WEBVTT

1
00:00:00.115 --> 00:00:02.895
Um, please welcome Colonel Douglas Wicker.

2
00:00:08.905 --> 00:00:10.755
All right, thank you, Pete. So,

3
00:00:10.865 --> 00:00:14.515
it's almost like a design the way the, uh, uh,

4
00:00:14.515 --> 00:00:16.875
this was laid out with, uh, with Ben and then, uh,

5
00:00:17.485 --> 00:00:18.825
and then ulu, and then this one.

6
00:00:18.885 --> 00:00:22.485
So this is, uh, we introduced risk awareness at,

7
00:00:22.585 --> 00:00:23.765
at Anaheim this year.

8
00:00:24.225 --> 00:00:26.925
Uh, and this is, uh, this is not the same presentation.

9
00:00:27.385 --> 00:00:30.805
Uh, this is, uh, some examples, some successes

10
00:00:30.805 --> 00:00:33.845
of risk awareness, as well as some additional tools, uh, one

11
00:00:33.845 --> 00:00:37.045
of them being SDPA and how SDPA feeds into risk awareness.

12
00:00:38.555 --> 00:00:40.975
Uh, risk awareness really grew out of, uh, prior

13
00:00:40.975 --> 00:00:43.415
to being at, at, in that funny shape, building on the banks

14
00:00:43.415 --> 00:00:48.285
of the Potomac, uh, where I am currently, um, I was a,

15
00:00:48.285 --> 00:00:51.205
uh, a group commander with, uh, 13 flight test squadrons.

16
00:00:51.815 --> 00:00:53.635
And, and during my two years of command,

17
00:00:53.735 --> 00:00:57.395
we had two total loss class a's including,

18
00:00:57.395 --> 00:00:58.435
including a fatality.

19
00:00:59.335 --> 00:01:02.675
And so, as you naturally do in the aftermath of those,

20
00:01:02.675 --> 00:01:05.075
you do a lot of soul searching, a lot of reflection.

21
00:01:06.425 --> 00:01:09.045
Uh, so sitting down with, uh, the squadron commanders, the,

22
00:01:09.045 --> 00:01:11.365
uh, the test engineers, the dos, uh,

23
00:01:11.385 --> 00:01:15.045
we really developed risk awareness, uh, as an appreciation

24
00:01:15.185 --> 00:01:19.495
for, uh, what can we really do differently.

25
00:01:19.875 --> 00:01:21.935
Uh, that, that's really the kind of the key question.

26
00:01:23.855 --> 00:01:27.045
The, uh, there's no shortage of literature, uh,

27
00:01:27.045 --> 00:01:28.925

on the subject to risk management and safety.

28
00:01:29.545 --> 00:01:32.605
Uh, unfortunately, most of the, uh, the mountains of ink,

29
00:01:32.705 --> 00:01:35.485
uh, on the subject are not really applicable to flight test.

30
00:01:36.275 --> 00:01:37.695
Um, and, and,

31
00:01:37.795 --> 00:01:39.815
and the real fundamental problem is

32
00:01:39.815 --> 00:01:41.975
that flight test is the exploration of the unknown.

33
00:01:42.595 --> 00:01:45.815
And most of our traditional things, including, you know,

34
00:01:45.815 --> 00:01:47.095
and SMS is very important.

35
00:01:47.155 --> 00:01:49.215
And we've had a lot of good discussion on that.

36
00:01:49.715 --> 00:01:51.055
Uh, but that helps with things

37
00:01:51.055 --> 00:01:52.415
that are understood and known.

38
00:01:52.475 --> 00:01:53.735
It doesn't help you with the things

39
00:01:53.735 --> 00:01:54.975
that are, that are unknown.

40
00:01:55.715 --> 00:01:57.975
And so that's really the basic, uh, the basis

41
00:01:58.115 --> 00:01:59.455
for, uh, risk awareness.

42
00:02:00.015 --> 00:02:01.855
I think everyone's familiar with situational awareness

43
00:02:02.275 --> 00:02:04.575
and risk awareness is conceived in the same spirit.

44
00:02:05.255 --> 00:02:07.795
So, risk awareness is the perception of the elements

45
00:02:07.795 --> 00:02:11.215
of uncertainty and the potential projected outcomes

46
00:02:11.245 --> 00:02:12.535
resulting from uncertainty.

47
00:02:13.025 --> 00:02:16.325
And you, and just like sa, just as you can develop

48
00:02:16.325 --> 00:02:19.625
that over a course of time through experience, uh, by

49
00:02:20.345 --> 00:02:22.425
briefing to it, by debriefing to it, uh,

50
00:02:22.525 --> 00:02:24.025
you can actually develop risk

51
00:02:24.025 --> 00:02:25.345
awareness through the same way.

52
00:02:25.725 --> 00:02:28.825
And just like you can recognize when your essay is low,

53
00:02:28.825 --> 00:02:30.025
you're missing radio calls.

54
00:02:30.445 --> 00:02:33.585

You can start to recognize when your risk awareness is low,

55
00:02:33.585 --> 00:02:36.745
either at an individual or at an organizational level.

56
00:02:37.125 --> 00:02:38.605
So you can see the parallels

57
00:02:38.605 --> 00:02:40.005
with the definition of situational awareness.

58
00:02:41.005 --> 00:02:44.385
Uh, Tom already, uh, mentioned the, the paper from Anaheim.

59
00:02:44.685 --> 00:02:46.585
Uh, you can obviously get that from the, uh,

60
00:02:46.865 --> 00:02:48.505
SATP, uh, paper search.

61
00:02:48.925 --> 00:02:51.385
Uh, sometimes I have a hard time actually logging in

62
00:02:51.465 --> 00:02:52.905
'cause I don't know what my password is and everything.

63
00:02:52.925 --> 00:02:55.705
So, uh, I posted it to my, uh, my LinkedIn page.

64
00:02:56.455 --> 00:02:57.795
Uh, so you can download it from there,

65
00:02:58.015 --> 00:02:59.605
or probably the easiest thing to do.

66
00:02:59.605 --> 00:03:02.045
That's my, um, Pentagon cell phone number.

67
00:03:02.465 --> 00:03:04.525
Uh, if you text that, uh, immediately

68
00:03:04.525 --> 00:03:07.405
after this, I'll send you a Google link, uh, to

69
00:03:07.405 --> 00:03:09.285
where you can download the, uh, risk awareness paper.

70
00:03:13.255 --> 00:03:16.395
So, Tom Huff gave the, uh, the box score, the rather, uh,

71
00:03:16.595 --> 00:03:17.875
somewhat depressing box score for the last

72
00:03:17.875 --> 00:03:18.955
seven and a half years yesterday.

73
00:03:20.585 --> 00:03:23.685
And for the, uh, for the 18 mishaps that I can

74
00:03:24.585 --> 00:03:26.365
obtain accident reports on.

75
00:03:26.465 --> 00:03:28.885
Uh, this is kind of the, uh, the predominant cause

76
00:03:29.545 --> 00:03:31.565
of those in, in one of three different categories.

77
00:03:31.985 --> 00:03:34.405
Uh, you've got random things that just just broke.

78
00:03:35.085 --> 00:03:37.825
Uh, you've got ops issues, compliance issues,

79
00:03:38.405 --> 00:03:40.785
and then there's the realm of uncertainty.

80
00:03:41.305 --> 00:03:43.125
And, and this is not surprising.

81
00:03:43.545 --> 00:03:46.725

Uh, this is, you know, a, a limited data set.

82
00:03:46.985 --> 00:03:51.005
Uh, this is 18, uh, accidents for which I could obtain, uh,

83
00:03:51.005 --> 00:03:52.405
records for in the last seven and a half years.

84
00:03:52.745 --> 00:03:55.245
Uh, I actually intend on having somebody, uh,

85
00:03:55.245 --> 00:03:56.325
having a student, uh,

86
00:03:56.325 --> 00:03:57.485
and my next assignment actually go back

87
00:03:57.485 --> 00:03:58.685
and research this for everything

88
00:03:58.685 --> 00:04:00.965
that we can get our hands on and figure out whether

89
00:04:00.965 --> 00:04:03.285
or not this conjecture that the preponderance

90
00:04:03.285 --> 00:04:04.965
of flight test mishaps are actually the

91
00:04:04.965 --> 00:04:06.085
result of uncertainty.

92
00:04:06.845 --> 00:04:09.345
Um, I think that's a very interesting research question

93
00:04:10.415 --> 00:04:11.505
when you really get down to it.

94
00:04:11.565 --> 00:04:14.825
So, so this, you know, our SMS efforts, which again,

95
00:04:15.095 --> 00:04:17.425
extremely important, but really insufficient.

