745 --> 01:41:28.785

after accident report,

1856

01:41:29.125 --> 01:41:31.825

and you know, what's, what's wrong with this picture?

1857

01:41:32.165 --> 01:41:34.145

And that is, you know, pilots are only human,

1858

01:41:35.385 --> 01:41:36.975

which is a great advantage,

1859

01:41:37.955 --> 01:41:41.575

but you can't expect them to be responsible

1860

01:41:41.675 --> 01:41:43.695

for all aspects of the control loop.

1861

01:41:44.275 --> 01:41:48.135

And that's when Nancy's message really got home to me, I,

1862

01:41:48.165 --> 01:41:51.135

like you am just learning about STPA and stamp.

1863

01:41:51.235 --> 01:41:54.135

But every time I go through one of these exercises,

1864

01:41:54.415 --> 01:41:56.175

I just get more excited about the process

1865

01:41:56.245 --> 01:41:58.695

because there are such great opportunities

1866

01:41:59.395 --> 01:42:02.975

for eliminating accidents, especially fatal accidents

1867

01:42:02.995 --> 01:42:04.295

by using this methodology.

1868

01:42:07.105 --> 01:42:09.305

Excellent. Yeah, and I have, uh, similar feelings.

1869

01:42:09.655 --> 01:42:12.145

Well, uh, Fred, awesome presentation.

1870

01:42:12.685 --> 01:42:14.865

Uh, we hope that you're gonna stick with us, uh,

1871

01:42:14.885 --> 01:42:17.225

for the two o'clock, uh, panel this afternoon.

1872

01:42:17.885 --> 01:42:20.145

Um, and, and perhaps can join us for that.

1873

01:42:20.165 --> 01:42:22.865

And folks can continue to put their questions into the,

1874

01:42:22.925 --> 01:42:24.105

the question tab, and maybe

1875

01:42:24.105 --> 01:42:25.185

we can address some of those later.

1876

01:42:25.925 --> 01:42:28.705

Um, but, uh, I can't thank you enough for,

1877

01:42:28.725 --> 01:42:29.745
uh, joining us today.

1878

01:42:30.125 --> 01:42:31.665
Really great presentation.

1879

01:42:32.365 --> 01:42:35.305
And, uh, I think lots of folks are, are chiming in here

1880

01:42:35.305 --> 01:42:37.065
and they really, uh, enjoyed it as well.

1881

01:42:37.925 --> 01:42:41.105
Uh, so with that, we have reached our break time.

1882

01:42:41.245 --> 01:42:42.865
Uh, so we're gonna take a 30 minute break,

1883

01:42:42.965 --> 01:42:45.585
but we will start, uh, exactly at the top of the hour.

1884

01:42:45.585 --> 01:42:47.825
We'll have the countdown timer, uh,

1885

01:42:47.895 --> 01:42:49.545
showing again on the screen.

1886

01:42:49.605 --> 01:42:50.665
So you've got two options.

1887

01:42:50.665 --> 01:42:53.545
Basically, you can leave the webinar and come back, uh,

1888

01:42:53.565 --> 01:42:55.305
or you can just leave the webinar up and,

1889

01:42:55.325 --> 01:42:57.105
and then you'll have that countdown timer

1890

01:42:57.285 --> 01:42:59.305

and we're gonna kick back off again.

1891

01:42:59.845 --> 01:43:02.825

So with that, I, again, thank all our presenters and, uh,

1892

01:43:03.445 --> 01:43:04.545

and wish you all a good break,

1893

01:43:04.565 --> 01:43:06.025

and we'll see you here in about half an hour.

1894

01:43:06.025 --> 01:43:06.425

Thank you.

1895

02:10:13.625 --> 02:10:15.195

Well, welcome back from break, everybody.

1896

02:10:16.975 --> 02:10:20.595

So we've, we've had, uh, as I said, a very condensed day

1897

02:10:20.595 --> 02:10:23.955

and a half, and if I could recap perhaps a little bit

1898

02:10:23.955 --> 02:10:27.115

of the journey, we started with perhaps more

1899

02:10:27.115 --> 02:10:30.875

of an academic slant, a little bit more of the theory on

1900

02:10:31.395 --> 02:10:32.875

STPA and stamp,

1901

02:10:33.225 --> 02:10:37.525

and now we're going to transition to perhaps more, uh,

1902

02:10:37.555 --> 02:10:38.765

practical application

1903

02:10:38.825 --> 02:10:41.885

and specifically how we might be able to adopt, uh,

1904

02:10:41.885 --> 02:10:44.605

these methodologies to the work that we do.

1905

02:10:45.425 --> 02:10:49.565

And, uh, I think we've got the best person to, uh,

1906

02:10:49.835 --> 02:10:51.085

discuss that with us today.

1907

02:10:51.305 --> 02:10:53.005

And that's major Sarah Summers.

1908

02:10:53.585 --> 02:10:56.805

Um, I had the pleasure of meeting, uh, poncho up at, uh,

1909

02:10:56.865 --> 02:11:01.645

Boston at MIT during the STPA workshop year

1910

02:11:01.645 --> 02:11:04.565

or two ago, and, uh, was very impressed with this, uh,

1911

02:11:04.565 --> 02:11:06.925

young Air Force officer who's, uh,

1912

02:11:06.925 --> 02:11:08.125

got quite an impressive resume.

1913

02:11:08.745 --> 02:11:12.645

Uh, currently she is the CV 22 program element Monitor,

1914

02:11:13.065 --> 02:11:16.885

as beaker mentioned yesterday in the Air Force Secretariat

1915

02:11:16.885 --> 02:11:19.165

office for Acquisition Technology and Logistics.

1916

02:11:19.975 --> 02:11:22.405

She's a former aircraft maintenance officer on the E three

1917

02:11:22.665 --> 02:11:25.445

aac, I can't imagine the maintenance headaches with, with

1918

02:11:25.445 --> 02:11:26.445

that legacy aircraft.

1919

02:11:26.905 --> 02:11:29.485

And also an engineering executive officer at Air Force

1920

02:11:29.845 --> 02:11:32.005

Research Lab at Wright Paris Air Force Base.

1921

02:11:32.065 --> 02:11:33.845

So she's been around

1922

02:11:34.105 --> 02:11:37.325

and has got a lot of, uh, experience both operationally

1923

02:11:37.505 --> 02:11:38.885

and on the flight test side,

1924

02:11:39.615 --> 02:11:42.165

Sarah is an Air Force test pilot school graduate.

1925

02:11:42.305 --> 02:11:43.645

She serves as a flight test engineer

1926

02:11:43.645 --> 02:11:46.205

with the Fort 18th Flight Test Squadron, as well

1927

02:11:46.265 --> 02:11:48.325

as being the director of operations

1928

02:11:48.865 --> 02:11:52.325

for the seven 72nd test squad.

1929

02:11:52.815 --> 02:11:55.165

She's an Air Force MIT fellow select.

1930

02:11:55.165 --> 02:11:57.005

That's impressive in its own right.

1931

02:11:57.025 --> 02:11:59.445

And besides being, uh, uh,

1932

02:11:59.845 --> 02:12:01.085

a previously earning AM bachelor's

1933

02:12:01.085 --> 02:12:02.245

and master's degree in aeronautics,

1934

02:12:02.245 --> 02:12:05.805

she has earned a PhD prerequisite Master's in Engineering

1935

02:12:05.925 --> 02:12:07.285

and management from MIT.

1936

02:12:07.285 --> 02:12:12.205

And I assume, uh, Sarah, that that is, um, on the pathway

1937

02:12:12.385 --> 02:12:16.685

for you to get your doctorate degree from MIT, which will be

1938

02:12:17.685 --> 02:12:19.045

a nice feather for your cap.

1939

02:12:19.745 --> 02:12:21.805

So we're honored to have you with us today

1940

02:12:22.105 --> 02:12:27.005

and discuss perhaps how we can apply STPA now to the things

1941

02:12:27.005 --> 02:12:28.405

that are most important to us.

1942

02:12:29.105 --> 02:12:32.565

Um, and that is at the program and flight test level.

1943

02:12:32.665 --> 02:12:34.205

So with that, I'll turn it over to you.

1944

02:12:35.615 --> 02:12:37.595

All right, thanks Tom. Thanks for the introduction.

1945

02:12:37.655 --> 02:12:38.835

Thanks for hosting this.

1946

02:12:39.215 --> 02:12:40.475

Uh, it's been a great event

1947

02:12:40.505 --> 02:12:42.235

with some really awesome speakers.

1948

02:12:42.815 --> 02:12:46.475

Uh, so I think, are you guys seeing my slides at this point?

1949

02:12:51.265 --> 02:12:54.245

Yes, but we're also seeing the, uh, side panel as well.

1950

02:12:54.565 --> 02:12:56.605

I don't know if you can shift to a show mode.

1951

02:12:57.545 --> 02:12:58.805

Do you see the show mode now

1952

02:13:01.515 --> 02:13:03.055

or is it still the panel on the side?

1953

02:13:03.605 --> 02:13:05.245

Yeah, we're still seeing the preview panel.

1954

02:13:06.095 --> 02:13:08.105

Alright, there we Go. That did it.

1955

02:13:08.235 --> 02:13:09.585

There we go. Off

1956

02:13:09.585 --> 02:13:10.585

You go. All right.

1957

02:13:10.585 --> 02:13:11.585

All right.

1958

02:13:12.045 --> 02:13:14.665

So I'm gonna talk about STPA applied

1959

02:13:14.725 --> 02:13:16.905

to both design and to test safety.

1960

02:13:17.025 --> 02:13:18.705

I think it's important to talk about design

1961

02:13:18.705 --> 02:13:21.065

because if you start STPA in the test phase,

1962

02:13:21.315 --> 02:13:22.505

we're way too late in the game,

1963

02:13:22.885 --> 02:13:25.745

and we need to get early tester involvement in, in design.

1964

02:13:26.145 --> 02:13:27.585

I don't think anyone's gonna argue that.

1965

02:13:27.845 --> 02:13:29.905

And this is an opportunity to do so.

1966

02:13:29.925 --> 02:13:32.485

And then, of course, in our day-to-day lives doing tests,

1967

02:13:32.555 --> 02:13:34.285

it's important to understand how SCPA

1968

02:13:34.285 --> 02:13:35.485

applies to that as well.

1969

02:13:39.205 --> 02:13:41.865

So, before I get into how I got into SCPA, I'll talk about

1970

02:13:41.885 --> 02:13:43.065

how I got into safety.

1971

02:13:43.525 --> 02:13:46.265

Uh, both of my folks are retired Air Force officers.

1972

02:13:46.685 --> 02:13:50.225

Um, and, uh, I toured the idea of joining the Air Force.

1973

02:13:50.925 --> 02:13:52.745

Um, since I do come from an Air Force family,

1974

02:13:52.845 --> 02:13:54.865

my brother's actually listening to this too.

1975

02:13:54.925 --> 02:13:57.865

He, he works for the Air Force as a, as a software engineer.

1976

02:13:58.485 --> 02:14:01.825

Um, and, uh, a few months into my dad's, uh,

1977

02:14:01.825 --> 02:14:04.545

squadron command tour, uh, there was a mid air collision.

1978

02:14:04.645 --> 02:14:06.345

He was a helicopter pilot. There's a mid air collision

1979

02:14:06.345 --> 02:14:08.825

that killed, uh, 12 members of his squadron.

1980

02:14:10.285 --> 02:14:13.305

And, um, it was a devastating accident.

1981

02:14:13.685 --> 02:14:16.025

Uh, seven spouses lost their husband,

1982

02:14:16.465 --> 02:14:18.385

13 kids lost their fathers.

1983

02:14:18.845 --> 02:14:20.585

And as a, as a 16-year-old,

1984

02:14:20.585 --> 02:14:24.305

that was an incredibly impactful, um, moment for me.

1985

02:14:24.365 --> 02:14:27.225

And the next day after that accident happened, I decided

1986

02:14:27.225 --> 02:14:29.105

that I did indeed wanna join the Air Force,

1987

02:14:29.485 --> 02:14:32.625

and I wanted to serve and honor of those that die that day.

1988

02:14:33.205 --> 02:14:35.785

And what that has come to be throughout, uh,

1989

02:14:35.785 --> 02:14:37.265

the various assignments that I've had

1990

02:14:37.805 --> 02:14:39.425

is a focus on making sure

1991

02:14:39.425 --> 02:14:42.105

that our war fighters have the tools that they need

1992

02:14:42.205 --> 02:14:44.105

to complete their mission and come home

1993

02:14:44.105 --> 02:14:45.185

safely to their families.

1994

02:14:46.275 --> 02:14:49.175

So, uh, and safety as a maintenance officer,

1995

02:14:49.335 --> 02:14:51.815

I attended Jet Engine Mishap investigation course

1996

02:14:52.485 --> 02:14:53.735

when I was in A FRL.

1997

02:14:54.175 --> 02:14:57.215

I, uh, investigated several small UAS mishaps

1998

02:14:57.675 --> 02:14:58.855

and then an A FTC.

1999

02:14:58.915 --> 02:15:01.855

Of course. Uh, safety is a daily part, uh, of what we do.

2000

02:15:03.095 --> 02:15:05.715

And what I saw, especially when I was doing the, uh,

2001

02:15:06.115 --> 02:15:08.635

mishap investigations, is that the,

2002

02:15:08.635 --> 02:15:11.675

the way we approach safety is as a chain of events.

2003

02:15:12.175 --> 02:15:14.475

So, uh, you know, something happened 10 seconds

2004

02:15:14.775 --> 02:15:17.835

before, uh, the mishap 20 seconds, et cetera.

2005

02:15:18.295 --> 02:15:20.435

And what that, that doesn't allow us to capture

2006

02:15:21.155 --> 02:15:23.355

systemic programmatic type issues.

2007

02:15:23.655 --> 02:15:26.595

And what I saw was the mishaps that I investigated was each

2008

02:15:26.595 --> 02:15:30.475

of them had a technical reason why the mishap occurred,

2009

02:15:30.475 --> 02:15:33.875

whether it's a structural failure, um, component

2010

02:15:33.875 --> 02:15:35.715

of some component failure of some sort,

2011

02:15:36.455 --> 02:15:40.355

but there was also a programmatic reason, uh, such as, um,

2012

02:15:40.555 --> 02:15:41.715
requirements creep.

2013

02:15:42.135 --> 02:15:44.155
I'm sure no one's ever seen that before in a program.

2014

02:15:44.155 --> 02:15:48.795
They've worked. Um, uh, poor communication, uh, uh,

2015

02:15:48.795 --> 02:15:49.955
manufacturing issues.

2016

02:15:49.955 --> 02:15:51.875
There were all sorts of different things that were occurring

2017

02:15:52.105 --> 02:15:54.115
that, that allowed these mishaps to occur.

2018

02:15:54.335 --> 02:15:57.955
And it was not a good way in the Air Force safety system

2019

02:15:58.145 --> 02:16:00.995
that we input our investigation results into

2020

02:16:01.415 --> 02:16:03.515
to really capture that, uh, very well.

2021

02:16:04.735 --> 02:16:07.235
So that, that was my first insight into maybe,

2022

02:16:07.235 --> 02:16:09.035
maybe there's something that we can do better.

2023

02:16:09.735 --> 02:16:13.195
Uh, also as, as was just mentioned on previous talk,

2024

02:16:13.295 --> 02:16:16.955
we often blame the operator versus fix the design, um,

2025

02:16:17.095 --> 02:16:21.315

or fix the system That led to a dangerous design.

2026

02:16:21.735 --> 02:16:23.955

And I think STPA allows us to do that.

2027

02:16:24.575 --> 02:16:26.555

And then when I got into flight tests, I saw

2028

02:16:26.555 --> 02:16:29.325

that we use a lot of previous knowledge

2029

02:16:29.325 --> 02:16:32.325

and judgment, which is really great if we're doing similar

2030

02:16:32.485 --> 02:16:34.485

projects, whether it's the same aircraft,

2031

02:16:34.505 --> 02:16:35.805

but with new modifications

2032

02:16:36.465 --> 02:16:40.205

and aerial refueling working KC one 30 fives, uh,

2033

02:16:40.205 --> 02:16:44.005

you dust off a safety plan from a previous uh, program.

2034

02:16:44.625 --> 02:16:47.045

You make sure that it looks good based off the new receiver,

2035

02:16:47.345 --> 02:16:48.885

and you go and you execute.

2036

02:16:49.385 --> 02:16:50.445

And that's good as long as

2037

02:16:50.445 --> 02:16:51.605

you're doing things that are similar.

2038

02:16:51.705 --> 02:16:54.605

And as long as you have experienced testing teams who,

2039

02:16:54.745 --> 02:16:58.325

who have experienced the knowledge that they can rely on.

2040

02:16:58.545 --> 02:17:00.405

But what happens if you have a new test team

2041

02:17:00.625 --> 02:17:02.685

or what happens if you're doing, uh, um,

2042

02:17:02.715 --> 02:17:06.045

test on a new system that you haven't looked at before?

2043

02:17:06.305 --> 02:17:08.925

For example, my squadron also did KC 46 testing,

2044

02:17:09.505 --> 02:17:12.845

and the mishaps and hazards associated with KC 46 testing

2045

02:17:13.185 --> 02:17:15.725

and KC 1 35 testing are gonna be roughly the same.

2046

02:17:16.065 --> 02:17:19.405

We care about mid-air collision, we care about boom strikes,

2047

02:17:19.405 --> 02:17:21.565

we care about fuel system compatibility.

2048

02:17:22.225 --> 02:17:23.725

Um, but the causes

2049

02:17:23.725 --> 02:17:25.485

of those mishaps are going to be different.

2050

02:17:25.585 --> 02:17:28.525

We have a remote vision system now, instead of looking out

2051

02:17:28.525 --> 02:17:33.205

of a window, we have a flyby wire boom instead of a a, um,

2052

02:17:33.895 --> 02:17:35.205

hydro mechanical boom.

2053

02:17:35.825 --> 02:17:38.445

So the reason that those hazards

2054

02:17:38.445 --> 02:17:40.485

and mishaps occur are going to be different.

2055

02:17:40.945 --> 02:17:45.245

And if, if we have a methodology such as STPA to go

2056

02:17:45.245 --> 02:17:47.005

and look at that, uh, that's really helpful

2057

02:17:47.005 --> 02:17:50.245

because we may not be able to rely just on past judgment

2058

02:17:50.305 --> 02:17:53.925

and experience with, uh, other, other MDSs.

2059

02:17:55.105 --> 02:17:58.405

So I got the great opportunity to go to MIT,

2060

02:17:58.905 --> 02:18:01.645

and uh, the first semester I took Professor Leviton's class,

2061

02:18:02.105 --> 02:18:04.765

and I think the first day you could literally see a light

2062

02:18:04.765 --> 02:18:06.005

bulb above my head.

2063

02:18:06.425 --> 02:18:08.965

Uh, it, it was all of the issues

2064

02:18:08.965 --> 02:18:10.245

that I've seen over my career.

2065

02:18:11.025 --> 02:18:13.725

Uh, were right here, there, there's a way

2066

02:18:13.945 --> 02:18:15.605
to resolve a lot of those issues.

2067

02:18:16.025 --> 02:18:18.045
So I'm very passionate about SCPA.

2068

02:18:18.165 --> 02:18:23.125
I believe that it is a good opportunity to, to solve a lot

2069

02:18:23.125 --> 02:18:25.805
of these issues, uh, that, that, that exist.

2070

02:18:25.865 --> 02:18:28.365
And I'm sure you all have seen similar issues in,

2071

02:18:28.365 --> 02:18:30.885
in your various organizations in your careers as well.

2072

02:18:33.025 --> 02:18:34.205
So why do we need something new?

2073

02:18:34.205 --> 02:18:35.565
This was touched on yesterday.

2074

02:18:36.065 --> 02:18:40.645
Uh, FIA was, um, was created in 1949.

2075

02:18:40.655 --> 02:18:42.725
Fault analysis was in 1962.

2076

02:18:42.995 --> 02:18:46.445
Just because they're old doesn't mean that they're bad.

2077

02:18:46.885 --> 02:18:48.325
I think they're great at what they do.

2078

02:18:48.395 --> 02:18:50.485
They're great for electromechanical systems.

2079

02:18:50.795 --> 02:18:53.045

They're not designed for complex software

2080

02:18:53.275 --> 02:18:54.725
that didn't really exist at the time,

2081

02:18:55.105 --> 02:18:56.205
and they're not really meant

2082

02:18:56.305 --> 02:18:58.645
for human integrated systems either

2083

02:18:58.645 --> 02:19:01.325
because humans don't fail like a, like a valve fails

2084

02:19:01.325 --> 02:19:02.725
or a mechanical system fails,

2085

02:19:03.205 --> 02:19:05.445
software doesn't fail like a valve fails.

2086

02:19:05.905 --> 02:19:08.485
So, um, we've gotten really,

2087

02:19:08.485 --> 02:19:10.765
really good at reliability engineering

2088

02:19:10.875 --> 02:19:12.125
over the last 60 years.

2089

02:19:12.705 --> 02:19:14.725
And you actually see a lot

2090

02:19:14.725 --> 02:19:16.805
of our aerospace accidents are no longer

2091

02:19:16.905 --> 02:19:18.165
due to component failure.

2092

02:19:18.635 --> 02:19:21.485
Most of them are due to behaviors of the system.

2093

02:19:21.585 --> 02:19:24.485

So it's how, how we designed it to operate.

2094

02:19:25.105 --> 02:19:29.415

And, and so what makes STPA different?

2095

02:19:29.415 --> 02:19:31.895

Some of this has already been touched on in previous talks,

2096

02:19:32.235 --> 02:19:35.015

um, but STPA analysis really starts before the design.

2097

02:19:35.205 --> 02:19:37.055

I'll talk about that here in a couple slides.

2098

02:19:37.515 --> 02:19:39.575

It focuses on controlling the system behavior.

2099

02:19:39.575 --> 02:19:41.055

Hopefully you've seen that so far.

2100

02:19:41.675 --> 02:19:44.655

And I think, uh, Dr. Thomas has done a great job showing

2101

02:19:44.755 --> 02:19:47.655

how it considers the entire sociotechnical system,

2102

02:19:48.235 --> 02:19:50.415

not just the aircraft or system that's under test.

2103

02:19:51.935 --> 02:19:53.275

Uh, it has traceability.

2104

02:19:53.335 --> 02:19:56.035

Any good systems engineering approach has traceability,

2105

02:19:56.335 --> 02:19:58.955

and that connects your sy your safety mitigation

2106

02:19:59.455 --> 02:20:01.995

to the associated hazard or mishap.

2107

02:20:03.075 --> 02:20:04.135

It can be reused

2108

02:20:04.155 --> 02:20:06.975

and updated throughout the lifecycle of the system system.

2109

02:20:06.975 --> 02:20:09.135

If you complete an STPA analysis

2110

02:20:09.435 --> 02:20:12.935

and then you make a modification to your system, you can,

2111

02:20:13.075 --> 02:20:17.135

uh, use the traceability associated with STPA to understand

2112

02:20:17.315 --> 02:20:19.295

how you're changing the safety of your system.

2113

02:20:19.845 --> 02:20:20.975

With those modifications

2114

02:20:21.755 --> 02:20:24.895

and the STPA artifacts that you get from the design phase,

2115

02:20:24.895 --> 02:20:27.055

your safety control structure, your mitigation

2116

02:20:27.675 --> 02:20:30.135

can easily flow into your test safety program.

2117

02:20:31.695 --> 02:20:33.195

And I think it's really important to note too,

2118

02:20:33.195 --> 02:20:34.955

that TPA isn't just for safety.

2119

02:20:35.225 --> 02:20:36.475

That loss can be anything.

2120

02:20:36.535 --> 02:20:39.955

It can be mission loss, it can be environmental concerns,

2121

02:20:40.675 --> 02:20:44.115

whatever, whatever your organization cares about, you can,

2122

02:20:44.215 --> 02:20:46.315

you can include in your STP analysis.

2123

02:20:46.615 --> 02:20:49.235

So I look at tpa not just as a safety analysis,

2124

02:20:49.295 --> 02:20:51.835

but really a mission assurance analysis.

2125

02:20:54.905 --> 02:20:56.285

So, uh, yesterday, one

2126

02:20:56.285 --> 02:20:57.765

of the questions was what comes first?

2127

02:20:58.265 --> 02:20:59.445

Uh, the had and hazards

2128

02:20:59.445 --> 02:21:02.085

or the safety control structure in, in my mind,

2129

02:21:02.125 --> 02:21:04.565

I don't know if this is a book answer that, that John Thomas

2130

02:21:04.745 --> 02:21:07.285

or Nancy Levison, um, would agree on,

2131

02:21:07.345 --> 02:21:09.405

but this is how I see it in my brain.

2132

02:21:09.665 --> 02:21:11.405

Uh, you've got your mishaps and hazards,

2133

02:21:11.425 --> 02:21:14.085

and that's your start of a system theoretic analysis.

2134

02:21:14.465 --> 02:21:16.565

Any good systems engineering approach starts

2135

02:21:16.715 --> 02:21:17.805

with high level goals.

2136

02:21:18.105 --> 02:21:20.605

If I'm designing a new cargo aircraft, I'm thinking about

2137

02:21:20.985 --> 02:21:23.485

how much, how much weight do I want it to carry?

