WEBVTT

1
00:00:07.730 --> 00:00:11.280
Move this back down to turbo level. There we go. Uh,

2
00:00:11.420 --> 00:00:13.600
Stu thanks for inviting me to chair the session,

3
00:00:14.220 --> 00:00:17.280
and I'd like to echo both your comments and turbo's comments.

4
00:00:17.380 --> 00:00:21.480
And thank the presenters for putting all the hard work into

5
00:00:21.830 --> 00:00:25.160
preparing and then getting up here and delivering, uh,

6
00:00:25.300 --> 00:00:27.950
the presentations you're gonna present. Well,

7
00:00:27.950 --> 00:00:30.830
we've got a bunch of interesting topics, uh, for session one this morning.

8
00:00:31.410 --> 00:00:35.390
And we're gonna start out, uh, with Rod Hue, uh,

9
00:00:35.390 --> 00:00:40.030
who's gonna be presenting a paper on the historical case study of why

10
00:00:40.410 --> 00:00:44.050
the flight test, uh, safety Council exists. Uh,

11
00:00:44.050 --> 00:00:45.570
he's no stranger to the workshop,

12
00:00:45.570 --> 00:00:49.740
and he's no stranger to the other symposia we have throughout the year. Uh,

13
00:00:49.930 --> 00:00:53.740

he's a test pilot consultant and d e r, uh,

14
00:00:53.750 --> 00:00:58.420
spent quite a few years with the F A A and is a retired Air Force test pilot.

15
00:01:00.060 --> 00:01:03.400
Uh, he, uh, also a fellow national test pilot school instructor,

16
00:01:03.700 --> 00:01:08.200
and was the author of the 40, 40, uh, 26, uh,

17
00:01:08.490 --> 00:01:11.480
regulation that we saw earlier the week. Uh,

18
00:01:11.790 --> 00:01:16.680
also was the FA lead for implementing the flight test safety database and

19
00:01:16.680 --> 00:01:20.360
two time winner of the Tony Lavere Flight Test Safety Award.

20
00:01:21.370 --> 00:01:23.940
Also on the, uh, flight test safety committee, uh,

21
00:01:24.260 --> 00:01:29.140
director emeritus and is also an s e tp, uh, fellow. Uh,

22
00:01:29.140 --> 00:01:32.420
like I said, a lot of the presenters put a lot of work into preparing,

23
00:01:32.800 --> 00:01:36.340
and I did catch Rod preparing for his presentation today by making some notes.

24
00:01:37.040 --> 00:01:40.540
Uh, only note he had on his paper was his name Rod. So, uh,

25
00:01:40.570 --> 00:01:43.580
he's at least gonna get that right. Uh, rod, please, uh, come up to the podium.

26

00:01:59.470 --> 00:02:04.400
Well, first off, hope I get to wake you up and set the, uh,

27
00:02:04.460 --> 00:02:08.400
set, set the stage for the rest of the, uh, the workshop. Um,

28
00:02:09.400 --> 00:02:14.380
and, uh, there's 153 people signed up for the, uh, for the workshop. Um,

29
00:02:15.000 --> 00:02:18.340
and, uh, and you know why you're here. And, uh,

30
00:02:18.340 --> 00:02:23.220
what I'm gonna do or try to do is to reinforce the reasons why you're here

31
00:02:23.720 --> 00:02:24.553
and, and, uh,

32
00:02:24.560 --> 00:02:28.700
the title is The Reasons Why the Flight to Safety Committee exists. So,

33
00:02:28.700 --> 00:02:33.340
what I'm gonna show you, uh, is a case study that I, uh,

34
00:02:33.490 --> 00:02:38.220
came up with, uh, by looking at the X 31, um, lessons learned video,

35
00:02:39.280 --> 00:02:43.500
um, breaking the chain, and, and that light bulb came up and I said,

36
00:02:43.500 --> 00:02:46.980
wait a minute. This accident happened and we were doing things,

37
00:02:48.780 --> 00:02:53.680
uh, about before that that could have prevented that accident.

38
00:02:54.140 --> 00:02:56.720
So that's what I'm gonna try to show you with, uh,

39
00:02:57.230 --> 00:02:59.920

with the two videos that compare one-to-one,

40
00:03:01.170 --> 00:03:03.590
how this accident could have been prevented, I think,

41
00:03:05.150 --> 00:03:08.770
if they had adopted what we were trying to promote before that,

42
00:03:08.770 --> 00:03:13.200
three years before. So, uh,

43
00:03:13.880 --> 00:03:18.030
a little bit of background. This is what's published in the, uh,

44
00:03:18.210 --> 00:03:22.630
in the website for the charter. And, uh, it hasn't changed for about 30 years,

45
00:03:23.990 --> 00:03:28.940
but the, the point that I wanna make here is the sharing part. Uh,

46
00:03:29.040 --> 00:03:33.630
we are here to share lessons learned and also experiences

47
00:03:34.170 --> 00:03:38.150
or programs that, uh, people can adopt and go back and take it home and,

48
00:03:38.210 --> 00:03:43.170
and actually do the five things that, uh, turbo said. And, uh,

49
00:03:43.200 --> 00:03:45.410
it's not just good enough to come here and listen,

50
00:03:45.550 --> 00:03:48.970
but you gotta take it home and, and, uh, institutionalize it.

51
00:03:49.390 --> 00:03:51.010
And that's what we expect you to do.

52
00:03:53.920 --> 00:03:58.530
So in the early 1990s, almost 30 years ago, uh,

53
00:03:59.870 --> 00:04:04.610
the, uh, that group of, and I was part of that group, uh, we,

54
00:04:04.670 --> 00:04:04.990
we,

55
00:04:04.990 --> 00:04:09.130
we were thinking that there was something that we needed to do to promote flight

56
00:04:09.130 --> 00:04:12.850
test safety and, and flight test safety, uh, itself,

57
00:04:13.030 --> 00:04:16.860
not just flight test. The, the, uh,

58
00:04:17.320 --> 00:04:18.660
the SMB banquet,

59
00:04:19.540 --> 00:04:24.490
the annual symposium wasn't good enough because it

60
00:04:24.510 --> 00:04:29.310
didn't focus enough on flight test safety. So then Phil Schultz,

61
00:04:30.520 --> 00:04:31.700
uh, came up with, uh,

62
00:04:31.770 --> 00:04:36.020
when Ed Snyder was the president of S A T P and came up with the idea of forming

63
00:04:36.020 --> 00:04:40.780
a separate committee and, uh, proposed it to US Ed Ni, ed Snyder,

64
00:04:41.200 --> 00:04:42.033
and, uh,

65
00:04:42.480 --> 00:04:46.260
and Ed Snyder gave it to John Jones cause I was the next president.

