WEBVTT

1
00:00:00.235 --> 00:00:04.735
I'd like to invite everybody back to the final paper, uh,

2
00:00:05.075 --> 00:00:07.395
of our, uh, workshop Today.

3
00:00:08.475 --> 00:00:12.955
You may recognize, uh, the name William B. Scott.

4
00:00:13.095 --> 00:00:15.755
He was a writer for Aviation Week and Space Technology.

5
00:00:15.905 --> 00:00:19.425
He's now retired. He also has written several novels

6
00:00:19.855 --> 00:00:21.545
that are listed in his bio.

7
00:00:22.965 --> 00:00:25.765
He's a, has a commercial ticket, uh,

8
00:00:25.905 --> 00:00:30.565
and has flown, uh, approximately 81 aircraft in in his,

9
00:00:30.705 --> 00:00:33.125
uh, writing career, uh, career.

10
00:00:33.915 --> 00:00:36.405
He's also been a, uh, uh, excuse me,

11
00:00:36.425 --> 00:00:38.525
he is a flight test engineer, uh,

12
00:00:39.045 --> 00:00:41.365
graduate from the US Air Force Test Pilot School.

13
00:00:42.185 --> 00:00:44.605
So without further ado, I'd like to introduce his paper.

14
00:00:44.955 --> 00:00:45.605
Zero margin.

15
00:00:49.435 --> 00:00:50.185
We've got it, sir.

16
00:00:52.825 --> 00:00:53.315
Alright.

17
00:00:58.525 --> 00:01:02.455
Okay. There we go. Thank you for the introduction

18
00:01:03.755 --> 00:01:05.175
and I'll jump right in here.

19
00:01:05.225 --> 00:01:07.815
Being the last guy on the list here, try

20
00:01:07.815 --> 00:01:08.895
to wrap this up in a hurry.

21
00:01:09.905 --> 00:01:12.205
On January 28th, 1986,

22
00:01:13.495 --> 00:01:17.125
space Shuttle Challenger stood on Pad 39 B blanketed in ice

23
00:01:17.875 --> 00:01:19.005
workers at the Cape

24
00:01:19.065 --> 00:01:21.085
and never experienced such low temperatures

25
00:01:22.035 --> 00:01:24.845
technicians accustomed to servicing NASA's space.

26
00:01:24.845 --> 00:01:27.725
Truck under balmy border of skies struggled

27
00:01:27.725 --> 00:01:30.925

to prepare a challenger for an already delayed flag.

28
00:01:32.175 --> 00:01:33.555
In launch, control managers

29
00:01:33.555 --> 00:01:35.755
and engineers argued about the impacts

30
00:01:35.815 --> 00:01:38.195
of sustained frigid temperatures on systems

31
00:01:38.255 --> 00:01:41.235
and materials that had never been cold soaked.

32
00:01:41.235 --> 00:01:43.615
Prior to launch, those

33
00:01:43.635 --> 00:01:46.255
who had make the go no-go decision were under intense

34
00:01:46.575 --> 00:01:49.255
pressures because America's first teacher

35
00:01:49.315 --> 00:01:50.495
in space was on board.

36
00:01:50.495 --> 00:01:51.615
Millions were watching

37
00:01:52.675 --> 00:01:54.655
and the launch had already been delayed.

38
00:01:55.155 --> 00:01:57.455
And of course, Congress was demanding the shuttle live up

39
00:01:57.455 --> 00:02:02.135
to NASA's promises on the go side were a record

40
00:02:02.195 --> 00:02:05.895
of 24 successful missions, anxious to fly astronauts

41
00:02:05.895 --> 00:02:10.095
and NASA managers desperate to showcase that space truck

42
00:02:10.435 --> 00:02:12.855
as an efficient, safe transportation system.

43
00:02:13.915 --> 00:02:16.695
On the no-go side were conservative engineers,

44
00:02:16.695 --> 00:02:17.815
seasoned astronauts

45
00:02:18.035 --> 00:02:21.695
and pad supervisors who knew launch crews were tired

46
00:02:21.695 --> 00:02:25.175
after days of working in those unprecedented cold weather.

47
00:02:26.335 --> 00:02:30.335
Ultimately those concerns were minimized or dismissed.

48
00:02:31.675 --> 00:02:36.455
The shuttle launched a disaster, struck this image

49
00:02:36.455 --> 00:02:38.255
of challenges horrific destruction.

50
00:02:38.375 --> 00:02:40.415
This seared into all of our memories

51
00:02:41.235 --> 00:02:44.375
and millions of us agonized over the same questions.

52
00:02:44.765 --> 00:02:47.655
What happened? How could this nightmare have been avoided?

53
00:02:48.685 --> 00:02:51.055
Reasons for the tragedy were documented

54
00:02:51.195 --> 00:02:53.055

and investigation boards exhaustive

55
00:02:53.055 --> 00:02:54.455
findings and recommendations.

56
00:02:56.115 --> 00:02:58.815
But for flight test pro uh, professionals,

57
00:02:59.545 --> 00:03:02.165
the challenger accident has some familiar overtones.

58
00:03:02.935 --> 00:03:06.525
Other less well known mishaps had their risk in the same

59
00:03:06.845 --> 00:03:10.045
phenomenon that killed seven challenger astronauts.

60
00:03:10.995 --> 00:03:14.325
Zero margin. A sinister yet natural process

61
00:03:15.035 --> 00:03:18.125
that can infect any high risk endeavor.

62
00:03:19.985 --> 00:03:22.805
At the outset of a complex development test program,

63
00:03:22.945 --> 00:03:24.165
safety is paramount.

64
00:03:24.795 --> 00:03:26.595
Conservative approaches are gospel

65
00:03:27.415 --> 00:03:31.035
flight test plans dictate go slope, envelope expansion,

66
00:03:31.595 --> 00:03:32.795
adequate time for data review.

67
00:03:33.605 --> 00:03:36.155
Large safety margins are built into every step.

68
00:03:37.315 --> 00:03:39.935
So we have a flawless first flight is celebrated

69
00:03:40.275 --> 00:03:42.335
and an aggressive test program is launched.

70
00:03:43.205 --> 00:03:47.175
However, flight one also could be the first step on

71
00:03:47.175 --> 00:03:48.455
that road to zero margin.

72
00:03:49.625 --> 00:03:52.455
After a long run of safe problem free flights,

73
00:03:52.455 --> 00:03:55.335
there's a tendency to believe safe operations have become

74
00:03:55.335 --> 00:03:59.095
routine and will continue Everything's going well,

75
00:03:59.875 --> 00:04:02.495
but thanks in large part to rigorous procedures

76
00:04:02.595 --> 00:04:03.975
and pervasive safety.

77
00:04:04.025 --> 00:04:07.495
First mentality, then it gradually erosion

78
00:04:07.595 --> 00:04:10.535
to safety margins begins thanks to external pressures

79
00:04:11.235 --> 00:04:12.715
in the flight test arena.

80
00:04:12.995 --> 00:04:14.835
Problems inevitably arise.