96
00:04:17.625 --> 00:04:20.665
'cause it, it gets to the things on the left hand side, no,

97
00:04:20.685 --> 00:04:22.465
you can't really do anything about the acts of God.

98
00:04:23.515 --> 00:04:26.855
But the big, the big problem, the big challenge

99
00:04:26.915 --> 00:04:30.235
of flight test is the fact that there, it's,

100
00:04:30.235 --> 00:04:31.555
it's the exploration of the unknown.

101
00:04:32.115 --> 00:04:34.335
So the first step in developing

102
00:04:34.875 --> 00:04:37.655
and cultivating risk awareness is understanding the

103
00:04:37.655 --> 00:04:39.415
distinction of different types of knowledge.

104
00:04:40.485 --> 00:04:42.885
So you've got fully deterministic things.

105
00:04:42.885 --> 00:04:45.285
You've got random things that are astic,

106
00:04:45.305 --> 00:04:47.205
but you can predict them within a certain bound.

107
00:04:47.265 --> 00:04:49.285
You have ambiguous scenarios.

108
00:04:49.825 --> 00:04:52.045

Uh, you have things that we know you can't know.

109
00:04:52.465 --> 00:04:56.485
So in physics, you can't simultaneously know the, uh,

110
00:04:56.725 --> 00:04:58.525
position and momentum, uh, of a particle.

111
00:04:58.525 --> 00:05:00.085
We know that. Uh, but then there's

112
00:05:00.085 --> 00:05:01.205
also the unknown unknowns.

113
00:05:01.355 --> 00:05:02.645
It's traditional in the literature

114
00:05:02.645 --> 00:05:04.445
to actually divide up the,

115
00:05:04.825 --> 00:05:06.965
the knowledge space into two different dimensions.

116
00:05:06.985 --> 00:05:09.005
So you've got a variable uncertainty,

117
00:05:09.305 --> 00:05:10.765
and then you have a knowledge uncertainty.

118
00:05:11.735 --> 00:05:13.475
Uh, and they're called somewhat.

119
00:05:13.855 --> 00:05:16.035
Uh, unfortunately, the, the, the,

120
00:05:16.035 --> 00:05:18.435
that top left quadrant there is called the risk domain.

121
00:05:18.935 --> 00:05:20.475
Um, and it's somewhat appropriate

122
00:05:20.475 --> 00:05:23.405
because the idea is that your knowledge is high.

123
00:05:23.745 --> 00:05:24.965
Uh, but there's a randomness.

124
00:05:24.965 --> 00:05:27.525
So all of your casino games fall into this category.

125
00:05:27.745 --> 00:05:29.525
You know, you can walk into a, you know, a casino

126
00:05:29.525 --> 00:05:31.125
and know what your odds are for a roulette

127
00:05:31.125 --> 00:05:32.245
or, you know, blackjack.

128
00:05:32.425 --> 00:05:33.565
You can calculate that.

129
00:05:34.515 --> 00:05:36.655
And we treat traditionally

130
00:05:37.285 --> 00:05:39.495
with our risk cubes and risk matrices.

131
00:05:39.635 --> 00:05:41.415
Uh, Ben Luther and I were talking on the break about

132
00:05:41.415 --> 00:05:43.455
how much we dislike, uh, the risk matrix.

133
00:05:43.915 --> 00:05:47.615
Uh, we tradi, we traditionally treat problems

134
00:05:47.615 --> 00:05:49.575
as if they're risk domain problems in flight tests.

135
00:05:49.595 --> 00:05:51.935

But really, flight test is the right

136
00:05:51.965 --> 00:05:53.095
half of the knowledge plane.

137
00:05:53.785 --> 00:05:55.525
Uh, we can collectively call that ignorance,

138
00:05:55.545 --> 00:05:57.045
and that is not a pejorative term.

139
00:05:57.525 --> 00:05:59.695
Ignorance merely means lack of knowledge.

140
00:05:59.955 --> 00:06:02.015
And that's really what we're doing in flight test,

141
00:06:02.035 --> 00:06:04.735
is we're building knowledge about the system under test.

142
00:06:06.705 --> 00:06:09.685
The, the reason this is the first step is it turns out,

143
00:06:09.785 --> 00:06:12.165
and I won't go into it in this presentation, uh,

144
00:06:12.325 --> 00:06:14.125
'cause that was really the subject of, of Anaheim

145
00:06:14.125 --> 00:06:16.125
and the subject of the paper, there's different cognitive

146
00:06:16.125 --> 00:06:18.205
tools that are appropriate for the different domains.

147
00:06:18.545 --> 00:06:20.045
Uh, and I'll, I'll leave that at that.

148
00:06:21.455 --> 00:06:24.835
The overall arching objective is to prevent accidents.

149
00:06:25.175 --> 00:06:27.755
Uh, so an accident is a sudden unexpected event

150
00:06:27.825 --> 00:06:29.355
that results in a negative outcome.

151
00:06:29.655 --> 00:06:31.235
Uh, if it's not sudden, you know,

152
00:06:31.235 --> 00:06:32.235
so if it's a hurricane coming down the

153
00:06:32.235 --> 00:06:33.075
coast, it's not an accident.

154
00:06:33.575 --> 00:06:36.435
Uh, if it's, uh, an unexpected event,

155
00:06:36.435 --> 00:06:37.755
but it's a good thing, like you won

156
00:06:37.755 --> 00:06:38.875
the lottery, then you're happy.

157
00:06:39.945 --> 00:06:42.285
So what we traditionally do, uh,

158
00:06:42.545 --> 00:06:44.645
is you can either prevent the unexpected event

159
00:06:45.105 --> 00:06:46.445
or prevent the negative outcome,

160
00:06:46.725 --> 00:06:48.565
mitigate the negative outcome if that event does occur,

161
00:06:49.025 --> 00:06:50.165
uh, and prevent the accident.

162
00:06:50.165 --> 00:06:53.285

And this, so this is, again, the realm of what th a's do

163
00:06:53.285 --> 00:06:56.325
and GMC and STPA falls in those class as well.

164
00:06:56.745 --> 00:06:58.365
But again, in flight test, there's

165
00:06:58.365 --> 00:06:59.485
that entire left hand side.

166
00:06:59.485 --> 00:07:01.525
There's the uncertainty about the design.

167
00:07:01.625 --> 00:07:05.245
We have fundamental ignorance about the design,

168
00:07:05.465 --> 00:07:08.205
and that's really what risk awareness tries to do.

169
00:07:08.225 --> 00:07:09.725
So it's, it's not one of the either.

170
00:07:09.955 --> 00:07:14.045
It's really about looking at the entire problem in

171
00:07:14.205 --> 00:07:16.565
approaching it in order to, uh, do the risk management.

172
00:07:17.785 --> 00:07:21.285
Uh, so Ben already hit upon, uh, Nancy Levinson's system,

173
00:07:21.425 --> 00:07:23.965
uh, engineering, safer world, safer world.

174
00:07:24.385 --> 00:07:26.565
And then Tom just talked about the STPA handbook.

175
00:07:27.585 --> 00:07:31.925
So since Anaheim, I, I actually, uh, started collaborating

176
00:07:31.925 --> 00:07:34.805
with Nancy Levison and her students, uh, up at MIT.

177
00:07:35.305 --> 00:07:39.045
Uh, I was, I was actually slow, uh, to come around to STPA.

178
00:07:39.505 --> 00:07:41.645
Um, it is somewhat complicated,

179
00:07:41.905 --> 00:07:43.645
and I'm not going to attempt to teach it.

180
00:07:43.805 --> 00:07:46.725
I, I think each briefer Ben did it, and then suer did it.

181
00:07:46.725 --> 00:07:48.085
Oh, the next guy's gonna tell you how to use it.

182
00:07:48.425 --> 00:07:51.085
Um, that is, that's much more than I can get into.

183
00:07:51.745 --> 00:07:53.725
Uh, it is a top-down process.

184
00:07:54.705 --> 00:07:56.765
Uh, it actually lets you start

185
00:07:56.785 --> 00:07:59.325
before you have a design, which is very handy.

186
00:07:59.385 --> 00:08:01.645
So you don't actually have to have wait to have a design

187
00:08:01.985 --> 00:08:03.405
to do a ika, uh,

188
00:08:03.405 --> 00:08:05.365
before you can start to do the reliability at the component

189
00:08:05.365 --> 00:08:07.085

level, and then build that up and do your safety planning.

190
00:08:07.085 --> 00:08:10.095
You can actually do it while you still just have a concept

191
00:08:10.395 --> 00:08:12.815
and start to work out your, your constraints.

192
00:08:15.905 --> 00:08:17.435
This is the, uh, the four step process

193
00:08:17.535 --> 00:08:18.715
is straight outta the handbook.