66
00:04:46.320 --> 00:04:49.620
And John Jones adopted and made the, uh, board approved it.

67
00:04:49.640 --> 00:04:51.660
And the Flight to Safety Committee was formed

68
00:04:54.610 --> 00:04:55.750
in, uh, 1994.

69
00:04:56.800 --> 00:05:00.140
The first flight to safety workshop was in 1996,

70
00:05:01.870 --> 00:05:06.270
and it was in a Ann Valley in, in Lancaster. And however,

71
00:05:06.830 --> 00:05:11.270
1996, there was one in 1995 run by the, uh, uh,

72
00:05:12.060 --> 00:05:15.720
uh, S FTE E when, uh, Paul Rukov was the president.

73
00:05:16.890 --> 00:05:20.750
And, uh, Phil Schult asked Paul Rukov, are you gonna continue doing this? And,

74
00:05:20.890 --> 00:05:23.790
and Paul said, no. Okay, so we'll pick it up.

75
00:05:24.130 --> 00:05:28.110
And so the fir first flight test safety workshop was done in 1996.

76
00:05:32.040 --> 00:05:36.220
So about that time at Edwards, when I was the chief of safety,

77
00:05:36.880 --> 00:05:40.660
we were promoting test and evaluation crew resource management.

78
00:05:42.920 --> 00:05:45.340
And, uh, well, actually we put a program together where we,

79
00:05:45.400 --> 00:05:49.740
we included the control room and we, we hired John Na Naz, who is, uh,

80
00:05:50.240 --> 00:05:53.620
uh, a well, a well-known, uh, consultant. Uh,

81
00:05:53.640 --> 00:05:57.860
he was in the Air Force Reserves then. And we put together a, a video,

82
00:05:59.420 --> 00:06:03.830
which I will show part of it, to, to,

83
00:06:03.970 --> 00:06:08.620
to institutionalize the, uh, the program. And what you'll see in the video is,

84
00:06:08.760 --> 00:06:12.580
uh, a simulated scenario where we showed how, what,

85
00:06:12.770 --> 00:06:14.260
what things could go wrong.

86
00:06:14.920 --> 00:06:18.780
And when you're not working as a team in a flight test.

87
00:06:21.960 --> 00:06:25.140
And because there was no flight test safety committee,

88
00:06:25.890 --> 00:06:30.740
John NZ and I presented a paper in 1993 at the SMB Symposium,

89
00:06:31.890 --> 00:06:32.723
uh, called

90
00:06:36.020 --> 00:06:38.070
Testing Evaluation Crew Resource Management.

91
00:06:38.100 --> 00:06:41.590
That paper is our now available in the website,

92

00:06:42.050 --> 00:06:44.230
in in the Flight Safety Committee website.

93
00:06:46.220 --> 00:06:49.690
So that wasn't good enough. Like I said,

94
00:06:49.790 --> 00:06:52.930
it was at the Sctp Symposium. It wasn't,

95
00:06:53.190 --> 00:06:57.770
the symposium wasn't necessarily focused on, uh, safety necessarily.

96
00:06:58.970 --> 00:07:03.060
Uh, so unfortunately three years later,

97
00:07:04.140 --> 00:07:08.350
NASA locks lost a and X 31. They had three,

98
00:07:08.820 --> 00:07:13.040
they lost one. And what, uh,

99
00:07:13.110 --> 00:07:17.810
what what I found is that many of the things we're trying to

100
00:07:17.810 --> 00:07:22.420
promote three years before you will see in the video,

101
00:07:23.160 --> 00:07:28.030
and I try to correlate one to one because I'm gonna show you both videos

102
00:07:28.420 --> 00:07:33.240
that what was promoted and what happened, and,

103
00:07:33.240 --> 00:07:36.640
uh, they went and lost the X 31.

104
00:07:40.000 --> 00:07:41.700
So as you look at the videos,

105
00:07:42.330 --> 00:07:46.590
I'll show you the t and e CRM Edwards video first,

106
00:07:47.010 --> 00:07:48.190
and then the X 31 video.

107
00:07:48.740 --> 00:07:52.460
What I want you to do is take that i that orange notebook,

108
00:07:54.040 --> 00:07:58.820
and instead of writing a love letter to, uh, art Thomasetti, uh,

109
00:07:59.260 --> 00:08:00.980
I would encourage you to,

110
00:08:01.200 --> 00:08:05.580
to write down what you see as common elements between the two,

111
00:08:06.100 --> 00:08:08.110
what was promoted three years before,

112
00:08:08.930 --> 00:08:13.400
and one actually happened three years later. So,

113
00:08:13.740 --> 00:08:15.840
and there'll be a test at the end of the video.

114
00:08:17.900 --> 00:08:21.810
So take good notes. I think you'll enjoy it.

115
00:08:23.180 --> 00:08:25.720
So here we go. Here's John Nance,

116
00:08:26.100 --> 00:08:29.240
and here's the t and E CM Edwards video.

117
00:08:30.060 --> 00:08:32.960
In about 19 92, 19 93 timeframe,

118
00:08:35.110 --> 00:08:37.690
The aviation world is going through a revolution.

119

00:08:38.400 --> 00:08:42.930
It's a revolution based on the primary realization that despite all our

120
00:08:42.930 --> 00:08:43.970
technical expertise,

121
00:08:44.540 --> 00:08:48.690
we've traditionally failed to apply standard engineering principles to the most

122
00:08:48.930 --> 00:08:52.450
critical component in the aerospace equation, the human being,

123
00:08:52.910 --> 00:08:56.800
the human test pilot, the flight test engineer, the maintenance technician.