81
00:04:15.435 --> 00:04:17.435

Threatening success oriented schedules

82
00:04:17.455 --> 00:04:20.915
and plans for, again, managers are pressured by

83
00:04:20.915 --> 00:04:24.315
what I call the money givers commercial financiers,

84
00:04:24.535 --> 00:04:25.915
the Pentagon Congress

85
00:04:26.615 --> 00:04:29.355
and customers waiving contracts with hard delivery dates.

86
00:04:30.935 --> 00:04:33.915
As cost grow and schedule pads evaporate,

87
00:04:33.915 --> 00:04:36.195
those managers start badgering the engineers,

88
00:04:36.195 --> 00:04:38.355
instrumentation, technicians, mechanics,

89
00:04:38.895 --> 00:04:40.915
and eventually the flight test air crews.

90
00:04:42.185 --> 00:04:44.435
Soon everybody's working long hours

91
00:04:44.495 --> 00:04:47.435
and weekends busting tail to resolve technical problems.

92
00:04:48.515 --> 00:04:49.935
Air crews start flying two

93
00:04:49.935 --> 00:04:52.495
and three tests, hops a day, striving to catch up,

94
00:04:53.265 --> 00:04:54.575
gotta get back on schedule.

95
00:04:55.895 --> 00:04:57.915
But the human body cannot function in

96
00:04:57.915 --> 00:04:59.115
surge mode indefinitely.

97
00:04:59.995 --> 00:05:02.125
Fatigue induced mistakes start occurring.

98
00:05:03.125 --> 00:05:04.845
Shortcuts and workarounds creep into

99
00:05:04.845 --> 00:05:06.165
processes and procedures.

100
00:05:06.755 --> 00:05:09.045
Once etched in the holy stone of safety

101
00:05:10.375 --> 00:05:13.555
before long safety margins are being steadily eroded.

102
00:05:14.895 --> 00:05:17.635
But recognizing when those margins are approaching zero

103
00:05:17.975 --> 00:05:19.355
and then having the smarts

104
00:05:19.375 --> 00:05:22.555
and courage to back off requires discipline.

105
00:05:23.665 --> 00:05:26.145
A flight test history has a long list of professionals

106
00:05:26.205 --> 00:05:30.625
who are trapped in zero margin situations, shouting warnings

107
00:05:30.625 --> 00:05:32.585
and sounding alarm only to be ignored.

108
00:05:34.045 --> 00:05:37.785

And after an accident, experienced test pilots, engineers,

109
00:05:38.225 --> 00:05:40.145
managers, flight line mechanics,

110
00:05:40.145 --> 00:05:42.865
and distraught spouses, often not lamented.

111
00:05:43.585 --> 00:05:45.545
I saw it coming but couldn't stop it.

112
00:05:46.675 --> 00:05:49.205
None were able to convince top decision makers

113
00:05:49.785 --> 00:05:51.445
and those powerful money givers.

114
00:05:51.915 --> 00:05:53.405
There's no safety margin.

115
00:05:53.555 --> 00:05:58.065
Left example Dave Barnes Northrop

116
00:05:58.065 --> 00:06:01.705
testified he lost his life in an F 20 tiger shark crash

117
00:06:02.415 --> 00:06:04.385
fell in the accident, was imminent,

118
00:06:04.805 --> 00:06:06.625
but had no idea how to head it off.

119
00:06:07.875 --> 00:06:09.485
Like his hard charging colleagues,

120
00:06:09.545 --> 00:06:11.605
he thought he could just suck it up and keep flying.

121
00:06:12.475 --> 00:06:15.525
Even though the entire flight testing knew safety

122
00:06:15.555 --> 00:06:16.805
margins were shrinking.

123
00:06:18.015 --> 00:06:19.745
Competition, whether it's real

124
00:06:19.745 --> 00:06:23.265
or imagined among pilots also is a powerful incentive

125
00:06:23.285 --> 00:06:25.705
to press on one test.

126
00:06:25.705 --> 00:06:26.705
Pilot confided.

127
00:06:26.975 --> 00:06:29.385
There's always another guy waiting to take your slot.

128
00:06:30.325 --> 00:06:32.265
We all know he is thinking, I'll take

129
00:06:32.265 --> 00:06:33.705
that admission if you can't hack it.

130
00:06:35.105 --> 00:06:39.025
Consequently, nobody refuses to fly. Just one more flight.

131
00:06:39.935 --> 00:06:41.545
Even if you've already flown three

132
00:06:41.545 --> 00:06:42.945
test hops and you're whipped.

133
00:06:43.635 --> 00:06:46.545
Especially when everybody out there in a hangar busted their

134
00:06:46.595 --> 00:06:48.305
tails to get the bird ready to fly.

135
00:06:51.405 --> 00:06:55.345

Ron, He was one

136
00:06:55.345 --> 00:06:58.225
of Canada Air's most experienced and skilled test pilots.

137
00:06:58.935 --> 00:07:02.145
Norm died in another challenger, a business jet built

138
00:07:02.165 --> 00:07:06.635
by then Canada Air down Bombardier for weeks.

139
00:07:06.935 --> 00:07:10.235
He had warned company managers about dangerous deficiencies

140
00:07:10.295 --> 00:07:14.075
and yet those warnings were unable to halt that juggernaut.

141
00:07:14.075 --> 00:07:15.475
He was right into disaster.

142
00:07:16.895 --> 00:07:19.275
An empire test pilot school grad.

143
00:07:19.825 --> 00:07:24.085
Norm was at the height of a stellar career when he took off

144
00:07:24.105 --> 00:07:26.045
for a series of stall tests on the morning

145
00:07:26.045 --> 00:07:27.365
of April 3rd, 1980.

146
00:07:28.625 --> 00:07:31.525
As his flight test engineer board challenger one,

147
00:07:32.455 --> 00:07:34.695
I saw several critical aircraft

148
00:07:34.755 --> 00:07:39.535
and test systems fail in quick succession shortcuts,

149
00:07:39.615 --> 00:07:40.895
deferred engine maintenance

150
00:07:40.915 --> 00:07:44.535
and flawed designs of vital test systems converged

151
00:07:44.535 --> 00:07:47.015
to eliminate the last smidgen of safety margin.

152
00:07:48.205 --> 00:07:51.695
When we hit zero margin, norm ordered us to bail out

153
00:07:52.715 --> 00:07:55.735
the copilot and I jumped at very low altitude and survived.

154
00:07:56.765 --> 00:08:00.175
Norm got out, never had time to pull his parachutes due.

155
00:08:02.825 --> 00:08:04.785
A common thread, Lincoln, these

156
00:08:04.845 --> 00:08:07.825
and other accidents is a toxic environment

157
00:08:07.825 --> 00:08:10.425
that enabled safety margins eroding to nothingness.

158
00:08:11.525 --> 00:08:13.785
Now, I suspect most of you have heard precursors

159
00:08:13.785 --> 00:08:17.025
to an accident statements like these

160
00:08:18.345 --> 00:08:20.625
tomorrow afternoon to fix a hydraulic fleet.

161
00:08:20.805 --> 00:08:24.145
No way this bird's gotta be airborne by seven o'clock.

