Episode 3: Failure is Not an Option

August 2018

@NASAKennedy
#NASARocketRanch

New episodes every month!

1
00:00:02,899 --> 00:00:05,680
Michael Leinbach: It's an indescribably empty
feeling.

2
00:00:05,680 --> 00:00:09,080
That day that they didn't come home.

3
00:00:09,080 --> 00:00:13,110
Knowing that the astronauts were gone and
we-we failed them.

4
00:00:13,110 --> 00:00:14,620
[MUSIC]

5
00:00:14,620 --> 00:00:22,280
Launch Countdown Sequence: EGS Program Chief
Engineer.

6
00:00:22,280 --> 00:00:23,280
Verify no constraints to launch.

7
00:00:23,280 --> 00:00:24,280
EGS Chief Engineer team has no constraints.

8
00:00:24,280 --> 00:00:25,380
I copy that.

9
00:00:25,380 --> 00:00:27,490
You are clear to launch.

10
00:00:27,490 --> 00:00:31,180
Five, four, three, two, one, and lift-off.

11
00:00:31,180 --> 00:00:32,230
All clear.

12
00:00:32,230 --> 00:00:36,450
Now passing through max Q, maximum dynamic

pressure.

13
00:00:36,450 --> 00:00:38,040
Welcome to space.

14
00:00:46,860 --> 00:00:48,300
Amanda Griffin: Welcome to the Rocket Ranch.

15
00:00:48,300 --> 00:00:49,540
I'm NASA Kennedy's Amanda Griffin.

16
00:00:49,540 --> 00:00:54,480
Shout-out to our host, Joshua Santora, who
welcomed a baby girl into the world before

17
00:00:54,480 --> 00:00:56,380
the completion of this episode.

18
00:00:56,380 --> 00:00:57,380
Congratulations, Joshua.

19
00:00:57,380 --> 00:01:01,980
Here's wishing you a happy, healthy newborn
and a good night's sleep.

20
00:01:05,640 --> 00:01:10,320
As we prepare to launch humans into space
on new American-made rockets and spacecraft,

21
00:01:10,320 --> 00:01:14,250
it's more important than ever that we revisit
what led to two of the most tragic days in

22
00:01:14,250 --> 00:01:15,820
NASA's human space flight history.

23
00:01:15,820 --> 00:01:18,531
Michael Ciannilli: Winston Churchill said
it, you know, "those who have failed to learn

24
00:01:18,531 --> 00:01:19,890
from history are doomed to repeat it."

25
00:01:19,890 --> 00:01:21,130
And that's so true.

26
00:01:21,130 --> 00:01:25,850
Amanda Griffin: In this episode, we're exploring
not just the technical issues that brought

27
00:01:25,850 --> 00:01:30,450
down the crews of both Challenger and Columbia,
but the cultural environment that proved just

28
00:01:30,450 --> 00:01:31,480
as deadly.

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00:01:31,480 --> 00:01:32,830
What are the lessons we learned?

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00:01:32,830 --> 00:01:34,950
And have we really learned them?

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00:01:34,950 --> 00:01:44,540
Joshua Santora (Host): All right, I'm back
here in the booth with Michael Ciannilli and

32
00:01:44,540 --> 00:01:45,540
Michael Leinbach.

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00:01:45,540 --> 00:01:47,950
Uh, Michael Ciannilli, we're gonna call him
Chach.

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00:01:47,950 --> 00:01:51,910
Uh, he bears a striking resemblance to Scott
Baio-- at least, uh, back in the heydays of

35
00:01:51,910 --> 00:01:53,090
"Happy Days" he did.

36
00:01:53,090 --> 00:01:57,460
And Michael Leinbach is a retired launch director
for NASA, so--

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00:01:57,460 --> 00:01:58,460
Michael Leinbach: Right.

38
00:01:58,460 --> 00:02:00,730
Host: A decorated history of shuttle launches.

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00:02:00,730 --> 00:02:05,670
And Chach also worked with Mike on shuttle
flights, um, as a NASA test director.