2138

02:21:23.915 --> 02:21:26.645

What kind of range do I think it needs to have, uh,

2139

02:21:26.675 --> 02:21:28.765

what types of things do I wanna carry on it

2140

02:21:28.765 --> 02:21:29.845

so I understand the internal

2141

02:21:29.845 --> 02:21:31.245

dimensions that it needs to have.

2142

02:21:31.585 --> 02:21:33.325

So you start with these very high level goals,

2143

02:21:33.385 --> 02:21:35.565

and then from there, you can derive your more

2144

02:21:35.765 --> 02:21:36.845

specific technical requirements.

2145

02:21:37.285 --> 02:21:39.325

STPA is no different than any other systems

2146

02:21:39.645 --> 02:21:41.165

engineering analysis that you might do.

2147
02:21:42.685 --> 02:21:44.745
And then the safety control structure is necessary

2148
02:21:44.885 --> 02:21:47.745
to understand the systems and determine your UCA.

2149
02:21:47.845 --> 02:21:49.505
So out of your safety control structure,

2150
02:21:49.845 --> 02:21:52.345
you get your commands that go from your controllers

2151
02:21:52.345 --> 02:21:53.785
to your processes, and

2152
02:21:53.785 --> 02:21:55.865
that's gonna feed into your unsafe control action.

2153
02:21:56.485 --> 02:21:58.425
And then also from the safety control structure,

2154
02:21:58.725 --> 02:22:02.145
you get the feedback that goes from your processes back

2155
02:22:02.145 --> 02:22:03.825
to the controllers, and you can help,

2156
02:22:04.045 --> 02:22:07.665
you can use the feedback to help derive your scenarios.

2157
02:22:09.715 --> 02:22:12.935
And, uh, another thing to know this is the traceability.

2158
02:22:13.195 --> 02:22:15.215
So your, your scenarios trace back

2159
02:22:15.215 --> 02:22:17.615
to your unsafe control actions, which trace back

2160
02:22:17.615 --> 02:22:20.535

to your hazards, which trace back to your mishaps.

2161

02:22:20.915 --> 02:22:22.855

So as you go through this analysis,

2162

02:22:23.035 --> 02:22:26.045

you can see in the sub-bullet I have there hazard one,

2163

02:22:27.685 --> 02:22:29.165

mishap one, mishap two.

2164

02:22:29.425 --> 02:22:30.725

That's how I, I write it.

2165

02:22:30.725 --> 02:22:32.565

So I would say whatever my hazard one is,

2166

02:22:32.585 --> 02:22:34.725

and then in parentheses, I would identify

2167

02:22:34.795 --> 02:22:36.485

what mishaps it traces to.

2168

02:22:36.795 --> 02:22:37.925

Same with ucas.

2169

02:22:38.465 --> 02:22:42.205

And that's, that's really key for, for a lot of utility, uh,

2170

02:22:42.205 --> 02:22:43.445

with, with s tpa.

2171

02:22:44.395 --> 02:22:46.255

The other thing, another question I was asked is,

2172

02:22:46.475 --> 02:22:48.095

how do you know if you've captured everything?

2173

02:22:48.615 --> 02:22:51.335

I don't think in any analysis that exists, you're gonna know

2174

02:22:51.395 --> 02:22:53.135
for sure that you've captured everything.

2175

02:22:53.595 --> 02:22:55.815
But, um, this traceability makes you

2176

02:22:55.925 --> 02:22:57.535
revisit the previous step.

2177

02:22:58.035 --> 02:23:00.255
So if you, if you look at your hazards

2178

02:23:00.515 --> 02:23:02.855
and your tracing your hazard back to your mishap,

2179

02:23:02.875 --> 02:23:05.095
and you think, I don't really have a mishap

2180

02:23:05.095 --> 02:23:08.335
that trace traces to this hazard, um, that's,

2181

02:23:08.395 --> 02:23:10.335
that's an opportunity for you to step back

2182

02:23:10.335 --> 02:23:11.975
and think, well, what, what am I missing

2183

02:23:12.345 --> 02:23:13.575
about this analysis?

2184

02:23:16.355 --> 02:23:17.935
All right, I have a few of these little orange boxes

2185

02:23:17.935 --> 02:23:19.015
throughout my presentation.

2186

02:23:19.055 --> 02:23:21.735
I wasn't sure how interactive this is going be.

2187

02:23:22.235 --> 02:23:24.415

Um, so this is just some food for thought.

2188

02:23:24.415 --> 02:23:26.215

If we have time at the end in the qa,

2189

02:23:26.235 --> 02:23:27.775

we can go back and talk about these.

2190

02:23:27.925 --> 02:23:29.975

Otherwise, you can think about it on your own

2191

02:23:29.995 --> 02:23:31.135

if you review these slides.

2192

02:23:31.635 --> 02:23:34.215

So the first one is, what happens if your UCA

2193

02:23:34.405 --> 02:23:35.655

doesn't trace to a hazard?

2194

02:23:36.035 --> 02:23:39.535

So think, think about what that might mean in your analysis.

2195

02:23:42.915 --> 02:23:45.475

I, I'll jump into TPA applied to design.

2196

02:23:46.575 --> 02:23:49.635

So again, TPA is focused on system behavior,

2197

02:23:50.015 --> 02:23:53.275

and they can be used very early in the design phase, um,

2198

02:23:53.535 --> 02:23:56.515

or in your requirements definition phase based on whatever

2199

02:23:56.515 --> 02:23:57.915

your intended functionality might be.

2200

02:23:58.575 --> 02:24:03.195

So, um, since I did a lot of AR testing, i, I tend to use

2201

02:24:03.195 --> 02:24:04.275
that as an example a lot.

2202

02:24:04.415 --> 02:24:06.435
So let's pretend it's, you know, uh,

2203

02:24:06.525 --> 02:24:09.875
we've never had an aerial refueling aircraft before 2020.

2204

02:24:09.895 --> 02:24:12.755
We decided it's high time to have that capability,

2205

02:24:13.865 --> 02:24:15.285
but we don't, we don't know what it's gonna look like.

2206

02:24:15.745 --> 02:24:18.525
Um, if, if anyone's familiar with systems architecture,

2207

02:24:19.025 --> 02:24:22.085
the things often stated in systems architecture is

2208

02:24:22.085 --> 02:24:23.245
form follows function.

2209

02:24:23.545 --> 02:24:26.325
We have to understand the functionality that we want to have

2210

02:24:26.665 --> 02:24:29.765
before we ever start getting into the actual physical form

2211

02:24:30.065 --> 02:24:31.605
of the system that we're designing.

2212

02:24:32.225 --> 02:24:33.965
So right now, we're just thinking function.

2213

02:24:34.305 --> 02:24:36.525
You've got the refuel, you've got the receiver.

2214

02:24:36.865 --> 02:24:38.445

We don't really know what these look like,

2215

02:24:39.025 --> 02:24:42.805

and we need to define the interactions between, uh,

2216

02:24:42.935 --> 02:24:46.205

these two, these two, uh, functional systems.

2217

02:24:46.785 --> 02:24:47.845

So I threw a few up here.

2218

02:24:47.845 --> 02:24:50.285

This is certainly not, uh, an all inclusive list,

2219

02:24:50.825 --> 02:24:52.885

but I thought it, well, the receiver needs to be able

2220

02:24:52.885 --> 02:24:55.285

to tell the refuel that it's ready for fuel.

2221

02:24:56.215 --> 02:24:59.605

Maybe it needs to tell the refuel if there's some kind

2222

02:24:59.605 --> 02:25:01.165

of abnormal condition that it's seen.

2223

02:25:01.505 --> 02:25:04.005

And it should tell the refuel when it, when it's ready for,

2224

02:25:04.225 --> 02:25:08.445

uh, fuel to be stopped for the refuel,

2225

02:25:09.105 --> 02:25:11.645

it maybe needs to tell the receiver that fuel's flowing.

2226

02:25:12.305 --> 02:25:15.405

It needs to tell the receiver if it's in a safe

2227

02:25:15.785 --> 02:25:16.805

or unsafe position.

2228

02:25:17.265 --> 02:25:19.085

And then again, maybe if there's some kind

2229

02:25:19.085 --> 02:25:20.685

of abnormal condition that it's seeing.

2230

02:25:21.025 --> 02:25:24.085

So at this point, we're just looking at functionality.

2231

02:25:24.295 --> 02:25:25.925

We're not saying how it's going to be done.

2232

02:25:25.945 --> 02:25:28.565

It could be voice, it could be some kind of wifi network.

2233

02:25:28.985 --> 02:25:31.565

It can be, you know, uh, hardwired into

2234

02:25:32.205 --> 02:25:34.965

whatever methodology we use to, to actually pass the fuel.

2235

02:25:34.965 --> 02:25:37.645

There's a variety of ways that you can accomplish that,

2236

02:25:37.955 --> 02:25:39.565

this communication in this interaction.

2237

02:25:39.565 --> 02:25:40.685

At this point, we don't care.

2238

02:25:40.945 --> 02:25:42.325

We just need to define

2239

02:25:42.715 --> 02:25:44.445

what the appropriate interactions are.

2240

02:25:45.815 --> 02:25:47.955

And then you can conduct your s tpa a analysis.

2241

02:25:47.955 --> 02:25:50.635

Obviously, this is a very, very high level analysis, right?

2242

02:25:51.255 --> 02:25:53.555

And out of that, you can get safety requirements,

2243

02:25:53.855 --> 02:25:55.635

and those should feed into your

2244

02:25:55.635 --> 02:25:57.035

technical requirements definition.

2245

02:25:57.035 --> 02:26:00.515

Just like any other, um, definition you may have, like,

2246

02:26:00.655 --> 02:26:02.875

you know, how much gas you want the refuel to be able

2247

02:26:02.875 --> 02:26:05.355

to hold, uh, those types of requirements,

2248

02:26:05.545 --> 02:26:07.235

they should feed into it just the same

2249

02:26:07.235 --> 02:26:08.795

as any other technical requirements.

2250

02:26:09.095 --> 02:26:10.555

And once you get out of this, is

2251

02:26:10.555 --> 02:26:12.635

that your safety mitigations are baked into your

2252

02:26:12.635 --> 02:26:13.755

design, which is really awesome.

2253

02:26:14.355 --> 02:26:16.995

I gave this talk, uh, I guess it's been about a year now,

2254

02:26:17.695 --> 02:26:20.955

and there were, there was an airworthiness guru in the room,

2255

02:26:22.015 --> 02:26:25.635

and he told me that, um, he didn't think there was any way

2256

02:26:25.635 --> 02:26:27.955

that you can analyze the safety of your system

2257

02:26:28.445 --> 02:26:30.475

until you have the system completely designed.

2258

02:26:30.895 --> 02:26:32.435

And if you're using fault tree analysis

2259

02:26:32.435 --> 02:26:33.555

or fia, that might be the case,

2260

02:26:33.625 --> 02:26:35.755

because at this point, we don't have components.

2261

02:26:35.895 --> 02:26:37.395

So you can't look at component failure.

2262

02:26:37.695 --> 02:26:39.635

But when you're talking about system behavior

2263

02:26:39.975 --> 02:26:44.035

and expected functionality, you absolutely can look at, um,

2264

02:26:44.855 --> 02:26:47.795

at safety and do an analysis very early on.

2265

02:26:48.535 --> 02:26:51.635

And I think that's a very powerful, um, aspect of,

2266

02:26:54.665 --> 02:26:57.985

a lot of you are familiar with the OODA loop, I imagine.

2267

02:26:58.405 --> 02:27:01.665

So if you're not, um, it was created by Colonel John Boyd.

2268

02:27:01.775 --> 02:27:04.465

It's observe, orient, decide, and act.

2269

02:27:04.885 --> 02:27:08.025

Uh, so if you're in conflict with someone, you're going

2270

02:27:08.025 --> 02:27:10.905

to observe the situation, orient yourself to that, uh,

2271

02:27:11.305 --> 02:27:13.025

situation, decide on what you need

2272

02:27:13.025 --> 02:27:14.265

to do, and then you're gonna go do it.

2273

02:27:14.525 --> 02:27:18.185

And then you're gonna observe the effects of that act and,

2274

02:27:18.245 --> 02:27:19.585

and go through the whole loop again.

2275

02:27:20.205 --> 02:27:22.385

Um, professor Levison has a similar loop.

2276

02:27:22.385 --> 02:27:26.665

I've adapted it here to design, analyze, mitigate.

2277

02:27:26.845 --> 02:27:29.225

So you come up with a high level functional design, kind

2278

02:27:29.225 --> 02:27:31.425

of like what I just showed you with the refuel and receiver.

2279

02:27:31.845 --> 02:27:32.865

You analyze it,

2280

02:27:33.525 --> 02:27:36.145

you incorporate those mitigations into your design.

2281

02:27:36.645 --> 02:27:40.705

And as you, um, as you detail your design, um,

2282

02:27:41.495 --> 02:27:44.745

more and more go from, you know, PDR to CDR, et cetera,

2283

02:27:45.165 --> 02:27:49.225

you can continually, um, uh, go through this design loop

2284

02:27:49.805 --> 02:27:53.305

and continue to bake safety into your design.

2285

02:27:56.005 --> 02:27:57.265

So John showed, uh,

2286

02:27:57.265 --> 02:27:59.225

John Thomas showed the technical processes,

2287

02:27:59.365 --> 02:28:01.385

or excuse me, showed the V yesterday.

2288

02:28:01.845 --> 02:28:03.945

Um, so I think what's really important

2289

02:28:03.945 --> 02:28:05.545

to know here is the tighter that your

2290

02:28:06.085 --> 02:28:07.825

design decision loop is coupled,

2291

02:28:08.125 --> 02:28:10.345

the faster the constraints will be identified.

2292

02:28:10.445 --> 02:28:12.585

And that's gonna reduce design rework.

2293

02:28:12.885 --> 02:28:15.625

So imagine in your requirements developed, you realize

2294

02:28:15.625 --> 02:28:17.745

that you need, there's certain safety mitigations

2295

02:28:17.745 --> 02:28:19.385

that you need to make, um,

2296

02:28:19.645 --> 02:28:20.945
to make sure that the system is safe.

2297

02:28:21.305 --> 02:28:24.485
And you find that out there instead of, uh, you've,

2298

02:28:24.485 --> 02:28:27.085
you've integrated your system, you're doing ground test

2299

02:28:27.085 --> 02:28:29.165
or flight test, and now you find out

2300

02:28:29.165 --> 02:28:30.925
that there's a safety mitigation that you've missed.

2301

02:28:31.185 --> 02:28:33.925
You've wasted a lot of time, you've wasted a lot of money.

2302

02:28:34.385 --> 02:28:38.725
And unfortunately, in a world of constrained, um, finances

2303

02:28:38.725 --> 02:28:40.645
that we live in, there's a chance that

2304

02:28:40.645 --> 02:28:42.565
that safety mitigation never gets made.

2305

02:28:42.825 --> 02:28:46.045
The earlier that you make these changes in your design

2306

02:28:46.045 --> 02:28:48.805
process, the less it's gonna cost, um,

2307

02:28:48.915 --> 02:28:50.725
both in time and in money.

2308

02:28:51.425 --> 02:28:53.565
So, uh, it's, it's highly important

2309

02:28:53.715 --> 02:28:56.085
that we bake these safety mitigations in

2310

02:28:56.695 --> 02:28:58.725
early in the design process as we can.

2311

02:28:59.105 --> 02:29:01.645
And of course, it's gonna reduce the prizes once you get

2312

02:29:01.645 --> 02:29:02.765
to the right side of the V.

2313

02:29:02.905 --> 02:29:05.165
And we get into, into flight testing, ground tests.

2314

02:29:08.575 --> 02:29:12.515
So again, these, these STP requirements can be tested just

2315

02:29:12.515 --> 02:29:14.035
like any other technical requirement.

2316

02:29:14.055 --> 02:29:18.315
If you say that, um, uh, system A needs to talk to system B,

2317

02:29:18.315 --> 02:29:20.715
it needs to provide a certain message at a certain time,

2318

02:29:21.015 --> 02:29:22.475
you can test that and,

2319

02:29:22.475 --> 02:29:25.195
and make sure that, that it's working as you expect.

2320

02:29:25.695 --> 02:29:27.635
Uh, so that's, that's really important part

2321

02:29:27.635 --> 02:29:28.835
about s TPA as well.

2322

02:29:29.535 --> 02:29:31.235

And if, if you get into tests

2323

02:29:31.535 --> 02:29:33.635

and your system of behavior isn't as expected,

2324

02:29:33.745 --> 02:29:37.235

there's a few things that, that are, are possibly causing

2325

02:29:37.275 --> 02:29:39.395

that maybe your design was flawed,

2326

02:29:39.395 --> 02:29:40.915

it didn't meet the requirements,

2327

02:29:41.735 --> 02:29:43.755

or the operation of the system was not within

2328

02:29:44.175 --> 02:29:45.315

the expected bounds.

2329

02:29:45.735 --> 02:29:49.635

Uh, so maybe the assumptions that went into the design were,

2330

02:29:49.745 --> 02:29:54.515

were not right, or, um, the, the test was not designed, uh,

2331

02:29:54.735 --> 02:29:56.395

within the operation of the system.

2332

02:29:58.245 --> 02:30:00.985

And then the last one is the safety requirement was not

2333

02:30:00.985 --> 02:30:02.065

written adequately.

2334

02:30:02.405 --> 02:30:07.265

Uh, s CPA A is, is going to be performed

2335

02:30:07.285 --> 02:30:08.905

by humans, and humans make mistakes.

2336

02:30:08.925 --> 02:30:12.785

And there's the opportunity that we, we ride a mitigation,

2337

02:30:12.845 --> 02:30:14.865

it turns out that, you know, maybe that wasn't written

2338

02:30:14.925 --> 02:30:16.105

as well as it could have been.

2339

02:30:16.525 --> 02:30:19.225

So what you can do with those, um, results,

2340

02:30:19.325 --> 02:30:23.025

if you see system behavior that's not expected, is, is feed

2341

02:30:23.025 --> 02:30:26.425

that back into your STPA analysis to resolve deficiencies.

2342

02:30:26.645 --> 02:30:27.665

And that's really important

2343

02:30:27.665 --> 02:30:30.745

because now you're gonna get a systemic fix to whatever

2344

02:30:31.175 --> 02:30:32.305

that deficiency is.

2345

02:30:32.635 --> 02:30:35.345

Often, I'm sure you all have seen it, when we,

2346

02:30:35.345 --> 02:30:38.265

when we find efficiencies, often we do bandaid fixes.

2347

02:30:38.605 --> 02:30:40.745

That's partly due to the constrained fiscal

2348

02:30:40.805 --> 02:30:42.185

and time environment that we live in.

2349

02:30:42.565 --> 02:30:45.185

And that may also be because of our knowledge of the system.

2350

02:30:45.685 --> 02:30:48.145

So if we're, if we have an SDPA analysis

2351

02:30:48.145 --> 02:30:49.585

that's already been completed,

2352

02:30:50.005 --> 02:30:53.705

and we can feed these results from test back into

2353

02:30:53.705 --> 02:30:57.225

that analysis, we're gonna get a much better solution, uh,

2354

02:30:57.225 --> 02:30:58.265

for those deficiencies.

2355

02:31:00.485 --> 02:31:02.745

Now, I'll get into, uh, test safety.

2356

02:31:03.765 --> 02:31:06.425

So this should look familiar to a lot of you.

2357

02:31:06.425 --> 02:31:08.705

This is traditionally how we do test safety planning.

2358

02:31:09.485 --> 02:31:12.585

Uh, first we identify the test unique hazards.

2359

02:31:13.035 --> 02:31:14.985

We're focusing again, on, on test unique.

2360

02:31:15.045 --> 02:31:17.665

We don't, we don't care about everything else if it doesn't

2361

02:31:17.665 --> 02:31:19.725

apply to our particular, uh, test program

2362

02:31:19.725 --> 02:31:20.805

that we're gonna go out and do,

2363

02:31:21.025 --> 02:31:22.285
and there's a variety of ways

2364

02:31:22.395 --> 02:31:24.685
that you can gather that information.

2365

02:31:24.805 --> 02:31:27.365
I put a few there. There's, uh, surely many more.

2366

02:31:27.865 --> 02:31:29.365
Uh, you can go back and look at other

2367

02:31:29.365 --> 02:31:30.805
tests or similar tests.

2368

02:31:31.335 --> 02:31:33.405
There should be a system safety hazard analysis

2369

02:31:33.405 --> 02:31:35.525
that was completed for your particular system.

2370

02:31:36.095 --> 02:31:39.085
Maybe there were other safety reviews along the way

2371

02:31:39.145 --> 02:31:41.005
during development that you can look at.

2372

02:31:41.585 --> 02:31:44.565
Uh, if there's aircraft, uh, modification documents

2373

02:31:44.585 --> 02:31:46.365
or other manuals, that type of thing

2374

02:31:46.365 --> 02:31:47.805
that have been developed, you can look at that

2375

02:31:49.505 --> 02:31:51.285
and then we're going to attempt to eliminate

2376

02:31:51.285 --> 02:31:52.405

or control those hazards.

2377

02:31:52.825 --> 02:31:55.845

And there's a variety of ways that you can do that as well.

2378

02:31:56.985 --> 02:31:58.565

And some are more effective than others.

2379

02:31:59.145 --> 02:32:02.485

Um, test design test methodology are,

2380

02:32:02.785 --> 02:32:07.085

are more effective than, uh, a, a caution or a warning.

2381

02:32:08.185 --> 02:32:09.605

And then once you've done that work,

2382

02:32:09.905 --> 02:32:11.085

now we document it for approval.

2383

02:32:11.105 --> 02:32:13.005

And that's gonna be different for every organization.

2384

02:32:13.545 --> 02:32:15.125

Uh, at the Air Force Test Center,

2385

02:32:15.145 --> 02:32:16.765

we use general minimizing procedures

2386

02:32:16.765 --> 02:32:18.125

and test hazard analysis.

2387

02:32:19.255 --> 02:32:20.515

And this is really effective.

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02:32:20.535 --> 02:32:23.435

If you have experienced teams, you have well-known systems,

2389

02:32:24.535 --> 02:32:25.995

um, that, that you can,

2390
02:32:26.185 --> 02:32:28.755
that you can rely on, uh, to do this work.

2391
02:32:28.935 --> 02:32:30.915
But what happens if you have a young team

2392
02:32:31.265 --> 02:32:33.595
that doesn't have decades of experience,

2393
02:32:33.595 --> 02:32:36.315
or you're doing something completely new in the Air Force?

2394
02:32:36.375 --> 02:32:38.035
You know, we're looking more at ai,

2395
02:32:38.045 --> 02:32:39.795
we're looking more at autonomy.

2396
02:32:39.885 --> 02:32:41.995
We're looking at these high speed weapons, all sorts

2397
02:32:41.995 --> 02:32:44.915
of different things that we have going on that are new.

2398
02:32:45.175 --> 02:32:47.595
So we don't have decades of experience

2399
02:32:47.975 --> 02:32:51.595
to fall back on in order to, uh, complete the,

2400
02:32:51.595 --> 02:32:52.755
this test safety planning.

2401
02:32:53.015 --> 02:32:54.955
So it's more likely that we're gonna miss things.

2402
02:32:55.335 --> 02:32:57.635
And again, we, we may understand the mishaps

2403
02:32:57.635 --> 02:32:59.075

and hazards really well, but

2404

02:32:59.075 --> 02:33:01.435

that doesn't mean we understand the causes and the scenarios

2405

02:33:01.775 --> 02:33:03.195

and the unsafe control actions

2406

02:33:03.585 --> 02:33:06.395

that could realize those mishaps and hazards.

2407

02:33:09.205 --> 02:33:12.345

Uh, so this is test safety planning with STPA,

2408

02:33:12.685 --> 02:33:13.985

it looks very similar.

2409

02:33:14.285 --> 02:33:16.185

So when we want to, I, ID

2410

02:33:16.205 --> 02:33:19.705

or test unique hazards, we, we develop our losses

2411

02:33:19.805 --> 02:33:22.505

and we develop our hazards that first, the first two steps

2412

02:33:22.725 --> 02:33:25.865

of TPA to eliminate or control those hazards.

2413

02:33:26.205 --> 02:33:28.825

We, uh, develop our safety control structure.

2414

02:33:28.925 --> 02:33:32.185

We come up with our ucas, we develop our scenarios,

2415

02:33:32.565 --> 02:33:34.705

and then that leads to our mitigations when we

2416

02:33:34.705 --> 02:33:36.065

implement those mitigations.

2417

02:33:36.725 --> 02:33:37.865

And then your documentation

2418

02:33:37.865 --> 02:33:40.665

for approval is gonna look like whatever you normally do

2419

02:33:40.965 --> 02:33:42.585

for your particular organization.

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02:33:43.185 --> 02:33:44.985

SCPA can be done completely in the background,

2421

02:33:45.125 --> 02:33:48.305

and then you can translate it into your current

2422

02:33:48.745 --> 02:33:49.905

documentation processes.

2423

02:33:54.465 --> 02:33:58.225

Changing, uh, changing a little bit into a reuse case,

2424

02:33:58.585 --> 02:33:59.945

I think it's been mentioned a couple times

2425

02:34:00.095 --> 02:34:03.105

that you can reuse an STPA analysis.