162
00:08:24.895 --> 00:08:26.185

Work all night if you have to,

163
00:08:26.245 --> 00:08:28.505
but that aircraft better be on the ramp, ready

164
00:08:28.505 --> 00:08:32.405
to go at six 30 Or hey,

165
00:08:32.805 --> 00:08:34.845
Congress equates flying time with progress.

166
00:08:35.145 --> 00:08:36.485
So we're gonna rack up hours.

167
00:08:37.485 --> 00:08:40.725
I don't care what tests you dream up, just fly the bird.

168
00:08:42.645 --> 00:08:44.005
Ultimately, it's the flight crew

169
00:08:44.075 --> 00:08:46.845
that must recognize safety margins are being reduced

170
00:08:46.905 --> 00:08:49.725
to dangerous levels and refuse to fly.

171
00:08:51.135 --> 00:08:54.865
Yeah, that's a non-starter for most test pilots and FTEs

172
00:08:54.865 --> 00:08:55.965
because 'cause we're confident

173
00:08:56.035 --> 00:08:58.405
that we can handle the problem any problem

174
00:08:58.595 --> 00:08:59.885
that pops up in flight.

175
00:09:01.115 --> 00:09:03.295
And few pros are really willing to put their jobs

176
00:09:03.395 --> 00:09:06.255
and reputations on the line by refusing to fly.

177
00:09:07.685 --> 00:09:10.175
Another pilot told me quote, you know,

178
00:09:10.175 --> 00:09:12.535
management will just tell someone else to take it.

179
00:09:13.365 --> 00:09:15.135
Even if everybody's butts dragging,

180
00:09:15.135 --> 00:09:17.575
there's always somebody ready to jump in that cockpit.

181
00:09:20.095 --> 00:09:22.535
Pressures imposed by the workplace hierarchy are readily

182
00:09:22.935 --> 00:09:25.215
identified by experienced flight test professionals

183
00:09:25.355 --> 00:09:27.175
and most of us learn how to deal with it.

184
00:09:28.185 --> 00:09:31.155
However, test teams also have to cope

185
00:09:31.155 --> 00:09:32.995
with other stress inducing factors.

186
00:09:34.225 --> 00:09:36.875
It's a synergistic combination of those elements

187
00:09:37.105 --> 00:09:41.725
that often contribute to an aircraft disaster while trying

188
00:09:41.745 --> 00:09:45.645
to manage, uh, trying to manage demands at work.

189
00:09:46.465 --> 00:09:49.245

Flight test personnel incur escalating stress at home.

190
00:09:49.665 --> 00:09:51.325
Things like, Hey,

191
00:09:51.555 --> 00:09:53.765
washing machines have been broken for a month.

192
00:09:53.865 --> 00:09:55.685
The upstairs toilet keeps backing up

193
00:09:55.685 --> 00:09:57.125
and the grass needs to be mowed.

194
00:09:57.865 --> 00:10:00.645
Surely then get along without you for just one day.

195
00:10:01.085 --> 00:10:02.125
Nobody's that important.

196
00:10:03.615 --> 00:10:05.955
Or, look, bud, Mary

197
00:10:05.955 --> 00:10:07.155
and I have been trying to get together

198
00:10:07.155 --> 00:10:08.475
with you guys for two months.

199
00:10:09.095 --> 00:10:11.835
If you don't wanna see us, just say so. It's okay.

200
00:10:13.595 --> 00:10:16.135
And of course, every time you promise, we'll go out

201
00:10:16.135 --> 00:10:17.815
for dinner in a movie or date gets broken

202
00:10:18.285 --> 00:10:20.055
because of your work.

203
00:10:20.705 --> 00:10:22.935
Sorry dear. Gotta fly One more fly.

204
00:10:23.755 --> 00:10:25.255
I'm always shoved off to the side

205
00:10:25.315 --> 00:10:28.155
and I've had it the bottom line.

206
00:10:28.665 --> 00:10:31.315
Desperately needed rest is sacrificed

207
00:10:31.315 --> 00:10:34.075
to keep the peace at home and lead a somewhat normal life.

208
00:10:35.695 --> 00:10:37.995
And myriad stressors are accompanied

209
00:10:38.055 --> 00:10:40.115
by a steadily diminishing margin of safety.

210
00:10:41.445 --> 00:10:43.045
Accidents may appear inevitable,

211
00:10:44.735 --> 00:10:47.355
but all of these precursors to unavoidable disaster

212
00:10:48.095 --> 00:10:52.195
merely the high cost of, uh, risk endeavors

213
00:10:52.975 --> 00:10:54.955
or can accidents be prevented?

214
00:10:59.215 --> 00:11:02.075
The aviation aerospace sector has developed tools

215
00:11:02.255 --> 00:11:03.795
to maintain safety margins.

216
00:11:04.475 --> 00:11:07.275

Thunderbirds and blue angels are good models

217
00:11:07.415 --> 00:11:09.115
for doing just exactly that.

218
00:11:10.695 --> 00:11:13.315
As we know, safety valves can be billed into program

219
00:11:13.795 --> 00:11:16.635
schedules, ensuring how goes at assessments are conducted.

220
00:11:16.635 --> 00:11:20.765
Periodically, these reviews can mitigate pressures

221
00:11:20.765 --> 00:11:22.165
before they reach the flight line.

222
00:11:23.075 --> 00:11:25.245
Ideally, somebody outside if traditional

223
00:11:25.275 --> 00:11:26.525
line management leads them.

224
00:11:28.365 --> 00:11:31.335
Some flight test organizations are incorporating effective

225
00:11:31.335 --> 00:11:33.295
measures that were identified in Dr.

226
00:11:33.365 --> 00:11:35.895
Tony Kern's superb book going pro.

227
00:11:37.045 --> 00:11:41.935
They consistently wage a global wear global war on

228
00:11:41.945 --> 00:11:45.535
error unquote via safety review boards,

229
00:11:45.855 --> 00:11:48.455
training test systems to monitor their own

230
00:11:48.455 --> 00:11:49.975
actions and condition.

231
00:11:50.395 --> 00:11:53.705
But these aren't always sufficient to break the chain

232
00:11:53.705 --> 00:11:56.145
of events leading to accidents and experience.

233
00:11:56.375 --> 00:12:00.585
Technically confident, strong-willed person with the power

234
00:12:00.585 --> 00:12:02.825
to call a halt shut down flight ops

235
00:12:02.925 --> 00:12:07.105
or any other activity can prove invaluable and his

236
00:12:07.125 --> 00:12:10.905
or her paycheck and career can't be on the line every time.

237
00:12:11.065 --> 00:12:14.105
A critical safety driven decision must be

238
00:12:14.105 --> 00:12:16.345
made to be effective.

239
00:12:16.615 --> 00:12:19.785
This ombudsman should report directly

240
00:12:19.785 --> 00:12:22.305
to a top level executive, not a manager.

241
00:12:22.425 --> 00:12:23.905
Beholden program success

242
00:12:23.925 --> 00:12:27.785
and schedules during the F 16 fighters

243
00:12:27.785 --> 00:12:28.825

full scale development.