194
00:08:19.135 --> 00:08:20.595
Uh, you, you define the system.

195
00:08:20.655 --> 00:08:23.355
You just figure out what the, uh, control structure is, uh,

196
00:08:23.355 --> 00:08:24.475
what the control actions are.

197
00:08:25.055 --> 00:08:28.075
Uh, and then here's where it really comes in handy as a tool

198
00:08:28.175 --> 00:08:29.235
for developing risk awareness,

199
00:08:29.615 --> 00:08:31.115
is you can look at those control actions

200
00:08:31.575 --> 00:08:34.565
and the unsafe control actions that result from that, uh,

201
00:08:34.705 --> 00:08:38.165
and then walk through what scenarios actually result from

202
00:08:38.165 --> 00:08:39.405
those unsafe control actions.

203
00:08:39.785 --> 00:08:42.085
And, and I'll have an example, the example later on

204
00:08:42.395 --> 00:08:45.485
that made me realize what a powerful tool

205
00:08:46.005 --> 00:08:50.575
SDPA is in theory.

206
00:08:51.035 --> 00:08:52.975
Uh, and again, this is straight outta the handbook.

207
00:08:53.435 --> 00:08:56.805
In theory, every single possible accident mishap

208
00:08:56.805 --> 00:08:58.885
that you could experience is on this chart.

209
00:08:59.845 --> 00:09:01.625
Uh, it won't do your thinking for you.

210
00:09:01.725 --> 00:09:03.985
You still have to think, uh, you still have

211
00:09:03.985 --> 00:09:05.865
to put into put the intellectual energy

212
00:09:05.935 --> 00:09:07.225
into, into doing this.

213
00:09:07.685 --> 00:09:09.985
But every possible thing to include component failures,

214
00:09:09.985 --> 00:09:14.545
to include human error, to include, uh, inadequate, uh, uh,

215
00:09:14.575 --> 00:09:17.785
process model errors, uh, is all in here.

216
00:09:18.045 --> 00:09:20.665

Uh, this is a useful framework when you're sitting down

217
00:09:20.665 --> 00:09:23.185
as a test team with that blank sheet of paper trying

218
00:09:23.185 --> 00:09:25.945
to figure out, uh, where are our hazards?

219
00:09:27.825 --> 00:09:29.525
Uh, but SDPA is not magic.

220
00:09:30.065 --> 00:09:32.485
Uh, and I, I do wanna offer two cautionary notes.

221
00:09:33.305 --> 00:09:37.375
Uh, so the first one, uh, most folks will probably remember,

222
00:09:37.555 --> 00:09:40.135
and once I start telling the story, air France 4 47.

223
00:09:40.135 --> 00:09:42.185
This is the one out of Rio, uh,

224
00:09:42.295 --> 00:09:44.345
that was lost in the Atlantic a couple hours,

225
00:09:44.485 --> 00:09:45.505
uh, after takeoff.

226
00:09:45.805 --> 00:09:47.745
Uh, this is the one where the co-pilot essentially

227
00:09:47.745 --> 00:09:49.905
mishandled, uh, the autopilot kicked off

228
00:09:49.905 --> 00:09:53.065
and the co-pilot started flying, got the nose up real steep,

229
00:09:53.655 --> 00:09:55.995
uh, and then they start descending.

230
00:09:56.015 --> 00:09:57.115
So he pulls back further.

231
00:09:57.915 --> 00:09:59.695
Uh, and they essentially in two

232
00:09:59.695 --> 00:10:01.695
and a half minutes, go from 37,000 feet

233
00:10:01.715 --> 00:10:04.095
to flying a perfectly good a three 30 into the,

234
00:10:04.095 --> 00:10:06.735
into the Atlantic Ocean, uh, in a deep stall the whole time.

235
00:10:06.955 --> 00:10:09.175
Uh, and the co-pilot's got his aft stick the whole time.

236
00:10:10.205 --> 00:10:13.575
It would be very tempting if you're a,

237
00:10:14.255 --> 00:10:15.915
if you're an engineer, uh,

238
00:10:15.915 --> 00:10:18.515
and I am an engineer, so I can, I can poke fun at us.

239
00:10:18.695 --> 00:10:20.635
It would be very tempting from an SDPA

240
00:10:20.635 --> 00:10:21.675
standpoint to say, you know what?

241
00:10:21.895 --> 00:10:23.155
We could design the system

242
00:10:23.375 --> 00:10:24.515
so that it wouldn't let you do that.

243
00:10:24.895 --> 00:10:26.915

If the nose gets up real high, we could design a system

244
00:10:26.915 --> 00:10:28.595
that would automatically push the nose down.

245
00:10:29.295 --> 00:10:33.505
Uh, just speaking hypothetically, uh, now I,

246
00:10:33.585 --> 00:10:34.665
I don't wanna make a lot of this,

247
00:10:34.665 --> 00:10:37.065
and I don't wanna imply that that is what, you know, that,

248
00:10:37.285 --> 00:10:40.025
you know, Boeing is actually a, a very big fan

249
00:10:40.025 --> 00:10:42.735
and an early adapter, uh, of STPA.

250
00:10:43.015 --> 00:10:45.495
I don't, I have no reason to believe that s st PA was,

251
00:10:46.035 --> 00:10:48.495
you know, it was part of this, but it is a, is a temptation

252
00:10:48.495 --> 00:10:49.855
to be aware of.

253
00:10:50.355 --> 00:10:52.695
And that's, that's the fact of the cursor complexity.

254
00:10:53.355 --> 00:10:55.375
As you make a system more complex,

255
00:10:55.435 --> 00:10:57.175
and this is really what Sulu was getting at,

256
00:10:57.555 --> 00:11:00.575
as you make a system more complex, the number

257
00:11:00.575 --> 00:11:02.735
of possible states of that system increases.

258
00:11:02.735 --> 00:11:04.135
So every single node that you add

259
00:11:04.135 --> 00:11:06.175
to a system increases the possible states.

260
00:11:06.175 --> 00:11:07.655
That system by a factorial,

261
00:11:07.875 --> 00:11:09.615
that's an end to the end problem.

262
00:11:10.115 --> 00:11:13.175
Uh, it quickly grows out of control.

263
00:11:13.175 --> 00:11:14.455
That is the curse of complexity.

264
00:11:14.455 --> 00:11:17.375
So that is a, a first cautionary note from an engineering

265
00:11:17.375 --> 00:11:20.095
standpoint of, of using STPA.

266
00:11:21.065 --> 00:11:22.645
The second one is more applicable

267
00:11:22.645 --> 00:11:24.805
and more directly, uh, appropriate for flight test.

268
00:11:25.265 --> 00:11:27.245
Uh, and this is a point that, that Nancy

269
00:11:27.465 --> 00:11:32.005
and I have, have had multiple, um, academic, uh,

270
00:11:32.315 --> 00:11:33.325

debates on, and,

271
00:11:33.325 --> 00:11:35.245
and we've just ultimately agreed to disagree.

272
00:11:36.085 --> 00:11:38.505
Um, and that's the fact that, again, in flight test,

273
00:11:38.555 --> 00:11:40.865
we're dealing with uncertainty.

274
00:11:41.125 --> 00:11:43.545
And what we're doing in flight test is we're actually

275
00:11:43.545 --> 00:11:47.415
that process model that is the heart of the controller

276
00:11:47.415 --> 00:11:48.495
and the heart of STPA.

277
00:11:49.395 --> 00:11:51.295
We are building that model in flight test.

278
00:11:51.555 --> 00:11:53.125
Uh, we, we, we think we know

279
00:11:53.125 --> 00:11:55.245
what it is from the engineering facts, uh,

280
00:11:55.585 --> 00:11:57.245
but it's the process of doing that.

281
00:11:57.345 --> 00:11:59.285
So if you're about to go

282
00:11:59.425 --> 00:12:03.125
and fly the biggest airplane in the world that's ever flown,

283
00:12:03.665 --> 00:12:05.725
uh, you may not have a good, you know,

284
00:12:05.875 --> 00:12:07.205
your model may be incomplete.

285
00:12:07.205 --> 00:12:08.685
And that's what risk awareness is.

286
00:12:08.755 --> 00:12:12.325
It's, it's realizing that there's uncertainty in the system,

287
00:12:12.825 --> 00:12:14.765
and it's acknowledging where that uncertainty lies

288
00:12:14.785 --> 00:12:16.805
and what could happen as a result of that uncertainty.

289
00:12:16.945 --> 00:12:18.285
And I'll have some examples on,

290
00:12:18.285 --> 00:12:19.485
on how you actually apply that.

291
00:12:21.945 --> 00:12:25.685
So we can, we can map that knowledge domain into, uh,

292
00:12:25.685 --> 00:12:26.725
the spectrum of ignorance.