124
00:08:57.430 --> 00:09:02.080
It's a revolution which is finally recognized that humans can be trained to

125
00:09:02.280 --> 00:09:03.160
minimize human error.

126
00:09:04.300 --> 00:09:09.120
We go to great links to engineer our computers and to our aluminum and titanium

127
00:09:09.120 --> 00:09:10.240
aerospace machines.

128
00:09:10.620 --> 00:09:15.240
We spare no expense in working to graph and document virtually all measurable

129
00:09:15.240 --> 00:09:17.600
parameters and a weapon system under development.

130
00:09:18.260 --> 00:09:21.920
But when it comes to understanding what makes us function and what makes us

131

00:09:22.030 --> 00:09:26.840
fail, aviation has always tended to turn its collective head and walk away,

132
00:09:27.350 --> 00:09:31.240
usually thinking that human failure is just too mysterious to predict and too

133
00:09:31.480 --> 00:09:35.920
complicated to control. For instance, the concept that people get tired,

134
00:09:36.580 --> 00:09:41.000
the concept that a fatigue human is more prone to mistake than a arrested one,

135
00:09:41.340 --> 00:09:45.160
and that some accidents probably have more to do with mental fatigue than metal

136
00:09:45.160 --> 00:09:48.640
fatigue. That's been pretty heretical until recently.

137
00:09:50.300 --> 00:09:55.040
Yet the correlation is provable and obvious when it comes to your

138
00:09:55.040 --> 00:09:57.120
world of flight test and evaluation.

139
00:09:58.100 --> 00:10:02.240
The fallible human equation becomes even more complex because now,

140
00:10:02.620 --> 00:10:03.680
as General Yi said,

141
00:10:04.610 --> 00:10:09.160
we're dealing with the need for teamwork and for teamwork communication,

142
00:10:09.700 --> 00:10:12.960
and for cooperation among what I like to call carbon-based units.

143
00:10:14.420 --> 00:10:16.960
To engineer a new component into this control room,

144
00:10:17.380 --> 00:10:20.880
you have to know the failure modes and the failure probabilities of that

145
00:10:20.880 --> 00:10:21.713
component.

146
00:10:21.980 --> 00:10:26.480
You also have to know how to minimize those failure modes and to absorb those

147
00:10:26.480 --> 00:10:28.600
failures that you can't totally eliminate.

148
00:10:29.380 --> 00:10:33.600
No engineer worth his salt would simply plug in a new computer in this room and

149
00:10:33.630 --> 00:10:37.840
hope for the best. Yet, when it comes to carbon-based units, us,

150
00:10:38.500 --> 00:10:42.520
our traditional method has been just to provide technical training and then just

151
00:10:42.520 --> 00:10:45.600
order the human not to make a mistake. You see,

152
00:10:45.600 --> 00:10:50.040
we never thought that humans could be trained to exercise better judgment and to

153
00:10:50.070 --> 00:10:54.000
have better communications and cooperations and team formation skills.

154
00:10:54.740 --> 00:10:58.840
We always thought that behavioral styles and personality traits were immaterial

155
00:10:58.880 --> 00:11:03.080
subjects, but it came to doing the job right and a highly technical environment.

156
00:11:03.740 --> 00:11:06.360
But that you see is the essence of this revolution.

157
00:11:06.660 --> 00:11:11.600
The realization that human fallibility can be minimized if we have the right

158
00:11:11.600 --> 00:11:13.000
tools and the right training.

159
00:11:13.700 --> 00:11:17.640
And that's what test and evaluation Crew resource management is all about.

160
00:11:18.300 --> 00:11:20.040
And it began from this necessity.

161
00:11:21.110 --> 00:11:22.900
There has been a piece missing in our training,

162
00:11:23.760 --> 00:11:26.220
how to get crew members to communicate better

163
00:11:27.430 --> 00:11:28.600
Test and evaluation.

164
00:11:28.630 --> 00:11:32.680
Crew resource management will provide new tools in five major areas.

165
00:11:33.640 --> 00:11:34.480
Attitude management,

166
00:11:34.670 --> 00:11:38.880
understanding and accepting our personality traits and behavioral styles,

167
00:11:39.170 --> 00:11:43.400
while giving us dynamic new methods of maximizing our strengths and a team

168
00:11:43.400 --> 00:11:44.233

environment.

169
00:11:44.950 --> 00:11:49.880
Crew management markedly improving our abilities to operate and communicate as a

170
00:11:49.880 --> 00:11:54.360
team by empowering each member of the team to use assertiveness with respect.

171
00:11:54.740 --> 00:11:59.000
And by charging each team leader with the responsibility of creating an open

172
00:11:59.000 --> 00:12:03.800
atmosphere we call authority with participation situational awareness,

173
00:12:04.390 --> 00:12:06.280
improving attention management skills.

174
00:12:06.790 --> 00:12:10.520
This is the process of keeping the forest firmly in view while examining the

175
00:12:10.520 --> 00:12:14.920
trees. And it used to be called the big picture Stress management,

176
00:12:15.270 --> 00:12:19.520
improving our individual and collective methods of coping with tense situations,

177
00:12:19.810 --> 00:12:23.640
especially when the stakes are high as they are in the flight test environment.

178
00:12:24.350 --> 00:12:28.840
Risk management vastly improving the overall process of reducing the chances of

179
00:12:28.840 --> 00:12:32.640
mistakes and mishaps by better understanding the human imperfections which

180
00:12:32.640 --> 00:12:33.473
caused them.

181
00:12:33.580 --> 00:12:37.560
And test and evaluation crew Resource management will accomplish this by

182
00:12:37.560 --> 00:12:39.040
increasing the margin of safety.

183
00:12:39.900 --> 00:12:44.200
One of the most frustrating elements in designing this course is getting people

184
00:12:44.220 --> 00:12:47.480
to understand that they are subject to the same human errors,

185
00:12:48.050 --> 00:12:50.720
especially those more experienced team members.

186
00:12:52.030 --> 00:12:53.600
Once we get 'em to understand that,

187
00:12:54.830 --> 00:12:58.560
then we'll get a buy-in from those team members in the flight test environment.

188
00:12:58.590 --> 00:13:00.480
Some people may think that they're not a crew,

189
00:13:01.250 --> 00:13:04.000
especially those who fly single seat fighter test programs.