244
00:12:28.985 --> 00:12:32.545
I witnessed the wisdom of having such an empowered ombudsman

245
00:12:33.085 --> 00:12:36.145
and how critical such a figure is to safe air operations.

246
00:12:37.665 --> 00:12:39.345
I was a flight test engineer assigned

247
00:12:39.345 --> 00:12:40.945
to F 16 A number three.

248
00:12:41.285 --> 00:12:44.465
The first single seat piper fitted with a full avionic suite

249
00:12:44.965 --> 00:12:46.385
and a 20 millimeter canon.

250
00:12:47.485 --> 00:12:49.305
My aircraft was scheduled for delivery

251
00:12:49.405 --> 00:12:52.505
to the Air Force prior to months in a milestone

252
00:12:52.505 --> 00:12:54.745
that would trigger a sizable progress payment

253
00:12:55.485 --> 00:12:57.385
to then General Dynamics Fort Worth.

254
00:12:57.845 --> 00:13:00.945
Now Lockheed Martin avionics

255
00:13:01.005 --> 00:13:02.625
and electrical system problems

256
00:13:02.855 --> 00:13:04.905
that surfaced on the first few test flights.

257
00:13:06.025 --> 00:13:08.665
Threatened to delay a three's transfer to the Air Force

258
00:13:09.715 --> 00:13:12.465
management pressures on engineers,

259
00:13:12.535 --> 00:13:16.785
technicians fight line maintenance personnel soon rapid up

260
00:13:16.885 --> 00:13:18.345
to abusive levels.

261
00:13:19.215 --> 00:13:20.545
Everybody involved getting

262
00:13:20.545 --> 00:13:21.905
that aircraft fixed and delivered.

263
00:13:22.255 --> 00:13:25.985
Working around the clock, exacerbated fatigue

264
00:13:26.445 --> 00:13:27.825
and triggered silly mistakes.

265
00:13:29.765 --> 00:13:31.665
Air Force program managers anxious

266
00:13:31.665 --> 00:13:34.985
to have the first avionics equipped F 16 A on

267
00:13:34.985 --> 00:13:36.025
the ramp at Edwards.

268
00:13:36.945 --> 00:13:40.545
Pressured this on scene test Pilot a major to quote,

269
00:13:40.575 --> 00:13:43.505
keep the heat on that contractor every day.

270
00:13:43.505 --> 00:13:44.625

The aircraft was late.

271
00:13:44.825 --> 00:13:47.265
Delayed testing that had to be completed

272
00:13:47.765 --> 00:13:49.345
for a critical program with you

273
00:13:52.125 --> 00:13:56.865
at a Friday night meeting contractor vice president declared

274
00:13:56.865 --> 00:13:58.745
that we would work through the night

275
00:13:58.885 --> 00:14:02.265
to make sure F 16 A number three was ready to fly.

276
00:14:02.665 --> 00:14:05.535
Saturday just to ensure on-time delivery,

277
00:14:06.835 --> 00:14:10.175
the Air Force test pilot pulled aside a GD safety officer

278
00:14:10.515 --> 00:14:12.535
who doubled as a program ombudsman.

279
00:14:13.715 --> 00:14:17.055
The major said the frantic fine fix flyaway things were

280
00:14:17.055 --> 00:14:20.335
being done, did little to inspire confidence.

281
00:14:21.115 --> 00:14:23.735
In fact, the Saturday flight would probably be a waste

282
00:14:23.735 --> 00:14:25.735
of time that we needed for troubleshooting.

283
00:14:27.255 --> 00:14:28.755
Why not scrub the Saturday flight?

284
00:14:28.825 --> 00:14:31.635
Send everybody home for the weekend, devote Monday

285
00:14:31.735 --> 00:14:32.955
to resolving problems

286
00:14:32.955 --> 00:14:34.555
and shoot for a successful flight

287
00:14:34.555 --> 00:14:35.915
on deadline or delivery day.

288
00:14:37.345 --> 00:14:40.195
When that suggestion was raised, the vice president

289
00:14:40.375 --> 00:14:43.075
and his program manager loudly objected

290
00:14:43.655 --> 00:14:46.435
Any problem encountered on a Monday test flight.

291
00:14:46.965 --> 00:14:50.555
Would virtually guarantee late delivery, better to fly

292
00:14:50.555 --> 00:14:52.845
as soon as possible, uncover those remaining

293
00:14:52.845 --> 00:14:54.085
problems and work 'em off.

294
00:14:54.105 --> 00:14:55.205
The managers insisted.

295
00:14:56.845 --> 00:15:00.825
The ombudsman safety officer surveyed our exhausted teams

296
00:15:00.995 --> 00:15:02.905
faces turned to the pilot

297
00:15:03.045 --> 00:15:06.025

and said, I agree, we're not flying tomorrow.

298
00:15:06.725 --> 00:15:08.385
We F six F 16.

299
00:15:08.585 --> 00:15:11.065
A number three is standing down for the weekend.

300
00:15:12.795 --> 00:15:15.365
Amid the Vice president's profanity, lace protest.

301
00:15:15.745 --> 00:15:18.405
Our ombudsman clocked the Air Force testified on the

302
00:15:18.525 --> 00:15:20.325
shoulder and said, let's go get a cup

303
00:15:20.325 --> 00:15:22.845
of coffee over the weekend.

304
00:15:23.665 --> 00:15:26.285
All those engineers, technicians, maintenance personnel,

305
00:15:26.285 --> 00:15:28.285
relaxed and spent time with their families.

306
00:15:29.025 --> 00:15:31.645
But they also were thinking about a three's glitches.

307
00:15:32.355 --> 00:15:35.645
They went to work Monday morning with new ideas, items

308
00:15:35.785 --> 00:15:38.365
to check, test to run, et cetera.

309
00:15:38.875 --> 00:15:41.485
Changes were made down, tests performed,

310
00:15:41.585 --> 00:15:44.965
and the aircraft flight deadline day

311
00:15:45.555 --> 00:15:47.805
test pilot flew a successful check flight

312
00:15:48.425 --> 00:15:50.565
and accepted F 16, A number three

313
00:15:51.355 --> 00:15:52.765
into the Air Force inventory.

314
00:15:54.245 --> 00:15:57.725
Contrary to conventional management, wisdom standing down

315
00:15:58.485 --> 00:16:00.405
ultimately produced the desired outcome.

316
00:16:02.235 --> 00:16:05.175
In an ideal world, every key player in the aerospace

317
00:16:05.495 --> 00:16:08.415
industry wouldn't be empowered to wave the unsafe flag

318
00:16:08.435 --> 00:16:09.775
and call for a stand down.

319
00:16:10.355 --> 00:16:14.735
Before bad stuff happened, program managers would pause

320
00:16:14.875 --> 00:16:16.255
to take the pulse of their teams.

321
00:16:17.115 --> 00:16:20.485
Are my people tired? Are we caught up in a whirlwind

322
00:16:20.485 --> 00:16:22.245
of knee jerk reactions to problems?

323
00:16:23.305 --> 00:16:25.525
Are we cutting corners just a little here?