293
00:12:27.575 --> 00:12:30.035
And there's, there's of course, recognized ignorance,

294
00:12:30.095 --> 00:12:31.755
and then there's the, the cloud of,

295
00:12:31.975 --> 00:12:33.435
of truly uncertain ignorance.

296
00:12:33.575 --> 00:12:35.195
And it's, it's important to recognize

297
00:12:35.195 --> 00:12:36.275

that there's irreducible

298
00:12:36.275 --> 00:12:37.955
and there's reducible ignorance in there.

299
00:12:38.255 --> 00:12:41.755
And what we're doing in our flight test safety planning is

300
00:12:41.805 --> 00:12:45.315
we're, we're attempting to reduce the reducible ignorance,

301
00:12:46.055 --> 00:12:48.595
you know, so our engineering models, our CFD, our,

302
00:12:48.595 --> 00:12:51.515
our wind tunnel models, that the buildup tests that we do,

303
00:12:51.575 --> 00:12:53.315
all of that is reducing reducible ignorance.

304
00:12:53.575 --> 00:12:54.915
And when it comes to safety planning,

305
00:12:55.495 --> 00:12:58.205
we should very deliberately look at, you know,

306
00:12:58.235 --> 00:12:59.845
what do we know and what haven't we known?

307
00:13:00.265 --> 00:13:03.245
Um, I am, we are not yet to the point

308
00:13:03.245 --> 00:13:05.085
where we're gonna be able to do away with the risk matrix.

309
00:13:05.505 --> 00:13:06.925
Uh, Ben and I we're both talking about

310
00:13:06.925 --> 00:13:07.965
how we'd like to do that.

311
00:13:08.425 --> 00:13:13.165
Uh, we spend too much energy, in my opinion, arguing, well,

312
00:13:13.165 --> 00:13:14.565
is it, you know, is it likely?

313
00:13:14.665 --> 00:13:16.045
Is it probable? Is it occasional?

314
00:13:16.385 --> 00:13:17.685
Uh, and we were kind of gaming it

315
00:13:17.805 --> 00:13:18.805
'cause we know what the answer is,

316
00:13:18.805 --> 00:13:19.605
it's gonna be in the yellow.

317
00:13:19.945 --> 00:13:21.525
Uh, and so we play with the probabilities.

318
00:13:21.625 --> 00:13:24.605
And in most case cases, those probabilities, uh,

319
00:13:24.605 --> 00:13:26.205
that engineers can come up with are,

320
00:13:26.585 --> 00:13:28.085
are no better than a wild guess.

321
00:13:28.745 --> 00:13:32.645
Um, you know, the DC 10 had a, uh, you know, probability

322
00:13:32.665 --> 00:13:34.805
of a, of a in-flight thrust failure,

323
00:13:34.865 --> 00:13:37.405
and a leading edge slat malfunction was 10 to minus nine,

324
00:13:37.925 --> 00:13:40.515

happened four times in the first two years, uh,

325
00:13:40.515 --> 00:13:43.155
including the, the single deadliest, uh,

326
00:13:43.155 --> 00:13:45.755
crash still in 1979 on US soil.

327
00:13:46.135 --> 00:13:48.475
Uh, so those probabilities are really not useful.

328
00:13:48.895 --> 00:13:50.995
Uh, what is more important, uh,

329
00:13:51.015 --> 00:13:53.075
and this is what we're starting to do now, uh,

330
00:13:53.655 --> 00:13:57.075
at the test center, is, is change the tone

331
00:13:57.135 --> 00:13:59.955
of the Safety Review board, uh, to really, uh,

332
00:13:59.955 --> 00:14:02.275
incorporate the ideas of risk awareness, identifying

333
00:14:02.585 --> 00:14:06.275
what is truly unknown, uh, what test didn't we do?

334
00:14:06.535 --> 00:14:07.795
Uh, so these were opportunities

335
00:14:08.135 --> 00:14:10.835
to reduce reduceable ignorance, and we didn't do it either

336
00:14:11.035 --> 00:14:12.115
'cause we didn't have time, or we didn't have

337
00:14:12.115 --> 00:14:13.155
cost, or it cost too much.

338
00:14:13.885 --> 00:14:16.425
Uh, where are there, so where are the gaps of our knowledge

339
00:14:16.425 --> 00:14:17.505
of the things that we know?

340
00:14:17.965 --> 00:14:20.225
Uh, how confident are we about those things?

341
00:14:21.325 --> 00:14:23.625
Uh, can we put confidence intervals on those unknowns?

342
00:14:24.265 --> 00:14:26.365
Uh, that very bottom bullet there.

343
00:14:26.745 --> 00:14:28.365
Is there sufficient schedule to learn?

344
00:14:28.665 --> 00:14:30.605
Uh, I'm not gonna talk about the drift model.

345
00:14:30.985 --> 00:14:33.405
Uh, I'll, I'll just mention it in two places during,

346
00:14:33.425 --> 00:14:34.525
uh, during today's brief.

347
00:14:34.865 --> 00:14:37.965
Uh, but that is a, a very powerful idea that seemed

348
00:14:37.965 --> 00:14:39.365
to resonate with a lot of people at Anaheim,

349
00:14:39.585 --> 00:14:41.005
is the idea of organizational drift.

350
00:14:41.505 --> 00:14:43.965
And the way that you combat that is making sure

351
00:14:43.965 --> 00:14:45.325

that you have sufficient schedule.

352
00:14:45.705 --> 00:14:47.805
And when you lay at that schedule, you, you,

353
00:14:47.825 --> 00:14:49.085
you try not to violate that.

354
00:14:53.725 --> 00:14:55.865
So I've got two examples here of, uh,

355
00:14:56.015 --> 00:14:57.585
successes of risk awareness.

356
00:14:58.205 --> 00:15:01.825
Uh, the, the first one is a tactics development test.

357
00:15:02.125 --> 00:15:03.865
Uh, it was actually two different squadrons.

358
00:15:03.865 --> 00:15:05.145
So this is after my change of command.

359
00:15:05.265 --> 00:15:06.585
I just heard about it after the fact.

360
00:15:07.085 --> 00:15:10.185
Uh, one of the squadrons wa was doing a test with a,

361
00:15:10.215 --> 00:15:11.545
with the 4, 2 2 at Nels.

362
00:15:12.125 --> 00:15:16.145
Um, and the, the a 10 pilot, you know, walks in there.

363
00:15:16.145 --> 00:15:17.545
And, uh, so they're, they're, you know,

364
00:15:17.545 --> 00:15:19.065
they're developing tactics and they have this new

365
00:15:19.065 --> 00:15:20.185
threat reaction they want to try.

366
00:15:20.685 --> 00:15:25.435
And a very young captain, uh, project engineer, uh,

367
00:15:25.575 --> 00:15:28.395
not a te, not a TPS grad, relatively new,

368
00:15:28.395 --> 00:15:30.435
but long enough, he had heard what we were talking about,

369
00:15:30.565 --> 00:15:31.635
about risk awareness.

370
00:15:32.385 --> 00:15:35.605
Um, ask the question, well, is that in three dash one,

371
00:15:35.605 --> 00:15:37.445
which is the, uh, tactics, techniques

372
00:15:37.445 --> 00:15:40.935
and procedures document for the, uh, um, for the Air Force?

373
00:15:41.235 --> 00:15:44.015
And of course, you know, the, the a 10 pilots, you know,

374
00:15:44.105 --> 00:15:45.975
major, you know, weapon,

375
00:15:45.975 --> 00:15:47.335
school patch, weapon school officer.

376
00:15:47.755 --> 00:15:48.775
And he's like, what do you mean?

377
00:15:48.775 --> 00:15:51.335
We we're the ones that write three dash one and,

378
00:15:51.355 --> 00:15:52.855

and this captain was uncowed.

379
00:15:52.855 --> 00:15:54.335
He's like, well, but, you know,

380
00:15:54.335 --> 00:15:55.815
have you done a dive analysis?

381
00:15:55.815 --> 00:15:59.385
Have you done time safety margin? And the a 10 guy's?

382
00:15:59.385 --> 00:16:00.505
Like, no, we don't need to do that.

383
00:16:00.645 --> 00:16:02.785
And so it actually got to the squadron commander level.

384
00:16:03.125 --> 00:16:05.785
Um, and they agreed, you know, the squadron commander, uh,

385
00:16:05.785 --> 00:16:09.565
that worked for me, um, said, you know what?

386
00:16:09.645 --> 00:16:11.165
We, we will, we'll do that later

387
00:16:11.165 --> 00:16:12.925
after we will do the analysis for you.

388
00:16:13.185 --> 00:16:15.445
But, you know, this is an opportunity. This is an unknown.

389
00:16:15.585 --> 00:16:18.005
Let us, you know, give us time to look at that.