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00:02:05,670 --> 00:02:09,510
So, really fast, can you give me a real quick
overview of what does it mean to be a NASA

41
00:02:09,510 --> 00:02:10,510
test director?

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00:02:10,510 --> 00:02:11,510
Michael Ciannilli: Great question.

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00:02:11,510 --> 00:02:15,209
Um, the NASA test director is, if you think
of an orchestra, right, like an orchestra

44
00:02:15,209 --> 00:02:18,489
has, um, all the different instrument players,
and then you have the conductor who helps

45
00:02:18,489 --> 00:02:19,510
lead the orchestra.

46

00:02:19,510 --> 00:02:21,689
Um, a test director's much like that.

47
00:02:21,689 --> 00:02:25,219
Uh, we have the honor to be in the firing
room and work with an amazing team of very

48
00:02:25,219 --> 00:02:29,909
talented folks who are–in this case, their
instruments are their systems on the vehicle.

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00:02:29,909 --> 00:02:32,420
So they're watching over the systems and the
health of the vehicle.

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00:02:32,420 --> 00:02:35,919
And we help, um, help guide them towards the
countdown toward T-zero.

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00:02:35,919 --> 00:02:38,019
Host: What's your role as the launch director?

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00:02:38,019 --> 00:02:41,769
Michael Leinbach: You know, I'm glad Chach
mentioned the, uh, the orchestra leaders as-as

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00:02:41,769 --> 00:02:45,159
the analogy for the test director, 'cause
that's the one I use all the time.

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00:02:45,159 --> 00:02:46,549
NTD is orchestra leader.

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00:02:46,549 --> 00:02:50,730
And I always like to describe the launch director
as sort of the owner of the orchestra.

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00:02:50,730 --> 00:02:55,779
I get to sit back-- I got to sit back and
watch the-- watch the orchestra, watch the

57
00:02:55,779 --> 00:02:56,900
launch team perform.

58
00:02:56,900 --> 00:03:01,890
And, um-- and just kinda make sure we're all-all
on the same page at the same time.

59
00:03:01,890 --> 00:03:04,769
And we felt good about problem resolution.

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00:03:04,769 --> 00:03:07,720
And-and then, ultimately, gave the final go
for launch.

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00:03:07,720 --> 00:03:12,709
But it was-it was a position that was created
long, long ago in the early days of America's

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00:03:12,709 --> 00:03:17,739
manned space flight program for-for one individual
to intentionally have very little to do.

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00:03:17,739 --> 00:03:20,620
I'm-I'm not-- I don't have a lot of call signs
in the procedure.

64
00:03:20,620 --> 00:03:25,249
Uh, but it's a position of-of authority and
responsibility, yes.

65
00:03:25,249 --> 00:03:29,430
But it's-it's one of sitting back and watching
the team perform, just get the sense of if

66
00:03:29,430 --> 00:03:31,650
we're really ready to launch that day or not.

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00:03:31,650 --> 00:03:33,469

And it's been that way since the Mercury days.

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00:03:33,469 --> 00:03:38,950
And-and it, um, was created by-by a bunch
of wise people back in the '60s, and-and it's,

69
00:03:38,950 --> 00:03:43,000
uh, it's a perfect way to, uh, to conduct
a launch, I believe.

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00:03:43,000 --> 00:03:48,370
Host: Yeah, certainly, uh, a long history
of very excellent, uh, men, until now.

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00:03:48,370 --> 00:03:52,290
Now we have our first female launch director
coming up here, Charlie Blackwell-Thompson.

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00:03:52,290 --> 00:03:57,199
Um, and so we're-we're here today to talk
about the idea of launching, from a historical

73
00:03:57,199 --> 00:03:58,199
context.

74
00:03:58,199 --> 00:04:00,079
Really exciting month for NASA.

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00:04:00,079 --> 00:04:02,489
We announced crews for-for crew missions.

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00:04:02,489 --> 00:04:07,409
Announcer: Ladies and gentlemen, I present
to you our commercial crew astronauts.