324
00:16:25.525 --> 00:16:29.085

And there are whittling down that big start

325
00:16:29.085 --> 00:16:30.485
of the program safety margin.

326
00:16:31.465 --> 00:16:33.565
Are we approaching zero margin?

327
00:16:35.465 --> 00:16:38.165
The challenge for leaders in every high risk endeavor is

328
00:16:38.165 --> 00:16:40.325
to establish a pro, a framework

329
00:16:40.345 --> 00:16:44.325
and culture that ensures good safety Margins are preserved.

330
00:16:45.495 --> 00:16:48.205
Smart executives and managers listen to their experts.

331
00:16:48.665 --> 00:16:51.245
The experienced men and women closest to the flight line,

332
00:16:52.185 --> 00:16:55.605
excuse me, launchpad and mission control.

333
00:16:57.115 --> 00:16:59.345
Those experts, analysis, judgments,

334
00:16:59.565 --> 00:17:01.345
and gut feelings are respected.

335
00:17:02.005 --> 00:17:03.585
Nobody fears losing his

336
00:17:03.585 --> 00:17:07.705
or her job for highlighting a safety concern regardless

337
00:17:07.805 --> 00:17:10.265
of the potential impacts on scheduling cost.

338
00:17:12.025 --> 00:17:13.995
Even then, test pilots

339
00:17:13.995 --> 00:17:17.275
and flight test engineers as the final guardians of safety

340
00:17:17.985 --> 00:17:20.555
must stay alert to the insidious chipping away

341
00:17:20.555 --> 00:17:24.075
of safety margins and be prepared to ground the test birds.

342
00:17:25.675 --> 00:17:27.415
And they also have to watch themselves

343
00:17:27.555 --> 00:17:28.615
and fellow crew members.

344
00:17:29.595 --> 00:17:33.775
Why? Because flight test professionals are type A can-do

345
00:17:33.775 --> 00:17:36.335
people with confidence in their own abilities.

346
00:17:36.485 --> 00:17:37.735
They're primed and cocked

347
00:17:37.735 --> 00:17:39.815
to believe they can handle known deficiencies

348
00:17:40.405 --> 00:17:45.055
through workarounds and keep flying right up to that day.

349
00:17:45.465 --> 00:17:47.095
Those deficiencies gang up

350
00:17:47.095 --> 00:17:49.255
and exceed a flight cruise performance.

351
00:17:50.705 --> 00:17:52.835

Then accidents occur and people die.

352
00:17:54.745 --> 00:17:59.325
During a conversation at the 1975 SETP annual symposium,

353
00:17:59.885 --> 00:18:03.025
hunter Wright, tiny lady who served as one

354
00:18:03.025 --> 00:18:05.105
of Germany's most illustrious test pilots

355
00:18:05.105 --> 00:18:09.305
during World War ii, offered me sage advice.

356
00:18:10.515 --> 00:18:14.105
Never be too proud to say, no, I won't go.

357
00:18:15.495 --> 00:18:17.825
Anybody can say yes, I'll fly that airplane.

358
00:18:18.675 --> 00:18:20.615
But it takes courage to say no.

359
00:18:21.415 --> 00:18:24.575
When you feel things aren't right, remember that

360
00:18:25.355 --> 00:18:26.565
and you'll live much longer.

361
00:18:29.035 --> 00:18:29.725
Last question.

362
00:18:44.455 --> 00:18:47.005
Let's see. Here's a question on slide six.

363
00:18:47.155 --> 00:18:49.565
Referring to the can challenger accident.

364
00:18:50.075 --> 00:18:53.965
What happened that prompted the, uh, crew to bail out?

365
00:18:55.575 --> 00:18:56.715
That's not a quick answer,

366
00:18:56.855 --> 00:19:00.315
but, uh, we were doing a whole series of stall tests,

367
00:19:01.095 --> 00:19:05.675
but the certifying agency, MOT in Canada had dictated

368
00:19:05.745 --> 00:19:07.635
that even though it was a detailed airplane,

369
00:19:08.455 --> 00:19:12.155
we could not have an electronic stall protection device.

370
00:19:12.335 --> 00:19:14.435
No stick shaker. No stick pusher.

371
00:19:14.815 --> 00:19:16.595
We had to have an aerodynamic stall.

372
00:19:17.015 --> 00:19:20.155
So we put a stall strip on the leading edge of one wing

373
00:19:21.015 --> 00:19:22.875
and we're testing over and over

374
00:19:22.875 --> 00:19:26.635
and over to optimize that to get a controlled roll off.

375
00:19:28.055 --> 00:19:32.955
But on our test flight, um, We,

376
00:19:33.055 --> 00:19:37.115
we had to look for a very loud banging noise

377
00:19:37.345 --> 00:19:40.555
that had pretty much scrubbed the previous flight

378
00:19:41.265 --> 00:19:43.475

maintenance cannot find a cause for it.

379
00:19:43.895 --> 00:19:45.915
So we were tasked with, if you hear it,

380
00:19:46.415 --> 00:19:48.515
see if you can isolate the source of it.

381
00:19:49.965 --> 00:19:53.145
We only heard it one time at one particular flap

382
00:19:53.145 --> 00:19:54.345
and gear configuration.

383
00:19:55.205 --> 00:19:58.375
Then we went to the next test point and didn't hear it.

384
00:19:58.435 --> 00:19:59.775
So we finished the test card

385
00:20:00.575 --> 00:20:03.315
and the captain Norm said, let's go back to

386
00:20:03.315 --> 00:20:04.835
that one configuration.

387
00:20:06.135 --> 00:20:09.915
And this time, as he did the turning approach to stall,

388
00:20:10.955 --> 00:20:13.215
he said, I'm gonna, as soon as we get the banging noise,

389
00:20:13.535 --> 00:20:16.775
I will hold that angle of attack while you bill, look

390
00:20:16.775 --> 00:20:18.135
around the cabin, see if you can

391
00:20:18.135 --> 00:20:19.215
find anything loose in there.

392
00:20:19.395 --> 00:20:22.185
Had a lot of equipment in there, a thousand pounds

393
00:20:22.205 --> 00:20:25.705
of water we could pump back and forth to control cg.

394
00:20:26.685 --> 00:20:27.945
So we did exactly that.

395
00:20:29.045 --> 00:20:30.915
About the time I turned around to say,

396
00:20:31.395 --> 00:20:33.755
I don't see anything here, we're hearing the banging noise.

397
00:20:33.765 --> 00:20:36.875
We're in the buffet. All of a sudden the copilot yelled

398
00:20:37.455 --> 00:20:38.835
30 more than 30.

399
00:20:40.405 --> 00:20:44.025
The, uh, the angled attack had gone from a constant

400
00:20:44.445 --> 00:20:47.145
to pegged and we were deep stalled.

401
00:20:47.425 --> 00:20:49.725
So now we can't get the nose down.

402
00:20:50.985 --> 00:20:52.965
So Norm called for the spin shoot.

403
00:20:52.995 --> 00:20:56.485
Spin shoot went out and we broke the stall.