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02:34:03.645 --> 02:34:07.025

So before I, uh, came out to the Pentagon, I worked

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02:34:07.025 --> 02:34:09.265

with an organization that was doing some weapons testing.

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02:34:09.335 --> 02:34:11.265

They had a few different weapons that they were going

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02:34:11.265 --> 02:34:14.305

to be testing over a relatively short period of time.

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02:34:14.685 --> 02:34:16.185

The weapons were still being developed,

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02:34:16.205 --> 02:34:18.445

so they didn't have a ton of system knowledge

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02:34:18.865 --> 02:34:20.645

for the weapons, but they still wanted to go ahead

2433

02:34:20.645 --> 02:34:22.165

and try to do an s st p analysis.

2434

02:34:22.585 --> 02:34:26.885

So what we looked at was you can do a higher level, uh,

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02:34:26.905 --> 02:34:30.845

safety analysis and treat that weapon as a black box.

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02:34:31.025 --> 02:34:33.325

And then once you have the data for that weapon,

2437

02:34:33.465 --> 02:34:36.325

you can incorporate that into your TP analysis.

2438

02:34:36.625 --> 02:34:38.845

And 90% of the work, 95%

2439

02:34:38.845 --> 02:34:41.205

of the work has already been completed.

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02:34:42.435 --> 02:34:45.935

So in this case, the blue box would stay the same,

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02:34:46.515 --> 02:34:49.615

and then though the, um, weapon, you would just change

2442

02:34:49.615 --> 02:34:50.655

that out as necessary.

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02:34:50.995 --> 02:34:54.455

Now, important caveat here is you need to verify

2444

02:34:54.455 --> 02:34:57.495

that your commands and feedback are, uh, to the weapon

2445

02:34:57.875 --> 02:34:59.815

and from the weapon are still accurate.

2446

02:35:00.005 --> 02:35:02.175

There's a possibility that, that

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02:35:02.325 --> 02:35:04.535

because these are different vendors, that

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02:35:05.085 --> 02:35:06.615

that could be different unless that

2449

02:35:06.685 --> 02:35:09.575

that was specified in the contract and in the design.

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02:35:11.535 --> 02:35:14.355

Uh, so this, this can be used in a lot of different ways.

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02:35:14.535 --> 02:35:18.035

So your next food for thought is what other testing, uh,

2452

02:35:18.035 --> 02:35:20.555

that you do in your particular organization or you've seen

2453

02:35:20.695 --> 02:35:23.635

before would work well for reuse.

2454

02:35:27.565 --> 02:35:30.655

Another thing to point out here too is, is that this is,

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02:35:30.655 --> 02:35:34.655

this is really good if you, unfortunately, a lot of times

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02:35:35.245 --> 02:35:38.655

with, uh, safety planning, that's, that's the one thing

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02:35:38.655 --> 02:35:40.855

that's keeping you from your test, test planning.

2458

02:35:40.855 --> 02:35:43.455

Usually, at least in the Air Force test planning usually

2459

02:35:43.455 --> 02:35:45.135

takes a little bit longer than expected.

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02:35:45.765 --> 02:35:46.815

It's hard to, it's hard

2461

02:35:46.815 --> 02:35:47.895

to do your safety planning if

2462

02:35:47.895 --> 02:35:49.015

your test plan is not complete.

2463

02:35:49.235 --> 02:35:50.455

And then we're squished in the middle

2464

02:35:50.715 --> 02:35:52.695

and we're trying to go as fast as we can

2465

02:35:52.975 --> 02:35:53.975

because no one wants

2466

02:35:53.975 --> 02:35:56.015

to change the date that the test starts.

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02:35:56.395 --> 02:35:57.655

So you're, you're running pretty

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02:35:57.655 --> 02:35:58.895

quickly to make this happen.

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02:35:59.405 --> 02:36:03.655

Well, if, uh, if you use some of a methodology like this,

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02:36:03.655 --> 02:36:06.455

you may be able to do a lot of your safety planning um,

2471

02:36:06.525 --> 02:36:07.975
upfront, even if some

2472

02:36:07.975 --> 02:36:09.935
of your test planning isn't completed yet.

2473

02:36:10.315 --> 02:36:12.335
So it gives you that opportunity as well.

2474

02:36:12.835 --> 02:36:15.735
And in, in the ideal land, uh,

2475

02:36:16.795 --> 02:36:19.895
you would incorporate SCPA into your test planning as well.

2476

02:36:22.475 --> 02:36:25.365
Alright, so last week I sat in on the Agility

2477

02:36:25.495 --> 02:36:26.805
Prime virtual event.

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02:36:26.985 --> 02:36:30.045
It was really well done. Um, for those who haven't heard

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02:36:30.045 --> 02:36:34.405
of Agility Prime, it's a new Air Force program, um,

2480

02:36:34.705 --> 02:36:38.925
really to create an EV toll, um, uh, ecosystem.

2481

02:36:39.385 --> 02:36:42.325
So there's gonna be a series of air races, um,

2482

02:36:42.765 --> 02:36:45.925
companies will be put on contract to bring vehicles out,

2483

02:36:46.225 --> 02:36:49.925
air vehicles out to participate in these air races.

2484

02:36:50.585 --> 02:36:53.005

So it's a, it'll be really neat to see how this goes,

2485

02:36:53.585 --> 02:36:55.245

but, um, that prevent,

2486

02:36:55.245 --> 02:36:57.445

that presents some interesting safety challenges

2487

02:36:57.445 --> 02:37:00.445

because we're gonna have multiple vendors, multiple systems

2488

02:37:00.915 --> 02:37:04.925

with all, all sorts of, uh, unique, um, designs.

2489

02:37:06.145 --> 02:37:09.165

So how, how can you do safety planning ahead of time

2490

02:37:09.415 --> 02:37:12.125

where you can treat the EV toll system as a black box,

2491

02:37:12.155 --> 02:37:14.685

just like we did with the weapons, um,

2492

02:37:15.185 --> 02:37:16.365

in the previous slide?

2493

02:37:16.625 --> 02:37:18.805

And you can, you may be able to answer a lot of questions

2494

02:37:18.805 --> 02:37:21.405

before you've even seen the actual set itself.

2495

02:37:21.985 --> 02:37:24.965

Uh, so do you want contractors piloting their own aircraft?

2496

02:37:25.665 --> 02:37:27.605

If so, what type of certifications

2497

02:37:27.605 --> 02:37:30.405

or training that do they need to go fly at, at Uter

2498

02:37:30.425 --> 02:37:32.085
or Yuma or wherever it might be?

2499

02:37:33.025 --> 02:37:35.845
Um, what, what does range safety need in order

2500

02:37:35.845 --> 02:37:37.645
to feel comfortable with, with that?

2501

02:37:37.945 --> 02:37:39.525
How do we deconflict the airspace?

2502

02:37:39.895 --> 02:37:42.605
We're gonna have multiple EV toll aircraft at the same

2503

02:37:42.605 --> 02:37:43.725
time, one at a time.

2504

02:37:44.225 --> 02:37:45.845
All sorts of different things that we can think

2505

02:37:45.845 --> 02:37:48.525
through using a high level safety control structure

2506

02:37:48.835 --> 02:37:52.005
with the EV toll black box, uh, ahead of time.

2507

02:37:52.265 --> 02:37:55.885
And that gives us a huge leg up in trying to be thoughtful

2508

02:37:55.885 --> 02:37:57.165
and answer a lot of questions.

2509

02:37:57.455 --> 02:37:59.365
We're not rushing at the end when we finally know

2510

02:37:59.365 --> 02:38:00.445
what these things are gonna look like.

2511

02:38:02.775 --> 02:38:04.315

So, another food for thought is,

2512

02:38:04.425 --> 02:38:08.315

what other questions can you answer without knowing, um,

2513

02:38:08.955 --> 02:38:11.995

specifics about the system in this particular type of a case

2514

02:38:11.995 --> 02:38:14.915

where you have multiple vendors coming out to do a test?

2515

02:38:17.885 --> 02:38:20.255

Switching gears, again, this has been, uh,

2516

02:38:20.445 --> 02:38:21.495

mentioned a little bit.

2517

02:38:21.535 --> 02:38:24.295

I wanted to explain a little bit more about what CAST is.

2518

02:38:24.685 --> 02:38:27.255

CAST is causal analysis using systems theory.

2519

02:38:27.515 --> 02:38:31.135

So STPA, as Dr. Thomas talked about a little bit earlier,

2520

02:38:31.855 --> 02:38:35.935

SCPA is used before the mishap occurs, and cast is used

2521

02:38:35.935 --> 02:38:37.215

after a mishap has occurred.

2522

02:38:37.355 --> 02:38:39.775

So now we, we, instead of possible mishaps

2523

02:38:39.775 --> 02:38:41.855

that you have using TPA, you know,

2524

02:38:41.855 --> 02:38:43.535

what the mishap was because it happened.

2525

02:38:44.075 --> 02:38:45.775

And CAST is important

2526

02:38:45.775 --> 02:38:47.895

because it provides actionable information

2527

02:38:48.315 --> 02:38:50.575

to improve the sociotechnical system,

2528

02:38:51.275 --> 02:38:53.415

and you can feed those results into

2529

02:38:53.675 --> 02:38:57.615

and up your previous SCPA analysis if that's been completed.

2530

02:38:57.835 --> 02:39:00.095

So I have my, my design loop there

2531

02:39:00.595 --> 02:39:03.335

and show how mitigation that come out

2532

02:39:03.335 --> 02:39:06.535

of your cast analysis can feed back into your design,

2533

02:39:06.955 --> 02:39:09.295

and that that might be the aircraft design,

2534

02:39:09.475 --> 02:39:12.015

or it might be your entire sociotechnical design.

2535

02:39:13.525 --> 02:39:16.005

I think what's important about this is it doesn't just

2536

02:39:16.075 --> 02:39:18.045

prevent like mishaps.

2537

02:39:18.425 --> 02:39:21.125

Um, if fixes the entire system that allowed the mishaps,

2538

02:39:21.265 --> 02:39:24.085

as I mentioned with the small UAS investigations that I did,

2539

02:39:24.465 --> 02:39:27.445

um, we kept having these different technical issues

2540

02:39:27.915 --> 02:39:29.885

that were causing these aircraft to crash.

2541

02:39:30.425 --> 02:39:33.405

But because we were so focused on the, the technical issue,

2542

02:39:33.945 --> 02:39:36.805

we, we, we never looked at what,

2543

02:39:36.995 --> 02:39:38.165

what is it about this program

2544

02:39:38.275 --> 02:39:39.885

that makes us keep crashing planes?

2545

02:39:40.265 --> 02:39:42.245

And so that's, that's really important to look at.

2546

02:39:42.245 --> 02:39:43.885

Otherwise, you're gonna be playing whack-a-mole,

2547

02:39:44.105 --> 02:39:45.405

you solve this technical problem,

2548

02:39:45.475 --> 02:39:46.485

then you have another crash,

2549

02:39:46.485 --> 02:39:47.365

you solve this technical

2550

02:39:47.365 --> 02:39:48.405

problem, then you have another crash.

2551

02:39:48.905 --> 02:39:52.085

So if you're able to, to, to bring it up to a high level

2552

02:39:52.265 --> 02:39:54.445

and look at it from a systemic perspective,

2553

02:39:55.005 --> 02:39:57.485

I think you'll find a lot of value associated with that.

2554

02:39:59.495 --> 02:40:02.955

I'm gonna go through, um, uh, a cast analysis.

2555

02:40:02.955 --> 02:40:05.595

This is an analysis that I did, um,

2556

02:40:05.695 --> 02:40:07.115

in Professor Leviton's class.

2557

02:40:07.185 --> 02:40:10.035

Some of you may be familiar with it or maybe not.

2558

02:40:10.185 --> 02:40:13.405

It's a Turkish Airlines flight 1951.

2559

02:40:14.065 --> 02:40:17.325

Uh, so just, just as, um, Dr. Thomas said yesterday,

2560

02:40:17.905 --> 02:40:19.485

I'm gonna be going through this quickly.

2561

02:40:19.755 --> 02:40:23.565

It's gonna be, um, um, more superficial.

2562

02:40:23.825 --> 02:40:26.685

Um, no accident is simple. There's a lot that goes into it.

2563

02:40:26.685 --> 02:40:29.645

But just to, to show you an idea of how cast works.

2564

02:40:30.865 --> 02:40:34.045

So for this Circuit Airlines flight in 1951,

2565

02:40:34.225 --> 02:40:37.685

the left radar altimeter failed during a short final.

2566

02:40:38.945 --> 02:40:42.045

The, uh, aircraft flight control system did not recognize

2567

02:40:42.045 --> 02:40:44.685

the failure due to the type of failure that had occurred.

2568

02:40:45.345 --> 02:40:48.565

Um, the aircraft intercepted the glide float from above.

2569

02:40:48.915 --> 02:40:52.565

Once they did that, they selected vertical speed mode, um,

2570

02:40:53.345 --> 02:40:54.965

in order to follow the glide slope.

2571

02:40:55.585 --> 02:40:59.245

And the, the RA fault activated the retard flare mode,

2572

02:40:59.375 --> 02:41:00.965

which cut the throttle, the idle.

2573

02:41:01.605 --> 02:41:03.695

Unfortunately, they were expecting the throttle

2574

02:41:03.695 --> 02:41:06.415

to be reduced because they, they were, you know,

2575

02:41:06.415 --> 02:41:08.255

beginning their, their glide slope descent.

2576

02:41:08.995 --> 02:41:11.495

Um, so they, it looked normal to them.

2577

02:41:12.155 --> 02:41:15.575

Uh, at some point they got towards the stall speed, six,

2578

02:41:15.995 --> 02:41:17.415

six shaker activated.

2579

02:41:17.785 --> 02:41:19.375

There was a safety pilot on board

2580

02:41:19.375 --> 02:41:20.975

because the first officer was in training.

2581

02:41:21.395 --> 02:41:24.175

The safety pilot warned that the airspeed was too low.

2582

02:41:24.915 --> 02:41:26.775

The crew pushed up the throttle,

2583

02:41:26.915 --> 02:41:29.455

but they didn't take the actions that they needed, uh,

2584

02:41:29.475 --> 02:41:31.175

to actually exit retard mode.

2585

02:41:31.515 --> 02:41:32.735

And they remained in it,

2586

02:41:32.805 --> 02:41:34.535

they in the crash short of the runway.

2587

02:41:36.245 --> 02:41:39.345

So, uh, it should be noted here that the, the air crew,

2588

02:41:39.515 --> 02:41:42.025

while the aircraft flight control system did not recognize

2589

02:41:42.025 --> 02:41:45.625

the failure, the air crew did recognize the RA failure,

2590

02:41:46.285 --> 02:41:49.425

and they, they did what they thought was the right thing,

2591

02:41:50.005 --> 02:41:52.465

um, to, to isolate that, that failure

2592

02:41:52.685 --> 02:41:55.385

so they could safely land the aircraft.

2593

02:41:56.745 --> 02:41:58.525

So I'll talk through that real quick.

2594

02:41:59.025 --> 02:42:03.445

So the, the radar altimeter A is what, what failed.

2595

02:42:04.025 --> 02:42:08.285

So what they did is they, they went to FCCB, they thought

2596

02:42:08.285 --> 02:42:12.845

that now the auto throttle would take data from FCCB, uh,

2597

02:42:12.845 --> 02:42:14.165

and that's on the left side there.

2598

02:42:15.195 --> 02:42:17.775

But how the system actually worked was

2599

02:42:17.965 --> 02:42:20.415

that the auto throttle was, was hardwired

2600

02:42:20.435 --> 02:42:22.655

to always take data from radar altimeter.

2601

02:42:22.815 --> 02:42:24.695

A fortunately

2602

02:42:24.695 --> 02:42:28.175

that was not well documented in, uh, the manual.

2603

02:42:28.515 --> 02:42:31.015

So they didn't realize that, uh,

2604

02:42:31.085 --> 02:42:33.375

they actually couldn't isolate FCC

2605

02:42:33.435 --> 02:42:35.335

or, uh, excuse me, radar altimeter.

2606

02:42:35.455 --> 02:42:39.255

A um, and this was a known issue.

2607

02:42:39.255 --> 02:42:43.495

There had been multiple, um, multiple RA failures.

2608

02:42:43.915 --> 02:42:46.295

Uh, Boeing decided that it was not a safety concern

2609

02:42:46.295 --> 02:42:49.335

because they believed that the air crew would always be able

2610

02:42:49.475 --> 02:42:53.735

to recover, um, uh, from the guitar mode in time.

2611

02:42:54.755 --> 02:42:58.685

They did put a warning that stated, um, that the,

2612

02:42:58.755 --> 02:43:01.445

with radio, radio altimeters, inoperative,

2613

02:43:02.145 --> 02:43:03.485

the associated autopilot

2614

02:43:03.505 --> 02:43:05.645

or auto throttle must not be used

2615

02:43:05.705 --> 02:43:06.965

for the approach and landing.

2616

02:43:07.545 --> 02:43:10.965

So if I read that, that makes me think that how they,

2617

02:43:10.965 --> 02:43:12.805

they thought the system worked is accurate.

2618

02:43:12.805 --> 02:43:16.485

Because it says the associated autopilot or auto throttle.

2619

02:43:16.665 --> 02:43:19.805

It doesn't say, um, don't use autopilot.

2620

02:43:19.985 --> 02:43:21.965

It says, just isolate the issue.

2621

02:43:22.265 --> 02:43:23.925

And that's what they attempted to do.

2622

02:43:25.405 --> 02:43:30.105

And another, um, unfortunate, um, uh, part

2623

02:43:30.105 --> 02:43:32.185

of this mishap as well is

2624

02:43:32.185 --> 02:43:36.305

that this particular mishap aircraft had two, um,

2625

02:43:37.365 --> 02:43:39.745

two previous flights, had the RA failure,

2626

02:43:40.325 --> 02:43:42.385

the air crew was able to recover from it

2627

02:43:42.385 --> 02:43:43.785

after entering retard mode.

2628

02:43:44.285 --> 02:43:48.235

Um, however, the, uh, uh,

2629

02:43:48.235 --> 02:43:49.715

they did not document it

2630

02:43:49.825 --> 02:43:51.115

because, uh,

2631

02:43:51.115 --> 02:43:54.115

maintenance had trouble duplicating on the ground.

2632

02:43:54.535 --> 02:43:56.795

And so they figured, well, it's not a safety concern.

2633

02:43:56.905 --> 02:43:58.555

Maintenance can't ever duplicate it,

2634

02:43:58.575 --> 02:44:00.035

so we're just not gonna write it up.

2635

02:44:03.275 --> 02:44:05.815

So this is, um, a safety control structure

2636

02:44:06.045 --> 02:44:07.175

that I put together.

2637

02:44:07.955 --> 02:44:10.975

Um, based off of reading the accident report,

2638

02:44:11.075 --> 02:44:12.695

you have the aircraft boundary.

2639

02:44:13.105 --> 02:44:14.695

Sorry if you can hear my dog barking.

2640

02:44:15.195 --> 02:44:18.095

Um, you've got the aircraft boundary there.

2641

02:44:18.355 --> 02:44:20.295

Within, within the aircraft boundary,

2642

02:44:20.295 --> 02:44:23.095

you have autopilot flight mode indication, your six shaker.

2643

02:44:23.315 --> 02:44:25.575

You have your first officer who, again,

2644

02:44:25.575 --> 02:44:28.295

was in training your captain and a safety pilot.

2645

02:44:28.875 --> 02:44:31.335

And then at the bottom, you've got air traffic control.

2646

02:44:31.755 --> 02:44:33.735

You have Boeing who's providing the aircraft

2647

02:44:33.735 --> 02:44:35.655
and the flight manuals, tur lines,

2648

02:44:35.755 --> 02:44:37.335
and other Turkish airlines air crews.

2649

02:44:37.835 --> 02:44:41.495
And so what I did was, uh, the arrows that are in red are,

2650

02:44:41.915 --> 02:44:46.565
um, portions of the safety control structure that, uh,

2651

02:44:46.795 --> 02:44:50.605
were ineffective in, in, um, controlling the safety

2652

02:44:50.625 --> 02:44:51.885
of this particular situation.

2653

02:44:52.305 --> 02:44:56.205
So for Boeing, um, their flight manuals did not adequately

2654

02:44:57.085 --> 02:44:59.365
describe the, the operation of the,

2655

02:44:59.505 --> 02:45:03.285
and the, uh, relationship between the radar altimeter

2656

02:45:03.625 --> 02:45:04.725
and the autopilot.

2657

02:45:05.665 --> 02:45:08.765
The other tur lines crews gotten to a point

2658

02:45:08.765 --> 02:45:12.045
where they felt like, well, no one ever fixes this problem,

2659

02:45:12.105 --> 02:45:13.725
so I'm not gonna bother report false.

2660

02:45:13.905 --> 02:45:17.285

I'm sure, um, others on this call have seen similar

2661

02:45:17.765 --> 02:45:20.205

incidents and other, other, uh, situations.

2662

02:45:21.105 --> 02:45:23.965

And then the safety pilot was supposed to provide feedback

2663

02:45:23.965 --> 02:45:26.405

to the captain if they saw anything that was unsafe.

2664

02:45:26.785 --> 02:45:28.805

And unfortunately, that did not happen,

2665

02:45:29.795 --> 02:45:31.615

and not really causal to the mishap.

2666

02:45:31.635 --> 02:45:33.535

But when they did change flight mode,

2667

02:45:33.535 --> 02:45:35.535

there was no flight mode change announcement.

2668

02:45:35.785 --> 02:45:38.415

Their belief was that, um, that was a suggestion,

2669

02:45:38.475 --> 02:45:39.815

but it was not a requirement.

2670

02:45:40.435 --> 02:45:42.175

And then of course, uh, they

2671

02:45:42.375 --> 02:45:44.615

provided autopilot input in an attempt

2672

02:45:44.615 --> 02:45:46.535

to isolate the radar altimeter.

2673

02:45:46.955 --> 02:45:48.375

But, uh, that did not happen.

2674

02:45:50.185 --> 02:45:55.045

So this, this gives you, uh, more systemic view as to,

2675

02:45:55.385 --> 02:45:56.765

uh, what caused the mishap

2676

02:45:56.765 --> 02:45:59.965

and what we can do to prevent similar mishaps.

2677

02:46:00.625 --> 02:46:03.365

Uh, and I, I think, um, Fred had a really,

2678

02:46:03.365 --> 02:46:06.125

really good point at the, at the end of his talk, where,

2679

02:46:06.125 --> 02:46:08.005

where he discussed, you know, what got him into,

2680

02:46:09.145 --> 02:46:12.445

and it's this idea of we can't blame the pilot.

2681

02:46:12.545 --> 02:46:15.925

And I think that's, that's very, very important.

2682

02:46:16.385 --> 02:46:19.805

Um, you could say, well, the safety pilot should have caught

2683

02:46:20.155 --> 02:46:22.845

that they were encroaching on stall speed.

2684

02:46:23.105 --> 02:46:25.325

The first officer and the captain both had an indication

2685

02:46:25.325 --> 02:46:26.565

that they were in retard mode.

2686

02:46:26.945 --> 02:46:29.565

Why didn't they take one of the actions that they needed

2687

02:46:29.585 --> 02:46:31.045
to, to get out of that?

2688

02:46:31.385 --> 02:46:35.245
Um, well, when you look at the entire situation,

2689

02:46:35.245 --> 02:46:38.525
they were on short final 'cause a TC had 'em turn in early.

2690

02:46:38.525 --> 02:46:40.805
They're trying to get the landing checklist done.

2691

02:46:41.155 --> 02:46:43.725
They're, um, they have someone in, in training.

2692

02:46:43.995 --> 02:46:46.805
When you start to add up all of these things, uh,

2693

02:46:46.835 --> 02:46:48.845
they were put into a tragic situation.

2694

02:46:48.845 --> 02:46:51.925
And human beings only have so much that they can do, um,

2695

02:46:52.105 --> 02:46:55.685
so much, um, capability to process their situation.

2696

02:46:56.185 --> 02:47:00.905
So I look at it as our job, uh, from, from a a,

2697

02:47:00.905 --> 02:47:02.345
whether it's a leadership perspective

2698

02:47:02.885 --> 02:47:06.265
or, um, a perspective of producing aircraft

2699

02:47:06.295 --> 02:47:07.625
that people are gonna go fly.

2700

02:47:08.135 --> 02:47:11.585

It's our job to make their lives easier to the best

2701

02:47:11.585 --> 02:47:13.185
of our ability so that,

2702

02:47:13.295 --> 02:47:15.985
that these unfortunate situations don't happen.

2703

02:47:16.255 --> 02:47:18.345
That we don't put, um, pilots

2704

02:47:18.345 --> 02:47:22.785
and operators in a position where, um, the, the situation

2705

02:47:23.405 --> 02:47:25.865
is, is too difficult to understand, to the point

2706

02:47:25.865 --> 02:47:27.545
that they cannot make, uh,

2707

02:47:27.905 --> 02:47:29.185
decisions that, that save their lives.

2708

02:47:31.695 --> 02:47:35.275
So, switching gears again, um, back to preventing mishaps.

2709

02:47:35.695 --> 02:47:39.075
Uh, I think, um, uh, Colonel Wicker's brief,

2710

02:47:39.075 --> 02:47:40.115
if you all heard that yesterday,

2711

02:47:40.215 --> 02:47:41.755
was, it's a really great brief.