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00:04:07,409 --> 00:04:09,439
[CHEERS AND APPLAUSE]

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00:04:09,439 --> 00:04:12,959

Host: I think it's been nine years since we announced a crew.

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00:04:12,959 --> 00:04:18,010
Um, and we want to talk today-- very sensitive subject about-- uh, historically, when launch

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00:04:18,010 --> 00:04:22,090
hasn't gone well, or when missions end in tragedy.

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00:04:22,090 --> 00:04:28,259
And-and what do we do as an agency, and as a nation, to-to get smarter and be better

82
00:04:28,259 --> 00:04:29,800
to protect human lives?

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00:04:29,800 --> 00:04:32,460
So I wanna start by looking back, uh, '86.

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00:04:32,460 --> 00:04:34,460
Um, the Challenger tragedy.

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00:04:34,460 --> 00:04:38,449
President Ronald Reagan: America will never forget that terrible moment when our elation

86
00:04:38,449 --> 00:04:41,650
turned to horror, and then to grief and pain.

87
00:04:41,650 --> 00:04:46,270
Seven of our finest perished as they reached for the boundaries of space.

88
00:04:46,270 --> 00:04:49,820
Where Earth ends and the path to the stars begins.

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00:04:49,820 --> 00:04:51,530
Host: So, I'll kick it off.

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00:04:51,530 --> 00:04:55,400
Uh, who wants to kind of start in here-- kind
of talking about, first, technically what

91
00:04:55,400 --> 00:04:56,400
happened?

92
00:04:56,400 --> 00:04:57,400
We lost a space shuttle.

93
00:04:57,400 --> 00:04:58,400
Um, but what happened?

94
00:04:58,400 --> 00:05:01,000
And-and, culturally, what was going on for-for
us as an agency?

95
00:05:01,000 --> 00:05:06,150
Michael Leinbach: Well, gosh, maybe, you know,
I'll start, and Chachi, you chime in anytime

96
00:05:06,150 --> 00:05:08,669
you want and correct me when I make a mistake.

97
00:05:08,669 --> 00:05:09,760
Um, I was here.

98
00:05:09,760 --> 00:05:14,240
I was a young engineer, a design engineer,
working out of the headquarters building.

99
00:05:14,240 --> 00:05:16,240
And-and I remember that morning very, very
well.

100
00:05:16,240 --> 00:05:17,930

I remember it like it was yesterday.

101
00:05:17,930 --> 00:05:20,710
And it was just a frigid, frigid morning.

102
00:05:20,710 --> 00:05:24,930
Newscaster: Launch today is set for 10:38
a.m.

103
00:05:24,930 --> 00:05:32,270
Current weather, uh, conditions call for scattered
clouds at 25,000 feet, with winds out of the

104
00:05:32,270 --> 00:05:34,639
northwest at 12 knots.

105
00:05:34,639 --> 00:05:37,409
Temperature at the pad right now is 24 degrees.

106
00:05:37,409 --> 00:05:42,500
Michael Leinbach: Uh, to the-to the extent
that-that our Firex system piping at the launch

107
00:05:42,500 --> 00:05:47,430
pad had-had frozen and burst, and we had icicles
at the launch pad.

108
00:05:47,430 --> 00:05:49,840
You know, foot and a half, two feet long.

109
00:05:49,840 --> 00:05:52,360
In-in Florida-- icicles, two feet long in
Florida.

110
00:05:52,360 --> 00:05:53,530
Host: Yeah, not a normal occurrence.

111
00:05:53,530 --> 00:05:55,020
Michael Leinbach: No, no, no.

112
00:05:55,020 --> 00:05:56,020
Far from it.

113
00:05:56,020 --> 00:05:58,330
And, um, a very frigid morning.

114
00:05:58,330 --> 00:06:00,500
Um, and watched the launch proceed.

115
00:06:00,500 --> 00:06:03,449
Launch Dialogue: We have main engine start.

116
00:06:03,449 --> 00:06:04,449
Four, three, two, one… and lift-off!