404
00:20:56.485 --> 00:20:58.405
Everybody thought we were going home, went

405
00:20:58.405 --> 00:21:01.245

to release the spin shoot, did it twice

406
00:21:01.265 --> 00:21:02.885
for the hydraulic release that didn't release.

407
00:21:03.195 --> 00:21:05.845
Went to the explosive bolts backup release

408
00:21:05.845 --> 00:21:07.445
system, and it failed.

409
00:21:08.185 --> 00:21:11.405
At that point, I called the altitude norm gave the immediate

410
00:21:11.595 --> 00:21:14.045
bailout and the rest is history.

411
00:21:14.665 --> 00:21:16.285
So why did we have a banging noise?

412
00:21:16.835 --> 00:21:18.605
They later found by looking at

413
00:21:19.405 --> 00:21:21.205
previous data from previous flights,

414
00:21:21.375 --> 00:21:24.405
which the poor engineers had never had time to look at,

415
00:21:25.065 --> 00:21:27.405
and found that we had one degraded engine

416
00:21:27.915 --> 00:21:29.325
that was compressor stalling.

417
00:21:30.285 --> 00:21:32.855
We'd heard compressor stalls, of course, at high altitude,

418
00:21:32.875 --> 00:21:35.255
but never at low altitude where we're doing these tests.

419
00:21:35.955 --> 00:21:39.335
And it turned out to be the engine translating slightly on

420
00:21:39.335 --> 00:21:40.495
the, the pylon.

421
00:21:40.635 --> 00:21:42.055
So it was banging the four

422
00:21:42.155 --> 00:21:44.855
and half stops creating this incredible

423
00:21:45.535 --> 00:21:46.655
structural banging noise.

424
00:21:47.605 --> 00:21:49.095
Okay, that was one problem.

425
00:21:49.235 --> 00:21:52.195
One another problem was the angle

426
00:21:52.195 --> 00:21:55.915
of attack vein on the nose, boom, nose test, boom, stuck.

427
00:21:56.615 --> 00:21:58.235
It stuck at the time we were trying

428
00:21:58.235 --> 00:21:59.995
to hold the constant angle of attack

429
00:22:00.945 --> 00:22:03.755
when there was enough buffet to make it break loose,

430
00:22:04.015 --> 00:22:05.115
that's when it pegged.

431
00:22:05.935 --> 00:22:09.595
And then why didn't the spin shoot release? We don't know.

432
00:22:10.165 --> 00:22:12.395

There never was a good answer for that.

433
00:22:12.815 --> 00:22:15.395
The explosive bolts activated on the

434
00:22:15.395 --> 00:22:16.475
ground when they recovered them.

435
00:22:17.415 --> 00:22:20.475
Uh, all this happened as you know, the typical

436
00:22:21.905 --> 00:22:25.045
way things do happen all happened at low altitudes.

437
00:22:25.045 --> 00:22:26.685
We were losing altitude fast

438
00:22:27.345 --> 00:22:29.805
and we literally did, went out of altitude

439
00:22:29.805 --> 00:22:31.045
and ideas at the same time.

440
00:22:31.945 --> 00:22:32.965
Got out very low.

441
00:22:33.085 --> 00:22:37.075
I think I jumped at around 1800 foot A GL Dave,

442
00:22:38.005 --> 00:22:39.955
about 800, the co-pilot.

443
00:22:40.855 --> 00:22:44.155
He broke his leg on landing. I was fine.

444
00:22:44.495 --> 00:22:47.115
And of course, norm didn't have enough time to get it out.

445
00:22:47.775 --> 00:22:48.915
So it was a banging noise.

446
00:22:49.495 --> 00:22:52.475
And then failure of at least two test unique systems,

447
00:22:52.935 --> 00:22:55.475
the stall vein or the angle of attack vein

448
00:22:56.255 --> 00:22:57.875
and the, uh, shoot release system.

449
00:23:02.395 --> 00:23:04.735
See Steve's ask, uh, or notes.

450
00:23:04.735 --> 00:23:06.575
There's a Steve Sto there's a lot

451
00:23:06.575 --> 00:23:07.975
of good lessons learned here,

452
00:23:08.875 --> 00:23:11.455
but does the industry really learn from these?

453
00:23:13.085 --> 00:23:15.575
Have have you seen examples of lessons learned out of

454
00:23:15.925 --> 00:23:17.095
that particular accident?

455
00:23:19.475 --> 00:23:23.685
Uh, that's a good question. I would say yes.

456
00:23:25.025 --> 00:23:29.515
Uh, particularly any organization

457
00:23:31.625 --> 00:23:35.205
as they move into a, a whole new realm, which at

458
00:23:35.205 --> 00:23:37.285
that time Canada was, they had never done,

459
00:23:38.185 --> 00:23:39.925

uh, a business jet.

460
00:23:40.035 --> 00:23:43.605
They had only done water bombers, straight wing airplanes.

461
00:23:43.605 --> 00:23:46.805
They had no experience with, uh, swept wing

462
00:23:47.455 --> 00:23:48.685
super critical wings.

463
00:23:49.185 --> 00:23:51.765
And that's why they came to the company I worked

464
00:23:51.765 --> 00:23:54.245
for was Flight Systems also there at Mojave,

465
00:23:54.245 --> 00:23:56.285
just down the ramp from flight research.

466
00:23:57.665 --> 00:24:02.075
And uh, and we were providing a lot of that expertise.

467
00:24:02.985 --> 00:24:07.675
However, there was not a lot of receptivity for, uh,

468
00:24:08.525 --> 00:24:09.665
for what we were offering.

469
00:24:10.325 --> 00:24:13.265
For instance, they said, we don't need telemetry,

470
00:24:13.855 --> 00:24:15.145
even for critical tests.

471
00:24:15.765 --> 00:24:18.145
We could not convince them that you really needed TM

472
00:24:18.235 --> 00:24:19.505
until after the accident.

473
00:24:20.485 --> 00:24:24.105
So I'd like to think that that accident, um,

474
00:24:24.995 --> 00:24:27.065
maybe some of the information promulgated

475
00:24:27.065 --> 00:24:30.945
through the industry and, uh, and made some changes.

476
00:24:31.725 --> 00:24:35.265
Um, but I will say it, it's pretty hard

477
00:24:35.365 --> 00:24:37.505
to change a certifying agency's

478
00:24:38.175 --> 00:24:39.905
mind if they have their mind made up.

479
00:24:40.775 --> 00:24:45.105
Unfortunately. Um, uh, there was one person

480
00:24:46.005 --> 00:24:50.685
at Canada, uh, Canada's MOT, that just would not hear

481
00:24:51.385 --> 00:24:55.745
of electronic, uh, stall protection system.

482
00:24:55.775 --> 00:24:58.425
Even though down here we gringo had figured

483
00:24:58.425 --> 00:24:59.505
it out a long time ago.

484
00:25:00.465 --> 00:25:02.425
It's hard to promulgate that information

485
00:25:02.425 --> 00:25:03.945
through the industry.