2712

02:47:41.825 --> 02:47:43.235
I've heard it a couple times now,

2713

02:47:43.235 --> 02:47:45.315
and I always learn something new when I hear it.

2714

02:47:45.815 --> 02:47:49.515

Um, so he talked about how systems trend towards,

2715

02:47:49.625 --> 02:47:51.755

towards respiratory an unsafe scenario.

2716

02:47:52.065 --> 02:47:54.995

There's a large variety of ways that can happen.

2717

02:47:55.415 --> 02:47:57.275

You can have changes in your manning,

2718

02:47:57.535 --> 02:47:59.595

you make modifications to the system.

2719

02:48:00.215 --> 02:48:03.235

Uh, you change your training processes or programs.

2720

02:48:03.775 --> 02:48:07.555

The way that you choose to operate the system is different.

2721

02:48:07.855 --> 02:48:10.195

Uh, I think about that, especially with Air Force aircraft.

2722

02:48:10.195 --> 02:48:12.275

You know, you think about the B 52 that's gonna be flying

2723

02:48:12.275 --> 02:48:13.795

for a hundred years, um,

2724

02:48:13.855 --> 02:48:15.755

by the time we finally retire this thing,

2725

02:48:15.755 --> 02:48:16.795

which is just incredible.

2726

02:48:17.335 --> 02:48:21.875

Um, I'm sure the way that people thought 70 years ago

2727

02:48:22.025 --> 02:48:24.795

that this, this aircraft is going to be flown

2728

02:48:25.215 --> 02:48:27.315
and operated is, is different now.

2729

02:48:27.375 --> 02:48:30.555
We, we've changed, um, we've, we've modified it.

2730

02:48:30.605 --> 02:48:32.755
We're flying it in in a different theater.

2731

02:48:32.765 --> 02:48:33.835
We're flying it in the desert.

2732

02:48:34.215 --> 02:48:35.475
Um, you know, all sorts of different things

2733

02:48:35.475 --> 02:48:36.555
are different now about it.

2734

02:48:37.795 --> 02:48:39.415
And then of course, maintenance processes.

2735

02:48:39.615 --> 02:48:41.775
I think, um, the DC 10 example

2736

02:48:41.775 --> 02:48:44.695
that Colonel Wicker gave was a, was a great example of

2737

02:48:44.755 --> 02:48:48.055
how maintenance processes can change over time.

2738

02:48:48.555 --> 02:48:51.175
So you have all of these different, um, modifications

2739

02:48:51.175 --> 02:48:53.455
and changes that are going on in your sociotechnical,

2740

02:48:54.155 --> 02:48:55.415
um, system over time.

2741

02:48:55.435 --> 02:48:56.455

And I think that's natural.

2742

02:48:56.995 --> 02:48:59.375

If you have, if you have turnover

2743

02:48:59.795 --> 02:49:03.215

and you have, um, you know, people just going through years

2744

02:49:03.215 --> 02:49:05.335

and years and years of operating systems,

2745

02:49:05.715 --> 02:49:07.015

you, you are going to have changes.

2746

02:49:07.445 --> 02:49:09.485

I don't think there's any way to freeze it and,

2747

02:49:09.585 --> 02:49:10.925

and not have any changes.

2748

02:49:11.585 --> 02:49:15.925

Um, then we need to understand how we can spot those changes

2749

02:49:16.545 --> 02:49:21.045

and, and catch, um, catch this before it leads to a mishap.

2750

02:49:21.785 --> 02:49:23.485

So if you use CPA

2751

02:49:23.485 --> 02:49:25.925

and A system, um, there's two ways

2752

02:49:25.925 --> 02:49:28.085

that you can derive leading indicators.

2753

02:49:28.825 --> 02:49:31.005

One is through documented assumptions.

2754

02:49:31.305 --> 02:49:33.125

So that can be things like assuming

2755

02:49:33.425 --> 02:49:37.165

how the system's gonna be operated, uh, assuming what kind

2756

02:49:37.165 --> 02:49:39.685

of maintenance schedule's going to have all sorts

2757

02:49:39.685 --> 02:49:42.325

of different, um, assumptions that can go into the design

2758

02:49:42.325 --> 02:49:45.045

of your system, whether that's your actual aircraft

2759

02:49:45.185 --> 02:49:47.485

or the sociotechnical system in which your aircraft

2760

02:49:47.665 --> 02:49:48.805

is going to be operated.

2761

02:49:50.685 --> 02:49:53.585

Um, and then you also have safety constraints

2762

02:49:53.585 --> 02:49:56.545

and mitigations that you derived out of your STP analysis.

2763

02:49:57.005 --> 02:50:00.145

So now if you, if you make modifications to your system

2764

02:50:00.765 --> 02:50:03.225

or, uh, you make transfer states

2765

02:50:03.325 --> 02:50:05.505

or whatever it might be, you can go back

2766

02:50:05.505 --> 02:50:08.225

and make sure, are my assumptions still valid?

2767

02:50:08.805 --> 02:50:11.745

Am I violating any constraints or mitigations?

2768

02:50:12.085 --> 02:50:14.385

And if you are, then you need to go back and,

2769

02:50:14.405 --> 02:50:17.785

and figure out, okay, do I need to do an, an, um, do

2770

02:50:18.535 --> 02:50:21.465

redo my safety control structure and do another analysis?

2771

02:50:21.805 --> 02:50:23.145

Do I need to make a different decision

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02:50:23.145 --> 02:50:24.265

that I'm making right now?

2773

02:50:24.905 --> 02:50:26.025

Whatever, whatever that might be.

2774

02:50:26.615 --> 02:50:29.465

Another point that's important, uh, to note is

2775

02:50:29.465 --> 02:50:32.305

that incidents often precede mishaps.

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02:50:32.645 --> 02:50:33.665

If you have an incident,

2777

02:50:34.055 --> 02:50:36.745

very likely a safety constraint was violated.

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02:50:37.245 --> 02:50:38.785

If you are doing low level testing

2779

02:50:39.525 --> 02:50:44.465

and the, the, um, the limit is 300 feet a GL for

2780

02:50:44.465 --> 02:50:45.465

that low level testing,

2781

02:50:45.805 --> 02:50:49.625

and you get to two 90, you have violated safety constraints.

2782

02:50:50.985 --> 02:50:55.325

So if you treat that as, as a mishap, and you go back

2783

02:50:55.325 --> 02:50:57.365

and you do a cast analysis, or you go back

2784

02:50:57.365 --> 02:51:00.645

and look at, well, why, why did my safety control structure,

2785

02:51:01.305 --> 02:51:05.485

um, uh, why was it not sufficient to prevent that incident?

2786

02:51:06.105 --> 02:51:08.485

Now you have the ability to, um,

2787

02:51:08.785 --> 02:51:10.845

to keep it from ever becoming a m happened.

2788

02:51:12.515 --> 02:51:14.795

I think Colonel Liquor's, uh, point to that yesterday was

2789

02:51:15.515 --> 02:51:16.595

surprises or warnings.

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02:51:19.345 --> 02:51:21.475

Another food for thought is in

2791

02:51:21.475 --> 02:51:25.835

what other ways do systems trend towards unsafe scenarios.

2792

02:51:26.135 --> 02:51:28.995

I'm sure you all have, have a plethora of, of, um,

2793

02:51:29.775 --> 02:51:30.955

of knowledge where you've seen

2794

02:51:30.955 --> 02:51:32.915

that happen in your particular organization.

2795

02:51:36.385 --> 02:51:39.925

All right. So, uh, where have we used STPA in the

2796

02:51:39.925 --> 02:51:41.125

Air Force and the DOD?

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02:51:41.385 --> 02:51:44.285

So the first one I'll talk about is the TPA pilot program,

2798

02:51:44.455 --> 02:51:46.285

which was mentioned briefly yesterday.

2799

02:51:46.785 --> 02:51:51.085

We did, uh, 10 test projects, um, with TPA

2800

02:51:51.945 --> 02:51:55.205

and yesterday it was, it was noted that, um, uh,

2801

02:51:55.315 --> 02:51:57.205

some folks felt like it didn't work.

2802

02:51:57.645 --> 02:51:59.565

I don't think that's the, the right response.

2803

02:51:59.585 --> 02:52:01.125

If you go out and you test the system,

2804

02:52:01.465 --> 02:52:03.485

and the system behavior's different than you expected,

2805

02:52:03.505 --> 02:52:04.605

you don't say your test failed.

2806

02:52:05.145 --> 02:52:06.365

You say that you learned something.

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02:52:06.425 --> 02:52:07.445

And I think that's what we did.

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02:52:07.525 --> 02:52:10.005

I think we learned something about when is an appropriate

2809

02:52:10.005 --> 02:52:14.925

time to use FT PA, uh, so in the particular case that, um,

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02:52:15.745 --> 02:52:19.765

uh, that was discussed is the, it was a B one software drop.

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02:52:19.955 --> 02:52:22.765

Well, how many B one software drops, um,

2812

02:52:22.835 --> 02:52:25.925

have we done over the course of, of that system?

2813

02:52:26.345 --> 02:52:27.685

I'm, I'm guessing at least a few.

2814

02:52:28.145 --> 02:52:32.565

So we have folks who are really good at, um, understanding

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02:52:33.225 --> 02:52:35.765

the, the B one, because there, I know there are folks

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02:52:35.765 --> 02:52:38.685

who have been working on it since it was, it was, uh, in,

2817

02:52:38.745 --> 02:52:41.165

in tests, you know, 30 plus years ago.

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02:52:41.615 --> 02:52:43.485

These folks know the system really, really well,

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02:52:44.025 --> 02:52:45.605

and they know tests really, really well.

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02:52:45.785 --> 02:52:49.635

So they're able to come up with a test program, um,

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02:52:49.975 --> 02:52:51.875

pretty easily that can go and,

2822

02:52:52.055 --> 02:52:53.715
and, um, ensure

2823

02:52:53.715 --> 02:52:55.995
that they get the data they need in a safe manner.

2824

02:52:56.575 --> 02:52:58.275
But I think what's interesting to note about

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02:52:58.275 --> 02:53:03.115
that particular, um, uh, uh, test pilot or,

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02:53:03.175 --> 02:53:06.715
or a, um, pilot program is that, uh, the team

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02:53:06.715 --> 02:53:10.155
that we used were relatively new to the B one

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02:53:10.655 --> 02:53:12.195
and to, to that type of testing.

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02:53:12.735 --> 02:53:15.875
And so they, they were able, they didn't find anything new.

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02:53:15.925 --> 02:53:17.075
There were no gotchas

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02:53:17.075 --> 02:53:19.195
that had been missed over the last 30 years,

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02:53:19.535 --> 02:53:23.835
but they were able to replicate what was, uh, what was done

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02:53:23.855 --> 02:53:26.475
by folks who were very experienced on the B one.

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02:53:26.595 --> 02:53:29.355
I think that's, that's a, a really, uh, important learning,

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02:53:29.815 --> 02:53:32.875

uh, point is that folks who were fairly new

2836

02:53:32.875 --> 02:53:35.115
to test fairly new to the B one,

2837

02:53:35.255 --> 02:53:38.475
had never done a software drop, uh, test before.

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02:53:38.945 --> 02:53:43.075
Were able to repeat what a bunch of folks with a lot

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02:53:43.075 --> 02:53:47.195
of experience were able to do, um, with, uh, with a lot

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02:53:47.195 --> 02:53:48.235
of knowledge on the system.

2841

02:53:49.095 --> 02:53:51.555
So I think that's really important to, to note

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02:53:51.705 --> 02:53:53.555
that it gives you the structured methodology

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02:53:53.615 --> 02:53:56.635
and allows you to think about the system in a way that

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02:53:56.635 --> 02:53:58.155
that produces a really good result.

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02:53:58.855 --> 02:54:01.275
Um, so, so that's, that's one

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02:54:01.275 --> 02:54:03.715
of the key learnings is if you, if you don't have a lot

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02:54:03.715 --> 02:54:07.675
of system knowledge, or if you have, uh, a young group of,

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02:54:07.895 --> 02:54:12.435
of test personnel, SEPA is a good opportunity to, uh,

2849

02:54:12.435 --> 02:54:14.035
for them to, to get that experience.

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02:54:15.315 --> 02:54:18.875
And then two, it's really good for complex systems.

2851

02:54:19.115 --> 02:54:20.955
I think Doc Thomas talked about that yesterday.

2852

02:54:21.095 --> 02:54:24.565
So if you have, um, if you have

2853

02:54:25.205 --> 02:54:27.245
software intensive systems, you have something

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02:54:27.245 --> 02:54:30.725
that's completely new, a lot of human integration, um,

2855

02:54:31.345 --> 02:54:34.405
that's really where you wanna focus your efforts with TPA.

2856

02:54:34.465 --> 02:54:36.605
So that's where we're going within the Air Force Test

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02:54:36.605 --> 02:54:38.645
Center, is we're, we're making sure

2858

02:54:38.645 --> 02:54:40.165
that we're using it on projects where,

2859

02:54:40.165 --> 02:54:42.645
where there's value added, um, for,

2860

02:54:42.705 --> 02:54:45.365
for these complex new systems that are coming along.

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02:54:46.105 --> 02:54:47.765
Uh, GBSG, um,

2862

02:54:47.885 --> 02:54:50.485

ground-based Strategic Deterrence is the first program

2863

02:54:50.485 --> 02:54:52.565
office to officially use TPA.

2864

02:54:52.825 --> 02:54:55.645
The flavor of p they're using is sec,

2865

02:54:55.815 --> 02:54:58.525
which is a cybersecurity application that was created

2866

02:54:58.625 --> 02:55:03.165
by Colonel Bill Dollar Young, who did his out ITT,

2867

02:55:04.505 --> 02:55:07.365
uh, on the Army side, future vertical lift,

2868

02:55:07.365 --> 02:55:09.325
they use TPA for a trade based study.

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02:55:09.425 --> 02:55:13.005
And I think, um, the Army Lab folks are continuing

2870

02:55:13.005 --> 02:55:14.645
to use SCPA on other projects.

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02:55:14.705 --> 02:55:17.085
I'm not fully in the loop on everything that they're doing.

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02:55:17.425 --> 02:55:21.685
The Air Force Research Laboratory is used TPA, um,

2873

02:55:21.865 --> 02:55:24.805
and the aerospace systems directorate, specifically on

2874

02:55:25.645 --> 02:55:28.165
autonomy, loyal wingman type work that they're doing.

2875

02:55:28.855 --> 02:55:30.165
About a year and a half ago,

2876
02:55:30.505 --> 02:55:32.925
we presented a two day technical interchange meeting

2877
02:55:33.145 --> 02:55:34.205
for SPO personnel.

2878
02:55:34.305 --> 02:55:36.005
So it was a lot of systems safety engineers

2879
02:55:36.065 --> 02:55:37.205
and air with I engineers

2880
02:55:37.205 --> 02:55:39.965
and other just interested folks that was sponsored

2881
02:55:40.085 --> 02:55:42.125
through the Air Force Institute of Technology.

2882
02:55:42.745 --> 02:55:44.965
Uh, that was a really good opportunity, uh,

2883
02:55:44.985 --> 02:55:49.285
to get folks spun up on, on STPA and, uh, Dr. Thomas

2884
02:55:49.425 --> 02:55:51.205
and Professor Levion came out for that.

2885
02:55:52.695 --> 02:55:55.775
TPS is incorporating systems theory into their curriculum.

2886
02:55:55.775 --> 02:55:58.455
They're not calling it TPA, um, but,

2887
02:55:58.675 --> 02:56:00.855
but it's that underlying systems theory.

2888
02:56:01.085 --> 02:56:03.255
They're also working on a, on a, uh,

2889
02:56:03.295 --> 02:56:06.095

I think it's a three month course for the,

2890

02:56:06.155 --> 02:56:07.815
the brand new Space Force.

2891

02:56:08.475 --> 02:56:10.895
Um, and it's gonna be incorporated into

2892

02:56:10.895 --> 02:56:11.935
that curriculum as well.

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02:56:12.395 --> 02:56:14.695
And John can, John Thomas can talk more about this,

2894

02:56:14.835 --> 02:56:18.375
but, um, my understanding is FA is looking at, um,

2895

02:56:18.705 --> 02:56:22.175
using SCPA for airworthiness for part 23 aircraft.

2896

02:56:22.755 --> 02:56:25.175
That's somewhere in some subcommittee or something.

2897

02:56:25.235 --> 02:56:27.935
I'm, I'm not quite up to the status of that.

2898

02:56:27.955 --> 02:56:29.975
And, uh, Dr. Thomas can talk more about that.

2899

02:56:32.155 --> 02:56:36.095
So a commonly asked question is, what about risk?

2900

02:56:36.955 --> 02:56:41.375
Um, so SCPA does not define a probability

2901

02:56:41.645 --> 02:56:44.455
because when you look at these scenarios that you derive,

2902

02:56:44.455 --> 02:56:47.575
it's often not possible to come up with, with a probability.

2903

02:56:47.995 --> 02:56:50.415

So I, I threw a few different examples there.

2904

02:56:50.515 --> 02:56:51.855

So what's the probability

2905

02:56:52.165 --> 02:56:54.415

that the test team missed a critical safety

2906

02:56:54.435 --> 02:56:56.375

of flight test parameter during safety planning?

2907

02:56:57.165 --> 02:56:59.735

Well, either it's zero 'cause they didn't, or it's one.

2908

02:56:59.895 --> 02:57:02.735

'cause they did, there's, there's no other option there.

2909

02:57:02.835 --> 02:57:05.455

And same with those others that I, that I showed there.

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02:57:06.205 --> 02:57:07.815

Does the system function as designed?

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02:57:08.635 --> 02:57:11.175

Was there a CRM issue with a, with a test program,

2912

02:57:11.605 --> 02:57:13.175

it's either zero or one.

2913

02:57:13.835 --> 02:57:18.055

So we can't use your, your normal risk matrices in order

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02:57:18.115 --> 02:57:21.695

to try to, um, define any kind of likelihood.

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02:57:23.035 --> 02:57:24.655

So what sdpa A does is it,

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02:57:24.755 --> 02:57:27.055

it identifies those unsafe scenarios

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02:57:27.055 --> 02:57:29.055

and actions that can lead to a mishap,

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02:57:29.055 --> 02:57:32.175

and then we choose how we want to act on that information.

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02:57:32.575 --> 02:57:36.015

I can tell you the earlier we do this in the design, um,

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02:57:36.115 --> 02:57:40.575

the easier it is to, to incorporate, uh, those mitigations

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02:57:41.205 --> 02:57:42.615

into, into the system.

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02:57:42.995 --> 02:57:45.255

The later we do this, the harder it is.

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02:57:46.865 --> 02:57:49.085

And, uh, I, I've free this before,

2924

02:57:49.225 --> 02:57:50.605

and someone told me, well, they,

2925

02:57:50.795 --> 02:57:53.285

they were unsure about using STPA

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02:57:53.515 --> 02:57:56.485

because if they couldn't show, if they couldn't explain

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02:57:56.485 --> 02:57:58.805

to their boss what the risk was

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02:57:59.025 --> 02:58:00.245

for the particular scenarios,

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02:58:00.245 --> 02:58:01.565

they didn't think their boss would like it.

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02:58:02.065 --> 02:58:03.445

And that's scary to me.

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02:58:03.585 --> 02:58:06.685

So they recognize they're gonna come up with new things

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02:58:07.115 --> 02:58:09.405

that they maybe haven't thought of, but

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02:58:09.405 --> 02:58:10.605

because they don't know what to do

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02:58:10.605 --> 02:58:12.245

with the information, they'd rather not know.

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02:58:12.545 --> 02:58:14.725

So that's called sticking your head in the sand.

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02:58:14.745 --> 02:58:16.565

And I think that's really, that's really scary

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02:58:16.565 --> 02:58:18.525

that some people have that type of an attitude.

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02:58:18.945 --> 02:58:21.045

I'd rather know and then struggle

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02:58:21.045 --> 02:58:22.925

with a really hard decision of what to do with

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02:58:22.925 --> 02:58:24.725

that than, than not know.

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02:58:26.215 --> 02:58:27.875

But if, you know, we,

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02:58:27.935 --> 02:58:30.515

we are in a fiscally constrained environment.

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02:58:31.135 --> 02:58:34.635

So you, you may have to make really hard decisions on

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02:58:34.635 --> 02:58:36.155
what mitigations you wanna go after

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02:58:36.615 --> 02:58:39.355
and what mitigation, uh, you may

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02:58:39.775 --> 02:58:43.315
or what, uh, type scenarios you, you may have to, to accept

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02:58:43.695 --> 02:58:47.795
or go for a, um, a less, um,

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02:58:48.385 --> 02:58:50.955
effective methodology like, uh,

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02:58:51.115 --> 02:58:53.715
constraining your flat envelope or putting cautions

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02:58:53.715 --> 02:58:55.955
and warnings into your manual,

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02:58:55.975 --> 02:58:57.355
or something along those lines.

2952

02:58:58.095 --> 02:59:01.995
Um, so there's two, two ways that you can attempt to, um,

2953

02:59:03.525 --> 02:59:05.965
organize your mitigation in order

2954

02:59:05.965 --> 02:59:07.205
to make those judgment calls.

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02:59:07.505 --> 02:59:08.645
The first is frequency.

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02:59:09.265 --> 02:59:12.605
If there is a single, uh, safety constraint

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02:59:12.605 --> 02:59:16.285

or mitigation that you come up with that knocks out a bunch

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02:59:16.285 --> 02:59:19.365

of ucas, then that's an easy kill, right?

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02:59:19.415 --> 02:59:21.565

Let's go after that. Let's low hanging fruit,

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02:59:21.585 --> 02:59:23.165

we can knock those out and,

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02:59:23.165 --> 02:59:25.405

and take care of a lot at the, at at one time.

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02:59:26.575 --> 02:59:28.075

So that's one way you can look at it.

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02:59:28.815 --> 02:59:30.635

And then the other one is mishap severity.

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02:59:30.895 --> 02:59:34.755

So let's say you have, uh, a mishap that's loss of life

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02:59:35.055 --> 02:59:37.995

and you have a mishap that's minor equipment damage

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02:59:38.015 --> 02:59:39.235

or something along those lines.

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02:59:39.455 --> 02:59:41.515

And you have a scenario, you have two scenarios.

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02:59:41.515 --> 02:59:44.555

One traces to death, one traces to minor equipment damage.

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02:59:44.785 --> 02:59:46.075

Well, I'm gonna guess you're gonna go

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02:59:46.075 --> 02:59:47.715

after the one that could cause death.

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02:59:47.855 --> 02:59:49.595

So that's another way. So you don't have the likelihood,

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02:59:49.595 --> 02:59:51.475

but you still can look at the severity.

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02:59:51.815 --> 02:59:53.635

So those are are two, two methods

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02:59:53.665 --> 02:59:55.315

that you can use potentially.

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02:59:57.285 --> 02:59:59.655

Alright, before we get into questions, couple,

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02:59:59.715 --> 03:00:00.855

couple last notes.

2977

03:00:01.115 --> 03:00:04.935

So one is, um, uh, for those of you who worked

2978

03:00:04.935 --> 03:00:06.735

for the government, there's a few of us that,

2979

03:00:06.735 --> 03:00:09.175

that have facilitated FCPA analyses before.

2980

03:00:09.875 --> 03:00:12.735

Um, I'm, I'm happy to help my email

2981

03:00:12.915 --> 03:00:14.095

to the bottom of the slide.

2982

03:00:14.165 --> 03:00:15.455

Feel free to reach out to me.

2983

03:00:16.035 --> 03:00:18.455

And, uh, I, I'm happy to, to work with you.

2984

03:00:18.815 --> 03:00:21.375

I, I completely agree with what was stated yesterday

2985

03:00:21.485 --> 03:00:24.455

that it's very difficult to do STPA

2986

03:00:24.565 --> 03:00:26.895

with just a few hours, uh, lecture.

2987

03:00:27.675 --> 03:00:31.375

But, um, if you have a facilitator, if possible,

2988

03:00:31.475 --> 03:00:33.055

so I'm happy to help out folks

2989

03:00:33.055 --> 03:00:35.655

that are within the government, uh, to do that.

2990

03:00:36.995 --> 03:00:40.055

And then, um, Dr. Thomas, maybe when you come on,

2991

03:00:40.435 --> 03:00:42.655

my understanding is for the ST stamp workshop

2992

03:00:43.195 --> 03:00:45.855

that's done every march up at MIT is that it's,

2993

03:00:45.915 --> 03:00:48.335

it may be rescheduled, it may go virtual.

2994

03:00:49.395 --> 03:00:50.975

Um, so that's another opportunity.

2995

03:00:51.035 --> 03:00:53.455

If you guys go to the PS a s website

2996

03:00:53.455 --> 03:00:56.815

that I think Dr. Thomas put up yesterday, just Google,

2997

03:00:57.255 --> 03:01:00.845

M-I-T-S-C-P-A, PS A-P-S-A-S, you can find it.

2998

03:01:01.345 --> 03:01:04.365

Um, there's, that might be an opportunity

2999

03:01:04.545 --> 03:01:06.045

to learn more about STPA.

3000

03:01:06.625 --> 03:01:09.085

And then, uh, as I mentioned, a year

3001

03:01:09.085 --> 03:01:11.405

and a half ago we did an air force, uh,

3002

03:01:11.645 --> 03:01:13.245

STPA technical interchange meeting.