190
00:13:05.100 --> 00:13:08.160
But if you really look at the way a test team is put together,

191
00:13:09.290 --> 00:13:12.740
they are a crew operation. You have the test air crew,

192
00:13:13.730 --> 00:13:17.550
you have the chase air crew, you have the test conductor test director,

193
00:13:18.210 --> 00:13:22.550
and you have the flight test engineers that are monitoring parameter or set

194
00:13:22.550 --> 00:13:23.950
parameters in the control room.

195
00:13:24.180 --> 00:13:27.070
They're all part of the team and they are crew environment.

196
00:13:27.450 --> 00:13:29.390
So we do have a crew environment in flight testing.

197
00:13:30.550 --> 00:13:34.070
Teamwork is really the key in this whole scenario. In any given day,

198
00:13:34.170 --> 00:13:35.150
any given test program,

199
00:13:35.690 --> 00:13:40.550
you may have a spectrum of experience levels and we would be subject to the same

200
00:13:40.550 --> 00:13:42.630
things that happens to the airlines. For example,

201
00:13:42.630 --> 00:13:44.190
what is called the halo effect,

202
00:13:44.840 --> 00:13:49.150
where you have a highly experienced pilot test pilot or test conductor in this

203
00:13:49.150 --> 00:13:52.910
case, and you have a lower experienced, uh,

204
00:13:52.940 --> 00:13:54.470
team members that may have,

205
00:13:54.530 --> 00:13:59.350

may be inhibited in bringing up problems as they see 'em and the communication

206
00:13:59.350 --> 00:14:02.230
is not there. And T N E C M,

207
00:14:02.570 --> 00:14:06.110
and we're gonna get into that and we're gonna hopefully get people to feel

208
00:14:06.110 --> 00:14:08.070
comfortable in communicating in this environment.

209
00:14:08.970 --> 00:14:11.870
At the Air Force Flight Test Center, at Edwards Air Force base,

210
00:14:11.870 --> 00:14:13.270
California flight test,

211
00:14:13.550 --> 00:14:17.550
engineers monitor their consoles and script charts as the pilot of an F 16

212
00:14:17.950 --> 00:14:20.630
positions his craft for another high angle of attack test point.

213
00:14:21.580 --> 00:14:23.350
With the flight proceeding smoothly,

214
00:14:23.410 --> 00:14:28.150
the pilot maneuvers the F 16 through the plan sequence as the telemetry signals

215
00:14:28.150 --> 00:14:30.190
downlink to the Ridley control room's. John Jones

216
00:14:30.190 --> 00:14:30.750
Flying record

217
00:14:30.750 --> 00:14:35.470
A wide variety of information from aerodynamic performance parameters to engine

218
00:14:35.470 --> 00:14:39.870
burner pressure, a signature of the health of the F 16 single engine. The F

219
00:14:39.870 --> 00:14:40.510
16 is

220
00:14:40.510 --> 00:14:40.730
Real.

221
00:14:40.730 --> 00:14:44.990
The test director and test conductor monitoring the cascade of realtime data on

222
00:14:44.990 --> 00:14:49.550
their C r T screens depend on the various members of the test team to tell them

223
00:14:49.550 --> 00:14:50.430
of any anomaly.

224
00:14:50.980 --> 00:14:54.880
But today they're unaware that one of their propulsion test engineers is

225
00:14:54.880 --> 00:14:58.320
troubled by the erratic tracings of a strip chart needle before him.

226
00:15:00.220 --> 00:15:03.970
After the anticipated test sequence, the pilot recovers the aircraft.

227
00:15:06.470 --> 00:15:09.290
He then begins the process of setting up for the next test point.

228
00:15:09.790 --> 00:15:14.050
Yet neither the pilot nor the test director have yet become aware that the

229
00:15:14.050 --> 00:15:18.010
engine's burner pressure is unstable and becoming more so with every test.

230
00:15:18.010 --> 00:15:18.843
Point

231
00:15:19.350 --> 00:15:20.183
On that

232
00:15:23.400 --> 00:15:24.000
Look good.

233
00:15:24.000 --> 00:15:26.330
Without knowledge of the unstable burner pressure,

234
00:15:26.470 --> 00:15:29.250
the test conductor clears the pilot for the next test point.

235
00:15:31.590 --> 00:15:33.490
As the F 16 climbs, once again,

236
00:15:33.550 --> 00:15:38.090
the worried propulsion engineer watches his readouts and begins an agonizing

237
00:15:38.090 --> 00:15:40.810
process of trying to decide whether to speak up,

238
00:15:41.260 --> 00:15:45.570
weigh in the protocol of the control room with the perceived receptivity of the

239
00:15:45.570 --> 00:15:46.403
test director.

240
00:15:55.280 --> 00:15:57.370
With the test pilot committed to the maneuver,

241
00:15:57.590 --> 00:16:01.330
the propulsion engineer's dilemma becomes acute yet again,

242
00:16:01.630 --> 00:16:02.850
he decides to stay silent.

243
00:16:04.670 --> 00:16:04.890
Hey,

244
00:16:04.890 --> 00:16:08.290
Take a look at this burner pressure trace. Does that look like it should?

245
00:16:09.650 --> 00:16:14.570
I don't know. It does look strange, but you're the expert.

246
00:16:15.430 --> 00:16:16.970
You think I had to tell Bob about it?

247
00:16:18.600 --> 00:16:21.890
Well, I guess it's up to you, but the last time I opened my mouth,

248
00:16:22.050 --> 00:16:22.970
I got my head chew off.

249
00:16:24.000 --> 00:16:26.010
Yeah, I know, I know what you mean.

250
00:16:26.750 --> 00:16:28.210
At 18, bow down.

251
00:16:31.860 --> 00:16:36.450
Seven, six. Recovered. Recovered. Good

252
00:16:40.140 --> 00:16:40.973
stagnation.

253
00:16:43.060 --> 00:16:44.250
Why'd we lose that engine?

254
00:16:44.800 --> 00:16:48.330
Well, I don't know. Um, yeah, was there, uh,

255
00:16:48.330 --> 00:16:51.130
something different about the engine performance on that maneuver?