486
00:25:04.745 --> 00:25:08.545

I think, um, what we're doing here right now is one

487
00:25:08.545 --> 00:25:12.425
of the best ways because hopefully people will take anything

488
00:25:12.445 --> 00:25:16.385
we learn at workshops like this back into their own

489
00:25:16.825 --> 00:25:20.065
companies and maybe little by little we get smarter

490
00:25:20.085 --> 00:25:21.265
and smarter at play testing.

491
00:25:23.505 --> 00:25:25.145
I think you just touched on this, uh,

492
00:25:25.225 --> 00:25:27.065
a little bit in your last couple of sentences,

493
00:25:27.085 --> 00:25:30.305
but Rod's asked, asked, was it this accident

494
00:25:30.305 --> 00:25:31.585
that may transport Canada

495
00:25:32.125 --> 00:25:33.905
change their stall pusher requirement?

496
00:25:35.385 --> 00:25:38.035
Good question. I can't answer that. I was not part of it.

497
00:25:41.725 --> 00:25:44.855
What, uh, do you have any particular lessons learned

498
00:25:44.855 --> 00:25:46.015
that came from this accident?

499
00:25:49.925 --> 00:25:53.235
Yes, I would say that, uh, you really need

500
00:25:53.235 --> 00:25:56.875
to be suspicious of the test unique systems,

501
00:25:58.055 --> 00:26:00.715
you know, the aircraft itself with design

502
00:26:00.735 --> 00:26:03.315
and built with lots of redundancy.

503
00:26:04.535 --> 00:26:09.075
And, uh, what was, what Canada in particular failed

504
00:26:09.075 --> 00:26:11.715
to realize is they needed redundancy in

505
00:26:11.715 --> 00:26:12.835
the test systems too.

506
00:26:13.745 --> 00:26:16.315
Okay. And ironically,

507
00:26:16.775 --> 00:26:20.515
before we ever did a series of stalls, we always tested

508
00:26:22.135 --> 00:26:24.435
the, uh, shoot attachment

509
00:26:24.615 --> 00:26:26.275
and release system, you know,

510
00:26:26.345 --> 00:26:29.915
just hydraulically driven clamps that held the air,

511
00:26:30.015 --> 00:26:32.035
the chute to the airplane, and they always were.

512
00:26:33.255 --> 00:26:37.835
But what didn't occur, what was never tested probably was,

513
00:26:38.055 --> 00:26:42.195

um, how that would act under pressure.

514
00:26:43.185 --> 00:26:45.525
But then there was one other factor in there.

515
00:26:45.705 --> 00:26:48.085
It was a dead end hydraulic system.

516
00:26:48.305 --> 00:26:50.285
It was not a circulating type system.

517
00:26:50.905 --> 00:26:52.285
And what that really means is

518
00:26:53.295 --> 00:26:56.405
there actually was a incompatibility between

519
00:26:57.025 --> 00:26:58.845
the hydraulic fluid, which was skyra

520
00:26:59.505 --> 00:27:01.685
and the seals in that system.

521
00:27:02.145 --> 00:27:04.285
So the seals have been deteriorating over time.

522
00:27:04.285 --> 00:27:07.525
They worked fine with no pressure on it, no shoot drag.

523
00:27:08.065 --> 00:27:09.805
But as soon as we had to use it in the real

524
00:27:09.805 --> 00:27:11.405
world, it didn't work.

525
00:27:11.945 --> 00:27:13.685
It could not open those jaws.

526
00:27:14.065 --> 00:27:16.205
Now why didn't the explosive bolts work?

527
00:27:17.265 --> 00:27:20.125
Not sure, but we think the best, um,

528
00:27:21.405 --> 00:27:24.085
probable reason was had to do with the switch.

529
00:27:24.305 --> 00:27:27.165
The activating switch we had seen in

530
00:27:27.165 --> 00:27:28.925
that airplane in the overhead panel

531
00:27:29.945 --> 00:27:33.125
had a a square type push on push off switches.

532
00:27:33.995 --> 00:27:37.625
Well, one, uh, and it had two sets of poles.

533
00:27:38.655 --> 00:27:40.035
One set would light the light,

534
00:27:40.375 --> 00:27:42.075
the other set would activate the system.

535
00:27:42.495 --> 00:27:46.475
Not good, especially not in a flight critical system.

536
00:27:47.175 --> 00:27:49.355
That's probably what happened here.

537
00:27:49.585 --> 00:27:51.555
It's the same type of switch used in

538
00:27:51.555 --> 00:27:53.875
that explosive bolts activating system.

539
00:27:54.575 --> 00:27:57.195
So when Dave, the copilot pushed that switch,

540
00:27:58.015 --> 00:28:01.825

the red light came on, he and I remembered it and we saw it,

541
00:28:02.485 --> 00:28:04.465
but it didn't activate the system.

542
00:28:04.965 --> 00:28:06.345
So it may have been as simple

543
00:28:06.525 --> 00:28:08.345
as a failure of a silly switch.

544
00:28:12.945 --> 00:28:14.845
How about a question from Chris?

545
00:28:15.025 --> 00:28:18.565
How about the ao a probe sticking on previous flights?

546
00:28:18.585 --> 00:28:20.525
Had that been observed prior to this?

547
00:28:21.525 --> 00:28:26.105
I don't think so. It turned out that, that angle

548
00:28:26.125 --> 00:28:30.055
of attack vein, as you know, on the big long, uh,

549
00:28:30.125 --> 00:28:31.815
test probe in the nose of the airplane,

550
00:28:32.555 --> 00:28:36.335
it came from the manufacturers missing an O ring.

551
00:28:36.555 --> 00:28:38.255
It was just a defective system.

552
00:28:39.275 --> 00:28:43.575
So here it set on the ramp at Mojave as, uh,

553
00:28:44.075 --> 00:28:48.135
you know, Scott will, will back me up on this mojave's

554
00:28:48.135 --> 00:28:49.775
where wind was invented and perfected.

555
00:28:50.075 --> 00:28:54.455
So we had all that fine sand blowing in there for months,

556
00:28:54.955 --> 00:28:57.815
and it got inside that system.

557
00:28:58.795 --> 00:29:01.535
We later found during the, the, uh,

558
00:29:03.355 --> 00:29:07.415
the investigation, accident investigation that the race in

559
00:29:07.415 --> 00:29:08.775
that system was scarred.

560
00:29:08.795 --> 00:29:10.615
So we knew there was sand in there

561
00:29:11.275 --> 00:29:13.815
and it just chose that particular time to seize up.

562
00:29:14.595 --> 00:29:16.975
So I don't know how you could have avoided that

563
00:29:17.245 --> 00:29:19.735
because once that stalling

564
00:29:20.645 --> 00:29:23.665
was in the manu in, uh, Canada air's hands,

565
00:29:24.365 --> 00:29:26.345
who would've thought to try to take it apart

566
00:29:26.365 --> 00:29:27.825
and look for a missing o-ring?

567
00:29:27.925 --> 00:29:30.865

No, it was a defect from the manufacturer.

568
00:29:31.805 --> 00:29:34.825
So be suspicious of everything,

569
00:29:35.645 --> 00:29:37.705
but test unique systems can bite you.