3003

03:01:13.975 --> 03:01:16.045

We're, we're looking to try to reinvigorate that.

3004

03:01:16.045 --> 03:01:17.765

We were gonna do one last year too

3005

03:01:17.765 --> 03:01:18.805

and make it an annual thing.

3006

03:01:18.825 --> 03:01:22.885

And, um, we, uh, we're overcome with other events.

3007

03:01:23.425 --> 03:01:25.365

So we're gonna try to put that back together

3008

03:01:25.545 --> 03:01:26.605

for some time this fall.

3009

03:01:27.145 --> 03:01:30.445

Um, if, uh, if you're interested in participating in that,

3010

03:01:30.705 --> 03:01:31.885

please give me a shout.

3011
03:01:32.665 --> 03:01:36.325
And, um, my thesis, um, if you, if you have a desire

3012
03:01:36.325 --> 03:01:38.925
to read it, um, you need some bedtime reading

3013
03:01:38.945 --> 03:01:40.325
to help your sleep, uh,

3014
03:01:40.875 --> 03:01:42.525
that link's down at the bottom as well.

3015
03:01:43.955 --> 03:01:45.165
Alright, now we can go to

3016
03:01:45.445 --> 03:01:46.445
Sarah. That's, uh,

3017
03:01:46.445 --> 03:01:49.925
fantastic. Certainly, uh, a lot there.

3018
03:01:50.065 --> 03:01:51.925
Really, really great information. Thank you.

3019
03:01:51.985 --> 03:01:55.005
And I love your story of coming to, coming to your,

3020
03:01:55.315 --> 03:01:58.045
your personal journey to safety through your family.

3021
03:01:58.045 --> 03:01:59.325
That's, uh, quite griping.

3022
03:02:00.425 --> 03:02:02.925
Now for those of us who, uh, those in the audience

3023
03:02:02.945 --> 03:02:04.805
who didn't get to see our little exchange earlier.

3024
03:02:04.915 --> 03:02:06.285

I'll resist the temptation for you

3025

03:02:06.285 --> 03:02:08.885

and I just to discuss refueling for the next half hour

3026

03:02:08.985 --> 03:02:10.725

and about how that's the greatest form

3027

03:02:10.725 --> 03:02:11.965

of flight test engineering ever.

3028

03:02:12.925 --> 03:02:14.925

A pair of 200 ton, yeah.

3029

03:02:15.345 --> 03:02:18.445

Aerial jousting between a pair of 200 and ton aircraft.

3030

03:02:18.515 --> 03:02:21.405

It's just great. But, uh, we have had a couple questions.

3031

03:02:21.505 --> 03:02:25.045

So, um, I'll pick on the one that relates

3032

03:02:25.105 --> 03:02:27.765

to the point you had at the end there with how do you report

3033

03:02:28.515 --> 03:02:30.525

risk to your boss, was the way you put it.

3034

03:02:30.625 --> 03:02:33.085

Mm-hmm. So behind that is the idea

3035

03:02:33.085 --> 03:02:35.445

that we come from an organization

3036

03:02:35.445 --> 03:02:38.045

that has existing practices.

3037

03:02:38.265 --> 03:02:40.245

If we're a mature organization, uh,

3038

03:02:40.335 --> 03:02:42.445
we've probably got processes and policies

3039

03:02:42.445 --> 03:02:45.805
and procedures if we're a startup, we've just got the way

3040

03:02:45.805 --> 03:02:47.045
that perhaps you

3041

03:02:47.045 --> 03:02:51.725
and I thought about it as a, as a sample of one, uh mm-hmm.

3042

03:02:51.865 --> 03:02:56.165
But ultimately, STPA produces uncontrolled actions,

3043

03:02:57.035 --> 03:02:59.165
ucas, and yet all

3044

03:02:59.165 --> 03:03:02.045
of our SMS literature is written in terms of hazards.

3045

03:03:03.185 --> 03:03:06.245
How are we gonna jam this STPA product

3046

03:03:07.075 --> 03:03:08.765
into an existing SMS structure?

3047

03:03:10.075 --> 03:03:11.855
Mm-hmm. That's a good question.

3048

03:03:11.955 --> 03:03:15.015
So I, I think, so you do have hazards that you get

3049

03:03:15.015 --> 03:03:16.215
with, with tpa.

3050

03:03:16.875 --> 03:03:19.295
Um, so, uh,

3051

03:03:19.615 --> 03:03:22.415

I think without knowing the specific specifics of, um,

3052

03:03:22.855 --> 03:03:25.015

a particular organization safety, uh,

3053

03:03:25.015 --> 03:03:28.215

safety management system, um, it's hard to talk, uh,

3054

03:03:28.615 --> 03:03:29.815

specifically, I think,

3055

03:03:30.455 --> 03:03:32.695

I think just having these conversations, um,

3056

03:03:32.795 --> 03:03:34.095

within your organization

3057

03:03:34.435 --> 03:03:38.535

and talking about, um, the, going through one

3058

03:03:38.535 --> 03:03:41.335

of these analyses, seeing what what is captured

3059

03:03:41.685 --> 03:03:44.895

that you may not have captured previously, I think that in

3060

03:03:44.895 --> 03:03:47.095

and of itself is, is a good start.

3061

03:03:47.515 --> 03:03:50.975

And then you can look at how do I incorporate this into my

3062

03:03:51.335 --> 03:03:54.335

existing documentation, um, whatever that might be.

3063

03:03:54.795 --> 03:03:57.685

So, um, in the bottom of my, my slide,

3064

03:03:57.725 --> 03:03:58.845

I don't know if I'm still sharing.

3065

03:03:59.045 --> 03:04:00.805

I don't think I'm, but yeah, you are.

3066

03:04:00.805 --> 03:04:05.445

And you'll see it if, okay, so, um, if, lemme go one more.

3067

03:04:06.185 --> 03:04:10.165

So this is how, this is how we do test hazard analysis, um,

3068

03:04:10.625 --> 03:04:12.045

at Edwards Air Force Base.

3069

03:04:12.425 --> 03:04:15.165

So we have, we have our hazards, we have what,

3070

03:04:15.305 --> 03:04:17.445

what's gonna cause it, the effects.

3071

03:04:17.705 --> 03:04:19.965

So, you know, death, destruction, loss of aircraft,

3072

03:04:19.965 --> 03:04:23.485

that type of thing are minimizing procedures, any corrective

3073

03:04:23.485 --> 03:04:25.165

or emergency actions that we need to take,

3074

03:04:25.345 --> 03:04:27.005

and any addition comments or remarks.

3075

03:04:27.025 --> 03:04:31.965

So what I did is I, I mapped, uh, TPA into our test hazard

3076

03:04:32.485 --> 03:04:33.645

documentation that we already have.

3077

03:04:34.185 --> 03:04:38.405

Um, so your applicable hazard, whatever that, uh, might be,

3078

03:04:38.995 --> 03:04:42.125

your UCA is gonna be your cause applic.

3079

03:04:42.265 --> 03:04:43.805

Um, and then your,

3080

03:04:43.805 --> 03:04:45.805

your effects are basically your hazard, right?

3081

03:04:45.875 --> 03:04:47.485

It's your death, it's your, your loss

3082

03:04:47.485 --> 03:04:48.565

of aircraft, that type of thing.

3083

03:04:49.145 --> 03:04:50.365

And then your mitigations

3084

03:04:50.505 --> 03:04:52.845

or your minimizing procedures, um,

3085

03:04:53.305 --> 03:04:56.085

tpa a doesn't necessarily have corrective actions.

3086

03:04:56.275 --> 03:04:58.605

Sometimes you can come up with them out, um,

3087

03:04:58.605 --> 03:05:00.325

through TPA, but not always.

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03:05:00.905 --> 03:05:03.445

So that may be something that you have to look at outside

3089

03:05:03.705 --> 03:05:06.325

of your s stpa analysis. And then if you,

3090

03:05:06.705 --> 03:05:10.005

So stpa a, to guide your, your hazards,

3091

03:05:10.035 --> 03:05:11.525

your search for hazards.

3092

03:05:13.195 --> 03:05:14.195

Yes. Would that be Fair

3093

03:05:15.525 --> 03:05:17.905

To using SCPA to guide your hazards,

3094

03:05:18.645 --> 03:05:20.625

Uh, to, to guide your search for hazards?

3095

03:05:21.385 --> 03:05:22.565

Oh, yes. Yeah, sure.

3096

03:05:22.705 --> 03:05:24.405

So you can, I think what you,

3097

03:05:25.225 --> 03:05:27.045

so some hazards you're gonna have a, a good idea

3098

03:05:27.045 --> 03:05:29.325

of already depending on the type of testing

3099

03:05:29.915 --> 03:05:30.965

that, that you're doing.

3100

03:05:31.225 --> 03:05:33.845

But what you'll find as you go through the ucas, there,

3101

03:05:33.935 --> 03:05:35.125

there may be, uh,

3102

03:05:35.395 --> 03:05:37.525

that traceability component that I talked about.

3103

03:05:37.825 --> 03:05:39.245

If you say, wow, if I do this,

3104

03:05:39.245 --> 03:05:42.525

this is gonna be really dangerous, um, then,

3105

03:05:42.705 --> 03:05:44.965

and you trace it back and you don't have a hazard

3106

03:05:45.025 --> 03:05:47.165

to trace it to, that means you miss the hazard.

3107

03:05:47.745 --> 03:05:50.325

Uh, so you can go back and, and look at that.

3108

03:05:51.535 --> 03:05:52.955

We mentioned traceability

3109

03:05:52.955 --> 03:05:54.315

there and the importance of that.

3110

03:05:54.315 --> 03:05:56.235

Mm-hmm. Because it provides us assurance

3111

03:05:56.335 --> 03:05:58.515

of our coverage across a breadth of area.

3112

03:05:59.875 --> 03:06:03.295

Is there an opportunity in SCPA to consolidate, like, use,

3113

03:06:03.675 --> 03:06:06.975

if you find, like with like in A UCA,

3114

03:06:07.955 --> 03:06:09.855

how do you handle that traceability?

3115

03:06:09.875 --> 03:06:12.175

Is there an opportunity to consolidate our effort here?

3116

03:06:14.035 --> 03:06:17.135

Uh, sure. So I, I think where you'll, you'll see that, um,

3117

03:06:17.755 --> 03:06:21.375

so one thing that Dr. Thomas mentioned yesterday was you may

3118

03:06:21.405 --> 03:06:26.295

find, uh, higher level constraints or mitigations,

3119

03:06:26.515 --> 03:06:29.575

and you don't need to go down all the way into scenarios.

3120

03:06:30.115 --> 03:06:33.375

So if you find that, uh, early on, you find that in hazard

3121

03:06:33.765 --> 03:06:36.615

that your hazard, um, analysis portion, um,

3122

03:06:37.405 --> 03:06:39.535

then you don't necessarily need to go through

3123

03:06:39.755 --> 03:06:42.775

to find your ucas and to find your, your, your scenarios,

3124

03:06:42.795 --> 03:06:44.615

or maybe you find it in ucas, you don't need

3125

03:06:44.615 --> 03:06:45.935

to go down into your scenario.

3126

03:06:46.235 --> 03:06:48.975

So, um, so that's one way to kind of aggregate.

3127

03:06:49.315 --> 03:06:51.695

Um, so I usually do this, uh,

3128

03:06:52.175 --> 03:06:53.575

analysis in an Excel spreadsheet.

3129

03:06:53.875 --> 03:06:58.045

So you, um, you can use some Excel tools

3130

03:06:58.505 --> 03:07:01.565

to identify where do I have, um, you know,

3131

03:07:01.565 --> 03:07:02.685

you can make a histogram for

3132

03:07:02.685 --> 03:07:03.725

example, or something like that.

3133

03:07:03.735 --> 03:07:07.485

Where, where are my very common mitigations? What are those?

3134

03:07:07.505 --> 03:07:12.165

And what, what does it affect to help, um, help you justify

3135

03:07:12.195 --> 03:07:13.765

what mitigations you need to go

3136

03:07:13.765 --> 03:07:14.925

after? Does that make sense? So,

3137

03:07:15.265 --> 03:07:17.845

So you're continuing your STPA until you're satisfied

3138

03:07:18.315 --> 03:07:19.605

with the, with the results.

3139

03:07:20.355 --> 03:07:24.325

Yeah. Yeah. One of the, uh, one of the questions we had was,

3140

03:07:24.595 --> 03:07:27.205

does STPA provide guidance on

3141

03:07:27.205 --> 03:07:28.485

how much testing should be done?

3142

03:07:29.465 --> 03:07:32.805

Mm-hmm. Yes. So it can definitely help with that.

3143

03:07:33.225 --> 03:07:35.845

Um, so in one of the analyses that I did,

3144

03:07:35.845 --> 03:07:39.085

it's actually in my thesis, um, if I go back up one

3145

03:07:39.595 --> 03:07:40.605

that you can find there.

3146
03:07:41.145 --> 03:07:45.965
So, uh, I actually, I found that, that there are situations

3147
03:07:45.965 --> 03:07:50.165
where, um, my mitigation was, we should have tested that

3148
03:07:50.165 --> 03:07:51.325
before we fielded.

3149
03:07:51.705 --> 03:07:54.845
So now, now you, now you know that, that I need

3150
03:07:54.845 --> 03:07:56.285
to incorporate that into my test program.

3151
03:07:57.605 --> 03:08:00.615
Okay. Tom, I, uh,

3152
03:08:01.295 --> 03:08:03.775
I see on the chat window that you have a question

3153
03:08:03.775 --> 03:08:05.895
that you are aiming to ask Sarah.

3154
03:08:08.995 --> 03:08:11.905
Sarah, great presentation. Really well done. Thank you.

3155
03:08:12.005 --> 03:08:15.745
Uh, one of your, one of your dot points, uh, on the,

3156
03:08:16.825 --> 03:08:19.365
uh, laundry list of, of, um,

3157
03:08:20.425 --> 03:08:23.145
attempts at using SST PA across different organizations.

3158
03:08:23.245 --> 03:08:24.425
You mentioned the FAA.

3159
03:08:24.425 --> 03:08:26.825

Can you go back to that one and explain the part 23

3160

03:08:27.445 --> 03:08:30.345

and the FAA interest in, in applying STPA?

3161

03:08:31.795 --> 03:08:34.695

So, um, uh, that's knowledge I have just talking

3162

03:08:34.715 --> 03:08:35.775

to Nancy and John.

3163

03:08:35.915 --> 03:08:37.135

So if John's with us,

3164

03:08:37.195 --> 03:08:39.455

he can hopefully provide some more details.

3165

03:08:39.675 --> 03:08:42.575

But my understanding is if you, uh,

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03:08:42.995 --> 03:08:44.615

and it's still through subcommittee, you know, any,

3167

03:08:44.715 --> 03:08:46.415

any government bureaucracy takes a while,

3168

03:08:46.915 --> 03:08:48.055

um, as I, as I know.

3169

03:08:48.335 --> 03:08:49.335

'cause I love it. Um,

3170

03:08:49.835 --> 03:08:53.055

but, uh, the idea is if you have an STP analysis

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03:08:53.055 --> 03:08:55.775

and you have those artifacts that can, that can help get you

3172

03:08:55.775 --> 03:08:58.335

through the airworthiness process, is my understanding.

3173

03:08:58.715 --> 03:09:00.135
Uh, if John's with us, he can,

3174

03:09:00.195 --> 03:09:01.295
he can talk further about that.

3175

03:09:01.295 --> 03:09:03.335
Maybe he'll be back here too. Yeah,

3176

03:09:03.965 --> 03:09:06.525
We can, we can defer that one to the panel session.

3177

03:09:07.265 --> 03:09:11.605
So can I just get your, your overall sense that it appears

3178

03:09:11.605 --> 03:09:14.605
that maybe program managers are willing to embrace this

3179

03:09:14.785 --> 03:09:17.485
or maybe the, the general, uh,

3180

03:09:17.995 --> 03:09:20.805
feeling you're getting it in the secretary's secretary's

3181

03:09:20.805 --> 03:09:24.845
office about maybe this is unlocking a lot of good potential

3182

03:09:24.985 --> 03:09:27.645
for acquisition, um,

3183

03:09:27.745 --> 03:09:30.525
and developing this through the program development phase

3184

03:09:30.745 --> 03:09:33.445
and then right on through to IOC

3185

03:09:33.445 --> 03:09:35.365
or certification for our programs. Mm-hmm.

3186

03:09:36.275 --> 03:09:37.495

So what's interesting is, I think,

3187

03:09:37.575 --> 03:09:40.255

I think testers really latch onto this well, I think one,

3188

03:09:40.255 --> 03:09:43.535

because, you know, we, we live the safety and

3189

03:09:43.595 --> 03:09:46.495

and risk analysis, uh, on the daily basis.

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03:09:47.235 --> 03:09:50.295

So we, I think this, um, resonates a lot with,

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03:09:50.295 --> 03:09:51.415

with the test community.

3192

03:09:51.915 --> 03:09:55.365

Um, uh, I've, I've struggled a bit probably

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03:09:55.365 --> 03:09:58.525

because I'm, maybe I'm a little too, too technical, uh, for,

3194

03:09:58.525 --> 03:10:01.285

for a lot of program managers, I've, I've struggled to,

3195

03:10:01.385 --> 03:10:04.165

to get, um, folks on board

3196

03:10:04.165 --> 03:10:07.165

because it's sometimes seen as it's, it's extra, right?

3197

03:10:07.885 --> 03:10:10.405

I already have these a thousand, you know,

3198

03:10:10.405 --> 03:10:12.565

airworthiness boxes I have to check.

3199

03:10:12.825 --> 03:10:15.245

And now this is something new that I have to check.

3200

03:10:15.545 --> 03:10:16.965

So I think really if,

3201

03:10:17.265 --> 03:10:20.245

if we can get the airworthiness folks on board

3202

03:10:20.355 --> 03:10:22.365

with understanding what SCPA is

3203

03:10:22.365 --> 03:10:25.405

and what it brings to the fight with respect to, um,

3204

03:10:25.885 --> 03:10:28.245

creating, uh, safer aircraft, I think

3205

03:10:28.245 --> 03:10:30.485

that will do us a lot of good.

3206

03:10:30.825 --> 03:10:33.325

Um, 'cause unfortunately, program managers live in

3207

03:10:33.325 --> 03:10:35.365

that same fiscally constrained environment.

3208

03:10:35.865 --> 03:10:39.645

And if, if this is seen as something, um, that they're going

3209

03:10:39.645 --> 03:10:41.285

to going to do, but it's not gonna,

3210

03:10:41.315 --> 03:10:43.045

airworthiness isn't gonna care about it,

3211

03:10:43.355 --> 03:10:47.245

then they're likely not going to to, to lead that charge.

3212

03:10:47.345 --> 03:10:50.245

So we've been pushing the rope from the Air Force Test

3213

03:10:50.245 --> 03:10:51.525

Center as much as we can,

3214

03:10:52.065 --> 03:10:55.485

but I think, um, getting, getting our FAA

3215

03:10:55.705 --> 03:11:00.125

and, uh, lc, M-C-E-N-E-Z partners involved with this, uh,

3216

03:11:00.125 --> 03:11:01.605

for the Air Force at least, um, I think

3217

03:11:01.605 --> 03:11:02.805

that will, will go a long way.

3218

03:11:04.005 --> 03:11:07.355

Sarah, can I press on that point where you said, uh, you,

3219

03:11:07.475 --> 03:11:08.515

you're very technical

3220

03:11:08.615 --> 03:11:11.755

and give you the opportunity if we, uh, throw a scenario

3221

03:11:11.825 --> 03:11:12.995

that says, uh, you

3222

03:11:12.995 --> 03:11:15.755

and I are flight test safety officers for a small startup.

3223

03:11:16.045 --> 03:11:18.715

We've got, uh, three of us, and mm-hmm.

3224

03:11:19.115 --> 03:11:20.595

Surprise, surprise, we're developing EV

3225

03:11:20.595 --> 03:11:21.955

tolls because mm-hmm.

3226

03:11:22.035 --> 03:11:23.155

There's a lot of us out there doing that now.

3227

03:11:23.935 --> 03:11:27.595

Uh, you know, your company's hopefully Yeah,

3228

03:11:27.665 --> 03:11:28.755

your company's got three people.

3229

03:11:28.775 --> 03:11:31.035

Mine's got four. There we go. We're we're very tiny.

3230

03:11:32.635 --> 03:11:34.075

I saw on your initial slides

3231

03:11:34.265 --> 03:11:36.155

that you had some really great steps,

3232

03:11:36.215 --> 03:11:40.175

or you laid out how A TPA would be used at each step.

3233

03:11:40.755 --> 03:11:41.975

Mm-hmm. Given

3234

03:11:41.975 --> 03:11:43.975

that our organizations don't have formalized steps,

3235

03:11:44.145 --> 03:11:46.015

we've got one objective, get to flight

3236

03:11:46.435 --> 03:11:49.455

and do it now, how could we use STPA in

3237

03:11:49.455 --> 03:11:50.615

our day-to-day operations?

3238

03:11:51.265 --> 03:11:53.675

What does it do for us? How does it change the way we think?

3239

03:11:53.785 --> 03:11:55.955

What does it, what can we do with it

3240

03:11:56.965 --> 03:11:58.985

if we don't have a large program office?

3241

03:11:59.445 --> 03:12:01.505

Mm-hmm. So I think, um,

3242

03:12:02.065 --> 03:12:04.545

I think STPA is actually easier

3243

03:12:04.725 --> 03:12:07.265

to implement once you have the knowledge of how

3244

03:12:07.265 --> 03:12:08.705

to do it than mm-hmm.

3245

03:12:08.725 --> 03:12:10.225

Uh, for me or for fault tree.

3246

03:12:10.565 --> 03:12:13.025

Um, so, you know, one thing, one thing

3247

03:12:13.025 --> 03:12:15.305

because it's a top down approach.

3248

03:12:15.885 --> 03:12:17.265

I'm only looking at this,

3249

03:12:17.265 --> 03:12:18.785

this is my mishap, this is my hazard.

3250

03:12:19.005 --> 03:12:21.025

And then what are all the things that can cause it?

3251

03:12:21.375 --> 03:12:24.585

When you have bottom up approaches, now you have to look at,

3252

03:12:25.135 --> 03:12:28.265

okay, if this component breaks, um, does it make me unsafe?

3253

03:12:28.285 --> 03:12:30.265

If this component breaks, does it make me unsafe?

3254

03:12:30.565 --> 03:12:33.785

So it's, it's, uh, it's actually from the,

3255

03:12:33.785 --> 03:12:35.345

not necessarily from the test perspective,

3256

03:12:35.345 --> 03:12:39.025

but from the design perspective, it's a lot more, uh,

3257

03:12:39.245 --> 03:12:41.705

or excuse me, a lot less manpower intensive.

3258

03:12:42.515 --> 03:12:43.535

So, so is it

3259

03:12:43.535 --> 03:12:45.295

Fair to say it's changed the way you think about it?

3260

03:12:46.475 --> 03:12:48.455

Has it changed the way you think for, for hazards?

3261

03:12:49.465 --> 03:12:50.965

It does, it does change the way that I,

3262

03:12:51.005 --> 03:12:54.405

I think it changes the way that I, I see systems in,

3263

03:12:54.505 --> 03:12:58.765

in the way of how, how would a, a person utilize this?

3264

03:12:59.105 --> 03:13:01.325

How could a person get themselves in a situation

3265

03:13:01.325 --> 03:13:04.245

where they think if they, you know, hit this button,

3266

03:13:04.245 --> 03:13:05.525

they're gonna be safe, but really

3267

03:13:06.035 --> 03:13:07.325

they're not going to be safe.

3268

03:13:07.345 --> 03:13:10.645

So it's changed my perspective dramatically in the way

3269

03:13:10.645 --> 03:13:12.805

that I view, uh, human

3270

03:13:13.365 --> 03:13:15.845

sy human systems interaction especially.

3271

03:13:17.525 --> 03:13:20.185

So it's brought in the, in the sociotechnical element.

3272

03:13:21.935 --> 03:13:22.935

Absolutely. Absolutely.

3273

03:13:23.315 --> 03:13:25.655

Uh, you know, we were talking during, um,

3274

03:13:26.715 --> 03:13:28.695

during Fred George's talk,

3275

03:13:28.695 --> 03:13:30.935

we were talking about essentially,

3276

03:13:31.645 --> 03:13:33.015

what does an operator need to know?

3277

03:13:33.015 --> 03:13:35.415

What does a pilot need to know about the system?

3278

03:13:35.915 --> 03:13:38.375

And we're, we're getting to a point where, you know,

3279

03:13:38.635 --> 03:13:40.735

to be a good pilot, you don't just need

3280

03:13:40.735 --> 03:13:41.815

stick and rudder skills, right?

3281

03:13:42.195 --> 03:13:45.775

You, you need to be able to be a system, a systems operator.

3282

03:13:45.835 --> 03:13:47.935

You need to understand the state of your system,

3283

03:13:48.475 --> 03:13:49.735

uh, at any given time.

3284

03:13:50.075 --> 03:13:52.815

And if you have some kind of abnormal condition, you need

3285

03:13:52.815 --> 03:13:54.815

to understand that abnormal condition in order

3286

03:13:54.835 --> 03:13:56.295

to be able to react.