256
00:16:53.620 --> 00:16:55.280

Uh, the, uh, the, uh,

257
00:16:55.280 --> 00:16:57.880
burner pressure has been erratic on the last two test points.

258
00:17:00.260 --> 00:17:01.550
Well, why didn't you say something?

259
00:17:02.020 --> 00:17:04.510
Well, I don't know. I didn't think it was important at the time.

260
00:17:08.950 --> 00:17:13.510
A vital piece of information not passed when needed an engine loss at the worst

261
00:17:13.870 --> 00:17:15.750
possible moment Connected events,

262
00:17:15.750 --> 00:17:19.070
which can heighten the possibility of a major flight test mishap,

263
00:17:19.850 --> 00:17:20.290
Having

264
00:17:20.290 --> 00:17:24.150
The means to communicate does not guarantee that communication will occur.

265
00:17:24.730 --> 00:17:28.630
Yet we've learned over the years that the consequences of not communicating in

266
00:17:28.630 --> 00:17:31.190
the flight test environment can be disastrous.

267
00:17:32.380 --> 00:17:36.950
Molding professional test pilots and test engineers into an effective team takes

268
00:17:37.310 --> 00:17:41.630
coordination and a willingness to speak up when important information needs to

269
00:17:41.630 --> 00:17:43.750
be passed. But most importantly,

270
00:17:43.930 --> 00:17:47.910
it takes a collective recognition by everyone that the day of the Lone Eagle

271
00:17:47.910 --> 00:17:48.690
test pilot

272
00:17:48.690 --> 00:17:51.400
Who needed no help from below is long gone.

273
00:17:53.170 --> 00:17:56.740
Okay, so I hope you took some notes. And, uh, here we go. Uh,

274
00:17:56.760 --> 00:18:00.580
here's what really happened, and I hope you make a com a one-to-one comparison.

275
00:18:09.730 --> 00:18:12.710
The aircraft is descending over the north base area.

276
00:18:17.810 --> 00:18:18.643
I have a,

277
00:18:21.870 --> 00:18:24.010
the pilot's outta the seat and the is good.

278
00:18:29.750 --> 00:18:34.330
We had a highly competent team, very experienced many flights under their belt.

279
00:18:34.870 --> 00:18:36.970
We had a number of pilots that flew the airplane.

280
00:18:37.550 --> 00:18:39.450
The pilot in particular that was flying that day,

281
00:18:39.750 --> 00:18:43.930

had been on the program from the very beginning, highly experienced, uh,

282
00:18:43.930 --> 00:18:45.010
with the X 31.

283
00:18:45.400 --> 00:18:49.930
Each mishap has its own set of circumstances and its own sequence of events.

284
00:18:50.950 --> 00:18:54.410
But you find similar issues, communications,

285
00:18:55.680 --> 00:19:00.330
complacency, assumptions that haven't been warranted, human frailties.

286
00:19:01.710 --> 00:19:04.730
And you have to account for these things in a program.

287
00:19:05.440 --> 00:19:08.370
This is like a chain. You make a chain.

288
00:19:08.640 --> 00:19:12.170
When you have any of these accidents, a chain of events,

289
00:19:12.990 --> 00:19:17.170
any link of the chain, if it were broken, you would not have an accident.

290
00:19:17.600 --> 00:19:21.850
This was the A team. We had the best people from every discipline,

291
00:19:22.000 --> 00:19:24.850
from every organization, and we lost an airplane.

292
00:19:25.790 --> 00:19:29.650
So if it can happen to the best team, it can happen to any team.

293
00:19:34.060 --> 00:19:38.410
There had been some changes to the configuration of the X 31 since its initial

294
00:19:38.440 --> 00:19:42.970

flights. In particular, the original PDO tube,

295
00:19:42.970 --> 00:19:45.650
which supplies air speed information to the plane's.

296
00:19:45.650 --> 00:19:50.530
Flight control computers had been replaced with another kind of PDO tube known

297
00:19:50.630 --> 00:19:51.610
as a keel probe.

298
00:19:52.890 --> 00:19:57.150
The keel probe gave more accurate air speed data at high angles of attack,

299
00:19:57.650 --> 00:19:59.590
but it was more vulnerable to icing,

300
00:20:00.080 --> 00:20:04.670
especially since the keel probe on the X 31 did not have any

301
00:20:04.880 --> 00:20:05.713
petto heat.

302
00:20:05.930 --> 00:20:08.990
We were never to fly the airplane in ice. That was a prohibited maneuver.

303
00:20:09.210 --> 00:20:12.510
So if you're prohibited from flying in ice, you don't need a heater.

304
00:20:13.910 --> 00:20:18.150
Normally the conditions at Edwards are warm and dry enough that icing or petto

305
00:20:18.150 --> 00:20:19.670
heat isn't a concern.

306
00:20:21.220 --> 00:20:25.640
But January 19th, 1995 was not a normal day.

307

00:20:27.670 --> 00:20:31.970
The unusual part of the day was we had a, uh, high humidity at altitude,

308
00:20:32.330 --> 00:20:36.850
actually conducive for freezing conditions. Uh, and, and airplane, uh,

309
00:20:36.870 --> 00:20:41.210
was operated for in and out of some fairly high moisture content for extended

310
00:20:41.210 --> 00:20:42.690
periods of time, uh,

311
00:20:42.750 --> 00:20:45.610
led to some indications in the cockpit in the control room that it was causing

312
00:20:45.610 --> 00:20:46.890
problems with the air data system.

313
00:20:50.210 --> 00:20:51.043
But some minutes,

314
00:20:51.980 --> 00:20:56.870
like five before the airplane went out of control and the pilot

315
00:20:56.890 --> 00:20:57.723
jumped out.

316
00:20:58.410 --> 00:21:03.290
The pilot observed that there was some moisture around

317
00:21:03.290 --> 00:21:07.940
where he was. So he turned the pedal heat switch on. Now,

318
00:21:07.940 --> 00:21:09.900
clearly when he turned the Peter hit switch on,

319
00:21:09.920 --> 00:21:13.580
he expected that the Peter heat would be working about, uh,

320

00:21:13.580 --> 00:21:14.620
two and a half minutes later,

321
00:21:14.710 --> 00:21:18.410
which is two and a half minutes before the accident. Uh,

322
00:21:18.590 --> 00:21:21.890
he mentioned that fact to the control room.