390
00:16:18.295 --> 00:16:20.205
Turns out, when they actually look at the time safety

391
00:16:20.205 --> 00:16:22.725
margin, uh, the maneuver that the A 10 wanted

392
00:16:22.725 --> 00:16:24.525
to do had a negative time safety margin.

393
00:16:25.255 --> 00:16:26.355
Uh, which is not to say

394
00:16:26.355 --> 00:16:28.235
that they would've actually crashed into the ground.

395
00:16:28.655 --> 00:16:30.915
Uh, 'cause you know, the pilot may have realized it may have

396
00:16:30.915 --> 00:16:32.035
gotten ground Russian recovered,

397
00:16:32.135 --> 00:16:33.955
but the opportunity is still there.

398
00:16:33.955 --> 00:16:35.475
Is that, there was, there was something

399
00:16:35.475 --> 00:16:38.595
that we could have learned and risk awareness in this case,

400
00:16:38.975 --> 00:16:41.495
let us learn that, uh, prevented

401
00:16:41.495 --> 00:16:43.215
what may have been, uh, money.

402
00:16:43.215 --> 00:16:45.095
Buck water was gonna talk tomorrow about the A 29.

403
00:16:45.095 --> 00:16:48.095
This could have been a, another, a 29 type mishap.

404
00:16:49.855 --> 00:16:52.955
Uh, the second example of a, of a positive app,

405
00:16:53.355 --> 00:16:55.235

positive application risk awareness, uh,

406
00:16:55.235 --> 00:16:57.035
comes from the four 11 fly test squadron.

407
00:16:57.595 --> 00:16:59.815
Uh, so one of the things you do as part

408
00:16:59.815 --> 00:17:02.725
of risk awareness is, is compare, you know,

409
00:17:02.725 --> 00:17:03.965
our model, we do a lot of models.

410
00:17:03.985 --> 00:17:06.805
We do a lot of engineering. Where do those deviate from?

411
00:17:07.125 --> 00:17:09.805
What the actual real system is doing?

412
00:17:10.495 --> 00:17:11.995
Uh, so what they've done, uh,

413
00:17:12.155 --> 00:17:13.795
I don't know if they've actually flown the first story

414
00:17:13.795 --> 00:17:14.835
with this or not yet,

415
00:17:14.855 --> 00:17:17.275
but they now have a capability of,

416
00:17:17.575 --> 00:17:19.995
as they're flying a flight sciences mission,

417
00:17:20.375 --> 00:17:22.635
of running at the same time, putting those inputs into

418
00:17:23.175 --> 00:17:27.515
the six staff, uh, simulation model, uh, of the aircraft

419
00:17:27.535 --> 00:17:29.715
and comparing them, uh, in the control room.

420
00:17:29.815 --> 00:17:31.955
So the, the flight sciences engineer is

421
00:17:32.475 --> 00:17:36.235
actually looking at the predicted model response against the

422
00:17:36.235 --> 00:17:37.395
actual aircraft response.

423
00:17:37.395 --> 00:17:40.245
At the same time, one of the key things, you know,

424
00:17:40.245 --> 00:17:42.365
so in situational awareness, if you start missing radio

425
00:17:42.365 --> 00:17:45.445
calls, you're like, okay, my essay is low in risk awareness.

426
00:17:45.865 --> 00:17:48.685
If you start to be surprised by things that like, Ooh,

427
00:17:49.195 --> 00:17:52.405
that was unexpected, that's an awareness, that's a,

428
00:17:52.405 --> 00:17:54.765
that's a indication that your risk awareness is low.

429
00:17:55.185 --> 00:17:57.525
So this is a built-in thing during flight tests

430
00:17:57.585 --> 00:17:59.885
to actually see that, wait a second,

431
00:17:59.885 --> 00:18:01.325
there's some gaps in our knowledge.

432
00:18:05.245 --> 00:18:07.665

So this next example is, is the one

433
00:18:07.665 --> 00:18:10.425
that made me a believer in SDPA.

434
00:18:11.145 --> 00:18:13.005
Uh, so, so Spaceship two,

435
00:18:13.125 --> 00:18:14.765
I think most people are probably familiar with it.

436
00:18:14.845 --> 00:18:17.445
I, I count Mike Alsbury, uh, as a very close friend.

437
00:18:18.475 --> 00:18:21.875
Um, real quickly, you know,

438
00:18:21.875 --> 00:18:23.595
so this is Powered Fight four.

439
00:18:24.055 --> 00:18:26.155
Um, Mike, uh, was the copilot

440
00:18:26.945 --> 00:18:29.575
and he, uh, unfettered,

441
00:18:29.575 --> 00:18:32.815
or he didn't unfeather he unlock the feathers, uh, early,

442
00:18:33.315 --> 00:18:34.415
uh, before the profile.

443
00:18:34.555 --> 00:18:37.695
So, uh, because of the scarf nozzle, there's actually, um,

444
00:18:38.635 --> 00:18:39.935
the scarf nozzle to help with the,

445
00:18:39.935 --> 00:18:41.695
the gamma maneuver, which is the pull up maneuver.

446
00:18:42.035 --> 00:18:45.935
Uh, there's, there's quite a high large aerodynamic load up,

447
00:18:45.935 --> 00:18:47.495
which would overpower the actuators.

448
00:18:47.495 --> 00:18:50.575
So there's hooks on the leading edge of the feather, uh,

449
00:18:50.635 --> 00:18:52.215
to actually hold the feathers in place.

450
00:18:53.075 --> 00:18:57.335
Uh, those were, uh, the, the locking mechanisms

451
00:18:57.335 --> 00:18:58.895
for those were unlocked early, uh,

452
00:18:58.955 --> 00:19:01.335
before the, uh, the aircraft of supersonic in,

453
00:19:01.635 --> 00:19:03.375
in three seconds, four seconds afterwards,

454
00:19:03.395 --> 00:19:04.615
the, uh, the aircraft broke apart.

455
00:19:05.035 --> 00:19:09.885
So if you do an SEPA analysis on

456
00:19:09.885 --> 00:19:12.125
just the feather unlock control, uh,

457
00:19:12.225 --> 00:19:14.045
and as Ben kind of pointed out, there's four,

458
00:19:14.675 --> 00:19:17.285
four approaches, uh, to an unsafe control action

459
00:19:17.425 --> 00:19:19.405

or to a control action to be an unsafe control.

460
00:19:19.465 --> 00:19:21.525
You can, is there a hazard that results,

461
00:19:21.525 --> 00:19:24.415
or a scenario that results from a, from from doing it?

462
00:19:24.795 --> 00:19:26.695
Uh, do you do it too long? Do you do it too late?

463
00:19:27.225 --> 00:19:31.165
Um, so if you do that, you come up, you come up with,

464
00:19:31.165 --> 00:19:32.925
with something that's rather revealing here.

465
00:19:32.945 --> 00:19:35.445
So looking at just the unlock control.

466
00:19:36.025 --> 00:19:39.125
Uh, and then in green, I have, uh, the process model

467
00:19:39.125 --> 00:19:42.125
that was in, in mini's, in, in mini's cranium.

468
00:19:42.505 --> 00:19:44.445
Uh, so he had three tasks to do.

469
00:19:44.445 --> 00:19:45.965
This is a very dynamic, uh, time.

470
00:19:46.745 --> 00:19:49.585
Uh, after, after, uh, lighting the motor

471
00:19:50.005 --> 00:19:53.865
and calling out the 0.8 for the transonic, uh, he,

472
00:19:54.045 --> 00:19:56.265
his next action was to call out, was

473
00:19:56.265 --> 00:19:58.105
to unlock the feathers at 1.4 mock.

474
00:19:58.525 --> 00:20:03.265
Um, there was no note, uh, no caution in the POH, uh, about,

475
00:20:03.365 --> 00:20:07.575
uh, early unlock, uh, on the previous powered flights.

476
00:20:07.575 --> 00:20:09.815
They'd unlocked it at 1.2 and 1.3.

477
00:20:10.195 --> 00:20:11.215
Uh, the other thing in,

478
00:20:11.215 --> 00:20:15.175
in Minnie's head in the process model is that at 1.5,

479
00:20:15.175 --> 00:20:17.655
there's a, a warning light that comes on to say that, Hey,

480
00:20:17.655 --> 00:20:19.695
you haven't unlocked, and at 1.8,

481
00:20:19.695 --> 00:20:21.055
you actually have to abort the burn.

482
00:20:21.515 --> 00:20:24.255
Uh, if you haven't unlocked at that point to, you know,

483
00:20:24.255 --> 00:20:26.535
take care of the fact that if the locks don't release,

484
00:20:26.595 --> 00:20:27.815
you don't want the hot reentry.