3287

03:13:56.715 --> 03:14:00.455

So I think, I think the skillset that made a good pilot in,

3288

03:14:00.755 --> 03:14:02.775

you know, world War II is not necessarily

3289

03:14:02.805 --> 03:14:05.895

what makes a good pilot in, in 2020.

3290

03:14:06.555 --> 03:14:09.495

So, um, those are, those are things that we need

3291

03:14:09.495 --> 03:14:11.695

to think about is what, what does a pilot

3292

03:14:12.035 --> 03:14:14.695

or an operator really need to understand about their system,

3293

03:14:15.285 --> 03:14:16.815

both when things are going well

3294

03:14:17.075 --> 03:14:19.135

and in, in abnormal conditions.

3295

03:14:19.135 --> 03:14:21.375

And I think we've seen tests that we've seen mishaps

3296

03:14:21.585 --> 03:14:24.655

associated with that where, uh, everything's good,

3297

03:14:25.795 --> 03:14:27.455

an abnormal condition occurs,

3298

03:14:27.875 --> 03:14:30.095

and how well does the, does the pilot

3299

03:14:30.115 --> 03:14:31.295

or the operator really understand

3300

03:14:31.295 --> 03:14:34.095

that abnormal condition in order to safely recover from it?

3301

03:14:34.715 --> 03:14:36.775

Do you have any cues that you use to look

3302

03:14:36.775 --> 03:14:38.095

for those abnormal conditions?

3303

03:14:40.115 --> 03:14:43.045

Well, so I think, I think it depends on, on the system

3304

03:14:43.045 --> 03:14:45.485

that, that you're, you're talking about, you know,

3305

03:14:45.605 --> 03:14:48.325

I think about, you know, air France 4, 4, 7, um,

3306

03:14:48.325 --> 03:14:51.445

there's a variety of, of, um,

3307

03:14:52.425 --> 03:14:54.725

of ways you can be in an abnormal condition, right?

3308

03:14:55.705 --> 03:14:58.565

One I've seen is that the weight on wheels, now

3309

03:14:58.565 --> 03:15:01.525

that we're using that for more than we ever thought we would

3310

03:15:02.615 --> 03:15:04.435

as a, as a point of control.

3311

03:15:04.655 --> 03:15:06.355

Are there any other points of control

3312

03:15:06.355 --> 03:15:07.795

that you are sensitive to?

3313

03:15:08.945 --> 03:15:11.645

Oh, man. Um, I don't know

3314

03:15:11.645 --> 03:15:12.725

that I've thought about it in that way.

3315

03:15:12.825 --> 03:15:14.005

You mentioned that a few times.

3316

03:15:14.325 --> 03:15:16.165

I don't know that I've thought of it in that way before.

3317

03:15:16.925 --> 03:15:18.045

I think it depends on the scenario

3318

03:15:18.045 --> 03:15:19.165

and the system that you're operating.

3319

03:15:21.345 --> 03:15:25.035

All right, Tom, I think we're, uh, probably on,

3320

03:15:25.225 --> 03:15:27.035

I've already used more than my allocated time.

3321

03:15:27.535 --> 03:15:29.875

Is it, uh, time to throw it open now, back

3322

03:15:29.875 --> 03:15:30.995
to a much broader panel?

3323

03:15:32.135 --> 03:15:34.915
Yep. So why Susan's bringing up the, uh, panel members,

3324

03:15:35.935 --> 03:15:38.795
uh, honcho, I hope you didn't take my comment about being a

3325

03:15:38.795 --> 03:15:40.515
young Air Force officer in the wrong way.

3326

03:15:40.665 --> 03:15:43.115
It's really a reflection of how old I am,

3327

03:15:43.855 --> 03:15:45.995
but, uh, I, I'm, I'm just so very impressed

3328

03:15:45.995 --> 03:15:47.195
with your accomplishments

3329

03:15:47.415 --> 03:15:50.805
and, uh, um, I, I see great things, uh,

3330

03:15:51.105 --> 03:15:52.285
for your career going forward.

3331

03:15:52.345 --> 03:15:53.965
And, and was I correct, you're, you're,

3332

03:15:53.965 --> 03:15:55.565
you're still striking for your PhD

3333

03:15:55.785 --> 03:15:57.565
and we're gonna call you Dr. Summers in the future.

3334

03:15:57.565 --> 03:15:58.845
Where, where does all that sit?

3335

03:15:59.545 --> 03:16:01.325

Um, I don't know. It depends on the, the, the,

3336

03:16:01.325 --> 03:16:02.925

what the Air Force has in store

3337

03:16:02.925 --> 03:16:03.965

for me over the next few years.

3338

03:16:04.105 --> 03:16:06.885

So, so we'll see. Uh, that's,

3339

03:16:06.885 --> 03:16:08.405

that's something I've definitely thought about,

3340

03:16:08.425 --> 03:16:11.565

but I'm not sure sure how it all will happen.

3341

03:16:12.395 --> 03:16:13.565

Well, I hope you get to do it

3342

03:16:13.665 --> 03:16:17.765

and, uh, uh, gosh, uh, we certainly know we, we need you

3343

03:16:17.765 --> 03:16:21.125

around to keep, uh, Colonel Wicker in line, so, uh,

3344

03:16:21.145 --> 03:16:22.285

we appreciate you doing that too.

3345

03:16:23.885 --> 03:16:25.425

Absolutely. Excellent.

3346

03:16:25.575 --> 03:16:28.065

Okay, so I'm gonna turn this really kind of back over

3347

03:16:28.065 --> 03:16:30.585

to you, Ben, to lead, but I see we've got Shem back on.

3348

03:16:30.795 --> 03:16:34.065

We're gonna keep you Sarah, we're hoping Fred George, uh,

3349

03:16:34.205 --> 03:16:35.585
can, can join us as well.

3350

03:16:36.585 --> 03:16:37.585
I see that

3351

03:16:38.555 --> 03:16:40.585
Shams invested many, many words.

3352

03:16:40.605 --> 03:16:41.605
You know, the question panel.

3353

03:16:43.145 --> 03:16:44.825
I see that. Yeah.

3354

03:16:45.455 --> 03:16:47.785
Yeah. Trying to keep up with them. There was a couple

3355

03:16:48.265 --> 03:16:49.265
Questions.

3356

03:16:49.375 --> 03:16:51.585
Yeah, some good questions there from very good

3357

03:16:51.785 --> 03:16:53.225
questions, actually.

3358

03:16:55.555 --> 03:16:59.615
Uh, shi I see you answered a few on, uh, how the FAA

3359

03:17:00.935 --> 03:17:03.835
is is, uh, stepping up with STPA.

3360

03:17:03.835 --> 03:17:05.435
Do you wanna elaborate on, on a few of those?

3361

03:17:05.755 --> 03:17:08.595
I see you've addressed that once or twice, can you? Yeah,

3362

03:17:08.915 --> 03:17:10.195

I, you know, there was a lot of,

3363

03:17:10.275 --> 03:17:11.875

For the broader audience. Yeah,

3364

03:17:12.635 --> 03:17:14.395

A lot of, a lot of questions on that.

3365

03:17:15.335 --> 03:17:19.075

So the FAA, um, you know, certainly the certification

3366

03:17:19.295 --> 03:17:21.355

and some of the other offices are aware,

3367

03:17:21.365 --> 03:17:22.595

we've been talking to them.

3368

03:17:23.735 --> 03:17:26.875

Um, you know, NTSB is another organization

3369

03:17:26.905 --> 03:17:31.195

that is very interested in trying to implement staff,

3370

03:17:31.495 --> 03:17:32.875

you know, cast in that regard.

3371

03:17:33.755 --> 03:17:36.935

But, uh, sorry, there's a bark dog.

3372

03:17:37.675 --> 03:17:41.555

Um, but that said, um,

3373

03:17:42.855 --> 03:17:45.745

they are, they're really just overwhelmed.

3374

03:17:45.885 --> 03:17:49.585

The, the people who are in the right places know

3375

03:17:49.765 --> 03:17:53.665

and understand and see the value that I can tell you, um,

3376

03:17:53.665 --> 03:17:55.705

this is just based on personal conversations.

3377

03:17:56.405 --> 03:17:58.865

The problem is that their workload is insane,

3378

03:17:59.445 --> 03:18:02.065

and they're trying to just keep up with this max.

3379

03:18:02.325 --> 03:18:05.225

And then we've discovered new things with other airplanes

3380

03:18:05.285 --> 03:18:08.675

and, and so they're in this crisis management mode,

3381

03:18:08.975 --> 03:18:10.075

is the best I can say.

3382

03:18:10.135 --> 03:18:13.115

But that said, uh, you know, I know

3383

03:18:13.115 --> 03:18:15.075

that John has been involved, uh,

3384

03:18:16.205 --> 03:18:21.065

on the A TSM committee, uh, working on creating a standard,

3385

03:18:22.145 --> 03:18:26.025

um, for, uh,

3386

03:18:26.095 --> 03:18:27.425

that would be part 23.

3387

03:18:27.965 --> 03:18:30.505

And there is, I've seen

3388

03:18:30.505 --> 03:18:35.115

and read the standard that it was developed for by RTCA

3389

03:18:35.375 --> 03:18:37.595
for, uh, cybersecurity.

3390

03:18:39.135 --> 03:18:42.915
And then there is also a, uh, standard

3391

03:18:43.105 --> 03:18:46.635
that is in the works from SAE,

3392

03:18:46.655 --> 03:18:49.085
and I believe John can correct me if I'm wrong,

3393

03:18:49.145 --> 03:18:53.765
but my understanding is I'm pretty sure that it's going

3394

03:18:53.765 --> 03:18:58.395
to be part of, um, a RP 47 61,

3395

03:18:58.735 --> 03:19:00.275
and 43 54.

3396

03:19:00.975 --> 03:19:05.795
Um, so tho you know, those are fairly much in adopted

3397

03:19:06.055 --> 03:19:07.275
how we do the methods.

3398

03:19:07.535 --> 03:19:08.675
So I, I'll,

3399

03:19:09.475 --> 03:19:12.545
I can chime in here, I can chime in here.

3400

03:19:12.575 --> 03:19:13.905
There's a lot of efforts.

3401

03:19:14.165 --> 03:19:17.105
Almost, uh, every organization you can imagine

3402

03:19:17.455 --> 03:19:20.585

that we've just mentioned, uh, has something, uh,

3403

03:19:20.585 --> 03:19:24.545

that they're doing with STPA, uh, with industry of course.

3404

03:19:24.805 --> 03:19:26.865

And that's sometimes where these things start.

3405

03:19:27.355 --> 03:19:30.625

We've got folks at, at Boeing in different, uh,

3406

03:19:31.525 --> 03:19:34.945

the Boeing organization, uh, advocating for SGPA

3407

03:19:34.945 --> 03:19:36.905

and using it internally on different projects.

3408

03:19:36.925 --> 03:19:39.465

And BRAYER has got the, the same, uh, type of thing.

3409

03:19:39.465 --> 03:19:40.665

Lots of airlines are using it.

3410

03:19:40.925 --> 03:19:45.185

And the FA has been getting a lot of pressure, uh, to kind

3411

03:19:45.185 --> 03:19:47.185

of get, get with the program in terms

3412

03:19:47.185 --> 03:19:50.385

of STPA since industry is, is really pushing, uh,

3413

03:19:50.485 --> 03:19:52.385

to start using it because it's working for them.

3414

03:19:52.885 --> 03:19:54.185

So about four

3415

03:19:54.445 --> 03:19:58.145

or five years ago, the FAA started adding STPA

3416

03:19:58.145 --> 03:19:59.545
to their internal training

3417

03:19:59.685 --> 03:20:01.545
for their own certification officers.

3418

03:20:01.735 --> 03:20:03.985
They have to teach their own staff how to,

3419

03:20:03.985 --> 03:20:05.025
how to do certification.

3420

03:20:05.255 --> 03:20:09.465
They started training them on STPA, uh, in preparation

3421

03:20:09.685 --> 03:20:13.505
for an application, uh, using STPA as a means of compliance.

3422

03:20:14.045 --> 03:20:17.505
Uh, since then, they have now broken it off with, uh,

3423

03:20:18.255 --> 03:20:22.745
more classes multiple times, uh, in a year, uh,

3424

03:20:22.975 --> 03:20:25.665
just on STPA for their internal staff,

3425

03:20:25.855 --> 03:20:27.945
including the folks in the Seattle office

3426

03:20:28.165 --> 03:20:30.625
who are involved in some very important,

3427

03:20:31.205 --> 03:20:32.905
um, certification issues.

3428

03:20:33.565 --> 03:20:37.545
And, uh, they're, they are ready to start using, uh,

3429

03:20:37.865 --> 03:20:42.065

STPA Now, in terms of requiring STPA, uh, that's not,

3430

03:20:42.065 --> 03:20:43.905
that's not quite what the FAA does.

3431

03:20:44.375 --> 03:20:47.145
They don't, uh, write a regulation that says,

3432

03:20:47.205 --> 03:20:48.785
you shall use STPA.

3433

03:20:48.785 --> 03:20:52.625
They don't even like to say you shall use 4 7, 6 1.

3434

03:20:52.625 --> 03:20:54.305
And you know what? Industry doesn't like them to say

3435

03:20:54.305 --> 03:20:58.145
that either, in fact, um, but they are very receptive.

3436

03:20:58.325 --> 03:21:02.705
We had someone at from the FAA at our MIT stamp workshop a

3437

03:21:02.705 --> 03:21:05.265
few years ago, and he said, I often get asked,

3438

03:21:05.275 --> 03:21:08.825
would we accept S tpa a as a, as part

3439

03:21:08.825 --> 03:21:10.305
of a certification application?

3440

03:21:10.485 --> 03:21:13.425
And he said, I'd be here to tell you, uh, unequivocally,

3441

03:21:13.445 --> 03:21:14.465
yes, we would.

3442

03:21:14.685 --> 03:21:16.065
We are waiting for that to happen.

3443
03:21:16.615 --> 03:21:19.105
I've been, I don't believe that's happened yet for the FAA,

3444
03:21:19.105 --> 03:21:23.705
but it's been told it has been, uh, done for IA in Europe.

3445
03:21:24.595 --> 03:21:26.215
Um, that's the FAA.

3446
03:21:26.395 --> 03:21:28.735
The other thing that's happening is the big, uh,

3447
03:21:28.735 --> 03:21:32.415
safety standards for aviation, uh, in the civilian side,

3448
03:21:32.855 --> 03:21:34.375
A RP 4 7 6 1,

3449
03:21:34.375 --> 03:21:39.175
and 4 7 5 4, uh, the committee has been introduced to,

3450
03:21:42.155 --> 03:21:45.245
um, and what we're doing is we've got a phased,

3451
03:21:45.505 --> 03:21:46.525
uh, approach.

3452
03:21:46.745 --> 03:21:50.725
The first step is not to put it directly into the arps,

3453
03:21:50.945 --> 03:21:53.965
but to establish a A IR,

3454
03:21:54.135 --> 03:21:58.605
which is an aerospace information report that defines STPA

3455
03:21:58.625 --> 03:22:00.405
as a standard that's being worked.

3456
03:22:00.405 --> 03:22:03.445

It's been in process for, uh, over a year now.

3457

03:22:03.985 --> 03:22:06.885

Um, I expect it to be out possibly this year, sometime

3458

03:22:07.255 --> 03:22:10.605

after that standard comes out, that's when, uh, we start

3459

03:22:10.605 --> 03:22:13.845

to talk about how to introduce it into 4, 7, 6 1.

3460

03:22:14.095 --> 03:22:17.805

There are a number of committee members that are, uh, eager

3461

03:22:18.025 --> 03:22:20.925

to, uh, see how that, uh, can be introduced,

3462

03:22:21.185 --> 03:22:24.525

but that's a longer process, uh, to change arps.

3463

03:22:24.705 --> 03:22:27.685

The other thing that I'll mention is there is another

3464

03:22:27.885 --> 03:22:30.325

standards committee, A STM, uh,

3465

03:22:30.585 --> 03:22:34.805

and there's a F 44 50 is a subcommittee there

3466

03:22:34.805 --> 03:22:36.125

that deals with functional safety.

3467

03:22:36.465 --> 03:22:40.125

Uh, the representation there seems to be mostly for

3468

03:22:40.635 --> 03:22:42.325

part 23 aircraft,

3469

03:22:42.805 --> 03:22:45.405

although it's the, the declaration, the definition

3470

03:22:45.405 --> 03:22:47.605

of the committee is not limited to, to part 23,

3471

03:22:47.625 --> 03:22:50.405

but that just seems to be the, the relevance of folks there.

3472

03:22:50.405 --> 03:22:52.045

And they're developing in parallel,

3473

03:22:52.525 --> 03:22:55.685

a a more streamlined standard, uh,

3474

03:22:55.835 --> 03:22:58.285

more streamlined than the A IR, which really kind

3475

03:22:58.285 --> 03:23:00.205

of has part 25 aircraft in mind.

3476

03:23:00.505 --> 03:23:03.805

Um, they're doing a part 23 version of an tpa,

3477

03:23:03.845 --> 03:23:06.685

a dedicated standard for evaluating safety

3478

03:23:06.865 --> 03:23:08.285

of smaller aircraft.

3479

03:23:08.595 --> 03:23:11.165

That standard is probably gonna be pop,

3480

03:23:12.015 --> 03:23:13.965

gonna be finished within a matter of months.

3481

03:23:14.465 --> 03:23:16.365

Um, it's already been written, it's already gone

3482

03:23:16.365 --> 03:23:17.885

through the first ballot and approved.

3483

03:23:18.025 --> 03:23:21.325

We were very, very close. So there's a lot of activity, uh,

3484

03:23:21.385 --> 03:23:24.965

in the industry standards in companies using it for safety,

3485

03:23:25.105 --> 03:23:28.085

but not claiming credit on the certification work, uh,

3486

03:23:28.105 --> 03:23:29.245

for tpa a all the time.

3487

03:23:29.265 --> 03:23:32.885

And at the FAA getting ready, they are ready to receive, uh,

3488

03:23:33.325 --> 03:23:35.085

STPA as part of an application.

3489

03:23:35.595 --> 03:23:39.285

John, you mentioned that companies are using STPA

3490

03:23:39.745 --> 03:23:41.645

and I'm now thinking airlines.

3491

03:23:42.635 --> 03:23:43.965

Shem, do you have any examples

3492

03:23:44.375 --> 03:23:46.685

where STPA has helped an operator?

3493

03:23:46.745 --> 03:23:50.005

So we've had a look at how it's used in the design phase,

3494

03:23:50.025 --> 03:23:52.525

and we've all agreed that STPA is early

3495

03:23:52.545 --> 03:23:53.645

as possible, is great.

3496

03:23:54.835 --> 03:23:58.895

Is it useful on the day-to-day operating basis? Yeah.

3497

03:23:59.505 --> 03:24:00.505

Using it for that.

3498

03:24:01.435 --> 03:24:03.615

So we're using it on both ends.

3499

03:24:03.635 --> 03:24:05.295

And I just wanna aside, John, take a look.

3500

03:24:05.375 --> 03:24:08.255

I just sent you a excellent question that you probably need

3501

03:24:08.255 --> 03:24:09.895

to jump in and answer when you get back.

3502

03:24:10.155 --> 03:24:14.175

Yep, yep. The, uh, the answer,

3503

03:24:14.475 --> 03:24:16.095

the short answer is absolutely.

3504

03:24:16.595 --> 03:24:21.195

Um, there are several airlines that are using it, um, for,

3505

03:24:21.765 --> 03:24:25.555

first of all, for part of the safety management system, uh,

3506

03:24:25.915 --> 03:24:27.675

causal analysis using system theory

3507

03:24:27.695 --> 03:24:31.315

or the CAS is absolutely part of investigating events

3508

03:24:31.535 --> 03:24:34.515

and development of methods and procedures.

3509

03:24:35.075 --> 03:24:36.955

I can tell you because it's public

3510

03:24:36.985 --> 03:24:38.235

that FedEx is one of them.

3511

03:24:39.055 --> 03:24:43.645

Uh, I know there are a couple in Asia

3512

03:24:43.905 --> 03:24:46.805

and Europe as well and more that are interested.

3513

03:24:46.945 --> 03:24:50.205

So, yeah, absolutely. And, uh, what do they

3514

03:24:50.205 --> 03:24:52.165

Get outta it on a day-to-day basis?

3515

03:24:52.275 --> 03:24:54.125

What do they get out of STPA?

3516

03:24:54.505 --> 03:24:56.685

Is this something pilots are walking into the aircraft with?

3517

03:24:56.685 --> 03:24:58.285

Is it something that's scheduled as a

3518

03:24:59.425 --> 03:25:02.805

No, it's really, so STPA, of course, is

3519

03:25:04.135 --> 03:25:08.545

how we're looking, um, at an accident

3520

03:25:08.545 --> 03:25:09.785

that hasn't happened yet.

3521

03:25:10.335 --> 03:25:15.305

Okay. And so in that case, it's, uh, using it for,

3522

03:25:15.765 --> 03:25:17.945

you know, you're implementing a new policy

3523

03:25:18.125 --> 03:25:19.825

or procedure or equipment.

3524

03:25:20.705 --> 03:25:24.925

Uh, of course, FedEx as many as you know, is also a bit

3525

03:25:24.925 --> 03:25:28.645

of an OEM developing, you know, various, uh,

3526

03:25:29.155 --> 03:25:32.685

various projects and technology as well.

3527

03:25:33.185 --> 03:25:35.715

But in addition, uh,

3528

03:25:36.175 --> 03:25:38.965

and just new policies

3529

03:25:38.965 --> 03:25:43.925

or procedures, you can, you can actually do an SDPA analysis

3530

03:25:43.925 --> 03:25:47.565

of it before you implement it as part of your risk analysis

3531

03:25:48.145 --> 03:25:49.165

before you make changes.

3532

03:25:49.345 --> 03:25:52.405

So it actually is part of that SMS process itself,

3533

03:25:52.865 --> 03:25:54.085

So it can be used operationally

3534

03:25:54.865 --> 03:25:55.865

Use as well.

3535

03:25:58.245 --> 03:26:00.785

I'm not sure where to direct this one from the question

3536

03:26:00.785 --> 03:26:03.785

panel or from the question, uh, inputs.

3537

03:26:03.805 --> 03:26:08.625

But to the broader panel, where does STPA fit into an SMS?

3538

03:26:11.565 --> 03:26:12.745

Any volunteers on that one?

3539

03:26:13.865 --> 03:26:14.885

Can you repeat that one more time?

3540

03:26:15.655 --> 03:26:19.325

Where, where does an STPA fit into an SMS?

3541

03:26:20.065 --> 03:26:23.135

So most of us have an SMS structure. Yeah, yeah.

3542

03:26:23.165 --> 03:26:25.415

Then we, then we decide that SDPA,

3543

03:26:25.415 --> 03:26:26.575

we wanna be doing some of this.

3544

03:26:27.035 --> 03:26:31.215

Do we put it into training, safety, promotion,

3545

03:26:32.175 --> 03:26:33.755

hazard, uh, risk management?

3546

03:26:34.705 --> 03:26:36.635

Yeah. It's part of quality assurance and,

3547

03:26:36.695 --> 03:26:38.475

and, uh, risk management, both

3548

03:26:38.475 --> 03:26:40.595

because, you know, you're, you're using it

3549

03:26:40.595 --> 03:26:43.075

for your post incident analysis and for that feed.

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03:26:43.695 --> 03:26:46.435

And again, as we said before, the process itself.

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03:26:46.455 --> 03:26:51.415

And, and Sarah said also that is sort of in the background.

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03:26:51.515 --> 03:26:53.175

In other words, it's the method you're using

3553

03:26:53.275 --> 03:26:55.295

to put the information into the system.

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03:26:55.395 --> 03:26:59.095

You're not, you know, you're, it's not necessarily built.

3555

03:26:59.205 --> 03:27:01.615

It's more of an adjunct to it. Um, so

3556

03:27:01.655 --> 03:27:05.655

A methodology, If anybody wants a real detailed answer.

3557

03:27:05.715 --> 03:27:10.335

By the way, there is a PhD thesis, uh, on this,

3558

03:27:10.515 --> 03:27:14.695

on this topic that we just, uh, completed at MIT is done by,

3559

03:27:15.155 --> 03:27:16.455

uh, Diego Castillo.

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03:27:16.605 --> 03:27:18.135

He's a Brazilian Air Force pilot,

3561

03:27:18.515 --> 03:27:21.375

and he looked at exactly this problem for both a civilian

3562

03:27:21.595 --> 03:27:23.415

and a military context.

3563

03:27:23.915 --> 03:27:28.615

But the short answer is any area where it's useful

3564

03:27:28.675 --> 03:27:32.095

to know what accident scenarios, uh, we have

3565

03:27:32.095 --> 03:27:34.655

to protect against, uh, that's an area

3566

03:27:34.655 --> 03:27:37.535

where SDPA results would be useful to you.

3567

03:27:37.795 --> 03:27:40.095

Uh, which is a pretty broad blanket.

3568

03:27:40.715 --> 03:27:42.605

One area that it's been used within.

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03:27:42.925 --> 03:27:44.565

I both of the last two questions.

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03:27:44.565 --> 03:27:47.165

Where is it used in airlines? Where is it used in, in sms?