323
00:21:24.440 --> 00:21:27.930
Okay, remind me, I just put the Peter heat on. Remind me to put it off.

324
00:21:28.160 --> 00:21:32.810
Copy that. Ready? The PTO heats not hooked up on apro.

325
00:21:34.950 --> 00:21:35.783
You got ambulance

326
00:21:37.690 --> 00:21:42.350
Mysteriously to this day. The control room gave him no response.

327
00:21:42.860 --> 00:21:47.350
They had an internal discussion as time the clock clicked down

328
00:21:48.330 --> 00:21:53.240
and internally it was commented that the Peter heat was not hooked

329
00:21:53.240 --> 00:21:54.073
up.

330
00:21:54.180 --> 00:21:58.800
But this vital piece of information was not relayed to the pilot for more than

331
00:21:58.860 --> 00:22:01.080
two minutes. And even when it was,

332
00:22:01.620 --> 00:22:05.920
the information was not stated as clearly or strongly as it could have been.

333

00:22:07.830 --> 00:22:09.360
Well leave it on for a moment.

334
00:22:09.990 --> 00:22:11.720
Yeah, we think it may not be hooked up.

335
00:22:12.900 --> 00:22:16.160
It may not be hooked up. That's good. I like this.

336
00:22:17.060 --> 00:22:19.800
We had side discussions that should have been going on,

337
00:22:19.800 --> 00:22:23.840
on the intercom so that everybody in the control room was part of the

338
00:22:23.840 --> 00:22:25.320
conversation. Instead,

339
00:22:25.320 --> 00:22:28.640
we'd pulled our headsets aside so that we could talk to each other because we're

340
00:22:28.640 --> 00:22:29.840
sitting adjacent to each other.

341
00:22:30.100 --> 00:22:32.840
And that's another part of just control room discipline that,

342
00:22:32.840 --> 00:22:34.040
that we broke down on.

343
00:22:34.270 --> 00:22:37.880
Meanwhile, the first signs of trouble were beginning to appear.

344
00:22:38.540 --> 00:22:41.680
So now the pilot, um,

345
00:22:42.070 --> 00:22:44.440
sees an anomaly in his air speed.

346
00:22:44.670 --> 00:22:49.010

He's at 20 degrees angle of attack and he can see that.

347
00:22:49.670 --> 00:22:53.930
And he says to the ground, and I briefed this many times, he said,

348
00:22:53.950 --> 00:22:57.010
I'm at 277, I mean 207 knots

349
00:22:58.230 --> 00:23:00.490
And in the air speed is off. Uh,

350
00:23:00.490 --> 00:23:04.010
reading 277 knots at 20 awa.

351
00:23:06.120 --> 00:23:07.010
Okay, pitch tablet.

352
00:23:09.140 --> 00:23:09.973
Well,

353
00:23:10.300 --> 00:23:13.110
anybody that's been on the program and the less of people have been on many

354
00:23:13.110 --> 00:23:17.390
years, would know that 20 degrees angle attack is somewhere around 135 knots,

355
00:23:17.550 --> 00:23:21.510
140 knots. Doesn't matter. It's not 207 knots.

356
00:23:22.190 --> 00:23:26.630
Apparently no one in the control room caught the possible significance of that

357
00:23:26.630 --> 00:23:29.950
discrepancy. And perhaps even more importantly,

358
00:23:30.540 --> 00:23:35.110
neither did the chase pilot for the simple reason that he couldn't hear any of

359
00:23:35.110 --> 00:23:36.270
the pilot's transmissions.

360
00:23:37.010 --> 00:23:40.710
We had a, a mechanism of hot mic,

361
00:23:41.340 --> 00:23:44.950
very important to the pilot in the X 31 that he'd be able to talk to the control

362
00:23:45.060 --> 00:23:48.120
room without having to press buttons at certain key times,

363
00:23:48.610 --> 00:23:50.240
especially at high angled attack,

364
00:23:51.180 --> 00:23:55.050
which was not gonna be a factor in this flight cuz it was gonna go to about 20

365
00:23:55.050 --> 00:23:55.970
degrees angled attack.

366
00:23:56.750 --> 00:24:00.490
But it was a general operating procedure

367
00:24:01.680 --> 00:24:06.170
that was compounded because our hot mic system didn't work always very well.

368
00:24:06.670 --> 00:24:07.530
And when it didn't work,

369
00:24:07.530 --> 00:24:12.370
it put a lot of static in the earphones of the chase pilot who wanted

370
00:24:12.390 --> 00:24:15.170
to hear the hot mic to know what's going on.

371
00:24:15.710 --> 00:24:20.610

So it was the one-sided nature of the communication that kept me from having

372
00:24:20.710 --> 00:24:25.010
the situational awareness to be able to step in and say, Hey,

373
00:24:25.190 --> 00:24:27.690
I'm reading X knots, uh,

374
00:24:27.750 --> 00:24:31.130
and you guys are reading y knots and these two numbers should be the same and

375
00:24:31.130 --> 00:24:31.963
they're not.

376
00:24:33.070 --> 00:24:33.903
For several minutes,

377
00:24:33.990 --> 00:24:38.310
we had indications that the air speed was becoming poor,

378
00:24:38.620 --> 00:24:42.790
both in the cockpit, in the control room, and in our last ditch catch,

379
00:24:42.790 --> 00:24:46.830
nobody stood up and yelled, wait a minute, this can't be right.

380
00:24:47.140 --> 00:24:49.190
Because had we realized what was going on,

381
00:24:49.370 --> 00:24:54.150
the the control system had the ability to go to fixed flight control gains and

382
00:24:54.410 --> 00:24:57.030
it with fixed flight con control gains, it would not have been a problem.

383
00:24:57.030 --> 00:25:00.030
They would've been able to land the airplane safely. Uh,

384

00:25:00.250 --> 00:25:04.590
but we just never got enough information to, to make the decision to do that.

385
00:25:04.820 --> 00:25:08.310
Some links in the chain are already built there. Management links,

386
00:25:08.740 --> 00:25:11.910
control room is now talked internally. They've heard some things.