485
00:20:27.835 --> 00:20:29.175
So looking at just the unlock

486
00:20:29.595 --> 00:20:31.375

and the unsafe control actions from that,

487
00:20:32.465 --> 00:20:36.585
we'll highlight a scenario that was not considered.

488
00:20:36.585 --> 00:20:39.705
So the quote there on the bottom right hand side is from Jim

489
00:20:39.975 --> 00:20:42.425
Ty's testimony to the National Transportation Safety Board.

490
00:20:42.685 --> 00:20:45.305
Uh, Jim TI also count as a close friend, uh,

491
00:20:45.325 --> 00:20:48.045
is probably the most brilliant aeronautical engineer

492
00:20:48.045 --> 00:20:49.445
that I have ever encountered.

493
00:20:49.945 --> 00:20:52.215
Um, and his point was like,

494
00:20:52.215 --> 00:20:53.455
we just didn't think that was possible.

495
00:20:53.715 --> 00:20:55.815
Uh, and of course, there, there's a huge risk

496
00:20:55.915 --> 00:21:00.095
of hindsight bias, um, in, in looking at through this way.

497
00:21:00.355 --> 00:21:04.375
But STPA is a tool, it's a framework.

498
00:21:04.405 --> 00:21:06.855
It's a deliberate approach to looking at problems so

499
00:21:06.855 --> 00:21:09.135
that when you're a test team sitting around the table trying

500
00:21:09.135 --> 00:21:11.215
to figure out what are the scenarios,

501
00:21:11.635 --> 00:21:12.735
you think through all those things.

502
00:21:12.915 --> 00:21:15.615
And if, if you do this, it might walk you

503
00:21:15.615 --> 00:21:17.095
to scenarios that you don't consider.

504
00:21:17.435 --> 00:21:18.815
Uh, it was thinking

505
00:21:18.815 --> 00:21:21.775
through this example from an STPA framework that really

506
00:21:22.565 --> 00:21:26.575
made me, because I was, I was actually slow to adopt STBA

507
00:21:26.575 --> 00:21:28.655
as a, uh, recognize it as the tool for

508
00:21:28.655 --> 00:21:29.975
what it is for building risk awareness.

509
00:21:31.705 --> 00:21:33.765
Uh, so in the paper, uh, this is,

510
00:21:33.765 --> 00:21:35.245
this is actually a slide from Anaheim.

511
00:21:35.445 --> 00:21:37.085
I, I go through several steps on how you,

512
00:21:37.385 --> 00:21:39.045
how you cultivate risk awareness

513
00:21:39.385 --> 00:21:41.605

and how you can recognize it at the organizational level.

514
00:21:42.185 --> 00:21:43.845
Uh, the first step is identifying,

515
00:21:43.845 --> 00:21:46.365
characterize the unknowns, reduce the reduceable ignorance,

516
00:21:46.905 --> 00:21:49.485
uh, democratize safety decision making, that really gets

517
00:21:49.485 --> 00:21:51.605
to the heart of a lot of the cultural things that we spoke

518
00:21:51.605 --> 00:21:53.845
through yesterday, uh, at the organizational level.

519
00:21:54.145 --> 00:21:55.365
And you can also use it.

520
00:21:55.665 --> 00:21:59.525
Um, I found this particularly powerful as a, uh,

521
00:21:59.545 --> 00:22:00.925
as essentially as a risk manager.

522
00:22:01.265 --> 00:22:03.645
Um, so I was, I was an og.

523
00:22:03.905 --> 00:22:06.085
Uh, I wasn't making the day-to-day calls.

524
00:22:06.125 --> 00:22:07.085
I didn't have my finger on the pulse,

525
00:22:07.085 --> 00:22:08.245
the squadron commanders were doing that.

526
00:22:08.265 --> 00:22:12.005
But I could use an organizational assessment, uh,

527
00:22:12.225 --> 00:22:13.325
of the squadrons

528
00:22:13.325 --> 00:22:15.525
and figure out this, this squadron is, appears

529
00:22:15.525 --> 00:22:16.845
to be very risk aware based on the

530
00:22:16.845 --> 00:22:17.925
way information's flowing through them.

531
00:22:18.465 --> 00:22:20.285
Uh, so there's details on, on how you do

532
00:22:20.285 --> 00:22:21.365
that in the paper as well.

533
00:22:21.905 --> 00:22:23.725
Uh, and then finally, a resisting drift

534
00:22:24.065 --> 00:22:25.165
is extremely important.

535
00:22:25.305 --> 00:22:29.885
So in, in the, the 22nd pitch on the drift model is

536
00:22:29.885 --> 00:22:34.605
that you have, there's always an unacceptable program delay

537
00:22:35.245 --> 00:22:37.885
boundary and a resource boundary where you,

538
00:22:37.885 --> 00:22:39.165
you have limited resources.

539
00:22:39.165 --> 00:22:41.965
Those boundaries naturally create gradients

540
00:22:42.555 --> 00:22:45.165

that push you towards the mishap boundary.

541
00:22:45.385 --> 00:22:46.445
And because uncertainty,

542
00:22:46.445 --> 00:22:48.005
you don't really know where that boundary is.

543
00:22:48.025 --> 00:22:49.765
So there will always be schedule pressure,

544
00:22:49.765 --> 00:22:51.325
there will always be resource pressures,

545
00:22:51.545 --> 00:22:53.045
and those are always going to push you.

546
00:22:53.105 --> 00:22:54.845
So once you've, when you've laid out that schedule,

547
00:22:55.115 --> 00:22:58.125
when early in the program, we need this much time to learn,

548
00:22:58.865 --> 00:23:00.245
you need that much time to learn.

549
00:23:00.515 --> 00:23:02.925
That is a, a key tenant of risk awareness.

550
00:23:03.505 --> 00:23:07.085
Uh, so recognizing when, when a program is drifting

551
00:23:07.085 --> 00:23:09.525
or when an organization is drifting is, is really key.

552
00:23:09.545 --> 00:23:13.045
And this is also another success, um, for risk awareness.

553
00:23:13.225 --> 00:23:15.005
One of the, uh, one of the squadrons, again, I found out

554
00:23:15.005 --> 00:23:16.645
after, you know, several nine months

555
00:23:16.645 --> 00:23:19.365
after my change of command, the squadron commander came up

556
00:23:19.365 --> 00:23:21.245
to me and said, we were getting a lot

557
00:23:21.245 --> 00:23:22.845
of pressure from the program office.

558
00:23:23.765 --> 00:23:25.705
And the squadron commander is able to stand up

559
00:23:25.705 --> 00:23:29.505
to the program manager and say, I think we're drifting,

560
00:23:29.525 --> 00:23:30.665
and you're pushing me too hard.

561
00:23:30.665 --> 00:23:32.945
And he used the drift model. So sometimes this is a language

562
00:23:32.945 --> 00:23:34.425
that PMs can understand,

563
00:23:35.205 --> 00:23:38.145
and it's sometimes useful to be able to have a language

564
00:23:38.205 --> 00:23:40.905
to talk back, uh, to management to say,

565
00:23:41.245 --> 00:23:42.865
we can't go any faster.

566
00:23:43.365 --> 00:23:44.785
Uh, 'cause we need time to learn.

567
00:23:47.695 --> 00:23:49.555

So here are the final thoughts.

568
00:23:49.975 --> 00:23:52.475
And, uh, some of the things that the test center's doing,

569
00:23:52.655 --> 00:23:56.075
uh, as part of a kind of change in the culture of, of

570
00:23:56.075 --> 00:23:57.795
how we're approaching safety planning and safety reviews.

571
00:23:57.855 --> 00:24:00.115
We still do ts we still do GMCs.

572
00:24:00.115 --> 00:24:01.155
We still come up with a risk matrix.

573
00:24:01.855 --> 00:24:04.275
Uh, but we're trying to change the tone

574
00:24:04.455 --> 00:24:07.515
of safety review boards, uh, to really encapsulate

575
00:24:07.515 --> 00:24:09.315
and really capture the essence of risk management.

576
00:24:09.375 --> 00:24:12.795
So identifying what do we truly know?

577
00:24:13.375 --> 00:24:16.635
Um, and then for the things that we, we think we know,

578
00:24:16.685 --> 00:24:18.315
let's put confidence intervals on that.

579
00:24:19.035 --> 00:24:20.855
Um, and then assessing, you know,

580
00:24:20.855 --> 00:24:22.495
as if I was chairing a safety review board,

581
00:24:22.495 --> 00:24:25.735
now I'd be looking at how well do I think that this team

582
00:24:25.735 --> 00:24:27.895
that's about to go out and test understands the system

583
00:24:29.025 --> 00:24:30.405
by the same nature, what is unknown

584
00:24:30.405 --> 00:24:31.645
with this test that we're about to do?