3571

03:27:47.865 --> 03:27:51.725

One area is in, uh, foca data analysis,

3572

03:27:51.945 --> 03:27:53.125

and there's two sides to that.

3573

03:27:53.185 --> 03:27:54.965

One is, of course, when we see, you know,

3574

03:27:54.965 --> 03:27:56.205

something going wrong in Foco,

3575

03:27:56.205 --> 03:27:59.045

like we see an unstable approach, uh, we already have, uh,

3576

03:27:59.045 --> 03:28:00.645

triggers in place, we go investigate.

3577

03:28:00.945 --> 03:28:04.365

But the thing is, can we get a leading indicator

3578

03:28:04.905 --> 03:28:06.925
before something actually goes wrong?

3579

03:28:07.105 --> 03:28:08.965
We would like to catch these problems.

3580

03:28:09.125 --> 03:28:13.085
I mean, the causes of unstable approach don't occur.

3581

03:28:13.505 --> 03:28:14.605
Uh, you know, the second

3582

03:28:14.625 --> 03:28:18.125
before you have the unstable approach, they are

3583

03:28:18.665 --> 03:28:20.685
in the system long before that.

3584

03:28:20.825 --> 03:28:23.565
For example, we worked with a, a large airline,

3585

03:28:23.865 --> 03:28:26.725
and we, we looked at their focal data, I talked to them,

3586

03:28:26.805 --> 03:28:28.765
I said, how do you come up with the triggers to look

3587

03:28:28.785 --> 03:28:30.365
for in your focal data?

3588

03:28:30.625 --> 03:28:33.125
Uh, and they said, well, we kind of just look at each, each,

3589

03:28:33.385 --> 03:28:35.885
uh, data point, we come up with thresholds,

3590

03:28:35.885 --> 03:28:37.845
or it is basically whatever we think is important.

3591

03:28:38.005 --> 03:28:40.605

Wouldn't it be nice to have a systematic process

3592

03:28:41.145 --> 03:28:43.605
to identify exactly what kinds

3593

03:28:43.605 --> 03:28:46.125
of indicators we should be looking for?

3594

03:28:46.145 --> 03:28:48.765
We came up with some indicators that, that are not

3595

03:28:48.765 --> 03:28:52.805
so obvious that indicate the pilots are confused about modes

3596

03:28:52.805 --> 03:28:56.205
the automation is in, for example, not waiting for the thing

3597

03:28:56.205 --> 03:28:59.485
to go to 203 oh feet out of the glide slope.

3598

03:28:59.785 --> 03:29:02.565
We can figure out before that happens, uh, that you've got,

3599

03:29:02.635 --> 03:29:05.525
your whole fleet of pilots are having a confusion

3600

03:29:05.525 --> 03:29:06.605
between these two modes.

3601

03:29:06.605 --> 03:29:09.045
When this mo occurs in the auto throttle system,

3602

03:29:09.065 --> 03:29:12.445
for example, that is really good to figure out

3603

03:29:12.545 --> 03:29:15.285
before, uh, we, we have problems with,

3604

03:29:15.285 --> 03:29:17.005
with go arounds or, or something like that.

3605

03:29:17.345 --> 03:29:20.605

In fact, we, on one of the airlines, we found that, uh,

3606

03:29:20.675 --> 03:29:23.285

this was around the time that the Asiana crash was being

3607

03:29:23.725 --> 03:29:25.485

investigated before the final report came out.

3608

03:29:25.755 --> 03:29:27.205

This was another airline

3609

03:29:27.205 --> 03:29:29.725

that flies triple sevens into San Francisco.

3610

03:29:29.945 --> 03:29:31.885

And we were looking through their focal data,

3611

03:29:31.905 --> 03:29:34.045

we developed these additional leading indicators.

3612

03:29:34.225 --> 03:29:37.725

And we found, although they didn't have, uh, that vast,

3613

03:29:37.785 --> 03:29:38.965

an unstable approach

3614

03:29:38.965 --> 03:29:41.845

that hadn't been flagged previously into San Francisco,

3615

03:29:42.075 --> 03:29:46.085

they had 12 events that were almost identical to

3616

03:29:46.085 --> 03:29:47.925

what happened in the Asia crash in terms

3617

03:29:47.925 --> 03:29:52.205

of the pilots being stuck in this mode without the, uh,

3618

03:29:52.385 --> 03:29:57.085

the automation, uh, feature being, being enabled, uh, that

3619

03:29:57.085 --> 03:29:58.645

that would increase the throttle for you.

3620

03:29:59.105 --> 03:30:02.285

And, uh, that was happening 12 times in the last three years

3621

03:30:02.285 --> 03:30:05.005

where it came real close, uh, to having a crash.

3622

03:30:05.305 --> 03:30:07.085

It was corrected within a hundred feet of,

3623

03:30:07.085 --> 03:30:08.805

of getting, of touching down.

3624

03:30:09.405 --> 03:30:12.805

Anyways, that thing was obscured by just looking at the,

3625

03:30:12.825 --> 03:30:15.245

the traditional deviations in the focal data.

3626

03:30:15.385 --> 03:30:18.125

That's just one example. That's just one small part of SMS.

3627

03:30:18.125 --> 03:30:22.005

But any time where it's useful to you to know

3628

03:30:22.385 --> 03:30:24.165

how pilots could get confused,

3629

03:30:24.265 --> 03:30:26.085

how the automation could get confused,

3630

03:30:26.145 --> 03:30:29.565

how we could get close to an accident, uh, that's where,

3631

03:30:29.625 --> 03:30:31.405

that's what the SD PA results are.

3632

03:30:31.545 --> 03:30:33.285

And, and you can use that throughout.

3633

03:30:35.145 --> 03:30:37.675

John, I see that, uh, Shem passed you a, a question

3634

03:30:39.055 --> 03:30:40.305

over the, uh, over the text.

3635

03:30:41.295 --> 03:30:44.465

Yeah. There was a question, uh, somebody posted, uh,

3636

03:30:44.465 --> 03:30:46.985

that Shem caught, uh, it was from one of our attendees.

3637

03:30:47.205 --> 03:30:50.985

Uh, it says, can SBA be used in non-deterministic systems?

3638

03:30:52.145 --> 03:30:53.545

Absolutely, for sure. Uh,

3639

03:30:53.545 --> 03:30:55.465

and the example given in the question is,

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03:30:55.575 --> 03:30:57.785

what about an autonomous vehicle defending

3641

03:30:57.785 --> 03:30:58.985

against a missile?

3642

03:30:59.405 --> 03:31:02.865

In fact, it's been applied to that exact example.

3643

03:31:03.325 --> 03:31:06.345

Um, it's been being used in autonomous vehicles of,

3644

03:31:06.605 --> 03:31:09.105

of all kinds in the military as well as, uh,

3645

03:31:09.265 --> 03:31:12.225

vehicles on the road where you don't know what kind

3646

03:31:12.225 --> 03:31:13.505
of environment you're gonna run into.

3647

03:31:13.665 --> 03:31:15.825
I mean, weather is non-deterministic, right?

3648

03:31:16.285 --> 03:31:18.745
Um, and it's, it, it works very, very well.

3649

03:31:19.045 --> 03:31:22.545
Uh, there's nothing in SDPA that assumes it's going

3650

03:31:22.545 --> 03:31:24.825
to be deterministic or non-deterministic.

3651

03:31:25.015 --> 03:31:27.145
It's really a black box analysis.

3652

03:31:27.165 --> 03:31:29.265
It doesn't matter how you implement your software.

3653

03:31:29.565 --> 03:31:32.705
In SDPA, we identify what are the interactions

3654

03:31:32.705 --> 03:31:34.345
that are going to get you into trouble.

3655

03:31:34.755 --> 03:31:36.825
Those interactions exist.

3656

03:31:37.045 --> 03:31:39.865
We can declare those, whether we have a deterministic

3657

03:31:39.885 --> 03:31:43.025
or non-deterministic system, we can define those,

3658

03:31:43.025 --> 03:31:44.825
declare those put requirements in place

3659

03:31:44.965 --> 03:31:46.585
to prevent them and so on.

3660

03:31:46.605 --> 03:31:49.145
So, yes, for sure it applies, uh,

3661

03:31:49.145 --> 03:31:50.425
to non-deterministic cases.

3662

03:31:52.815 --> 03:31:54.655
I like that it's gonna identify the areas

3663

03:31:54.655 --> 03:31:57.615
that are gonna get us into trouble, really doesn't matter

3664

03:31:57.625 --> 03:32:00.575
where they, whether they come from the, the ratio

3665

03:32:00.795 --> 03:32:03.095
or the technical side of the, the equation.

3666

03:32:05.035 --> 03:32:08.135
Tom, if I can, uh, ask you, be ready to,

3667

03:32:08.355 --> 03:32:10.455
to take it back at this point, I think I have

3668

03:32:10.455 --> 03:32:11.535
to thank the panel.

3669

03:32:12.885 --> 03:32:15.235
We're, uh, we're into our last five minutes

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03:32:15.255 --> 03:32:17.425
or so, so we need to wrap it up.

3671

03:32:17.645 --> 03:32:19.025
Uh, thank you for your input.

3672

03:32:19.365 --> 03:32:21.385

Uh, thank you for your insights into

3673

03:32:21.405 --> 03:32:22.905

how we can apply this tool

3674

03:32:23.725 --> 03:32:27.065

and how we can use it to enlighten what we do,

3675

03:32:27.445 --> 03:32:31.545

be it on the operating side, uh, with a large organization,

3676

03:32:31.665 --> 03:32:34.945

a small organization, or way back up the, the v diagram

3677

03:32:35.365 --> 03:32:36.425

as early as we can.

3678

03:32:37.355 --> 03:32:38.355

Thank you very much.

3679

03:32:40.245 --> 03:32:41.865

Hey, Ben, thanks a million for, uh,

3680

03:32:41.865 --> 03:32:43.425

moderating, uh, this session.

3681

03:32:43.805 --> 03:32:46.345

And, uh, Fred, we didn't throw a question your way on this

3682

03:32:46.345 --> 03:32:49.265

panel, but, uh, I think you really covered the waterfront

3683

03:32:49.265 --> 03:32:50.505

during your presentation.

3684

03:32:50.745 --> 03:32:53.745

I can't thank you enough for, uh, for, uh,

3685

03:32:53.745 --> 03:32:55.265

your participation today, Sarah,

3686

03:32:55.285 --> 03:32:57.745

and knocked out the ballpark, uh, very impressed.

3687

03:32:58.005 --> 03:33:01.665

And, uh, thank you for your, uh, presentation today

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03:33:01.665 --> 03:33:03.185

and participation in this workshop.

3689

03:33:03.695 --> 03:33:06.945

Shem, thanks for, uh, adding that context to all of this

3690

03:33:07.045 --> 03:33:08.985

and, and, uh, my hat's off to you

3691

03:33:08.985 --> 03:33:11.825

and the work that you're doing, uh, specifically

3692

03:33:11.825 --> 03:33:13.425

with Florida Tech, and I noticed

3693

03:33:13.425 --> 03:33:16.585

that you had been answering people specifically about, uh,

3694

03:33:16.985 --> 03:33:20.265

offerings to get smarter on STPA stamp cast, et cetera,

3695

03:33:20.565 --> 03:33:23.385

and that, uh, Florida Tech at some point, uh, uh,

3696

03:33:23.435 --> 03:33:26.425

could perhaps offer a certificate program in this.

3697

03:33:26.605 --> 03:33:28.025

And I think many on

3698

03:33:29.175 --> 03:33:32.785

John, John and Nancy are in, are closely involved.

3699

03:33:32.795 --> 03:33:34.425

We're gonna make sure, in fact,

3700

03:33:34.425 --> 03:33:37.405

they're gonna continuously continuing to be involved.

3701

03:33:38.105 --> 03:33:42.765

Um, part of the ideas, uh, I think John can add is

3702

03:33:42.765 --> 03:33:45.925

that it will, um, sorry for the background noise.

3703

03:33:46.185 --> 03:33:49.535

Uh, it will allow,

3704

03:33:51.235 --> 03:33:53.935

uh, the certificate program to take on kind

3705

03:33:53.935 --> 03:33:57.175

of the more basic, get people like a basic understanding

3706

03:33:57.195 --> 03:34:01.295

and handle on it, and then allow, um, you know, John

3707

03:34:01.295 --> 03:34:04.495

and Nancy to work on kind of the higher

3708

03:34:05.265 --> 03:34:06.815

level aspects of it.

3709

03:34:07.395 --> 03:34:10.055

Um, you know, John probably can elaborate on that,

3710

03:34:10.075 --> 03:34:12.575

but that's basically the idea behind it.

3711

03:34:14.295 --> 03:34:16.145

Outstanding. Well, that's great.

3712

03:34:16.685 --> 03:34:19.065

Um, again, thank you all, really appreciate it.

3713

03:34:19.245 --> 03:34:23.265

And, uh, uh, if I could, Susan, uh, call out the next slide

3714

03:34:23.485 --> 03:34:25.785

and, uh, we will, uh, we'll wrap this up.

3715

03:34:32.555 --> 03:34:35.895

As we mentioned at the kickoff, we stated our explicit,

3716

03:34:36.735 --> 03:34:39.455

explicit objectives for the workshop.

3717

03:34:40.075 --> 03:34:44.255

Um, and again, we are only gonna just cover the very, uh,

3718

03:34:44.315 --> 03:34:45.495

top level information

3719

03:34:45.995 --> 03:34:48.455

and perhaps, uh, wet your appetite on this.

3720

03:34:48.475 --> 03:34:50.335

And there's going to be a series of poll questions,

3721

03:34:50.335 --> 03:34:52.375

and so that's why I wanted to put these back up again.

3722

03:34:52.795 --> 03:34:54.895

But hopefully we gave you, uh, some awareness.

3723

03:34:54.965 --> 03:34:58.415

Pull back the, the curtains a little bit on STPA if you

3724

03:34:58.415 --> 03:35:00.375

haven't had any familiarity with it.

3725

03:35:00.475 --> 03:35:03.975

And the, one of your first polling questions was, um,

3726

03:35:04.875 --> 03:35:06.895

asking about your familiarity with STPA

3727

03:35:06.895 --> 03:35:08.415

and it showed about half had never heard

3728

03:35:08.415 --> 03:35:09.735

of it, this workshop.

3729

03:35:09.795 --> 03:35:11.455

So that, that's encouraging that, um,

3730

03:35:11.745 --> 03:35:13.615

we're having this level of interest in it.

3731

03:35:14.075 --> 03:35:17.455

We, and we will endeavor to talk more about this,

3732

03:35:18.035 --> 03:35:21.215

and we appreciate your engagement, uh, and interest.

3733

03:35:22.035 --> 03:35:24.695

So let's go to the first, uh, polling question

3734

03:35:24.755 --> 03:35:28.365

for the day two, if we could, Susan,

3735

03:35:29.755 --> 03:35:31.695

so she's gonna put up the poll so you can go ahead

3736

03:35:31.695 --> 03:35:32.935

and select it, but here's the question

3737

03:35:33.235 --> 03:35:37.375

or statement, your understanding of STPA

3738

03:35:37.675 --> 03:35:41.695

and let's, let's broadly characterize, uh, and throw, stamp

3739

03:35:41.835 --> 03:35:43.375

and cast in here as well.

3740

03:35:54.655 --> 03:35:57.035

And once Susan gets a, a feel for

3741

03:35:57.535 --> 03:36:00.315

how things are stabilizing here and the number of attendees.

3742

03:36:00.315 --> 03:36:04.115

And I see that, uh, we held strong at over 300 all the way

3743

03:36:04.225 --> 03:36:06.155

into the last, uh, session there,

3744

03:36:06.815 --> 03:36:08.315

and we've dipped just below 300

3745

03:36:08.385 --> 03:36:09.795

attendees, which is still great.

3746

03:36:10.535 --> 03:36:12.555

Um, so that's encouraging.

3747

03:36:12.575 --> 03:36:15.555

So, uh, just, uh, 1% there.

3748

03:36:15.555 --> 03:36:16.955

That's still kind of on the fence,

3749

03:36:17.055 --> 03:36:19.275

but, um, I'm gonna take that as good news that we,

3750

03:36:19.575 --> 03:36:20.635

we delivered on the promise.

3751

03:36:20.655 --> 03:36:25.075

So that was what we were after. Okay, next question, Susan.

3752

03:36:29.065 --> 03:36:31.625

I could apply STPA to a complex system.

3753

03:36:32.435 --> 03:36:34.305

Let's see what you think on this one.

3754

03:36:35.715 --> 03:36:38.135

And let me al, let's just also include that, uh,

3755

03:36:38.135 --> 03:36:40.415

maybe you're analyzing an accident or an incident.

3756

03:36:40.915 --> 03:36:42.775

So let's say that, uh, you're doing cast

3757

03:36:42.835 --> 03:36:45.775

or stamp as well applied to,

3758

03:36:45.875 --> 03:36:47.885

uh, to a system event.

3759

03:37:04.265 --> 03:37:05.445

All right, Susan, how are we doing?

3760

03:37:11.225 --> 03:37:14.595

This is what, what I, I really expected.

3761

03:37:14.855 --> 03:37:17.595

So this is exactly the percentage breakout

3762

03:37:17.595 --> 03:37:19.355

that I would've anticipated in guessed,

3763

03:37:20.015 --> 03:37:23.995

and hopefully we inspired you to, to look into this further.

3764

03:37:24.535 --> 03:37:28.515

Uh, what, what's, um, helpful is that

3765

03:37:29.535 --> 03:37:31.355

the, the materials are free.

3766

03:37:31.665 --> 03:37:32.675

They're at no cost.

3767

03:37:32.785 --> 03:37:35.115

It's really about your time investment

3768

03:37:35.375 --> 03:37:36.795

and researching it further.

3769

03:37:37.575 --> 03:37:40.835

Uh, the workshops in Boston, as far as I know,

3770

03:37:41.095 --> 03:37:42.155

are still free.

3771

03:37:42.265 --> 03:37:44.155

They're no cost. You just gotta get up there.

3772

03:37:44.155 --> 03:37:46.355

They're free, and they're free. Thank you, John.

3773

03:37:46.815 --> 03:37:50.275

And, uh, uh, I would encourage you,

3774

03:37:50.275 --> 03:37:51.475

if you have the opportunity

3775

03:37:51.615 --> 03:37:54.195

and you have the travel funding to do it, go on up.

3776

03:37:54.425 --> 03:37:56.035

It's a great campus environment.

3777

03:37:56.295 --> 03:37:58.475

You can feel the brain power walking in there,

3778

03:37:58.915 --> 03:37:59.955

although I never knew

3779

03:37:59.955 --> 03:38:02.155

that we would break the internet at MIT, John.

3780

03:38:05.335 --> 03:38:07.905

Okay, Susan, let's, uh, let's march on to the,

3781

03:38:09.835 --> 03:38:11.135

uh, next question.

3782

03:38:14.095 --> 03:38:16.735

I think STPA has real applicability to, to flight test,

3783

03:38:17.095 --> 03:38:20.455

adapting STPA to specifically your

3784

03:38:21.075 --> 03:38:22.255

flight test environment.

3785

03:38:28.295 --> 03:38:31.195

And John, why this is running, if since you're still online,

3786

03:38:31.335 --> 03:38:36.105

can you offer any upcoming, uh, online webinars

3787

03:38:36.105 --> 03:38:37.305

that you may be hosting that, that

3788

03:38:37.305 --> 03:38:38.505

folks might want to chime into?

3789

03:38:39.605 --> 03:38:41.825

You know, I was thinking about that

3790

03:38:42.325 --> 03:38:45.185

and just going through the homework submissions.

3791

03:38:45.685 --> 03:38:49.105

We got some really fantastic, uh, submissions

3792

03:38:49.105 --> 03:38:53.905

that I can just see of STPA screaming at us.

3793

03:38:54.645 --> 03:38:56.425

I'm thinking of turning a couple

3794

03:38:56.425 --> 03:38:59.025
of those homework submissions into a webinar.

3795

03:38:59.765 --> 03:39:03.265
Uh, maybe in the next few weeks, I'll reach out to, uh, some

3796

03:39:03.265 --> 03:39:05.065
of the folks who submitted that and,

3797

03:39:05.165 --> 03:39:07.105
and see if they, they're game for it.

3798

03:39:07.525 --> 03:39:10.265
Uh, I think that might happen, uh, pretty soon.

3799

03:39:10.765 --> 03:39:13.425
But in the longer run, uh, in the next, uh, month

3800

03:39:13.425 --> 03:39:17.825
or two, the Marsh workshop, uh, we couldn't hold, uh,

3801

03:39:17.825 --> 03:39:21.025
unfortunately, as, as we have for the last almost 10 years.

3802

03:39:21.485 --> 03:39:25.025
Uh, but we are going to convert it into a virtual workshop.

3803

03:39:25.565 --> 03:39:27.265
Um, so stay tuned for that.

3804

03:39:27.365 --> 03:39:30.145
We, um, we'll post the news everywhere on our website,

3805

03:39:30.245 --> 03:39:33.965
of course, MIT edu slash PSAs.

3806

03:39:34.745 --> 03:39:37.445
Um, we'll, we'll email out to everyone.

3807

03:39:37.505 --> 03:39:38.725

We can, uh, and,

3808

03:39:38.825 --> 03:39:43.765

and, uh, we'll have maybe 30 talks from folks all

3809

03:39:43.765 --> 03:39:46.445

around the world who have been applying STPA

3810

03:39:46.465 --> 03:39:49.285

and want to share what they have found, uh, from using,

3811

03:39:49.285 --> 03:39:52.925

it's very much an industry based, uh, conference, not

3812

03:39:52.925 --> 03:39:55.445

so much a theoretical academic conference.

3813

03:39:55.505 --> 03:39:57.565

If you, uh, I'm sure many

3814

03:39:57.565 --> 03:39:58.645

of you know what I'm talking about.

3815

03:39:58.945 --> 03:40:00.925

So those are the two things I think I would watch out

3816

03:40:00.945 --> 03:40:02.165

for next coming up.

3817

03:40:03.325 --> 03:40:05.425

So, John, uh, please accept, uh,

3818

03:40:05.525 --> 03:40:08.265

the flight test safety committees offer to assist in that,

3819

03:40:09.005 --> 03:40:12.985

any webinars that, uh, great, um, we can help with.

3820

03:40:13.165 --> 03:40:16.865

And further, uh, you have my promise to stay in touch so

3821
03:40:16.865 --> 03:40:19.345
that we can communicate this back out via our newsletter

3822
03:40:20.005 --> 03:40:22.345
and podcasting and our website.

3823
03:40:23.575 --> 03:40:25.395
Great. Okay.

3824
03:40:25.535 --> 03:40:28.435
So it looks like we've won hearts and minds here,

3825
03:40:28.455 --> 03:40:29.675
or at least convinced most

3826
03:40:29.905 --> 03:40:31.715
that we can apply this to flight test.

3827
03:40:32.295 --> 03:40:35.075
That's good. There's still some that may, uh,

3828
03:40:35.135 --> 03:40:36.835
be doubting Thomas's, and that's fine.

3829
03:40:37.015 --> 03:40:40.035
And, um, maybe they will continue to look into STPA

3830
03:40:40.035 --> 03:40:41.675
and see what they think going forward.

3831
03:40:41.935 --> 03:40:43.555
All right, Susan, next slide please.

3832
03:40:45.045 --> 03:40:47.495
Just quickly, I want to remind folks, uh,

3833
03:40:47.825 --> 03:40:50.495
there is abundant resources on our website,

3834
03:40:50.495 --> 03:40:53.935

and this is really kind of our venue

3835

03:40:54.435 --> 03:40:58.215

and offering to you all as flight testers to, uh,

3836

03:40:58.285 --> 03:41:00.055

provide you the resources that, that,

3837

03:41:00.235 --> 03:41:01.335

uh, we think are helpful.

3838

03:41:01.555 --> 03:41:03.615

And if you think that we need to, uh,

3839

03:41:03.615 --> 03:41:05.255

include others, then let me know.

3840

03:41:05.645 --> 03:41:10.435

Next, please. Again, all the video casting

3841

03:41:10.495 --> 03:41:14.195

to include this, um, given that the presenters, uh,

3842

03:41:14.195 --> 03:41:15.755

afford us, the permissions

3843

03:41:15.755 --> 03:41:18.835

to host it will be available on the website

3844

03:41:18.855 --> 03:41:20.955

to include their presentation materials.

3845

03:41:21.215 --> 03:41:24.915

So it's all there. And, um, we would encourage you

3846

03:41:24.915 --> 03:41:27.235

to take this back to your host organizations

3847

03:41:27.375 --> 03:41:28.595

and share it far and wide.

3848

03:41:29.255 --> 03:41:32.115

Um, we just released the Airshow Guide, so if you're in

3849

03:41:32.115 --> 03:41:35.115

that, in that business, then we highly recommend

3850

03:41:35.115 --> 03:41:37.635

that you go there because these were the best guys in the

3851

03:41:37.795 --> 03:41:40.195

business that contributed to the production of this guide,

3852

03:41:40.915 --> 03:41:44.275

SMS Resources, some good information on COVID-19

3853

03:41:44.575 --> 03:41:48.355

and, uh, continuation and resumption of, of operations

3854

03:41:48.355 --> 03:41:51.355

and flight tests, speci, uh, specifically, uh,

3855

03:41:51.455 --> 03:41:54.795

and then all of the SDPA resources, uh, are there

3856

03:41:54.795 --> 03:41:55.835

and available for you as well.