387
00:25:12.420 --> 00:25:16.280
They haven't said anything. Uh, some more links are built.

388
00:25:16.660 --> 00:25:19.640
We got this chain is building. Now the,

389
00:25:20.500 --> 00:25:24.160
the Chase pilot didn't hear anything about this, didn't know that he had,

390
00:25:24.300 --> 00:25:27.640
he didn't know anything was wrong with the airplane until he saw the airplane

391
00:25:27.640 --> 00:25:29.040
pitch up and the pilot jump out.

392
00:25:30.550 --> 00:25:32.920
Whereas he could have stopped this any time.

393
00:25:33.500 --> 00:25:34.333
At any rate,

394
00:25:34.510 --> 00:25:38.600
it's a total team concept and the Chase pilot has to be part of that team.

395
00:25:41.040 --> 00:25:44.970
Okay, so I hope you took some notes. Um,

396
00:25:46.300 --> 00:25:48.160
so we were trying to teach and,

397
00:25:48.260 --> 00:25:53.240
and promote the not to do these things three years before and happen. And,

398
00:25:53.500 --> 00:25:57.240
and, and, uh, I hope you realize now why we exist.

399
00:25:57.240 --> 00:26:01.700
Here are some of the things I wrote down, uh, that, that were common.

400
00:26:03.920 --> 00:26:06.660
Okay? And I think you would agree.

401
00:26:07.490 --> 00:26:10.910
So we expect that when you come here, you do the five a's that, uh,

402
00:26:11.050 --> 00:26:14.870
turbos mentioned, uh, and take home the lessons and try to,

403
00:26:14.890 --> 00:26:18.150
to apply 'em so you prevent something like that. That's why we exist.

404
00:26:18.150 --> 00:26:23.000
That's why we come here, okay? And we've been coming here for almost 30 years.

405
00:26:23.140 --> 00:26:27.780
Get the word out. So we now have,

406
00:26:28.120 --> 00:26:29.180
as Turbo said,

407
00:26:29.920 --> 00:26:33.900
all these things in the flight safety committee that makes us better.

408
00:26:34.630 --> 00:26:39.450
And we've learned how to do that in last 30 years and we'll continue to

409
00:26:39.450 --> 00:26:43.040
improve. So I hope you got the message. You know,

410
00:26:43.920 --> 00:26:45.850
come here, get the word out.

411
00:26:46.400 --> 00:26:50.210
Tell your friends to come here so you can actually apply some of the things that

412
00:26:50.210 --> 00:26:53.490
will prevent you to happen the next accident. Any questions?

413
00:26:57.260 --> 00:26:59.380
I see the clock is taken to zero.

414
00:27:03.290 --> 00:27:07.860
Okay. Uh, one question. Yes, there is a mic

415
00:27:16.480 --> 00:27:17.313
or comment.

416
00:27:23.860 --> 00:27:27.760
Oh, well there it is. Hey, so, uh, this isn't a question so much as a comment,

417
00:27:27.900 --> 00:27:32.080
but I just wanted to thank you for sharing this. So this org, the,

418
00:27:32.080 --> 00:27:35.920
that organization is where I work right now at NASA Armstrong. Again,

419
00:27:35.920 --> 00:27:38.360
those names, the people that we're talking in the video,

420
00:27:38.990 --> 00:27:41.560
they are some of the most respected, uh,

421
00:27:41.560 --> 00:27:46.120
people in the business and they made mistakes. Okay? Um,

422
00:27:46.660 --> 00:27:49.720
you say, how can this possibly happen? But all the things that, uh,

423
00:27:49.740 --> 00:27:53.360
rod talked about, we're all human, we're all fallible. Um,

424
00:27:54.140 --> 00:27:58.720
at NASA right now, we're getting ready to fly the X 59, which is our, uh,

425
00:27:58.770 --> 00:28:02.560
since the X 31, we haven't had an X plane. Uh,

426
00:28:02.560 --> 00:28:07.080
so it's been about 25, actually 30 years. So, um,

427
00:28:07.420 --> 00:28:10.800
our theme for the year at NASA has, uh,

428
00:28:10.800 --> 00:28:14.680
been replaying this show. We've been training our, uh,

429
00:28:15.550 --> 00:28:20.530
flight test engineers, our control room teams, and, uh, we've had,

430
00:28:20.630 --> 00:28:24.850
uh, there's a quote that the chief engineer says, it wasn't played here,

431
00:28:25.270 --> 00:28:27.930
but it's prepared for the unexpected and expect to be unprepared.

432
00:28:28.630 --> 00:28:32.530
So I just wanted to say that, that it can hit the most, uh,

433
00:28:32.530 --> 00:28:36.490
the best team out there, or a novice team, so it can happen to anybody.

434
00:28:37.100 --> 00:28:37.933
Thank you, Glenn.

435
00:28:42.050 --> 00:28:45.950
So Rod, it's a great example crm. Um,

436
00:28:46.570 --> 00:28:49.870

so if, if the team had taken to heart,

437
00:28:49.890 --> 00:28:53.150
the CRM stuff that you had done three years before might have had a different

438
00:28:53.150 --> 00:28:56.470
outcome. But CRM is something that today is,

439
00:28:56.570 --> 00:29:00.110
is one of those things that falls in our annual training requirements for most

440
00:29:00.110 --> 00:29:04.390
organizations. So we teach it every year, we talk to people about it every year,

441
00:29:04.410 --> 00:29:08.310
yet we still have CRM type accidents occur.

442
00:29:08.650 --> 00:29:13.130
Do you think it's how we're presenting is part of the issue as

443
00:29:13.130 --> 00:29:15.610
Well? That's a great question and, uh, and we'll,

444
00:29:15.610 --> 00:29:18.970
we can discuss it in the panel, but, uh, but the,

445
00:29:18.990 --> 00:29:23.210
the key is t and e crm because if you just, uh, um,

446
00:29:23.470 --> 00:29:27.730
do crm, uh, uh, with PowerPoint, death by PowerPoint, forget it.

447
00:29:28.360 --> 00:29:30.250
It's not gonna be effective. And I think that,

448
00:29:30.550 --> 00:29:32.770
I'm afraid a lot of organizations are doing that.