585
00:24:32.115 --> 00:24:33.565
What are we going to inform?

586
00:24:33.585 --> 00:24:35.005
And what is the nature of that unknown?

587
00:24:35.005 --> 00:24:37.685
Because that, you know, that feeds what type

588
00:24:37.685 --> 00:24:39.085
of cognitive tools we actually do that.

589
00:24:39.235 --> 00:24:40.645
What buildup test have we done?

590
00:24:40.795 --> 00:24:42.925
More importantly, which ones did we decide not to do?

591
00:24:43.165 --> 00:24:44.245
'cause we didn't think we needed to.

592
00:24:46.745 --> 00:24:48.175
Where are the gaps in our knowledge?

593
00:24:48.355 --> 00:24:50.375
Uh, where have we been surprised so far?

594
00:24:51.805 --> 00:24:54.135

That is, uh, again, surprises our warnings

595
00:24:54.205 --> 00:24:55.975
that we don't fully understand the system.

596
00:24:56.675 --> 00:24:58.535
Uh, is there sufficient schedule to learn?

597
00:24:58.595 --> 00:24:59.655
You know, are we drifting?

598
00:24:59.655 --> 00:25:01.575
These are key things that I think risk managers,

599
00:25:01.575 --> 00:25:03.615
at the risk managers level can now use to assess

600
00:25:06.935 --> 00:25:08.395
as part of that organization thing.

601
00:25:08.395 --> 00:25:10.115
How is information flowing across the organization?

602
00:25:10.145 --> 00:25:12.235
This, this lets you, you know, determine,

603
00:25:12.255 --> 00:25:14.275
and you can actually self-assess this as as well.

604
00:25:14.815 --> 00:25:16.235
Um, how much do we agree?

605
00:25:16.235 --> 00:25:18.395
And that's one of the ulu made the point, uh,

606
00:25:18.395 --> 00:25:20.395
the functional control diagram, you put that up there,

607
00:25:20.935 --> 00:25:22.435
and when three

608
00:25:22.435 --> 00:25:23.995
or four people said, well, that's not how it works,

609
00:25:23.995 --> 00:25:26.155
it works this way, that's an indication that, hey,

610
00:25:26.155 --> 00:25:28.635
we're not really thinking about the problem in the same way.

611
00:25:30.925 --> 00:25:33.265
And then this one is very, very important, um,

612
00:25:34.525 --> 00:25:36.205
possible versus plausible or probable.

613
00:25:36.545 --> 00:25:40.005
Uh, the thing that I dislike about the risk matrix is,

614
00:25:40.945 --> 00:25:43.485
is we spend a lot of energy talking about the probability.

615
00:25:44.485 --> 00:25:46.925
I care more about if, if it's possible.

616
00:25:46.985 --> 00:25:50.485
And that's what STPA as a tool lets you do is walk through

617
00:25:50.485 --> 00:25:51.765
and generate all those scenarios.

618
00:25:51.765 --> 00:25:53.805
So as a test team, you're sitting around the table

619
00:25:53.905 --> 00:25:55.405
and you're thinking about what could happen.

620
00:25:56.635 --> 00:25:58.595
STPA is a framework. It won't think for you.

621
00:25:58.655 --> 00:26:02.185

You still gotta think, but what I wanna know as a leader is,

622
00:26:02.325 --> 00:26:03.785
is the scenario possible?

623
00:26:04.025 --> 00:26:06.705
I don't care if it's, if, if, if you can argue

624
00:26:06.705 --> 00:26:08.385
that it's implausible, talk to me.

625
00:26:08.525 --> 00:26:11.025
Is there a possible logical sequence that that could happen?

626
00:26:11.775 --> 00:26:13.705
Well, let's think about that and let's talk about that.

627
00:26:15.715 --> 00:26:17.695
So the, the Greeks recognized hubris

628
00:26:18.075 --> 00:26:19.655
as a fundamental human flaw.

629
00:26:20.305 --> 00:26:21.365
Uh, and,

630
00:26:21.625 --> 00:26:23.325
and that's really, you know, they even have a story,

631
00:26:23.405 --> 00:26:25.765
a flight test story, uh, regarding hubris.

632
00:26:26.435 --> 00:26:30.805
Um, so the, the real, uh,

633
00:26:30.825 --> 00:26:33.445
if there's one thing to take away, uh, it's

634
00:26:33.445 --> 00:26:36.085
that our flight safety review should really be an

635
00:26:36.085 --> 00:26:37.285
inquiry based approach.

636
00:26:37.305 --> 00:26:39.205
And that's, that's what risk awareness is trying to get at,

637
00:26:39.505 --> 00:26:42.205
is, is making it an inquiry board as opposed

638
00:26:42.205 --> 00:26:43.325
to an advocacy board.

639
00:26:43.815 --> 00:26:45.975
I can remember as a young test pilot, uh,

640
00:26:45.985 --> 00:26:47.615
being the project pilot on something

641
00:26:47.875 --> 00:26:48.935
and feeling like, okay,

642
00:26:48.935 --> 00:26:50.695
the SRB is something I've gotta get through.

643
00:26:50.835 --> 00:26:52.695
You know, I've gotta pitch this a certain way.

644
00:26:52.895 --> 00:26:53.855
'cause the, you know, the O six

645
00:26:53.855 --> 00:26:55.015
is sitting out there at the top of the table.

646
00:26:55.355 --> 00:26:56.855
And if it, you know, and if we don't have all our

647
00:26:56.855 --> 00:26:58.095
stuff together, I'm gonna look foolish.

648
00:26:58.475 --> 00:27:03.295

So I'm, I'm advocating for testing as opposed to actually

649
00:27:04.155 --> 00:27:09.025
let's, as a group discuss what is, what are we about to do,

650
00:27:09.325 --> 00:27:11.305
and how well do we really understand this system?

651
00:27:11.325 --> 00:27:12.825
That's an inquiry-based approach.

652
00:27:12.825 --> 00:27:14.705
And so culturally, I think that's one

653
00:27:14.705 --> 00:27:16.065
of the fundamental things that we can do

654
00:27:16.485 --> 00:27:20.025
to really cultivate risk awareness in our organization and,

655
00:27:20.925 --> 00:27:23.905
and really have that humility over hubris

656
00:27:24.245 --> 00:27:25.305
as we approach flight test.

657
00:27:27.405 --> 00:27:28.405
Any questions?

658
00:27:48.345 --> 00:27:50.155
Yeah, thanks a lot for the presentation.

659
00:27:50.155 --> 00:27:52.315
That was the first time I, I missed a one in Anaheim

660
00:27:52.315 --> 00:27:53.715
and, uh, and I heard about it.

661
00:27:53.735 --> 00:27:56.515
And, uh, I'm glad to see you present

662
00:27:57.355 --> 00:27:58.435
I different version of it.

663
00:27:59.335 --> 00:28:02.555
Um, can you give us a specific examples

664
00:28:02.575 --> 00:28:04.035
how SDPA has been used?

665
00:28:04.195 --> 00:28:06.315
I mean, the theory is, is great,

666
00:28:06.655 --> 00:28:08.915
but, uh, it's, uh, it's kind

667
00:28:08.915 --> 00:28:10.715
of a very abstract, it is abstract.

668
00:28:10.815 --> 00:28:13.395
And, uh, so do you have an example

669
00:28:13.575 --> 00:28:15.915
or something you can provide to us later Yep.

670
00:28:16.055 --> 00:28:18.715
Of, uh, of how it was, uh, applied in the test program?

671
00:28:19.495 --> 00:28:23.475
So, so the test center did, um, uh, did a pilot project.

672
00:28:23.625 --> 00:28:25.515
Suho mentioned this. They actually did four different

673
00:28:25.515 --> 00:28:28.635
programs, uh, where they tried STPA out.

674
00:28:29.055 --> 00:28:31.795
Um, and in fact, uh, this has been the subject of a couple

675
00:28:31.795 --> 00:28:34.075

of the flight test facts that Mark Jones puts out.

676
00:28:34.495 --> 00:28:36.915
Uh, and, and compared the traditional planning with the,

677
00:28:36.915 --> 00:28:40.555
with the safety planning, this really, it STPA really needs

678
00:28:40.555 --> 00:28:43.875
to be done to be, to do it well early on in a program.

679
00:28:44.545 --> 00:28:46.965
And what the Air Force is doing now is actually pushing it

680
00:28:46.965 --> 00:28:48.605
upstream, or what the test center's doing now is pushing

681
00:28:48.605 --> 00:28:49.885
upstream into the program offices.

682
00:28:50.625 --> 00:28:53.125
So we've briefed STPA to Dr.