570
00:29:42.545 --> 00:29:45.145
Question from Brian. Um, in the, uh, NASA

571
00:29:45.725 --> 00:29:49.145
Apollo Pro from Apollo to challenger programs,

572
00:29:49.175 --> 00:29:52.785
they suffered three mishaps with similar causal factors.

573
00:29:54.125 --> 00:29:56.625
And in each mishap, individuals tried to speak up

574
00:29:56.645 --> 00:29:59.985
and stop the tests and launches, but they were overridden.

575
00:30:00.885 --> 00:30:03.865
How can a safety professional working in an organization

576
00:30:03.865 --> 00:30:06.785
with similar issues, convince management

577
00:30:06.785 --> 00:30:09.065
or leadership that they need to take the break?

578
00:30:09.285 --> 00:30:12.865
You, you talked about in earlier in the presentation?

579
00:30:15.275 --> 00:30:17.205
Well, I think it's been touched on earlier.

580
00:30:19.005 --> 00:30:20.845
I believe in the value of storytelling.

581
00:30:22.145 --> 00:30:26.665
So if the chief safety officer is briefing the CEO

582
00:30:26.665 --> 00:30:30.725
or the head of the program, uh, two approaches.

583
00:30:31.025 --> 00:30:34.045
One is tell those stories of what had happened before,

584
00:30:34.865 --> 00:30:37.245
but not just the stories of what happened

585
00:30:37.245 --> 00:30:38.965
because they're probably familiar with those.

586
00:30:39.585 --> 00:30:42.405
But I would say also relate the story of

587
00:30:42.405 --> 00:30:43.645
what happened thereafter.

588
00:30:44.585 --> 00:30:46.365
Not in terms of recovery or anything,

589
00:30:46.505 --> 00:30:48.205
but what happened to the people in charge.

590
00:30:49.345 --> 00:30:53.645
So if, if the money givers, if the CEOs, the guys

591
00:30:53.645 --> 00:30:57.085
with the final go no go decision, know

592
00:30:57.555 --> 00:30:59.485
that if we do have an accident,

593
00:30:59.825 --> 00:31:02.645
not only is it very expensive for the program,

594
00:31:03.065 --> 00:31:06.165

for the company, but also it could cost me my job

595
00:31:07.065 --> 00:31:08.605
and a whole lot of other people are gonna

596
00:31:08.605 --> 00:31:09.685
go out the door with me.

597
00:31:10.855 --> 00:31:12.815
I think it comes back to something like that.

598
00:31:12.875 --> 00:31:16.895
You have to relate the personal impact of these as well

599
00:31:16.895 --> 00:31:19.055
as the larger picture impact.

600
00:31:19.595 --> 00:31:22.335
And it is what I call the M factor. It's the motivation.

601
00:31:22.925 --> 00:31:26.055
What motivates that guy that has to make this final decision

602
00:31:26.915 --> 00:31:29.215
and, uh, and go ahead and,

603
00:31:29.865 --> 00:31:31.565
and poke that particular m factor.

604
00:31:33.505 --> 00:31:36.675
Well, kind of a follow up to that, I guess, uh,

605
00:31:36.675 --> 00:31:38.035
from Brad from,

606
00:31:38.115 --> 00:31:40.935
and I think, I think we've all encountered this.

607
00:31:42.085 --> 00:31:45.025
We, we, we often run into a management perception

608
00:31:45.025 --> 00:31:48.505
that flight time and frequency equates to progress.

609
00:31:50.635 --> 00:31:51.935
And, and you touch on that earlier

610
00:31:53.065 --> 00:31:57.405
and a lot of the times are, the counter argument is

611
00:31:57.475 --> 00:31:59.845
that just because we're not flying doesn't mean

612
00:31:59.845 --> 00:32:01.045
we're not making progress.

613
00:32:02.535 --> 00:32:04.755
Any other ideas on how to counteract that?

614
00:32:07.765 --> 00:32:09.125
I don't have a good answer for that

615
00:32:09.515 --> 00:32:13.565
because of, I, I've seen it occur over and over again.

616
00:32:14.745 --> 00:32:18.965
And you can use all the logical arguments, uh,

617
00:32:19.395 --> 00:32:20.605
that we have in our kit,

618
00:32:21.935 --> 00:32:23.595
but it does, doesn't always come through

619
00:32:23.945 --> 00:32:27.205
because I always say that perception

620
00:32:27.955 --> 00:32:29.045
overrides reality.

621
00:32:30.185 --> 00:32:34.145

And if the perception is that flight hours equates

622
00:32:34.145 --> 00:32:37.185
to progress, it's pretty hard to overcome that perception.

623
00:32:41.595 --> 00:32:41.955
I, uh,

624
00:32:51.715 --> 00:32:51.915
interesting.

625
00:32:57.095 --> 00:32:59.685
Thank there's, there's a lot

626
00:32:59.685 --> 00:33:01.925
of misinformation out there about that accident too.

627
00:33:02.905 --> 00:33:05.305
And, uh, and some

628
00:33:05.305 --> 00:33:07.225
of are arguments that'll never be resolved.

629
00:33:08.445 --> 00:33:11.065
We can do those offline. You

630
00:33:14.915 --> 00:33:15.915
Thank you.

631
00:33:16.025 --> 00:33:19.025
I think that's wraps up the questions here.

632
00:33:20.455 --> 00:33:21.705
Turn it back over to Pat.

633
00:33:24.345 --> 00:33:25.995
Well, thank you for the presentation.

634
00:33:26.105 --> 00:33:27.875
It's certainly, uh, sobering

635
00:33:28.335 --> 00:33:29.875
and a lot

636
00:33:29.875 --> 00:33:32.595
of us in the business have experienced these things

637
00:33:32.595 --> 00:33:36.775
that you're talking about and there's certainly, uh, uh,

638
00:33:37.175 --> 00:33:38.295
a lot to be learned from it.

639
00:33:39.755 --> 00:33:42.505
Terry, thank you for moderating the question and answers.

640
00:33:42.705 --> 00:33:46.665
I appreciate it. It's, uh, been a super, uh,

641
00:33:48.125 --> 00:33:49.825
uh, set of papers five and all.

642
00:33:50.845 --> 00:33:53.525
I would like, uh, make a shameless pitch

643
00:33:53.585 --> 00:33:55.445
for the Flight Test Safety Committee website.

644
00:33:55.665 --> 00:33:59.205
Uh, eventually there'll be, uh, access to some

645
00:33:59.205 --> 00:34:01.005
of these available via that site.

646
00:34:01.005 --> 00:34:02.205
There's lessons learned.

647
00:34:02.925 --> 00:34:05.545
Uh, there's a, a lot of data on there available

648
00:34:05.685 --> 00:34:08.655

for professionals to, uh, pick over

649
00:34:08.675 --> 00:34:10.055
and pour over as they need.

650
00:34:11.225 --> 00:34:13.885
And with that, I'd like to, uh, recall Turbo

651
00:34:14.025 --> 00:34:16.805
and thank him for the opportunity to have served

652
00:34:16.905 --> 00:34:18.205
as his session chairman.