449

00:29:32.960 --> 00:29:37.450
They just sit there and present, uh, CRM slides, teamwork, uh, assertiveness,

450
00:29:37.670 --> 00:29:39.610
all that, all that good stuff that the airline stage,

451
00:29:39.670 --> 00:29:42.680
if you don't do it in a simulator with a simulator scenario,

452
00:29:42.900 --> 00:29:47.040
you're not doing it right. And that is my, my takeaway from this.

453
00:29:47.770 --> 00:29:51.040
Don't just give lectures, go out and, and, uh,

454
00:29:51.540 --> 00:29:55.120
all the test pilot schools have, uh, simulators, uh, control rooms.

455
00:29:55.590 --> 00:29:59.080
They can connect to a simulator and, uh, and, uh,

456
00:29:59.300 --> 00:30:01.320
stream data to the, to the control,

457
00:30:01.380 --> 00:30:06.120
create a scenario and practice this PR and involve the engineers in the

458
00:30:06.120 --> 00:30:10.410
control room. Good question. Any other questions?

459
00:30:14.730 --> 00:30:15.563
One more.

460
00:30:19.580 --> 00:30:24.280
So, you know, one of the issues that, that I think is, uh, a problem, we,

461
00:30:24.280 --> 00:30:29.080
we all understand this, um, where we've been challenged is,

462
00:30:29.780 --> 00:30:33.880

you know, we all have these pressures. So test point production, tri efficient,

463
00:30:33.900 --> 00:30:37.440
get the test done. And the folks that are usually leading the,

464
00:30:37.440 --> 00:30:41.200
the test that day, the pilot and the test conductor there, you know,

465
00:30:41.200 --> 00:30:42.920
at the end they got a debrief management, Hey,

466
00:30:42.920 --> 00:30:46.120
how many points did you get done today? Are we on schedule, are on track?

467
00:30:46.970 --> 00:30:50.230
You combine that. So there's that, that pressure, you know,

468
00:30:50.230 --> 00:30:53.790
whether it's stated or not, that pressure is always there to get the point done.

469
00:30:54.410 --> 00:30:56.510
So you've got a dry airplane, for example, there,

470
00:30:56.770 --> 00:30:59.190
and you're in a condition at Edwards where, you know,

471
00:30:59.190 --> 00:31:03.430
at 99 times out of a hundred it's dry there and you say, Hey, wait a minute.

472
00:31:03.490 --> 00:31:06.790
You know, the chances of something happening are nil,

473
00:31:06.790 --> 00:31:10.910
99 times out of a hundred is successful and you got that one day where you got

474
00:31:10.910 --> 00:31:13.590
weather or something like that. And you know, again,

475
00:31:13.590 --> 00:31:16.150
99 times outta a hundred is gonna be successful kind of thing there.

476
00:31:16.170 --> 00:31:20.190
So you've got that junior, you know, test engineer or may,

477
00:31:20.190 --> 00:31:22.230
maybe someone else on the team that's got,

478
00:31:22.330 --> 00:31:26.430
got a no vote there and they're hesitant to do that, whether it's the pilot,

479
00:31:26.530 --> 00:31:28.070
the test conductor, the test engineer,

480
00:31:28.070 --> 00:31:32.620
because 99 times a hundred or 999 times out of a thousand it,

481
00:31:32.650 --> 00:31:37.300
it's successful. So you do, do you want to be that one person that says, no,

482
00:31:37.300 --> 00:31:39.460
I don't think we should go today, kind of thing there.

483
00:31:39.460 --> 00:31:44.460
And so it becomes a problem because it's just, hey, if I speak up,

484
00:31:45.420 --> 00:31:50.200
you know, it's, you can't prove the, the exclusion, you know,

485
00:31:50.200 --> 00:31:53.600
where it doesn't happen. So you, you speak up and you say, Hey, listen,

486
00:31:53.820 --> 00:31:57.040
you know, yeah, you probably, it was actually wouldn't have been an issue there.

487
00:31:57.890 --> 00:31:59.990
And, and, and it turns out not to be an issue.

488
00:31:59.990 --> 00:32:01.990
It's that person that's afraid to speak up.

489
00:32:02.170 --> 00:32:05.510
And I think the lesson learned that comes out of this is really empowering. I,

490
00:32:05.630 --> 00:32:07.950
I know this is cliche and folks have heard this before,

491
00:32:08.290 --> 00:32:13.110
but the most junior person on the test team has got to feel empowered to

492
00:32:13.110 --> 00:32:15.750
speak up and say, Hey, discipline,

493
00:32:15.970 --> 00:32:19.590
our team says if we don't have the weather conditions today to fly,

494
00:32:19.930 --> 00:32:23.750
we don't fly. Or if we encounter the conditions, we abort.

495
00:32:23.810 --> 00:32:26.870
But I've seen it in test where, hey, it's that moment here, it's a dry airplane.

496
00:32:26.870 --> 00:32:28.910
Hey, but moment, you know, we gotta get the test done,

497
00:32:28.910 --> 00:32:30.310
the airplane's bagged out with gas,

498
00:32:30.640 --> 00:32:32.430
we're committed for a three hour flight here,

499
00:32:32.890 --> 00:32:36.930
we can penetrate that cloud and we go ahead and do it because no one wants to

500
00:32:36.930 --> 00:32:37.700

say, Hey listen,

501
00:32:37.700 --> 00:32:40.490
don't do that kind of thing there because 99 times outta a hundred,

502
00:32:40.550 --> 00:32:42.530
it turns out okay anyway. Mm-hmm.

503
00:32:42.720 --> 00:32:46.850
Yeah. And, and, uh, there's a buzzword I just recently picked up and, uh,

504
00:32:48.390 --> 00:32:51.700
don't bother me with safety or sms. We gotta get to market

505
00:32:53.220 --> 00:32:56.640
and this is happening. E ev, tolls, hydrogen, all the, all the startups.

506
00:32:56.860 --> 00:33:01.080
That's the mentality that can happen and you are there to prevent that.

507
00:33:02.080 --> 00:33:06.030
I think we ran, probably ran out of time. So, so thank you very much.