3857

03:41:55.865 --> 03:42:00.825

Next chart, We're gonna be in London in October,

3858

03:42:01.365 --> 03:42:02.745

uh, hopefully, and this is

3859

03:42:02.745 --> 03:42:03.945

really gonna be an outstanding event.

3860

03:42:03.945 --> 03:42:06.105

We're gonna do safety risk management, um,

3861

03:42:06.565 --> 03:42:08.425

and yes, maybe somebody will mention

3862

03:42:08.445 --> 03:42:10.505

as TPA at the European workshop,

3863

03:42:10.965 --> 03:42:13.985

but, uh, at this point, re um, we,

3864

03:42:13.995 --> 03:42:15.145

we've made the call for papers.

3865

03:42:15.275 --> 03:42:17.665

We're still holding out for the registration as long

3866

03:42:17.665 --> 03:42:19.025

as we can to make sure that, uh,

3867

03:42:19.025 --> 03:42:20.425

it's gonna be safe to travel over there.

3868

03:42:20.765 --> 03:42:23.385

So please, uh, stay tuned for that next chart.

3869

03:42:25.835 --> 03:42:27.415

And of course, uh, we hope that,

3870

03:42:27.565 --> 03:42:29.135

that we can hit the fast forward button

3871

03:42:29.155 --> 03:42:30.815

and get, uh, COVID-19 behind us.

3872

03:42:31.305 --> 03:42:34.205

And we'll be in Denver a year from now talking about safety

3873

03:42:34.275 --> 03:42:37.285

promotion and, uh, enjoying, uh, hosting

3874

03:42:37.465 --> 03:42:39.285

by Boom Supersonic Next chart.

3875

03:42:42.255 --> 03:42:43.345
What we decided to do is

3876

03:42:43.345 --> 03:42:44.745
multi-year approach to our workshops.

3877

03:42:44.745 --> 03:42:45.945
So we're gonna start at bottom right

3878

03:42:45.945 --> 03:42:48.105
and go top left in the continental United States

3879

03:42:48.285 --> 03:42:49.505
and, and work our way across.

3880

03:42:49.795 --> 03:42:51.425
These are gonna be great venues.

3881

03:42:51.425 --> 03:42:53.665
We know that we've got a lot of flight test, uh,

3882

03:42:53.665 --> 03:42:55.425
footprint at each of these locations.

3883

03:42:55.805 --> 03:42:57.985
So, um, if you have opportunity

3884

03:42:57.985 --> 03:43:00.825
to attend the workshops in person, uh,

3885

03:43:00.825 --> 03:43:02.945
these are the locations that, uh, we'll be going

3886

03:43:02.945 --> 03:43:04.385
to here in the next few years.

3887

03:43:04.855 --> 03:43:09.675
Next chart, really

3888

03:43:09.675 --> 03:43:12.595

encourage, uh, folks to consume the flight test safety fact.

3889

03:43:12.775 --> 03:43:16.515

Um, again, email me your, your inputs on this

3890

03:43:16.575 --> 03:43:19.435

and, uh, we'll, we'll maybe consider doing an article on,

3891

03:43:20.015 --> 03:43:23.755

uh, your idea and, uh, at the conclusion of this call.

3892

03:43:23.755 --> 03:43:26.515

In fact, I'm getting together with our Turbo thomasetti

3893

03:43:26.515 --> 03:43:29.835

and we're gonna cut some sound bites for the next podcast.

3894

03:43:30.375 --> 03:43:33.035

So, um, we encourage people to do it.

3895

03:43:33.215 --> 03:43:36.195

And, uh, we, we do track the take rates on these things.

3896

03:43:36.335 --> 03:43:39.755

So, um, what we really wanna see people, uh,

3897

03:43:40.325 --> 03:43:43.795

leveraging these, these, uh, information tools, um,

3898

03:43:44.055 --> 03:43:45.355

and sharing them broadly,

3899

03:43:45.855 --> 03:43:48.035

and feel free to do so, it's in a PDF format,

3900

03:43:48.515 --> 03:43:51.515

specifically the, the Flight Test Safety Fact Next chart.

3901

03:43:53.935 --> 03:43:57.315

So here's just a couple quick, uh, final polling questions

3902

03:43:57.505 --> 03:43:59.835
regarding the Flight Test Safety Fact newsletter.

3903

03:44:00.495 --> 03:44:03.355
Please tell us if you get it, you read it,

3904

03:44:03.935 --> 03:44:06.075
you maybe you've gotten one, somebody forwarded it

3905

03:44:06.075 --> 03:44:07.195
to you and that's how you got it.

3906

03:44:07.935 --> 03:44:09.635
Uh, or you've never seen it at all.

3907

03:44:20.015 --> 03:44:21.635
And these are all archived, by the way,

3908

03:44:21.975 --> 03:44:23.595
on flight test safety.org,

3909

03:44:23.655 --> 03:44:25.515
so you can get the back issues as well.

3910

03:44:25.515 --> 03:44:29.425
They're all there. And I gotta throw

3911

03:44:29.425 --> 03:44:30.705
major props to Mark Jones.

3912

03:44:30.895 --> 03:44:33.505
He's our, our editor for this and the mastermind behind it,

3913

03:44:33.965 --> 03:44:35.945
and does quite a bit of the idea generation.

3914

03:44:36.805 --> 03:44:38.265
Um, and we, we go back

3915

03:44:38.265 --> 03:44:39.505

and forth quite a lot on

3916

03:44:39.855 --> 03:44:41.305

what would be relevant and important.

3917

03:44:41.565 --> 03:44:43.465

So we still have a large percentage of people

3918

03:44:43.465 --> 03:44:44.545

that have never seen it before.

3919

03:44:44.605 --> 03:44:46.545

So if you wanna get on a distribution list

3920

03:44:46.855 --> 03:44:49.505

with your own email, then just send us a note.

3921

03:44:49.525 --> 03:44:51.665

You can use my chairman@flighthousesafety.org,

3922

03:44:51.665 --> 03:44:55.105

or you can contact Susan, uh, via your, I think

3923

03:44:55.105 --> 03:44:57.345

that email address is available through the invitation

3924

03:44:57.405 --> 03:44:58.705

for this, uh, webinar.

3925

03:44:59.455 --> 03:45:01.745

Okay, next polling question.

3926

03:45:01.805 --> 03:45:03.905

And this one, uh, same question except

3927

03:45:03.905 --> 03:45:04.945

for the podcast, please.

3928

03:45:12.625 --> 03:45:15.005

One of the interesting things with this is that I, uh,

3929

03:45:15.245 --> 03:45:16.725
honestly, I didn't do podcasts.

3930

03:45:16.925 --> 03:45:18.405
I, I just didn't, didn't do it.

3931

03:45:18.465 --> 03:45:22.445
And then Mark Jones, uh, kind of edged me on and,

3932

03:45:22.505 --> 03:45:24.085
and then now I just subscribe and,

3933

03:45:24.185 --> 03:45:25.965
and have it downloaded and it was available.

3934

03:45:26.065 --> 03:45:28.245
So I just, uh, associate my phone

3935

03:45:28.245 --> 03:45:29.850
with the stereo system in my car.

3936

03:45:29.865 --> 03:45:32.005
So I'm hands free and legal and safe,

3937

03:45:32.105 --> 03:45:33.645
and I just listen to it on the way to work,

3938

03:45:33.825 --> 03:45:36.365
or I just put my earbuds in when I go for a run

3939

03:45:36.705 --> 03:45:37.765
and listen to the podcast.

3940

03:45:38.065 --> 03:45:41.885
We purposely made these things less than 10, 12 minutes.

3941

03:45:42.145 --> 03:45:43.845
Uh, some podcasting gets a little bit longer.

3942

03:45:43.845 --> 03:45:46.005

We felt like shorter is actually more impactful.

3943

03:45:47.145 --> 03:45:48.925

So again, really high percentages

3944

03:45:48.925 --> 03:45:49.965

that they didn't know there was a podcast.

3945

03:45:50.185 --> 03:45:52.205

So you can go to that channel, uh,

3946

03:45:52.225 --> 03:45:54.485

and that information is on the website as well.

3947

03:45:55.185 --> 03:45:59.605

Um, and, um, I think that, that one third there that, um,

3948

03:46:00.075 --> 03:46:02.325

gets the link and, and, uh, has listened

3949

03:46:02.325 --> 03:46:03.565

to some, but perhaps not all.

3950

03:46:03.785 --> 03:46:05.885

And then there's 10% out there that are,

3951

03:46:06.275 --> 03:46:07.525

that are listening to all of 'em.

3952

03:46:07.525 --> 03:46:10.325

That's fantastic. So thank you for that next chart.

3953

03:46:13.575 --> 03:46:15.785

Alright, we, we, one of our things that we do

3954

03:46:15.785 --> 03:46:16.785

as flight test safety committee

3955

03:46:16.785 --> 03:46:17.985

that we really do take seriously

3956

03:46:17.985 --> 03:46:20.065
and really do enjoy is seeing the submission,

3957

03:46:20.165 --> 03:46:22.025
the Tony Vere Flight Test Safety Award.

3958

03:46:22.605 --> 03:46:24.705
Um, there, there's some folks out there

3959

03:46:24.705 --> 03:46:26.985
that are doing really good work in flight testing,

3960

03:46:27.385 --> 03:46:28.545
specifically on the safety front.

3961

03:46:29.125 --> 03:46:31.425
Um, this award is sponsored by Gentech

3962

03:46:31.645 --> 03:46:34.825
and, uh, Sandy Sandberg is always, uh, very involved

3963

03:46:34.825 --> 03:46:36.305
with this and, and making sure

3964

03:46:36.305 --> 03:46:37.945
that we have this award year to year.

3965

03:46:38.445 --> 03:46:40.625
Uh, and we thank Gentech for their continued support.

3966

03:46:41.285 --> 03:46:42.985
And, um, you know, there,

3967

03:46:42.985 --> 03:46:45.305
there's some times very rigorous debate,

3968

03:46:45.305 --> 03:46:48.625
and unfortunately we can only recognize, uh, one person.

3969

03:46:49.205 --> 03:46:51.945

And this year, for 2020, I'm pleased to announce

3970

03:46:51.945 --> 03:46:53.305
that we selected Mr.

3971

03:46:53.305 --> 03:46:55.785
Darren McDonald from the Boeing Company.

3972

03:46:56.565 --> 03:46:58.265
Uh, Darren's been very involved in,

3973

03:46:58.485 --> 03:47:00.825
in specifically the manufacturer Flight Test Council,

3974

03:47:01.165 --> 03:47:05.025
and he had several people provide him very high praise

3975

03:47:05.165 --> 03:47:07.025
and recommendation for this particular award.

3976

03:47:07.045 --> 03:47:09.145
So I couldn't be more thrilled to make this announcement

3977

03:47:09.175 --> 03:47:10.785
that, that Darren got it.

3978

03:47:10.785 --> 03:47:14.465
And I think Susan's gonna bring him up on, uh, the webcam,

3979

03:47:14.825 --> 03:47:16.425
actually, so we can hear a few words from Darren

3980

03:47:16.425 --> 03:47:19.025
because unfortunately at the, uh, annual

3981

03:47:19.695 --> 03:47:23.945
symposium in banquet, um, we, we do a formal presentation

3982

03:47:23.945 --> 03:47:25.545
of the award, but they don't get to say anything.

3983

03:47:25.565 --> 03:47:27.225

So I thought I'd offer it to Darren

3984

03:47:27.285 --> 03:47:28.905

to say a few words, if you wouldn't mind.

3985

03:47:28.905 --> 03:47:30.745

Darren, good to see you, and congratulations.

3986

03:47:32.805 --> 03:47:34.575

Well, thank you so much, Tom.

3987

03:47:34.715 --> 03:47:36.255

Um, you know, uh,

3988

03:47:37.035 --> 03:47:40.725

and thank you for putting together such a great

3989

03:47:41.545 --> 03:47:45.105

six hours here of, uh, of education for us,

3990

03:47:45.125 --> 03:47:47.585

and they sat through here watching everything.

3991

03:47:47.705 --> 03:47:49.775

I realized you, you know, I had it,

3992

03:47:49.855 --> 03:47:52.975

I had this disconnect in my belief that, uh, you know,

3993

03:47:52.975 --> 03:47:56.135

the Tony Vere Award is, uh, it's just for pilots.

3994

03:47:56.395 --> 03:47:59.495

And, uh, so I, I I was shocked and,

3995

03:47:59.715 --> 03:48:02.335

and still kind of at a loss for words, um,

3996

03:48:02.925 --> 03:48:04.615

even be recognized with this award.

3997

03:48:04.795 --> 03:48:08.135

Um, it was a huge honor to be even nominated,

3998

03:48:08.135 --> 03:48:09.455

which I didn't even know had happened.

3999

03:48:09.555 --> 03:48:13.745

And then to, uh, be, uh, be recognized that this is,

4000

03:48:13.805 --> 03:48:15.625

is really something I, I'm excited.

4001

03:48:15.705 --> 03:48:17.345

I got, uh, yesterday in the mail,

4002

03:48:17.425 --> 03:48:19.465

I got a book about Tony Lavere.

4003

03:48:19.465 --> 03:48:22.555

So I'm gonna learn a little more about, uh, what kind of,

4004

03:48:22.575 --> 03:48:24.715

uh, shoes I'm, I'm following.

4005

03:48:24.855 --> 03:48:28.205

And, uh, you know, I'm just so honored to, uh,

4006

03:48:29.235 --> 03:48:31.805

when I look at the list of, of people that have,

4007

03:48:31.955 --> 03:48:35.445

have been recognized in the past with this award, uh, it,

4008

03:48:35.505 --> 03:48:38.045

it really still hasn't sunk in that, uh,

4009

03:48:38.605 --> 03:48:40.925

I could even be considered, uh, with them.

4010

03:48:41.185 --> 03:48:42.765

And, uh, you know,

4011

03:48:42.785 --> 03:48:44.925

you mentioned the manufacturer Flight Test Council,

4012

03:48:45.385 --> 03:48:50.325

and, uh, just how much benefit it's been for me

4013

03:48:50.505 --> 03:48:52.165

to, uh, spend time with,

4014

03:48:52.555 --> 03:48:54.285

with all those people that are part of that.

4015

03:48:54.505 --> 03:48:57.125

And, uh, you know, the things that we're able to,

4016

03:48:57.345 --> 03:48:58.405

to accomplish and,

4017

03:48:58.585 --> 03:49:02.205

and, um, improving safety and flight tests.

4018

03:49:02.505 --> 03:49:06.755

Uh, and I'm looking forward to creating stronger ties

4019

03:49:06.755 --> 03:49:08.075

with Flight Test safety committee

4020

03:49:08.095 --> 03:49:10.915

and others to make sure that we get more information out

4021

03:49:10.915 --> 03:49:14.315

there so that everybody can benefit. Thanks, Tom.

4022

03:49:15.065 --> 03:49:17.535

Thank you, Darren, and thanks for, uh, allowing us to,

4023

03:49:17.635 --> 03:49:18.775

to bring you on live here,

4024

03:49:18.775 --> 03:49:20.895

and, uh, congratulations again, well deserved.

4025

03:49:23.145 --> 03:49:26.385

Thank you. Okay, Susan, let's go

4026

03:49:26.385 --> 03:49:28.105

to our last chart if I could,

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03:49:28.105 --> 03:49:30.625

because I noticed I, I've taken a little bit extra

4028

03:49:30.625 --> 03:49:32.945

of your time and I really do appreciate it.

4029

03:49:33.005 --> 03:49:35.585

So I just wanted to, number one, thank all

4030

03:49:35.585 --> 03:49:37.105

of our presenters, uh,

4031

03:49:37.165 --> 03:49:39.345

and especially Ben Luther for co-hosting.

4032

03:49:39.925 --> 03:49:42.985

Um, he was real sport and, and doing that,

4033

03:49:43.285 --> 03:49:46.625

and I couldn't, we just couldn't do these events both in

4034

03:49:46.625 --> 03:49:49.385

person or, uh, remote if it wasn't

4035

03:49:49.445 --> 03:49:53.265

for Susan Bennett up in Maine at the Master command center.

4036

03:49:53.445 --> 03:49:55.065

So, uh, uh, Susan,

4037

03:49:55.165 --> 03:49:57.425

can you hear all the virtual applause, uh, from everybody?

4038

03:49:58.025 --> 03:50:00.825

I hope so, because, uh, awesome job.

4039

03:50:01.025 --> 03:50:03.865

I know this is a challenge to try to manage this webinar

4040

03:50:04.005 --> 03:50:06.585

and this platform and the IT challenges, et cetera.

4041

03:50:07.045 --> 03:50:09.985

But, um, my hat's off to you and many, many thanks.

4042

03:50:10.805 --> 03:50:13.105

Um, I, I had an exchange last night

4043

03:50:13.105 --> 03:50:16.065

as we were reviewing the homeworks, uh, with, uh, beaker.

4044

03:50:16.605 --> 03:50:19.545

And, uh, I wanted to share something that he mentioned,

4045

03:50:19.685 --> 03:50:20.905

and I, I agree a hundred percent,

4046

03:50:21.005 --> 03:50:24.185

and he goes, well, Tom, it's not just about, uh,

4047

03:50:24.435 --> 03:50:26.625

conducting flight tests safer.

4048

03:50:27.815 --> 03:50:32.225

It's about having, uh, safer products for our end users,

4049

03:50:32.225 --> 03:50:34.065

whether it's a war fighter, um,

4050

03:50:34.445 --> 03:50:36.705

or a commercial airline operator,

4051

03:50:37.185 --> 03:50:39.505

business aviation operator, doesn't matter.

4052

03:50:39.765 --> 03:50:41.065

That's what we're all here for.

4053

03:50:41.565 --> 03:50:44.705

And, um, uh, poncho's comments are really, I think,

4054

03:50:44.705 --> 03:50:46.705

germane here too, in that we, you know, we're kind

4055

03:50:46.705 --> 03:50:50.305

of the last hurdle in flight test certification and IOC

4056

03:50:50.305 --> 03:50:51.905

and that, and we can get pressurized,

4057

03:50:52.325 --> 03:50:53.745

and that can be very dangerous if

4058

03:50:53.745 --> 03:50:55.145

that's not controlled correctly.

4059

03:50:55.725 --> 03:50:57.505

And hopefully people understand

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03:50:57.805 --> 03:51:00.905

or understand better now, uh, the power of STPA

4061

03:51:00.905 --> 03:51:04.865

and maybe having this analysis occurring earlier

4062

03:51:05.405 --> 03:51:09.015

in the program development all the way back into design, uh,

4063

03:51:09.015 --> 03:51:10.695

that we can start thinking about these things,

4064

03:51:10.695 --> 03:51:12.135
doing some critical thinking earlier.

4065

03:51:12.145 --> 03:51:14.855
While we might have a little bit more time, um,

4066

03:51:14.955 --> 03:51:17.455
and less stress, um, program schedule.

4067

03:51:18.395 --> 03:51:23.035
Um, um, uh, Pete Donna, one of our, uh,

4068

03:51:23.035 --> 03:51:25.485
flight to Safety Committee members made an excellent comment

4069

03:51:25.545 --> 03:51:29.365
in the question tab about, uh, interacting more with the,

4070

03:51:29.365 --> 03:51:32.005
with the designers and, and the program developers.

4071

03:51:32.025 --> 03:51:34.085
And I think that's an important piece of this, is

4072

03:51:34.085 --> 03:51:38.645
that even though we may get very frustrated with, uh, uh,

4073

03:51:38.645 --> 03:51:40.405
the behaviors from program offices and,

4074

03:51:40.405 --> 03:51:42.845
and trying to drive towards, uh, schedule

4075

03:51:43.825 --> 03:51:46.765
and deliveries, et cetera, that, you know, we have

4076

03:51:46.765 --> 03:51:49.845
to be the voice of reason when it comes

4077

03:51:49.865 --> 03:51:52.485

to holding the line on acceptable levels of risk.

4078

03:51:53.145 --> 03:51:55.565

So, excellent com, uh, comments there,

4079

03:51:55.825 --> 03:51:57.045

one and all, and I appreciate that.

4080

03:51:57.705 --> 03:52:00.205

Um, what I hope you heard too is that, uh,

4081

03:52:00.225 --> 03:52:02.285

Dr. Thomas is eager to help.

4082

03:52:03.025 --> 03:52:05.565

Um, you know, if, if you are doing a new system

4083

03:52:05.745 --> 03:52:07.445

and you want to do an analysis, uh,

4084

03:52:07.865 --> 03:52:10.365

on a control structure, email it to him.

4085

03:52:10.525 --> 03:52:12.485

I bet he wouldn't, uh, bat an eye,

4086

03:52:12.705 --> 03:52:13.845

uh, uh, taking a look at it.

4087

03:52:13.845 --> 03:52:15.125

And I bet you get it back in your

4088

03:52:15.175 --> 03:52:16.885

inbox probably the same day.

4089

03:52:16.945 --> 03:52:18.765

I'm not trying to sign him John up for anything

4090

03:52:18.765 --> 03:52:20.245

that he's not able to do,

4091

03:52:20.505 --> 03:52:22.205

but that's just the kind of guy he is.

4092

03:52:22.745 --> 03:52:25.325

Um, and I would go further to say that, you know, John

4093

03:52:25.325 --> 03:52:28.605

and Nancy in maturing STPA

4094

03:52:28.605 --> 03:52:31.645

and these other methodologies are very open-minded about

4095

03:52:31.665 --> 03:52:32.765

making improvements.

4096

03:52:33.105 --> 03:52:34.685

So if you think you've got something to offer,

4097

03:52:35.195 --> 03:52:37.085

then please, uh, let 'em know.

4098

03:52:37.945 --> 03:52:40.965

Um, one last, uh, uh, plug

4099

03:52:40.965 --> 03:52:42.205

for the resources that are available.

4100

03:52:42.265 --> 03:52:44.205

So I mentioned flight test safety.org already,

4101

03:52:44.505 --> 03:52:47.405

but John mentioned it over on the MIT website.

4102

03:52:47.735 --> 03:52:50.405

There is an abundant amount of information

4103

03:52:50.405 --> 03:52:52.165

and resources related to STPA

4104

03:52:52.165 --> 03:52:53.685

to include the technical presentations

4105

03:52:53.685 --> 03:52:57.405

for previous workshops, uh, specifically STPA workshops,

4106

03:52:57.945 --> 03:53:02.125

as well as, uh, thesis and other, uh, documentation.

4107

03:53:02.305 --> 03:53:05.085

So, uh, excellent resource to go to as well.

4108

03:53:05.265 --> 03:53:09.625

Now here's my last, uh, parting shot. We want your feedback.

4109

03:53:09.685 --> 03:53:11.265

So yeah, we know that we,

4110

03:53:11.265 --> 03:53:12.465

we tripped over ourselves a little bit

4111

03:53:12.465 --> 03:53:13.705

with GoToWebinar, and that's fine.

4112

03:53:14.125 --> 03:53:17.585

Um, you know, I was more worried about, uh, content, uh,

4113

03:53:17.585 --> 03:53:19.385

versus conveyance and,

4114

03:53:19.405 --> 03:53:22.105

and hopefully we, we did a halfway decent job for you on,

4115

03:53:22.165 --> 03:53:23.785

on exposing to SDPA.

4116

03:53:24.765 --> 03:53:27.865

Uh, when Susan closes out this webinar, you're going

4117

03:53:27.865 --> 03:53:29.985

to immediately see a popup

4118

03:53:30.125 --> 03:53:32.425
to do a critique, uh, or feedback.

4119

03:53:33.005 --> 03:53:36.385
Um, if, if you opt out that, that's fine too.

4120

03:53:36.385 --> 03:53:39.865
What you will get is an, an email in your box to give us

4121

03:53:39.865 --> 03:53:40.865
that, that feedback.

4122

03:53:40.885 --> 03:53:43.105
So take your choice when she closes it out.

4123

03:53:43.115 --> 03:53:45.825
We'll do that immediately after I, I say goodbye.

4124

03:53:46.165 --> 03:53:48.825
Um, then, uh, you can go ahead and,

4125

03:53:48.825 --> 03:53:50.985
and knock that, that feedback form out right away.

4126

03:53:50.985 --> 03:53:52.825
It's just a few questions to take you two minutes.

4127

03:53:53.095 --> 03:53:55.225
There's some free folk fields in there as well,

4128

03:53:55.285 --> 03:53:57.425
so give us your recommendations and suggestions.

4129

03:53:57.615 --> 03:54:00.185
Otherwise, we'll take it later if you're

4130

03:54:00.185 --> 03:54:01.265
compelled, uh, via email.

4131

03:54:01.765 --> 03:54:04.745

Uh, and so with that, I'm, I'm gonna say thank you again

4132

03:54:04.745 --> 03:54:06.145

for attending the two day workshop.

4133

03:54:06.605 --> 03:54:10.025

Uh, and I do wish you, uh, individually

4134

03:54:10.725 --> 03:54:12.185

and your families

4135

03:54:12.405 --> 03:54:13.905

and your teammates, uh,

4136

03:54:13.925 --> 03:54:16.465

in your host organizations, uh, health and safety.

4137

03:54:16.835 --> 03:54:17.985

Thank you again for attending.