683
00:28:53.215 --> 00:28:55.205
Roper, uh, the service acquisition executive,

684
00:28:55.205 --> 00:28:57.325
and we're in the process of having the test center brief,

685
00:28:57.625 --> 00:29:01.155
uh, the program executive offices, uh, the PEOs to be able

686
00:29:01.155 --> 00:29:02.395
to push it down to the PMs so

687
00:29:02.395 --> 00:29:04.395
that when a program shows up at the test center,

688
00:29:04.625 --> 00:29:07.395
they've already got the functional control diagram done so

689
00:29:07.395 --> 00:29:08.955
that the test team can now take it

690
00:29:09.655 --> 00:29:12.195
and look at the unsafe control actions

691
00:29:12.195 --> 00:29:13.595
and generate scenarios from that.

692
00:29:14.095 --> 00:29:16.595
Uh, one program that has it on contract, uh,

693
00:29:16.815 --> 00:29:18.155
is the, the GBSD program.

694
00:29:18.155 --> 00:29:20.635
They've actually got STPA written into

695
00:29:20.635 --> 00:29:21.915
the contractual language.

696
00:29:22.455 --> 00:29:24.595
Uh, so that's in the very early stages of design,

697
00:29:24.595 --> 00:29:25.795
and that's really the right time to do it.

698
00:29:25.995 --> 00:29:27.435
'cause there's, there's things that you would actually

699
00:29:27.435 --> 00:29:31.155
design differently based on how STB informs you.

700
00:29:39.265 --> 00:29:40.715
Okay. Um, I

701
00:29:40.715 --> 00:29:44.925
Was wondering in this process, do you who's

702
00:29:44.925 --> 00:29:45.925

Talk I'm, I'm Sorry. I'm

703
00:29:45.925 --> 00:29:46.765
sorry. Oh,

704
00:29:46.905 --> 00:29:47.905
Hey. Hey,

705
00:29:47.905 --> 00:29:48.725
back here.

706
00:29:49.065 --> 00:29:51.645
Um, is it typical to include, um,

707
00:29:53.375 --> 00:29:55.865
simulator experiments when you're, when you're going

708
00:29:55.865 --> 00:29:57.145
through this process of trying

709
00:29:57.145 --> 00:29:58.625
to figure out what can go wrong?

710
00:29:59.405 --> 00:30:02.945
And in particular, do you do any diabolical

711
00:30:03.785 --> 00:30:08.275
simulator flying where you say purposely try to

712
00:30:08.825 --> 00:30:11.275
make something bad happen within the context

713
00:30:11.495 --> 00:30:12.515
of the test cards?

714
00:30:12.775 --> 00:30:16.385
Or a mistake that that could be made?

715
00:30:17.065 --> 00:30:18.065
I would say absolutely.

716
00:30:18.445 --> 00:30:21.185
Um, anything, you know, if it's a,

717
00:30:21.365 --> 00:30:24.065
if it's a possible scenario, you should,

718
00:30:24.085 --> 00:30:25.665
you should think about it as a test team.

719
00:30:26.185 --> 00:30:30.325
Uh, so in a simulator, um, in models, you know,

720
00:30:30.355 --> 00:30:32.925
that is all part of, of, of cultivating

721
00:30:33.265 --> 00:30:34.565
and, and growing risk awareness.

722
00:30:34.585 --> 00:30:37.565
So I, I'd say absolutely, uh, consider all those things

723
00:30:40.255 --> 00:30:41.255
Colonel Wilker. Yeah,

724
00:30:41.255 --> 00:30:43.105
a lot of great information. Appreciate it.

725
00:30:43.205 --> 00:30:47.025
Um, one thing that you touched on really

726
00:30:47.855 --> 00:30:51.395
struck a chord with me was the time to learn aspect of, uh,

727
00:30:51.505 --> 00:30:54.195
integrating that into the schedule, which,

728
00:30:54.505 --> 00:30:56.795
because the time is money factor in,

729
00:30:56.795 --> 00:30:58.435

particularly in the commercial world,

730
00:30:58.985 --> 00:31:00.595
it's a very difficult thing to do,

731
00:31:00.695 --> 00:31:03.675
and it creates undue schedule pressures

732
00:31:04.395 --> 00:31:06.505
throughout the whole test campaign.

733
00:31:07.305 --> 00:31:09.605
And, um, it just, you know,

734
00:31:09.845 --> 00:31:12.005
whatever advice you might give us on selling

735
00:31:12.035 --> 00:31:14.405
that up front, that would be appreciated.

736
00:31:15.085 --> 00:31:19.145
So we, I under, I recognize the fact that it's even more

737
00:31:19.145 --> 00:31:20.385
of a factor on the commercial side

738
00:31:20.385 --> 00:31:22.425
because the bottom line is, is king.

739
00:31:22.725 --> 00:31:24.065
Um, and,

740
00:31:24.765 --> 00:31:26.985
but we, we have the same problems on the military

741
00:31:27.015 --> 00:31:28.345
side and the way to do that.

742
00:31:28.545 --> 00:31:29.705
I, I look at temps and,

743
00:31:29.705 --> 00:31:33.185
and this is part of my position now, my role now, um,

744
00:31:33.405 --> 00:31:36.305
in terms of oversight of all the programs, the temp,

745
00:31:36.965 --> 00:31:38.145
uh, is a contract.

746
00:31:38.525 --> 00:31:39.945
Uh, and I think there's,

747
00:31:39.945 --> 00:31:41.705
there's probably an analogous thing in,

748
00:31:41.705 --> 00:31:43.465
in the commercial world in terms

749
00:31:43.465 --> 00:31:46.045
of when you're laying out a program, uh,

750
00:31:46.445 --> 00:31:47.805
figuring out, you know, what do we need?

751
00:31:47.945 --> 00:31:50.685
So, uh, last night I was, you know, read the, uh,

752
00:31:50.685 --> 00:31:53.285
the Gulf Stream report, um, and,

753
00:31:53.975 --> 00:31:56.315
and there was a five year certification window,

754
00:31:56.775 --> 00:31:59.515
and the test team was under a lot of pressure, uh,

755
00:31:59.515 --> 00:32:01.995
because that five year window was about to expire.

756
00:32:02.495 --> 00:32:04.875

Um, and the, and test had gotten it late.

757
00:32:04.875 --> 00:32:08.035
So there was an initial plan that the test team had

758
00:32:08.225 --> 00:32:10.635
that was already shrunk by the time the test team got it,

759
00:32:10.635 --> 00:32:11.955
because some system things weren't ready.

760
00:32:12.675 --> 00:32:15.635
I think with program management, when we sit down,

761
00:32:15.635 --> 00:32:18.115
we lay out that, and, you know, here's what we think we need

762
00:32:19.095 --> 00:32:20.425
that that's in Violet,

763
00:32:21.075 --> 00:32:24.655
or we make a very conscious decision to cut into that.

764
00:32:25.075 --> 00:32:28.775
Uh, so I, I would argue that we get a, we get an agreement,

765
00:32:29.195 --> 00:32:30.495
um, between PMs and

766
00:32:30.495 --> 00:32:33.055
and tests, um, which is what, which is

767
00:32:33.055 --> 00:32:36.105
how we're treating the temp now, uh, in the Air Force, is

768
00:32:36.105 --> 00:32:38.225
that that's a contract, uh, for the test team.

769
00:32:38.795 --> 00:32:40.115
Um, so

770
00:32:42.345 --> 00:32:45.845
yes, yes, it is.

771
00:32:48.035 --> 00:32:49.085
Call it at that. Yep.

772
00:32:49.305 --> 00:32:51.205
Uh, obligatory grip and grin and,

773
00:32:51.305 --> 00:32:55.095
and make sure you go get your, uh, coveted cup

774
00:32:55.515 --> 00:32:57.335
and patch from the safety committee.

775
00:32:57.505 --> 00:33:00.495
Thank you for the presentation. Thank you. Uh, I, uh,

776
00:33:06.955 --> 00:33:09.295
you, you, you touched on it, you touched on a handful

777
00:33:09.355 --> 00:33:10.535
of nerves that I have,

778
00:33:10.555 --> 00:33:13.455
and everybody here knows that I've got this opinion about,

779
00:33:13.595 --> 00:33:14.895
uh, program managers

780
00:33:15.515 --> 00:33:17.575
and, uh, my my feeling is they,

781
00:33:17.795 --> 00:33:19.615
if you cook 'em just right, they taste great.

782
00:33:20.635 --> 00:33:22.975
Um, so I didn't plan this really well.

783
00:33:23.195 --> 00:33:25.655

Our next, you know, I'm, we're going from Wicker

784
00:33:25.715 --> 00:33:29.555
to Wick Lund, so Steve Wicklund from Boeing is gonna come

785
00:33:29.555 --> 00:33:29.955
talk to us.