117
00:06:04,449 --> 00:06:16,349
Lift-off of the 25th space shuttle mission,
and it has cleared the tower.

118
00:06:16,349 --> 00:06:22,729
[INDISTINCT RADIO CHATTER]
Good roll program confirmed.

119
00:06:22,729 --> 00:06:28,610
Michael Leinbach: Uh, we were standing on
the deck of the launch-- as I say, I was an

120
00:06:28,610 --> 00:06:29,610
engineer.

121
00:06:29,610 --> 00:06:30,610
I wasn't in flight operations.

122
00:06:30,610 --> 00:06:33,250
I didn't know, uh, the abort scenarios at
all.

123

00:06:33,250 --> 00:06:35,210
But-but we watched lift-off occur.

124
00:06:35,210 --> 00:06:39,080
Launch Dialogue: Challenger, go with throttle
up.

125
00:06:39,080 --> 00:06:40,080
Roger.

126
00:06:40,080 --> 00:06:41,849
Go with throttle up.

127
00:06:41,849 --> 00:06:45,180
Michael Leinbach: And then the big fireball,
and--

128
00:06:45,180 --> 00:06:51,330
Launch Dialogue: Flight controller's here
looking very carefully at the situation.

129
00:06:51,330 --> 00:06:52,330
Obviously a major malfunction.

130
00:06:52,330 --> 00:06:55,939
Michael Leinbach: And I expected to see Challenger
peel out of that fireball and land behind

131
00:06:55,939 --> 00:06:58,460
me at the-at the shuttle landing facility.

132
00:06:58,460 --> 00:07:01,259
Not the knowing, the abort scenarios like
I-like I got to know them later.

133
00:07:01,259 --> 00:07:02,259
Host: Sure.

134
00:07:02,259 --> 00:07:03,259

Michael Leinbach: And of course it never did.

135
00:07:03,259 --> 00:07:04,300
Launch Dialogue: Uh, at that point we had
an apparent, uh, explosion.

136
00:07:04,300 --> 00:07:11,300
Subsequent to that, uh, the tracking, uh,
crews reported to the flight dynamics officer

137
00:07:11,300 --> 00:07:12,450
that the vehicle, uh, appeared to have exploded.

138
00:07:12,450 --> 00:07:18,479
And that, uh, we had an impact, uh, in the
water, down range.

139
00:07:18,479 --> 00:07:24,960
Michael Leinbach: And it turned out later
that, um, uh, you know, the failure was-was

140
00:07:24,960 --> 00:07:28,520
due to, um, a failure in the-in the solid
rocket booster.

141
00:07:28,520 --> 00:07:35,030
One of the two solid rocket boosters, uh,
one of the seals between the joints, uh, in

142
00:07:35,030 --> 00:07:36,490
the booster failed.

143
00:07:36,490 --> 00:07:43,750
An O-ring failed, which is a-which is a rubbery
material to-to keep pressures inside the-the

144
00:07:43,750 --> 00:07:44,750
SRB--

145

00:07:44,750 --> 00:07:49,599
Host: For those that aren't familiar, the
SRB was stacked a-- a giant cylinder that

146
00:07:49,599 --> 00:07:52,189
came to us in segments, and had to be assembled.

147
00:07:52,189 --> 00:07:54,770
So this was at one of the joining points of
those segments, correct?

148
00:07:54,770 --> 00:07:55,849
Michael Leinbach: That's exactly right.

149
00:07:55,849 --> 00:07:59,719
It came from, uh-- they were built and fueled
out in Utah.

150
00:07:59,719 --> 00:08:01,870
And got to us on a-on a train system.

151
00:08:01,870 --> 00:08:06,689
In four segments, we stacked them in the-in
the Vehicle Assembly Building.

152
00:08:06,689 --> 00:08:11,909
And then, uh, after the SRBs were stacked
in the-in the VAB, the external tank gets

153
00:08:11,909 --> 00:08:15,840
mated in between 'em, and then the orbiter
gets bolted to the side of the external tank.

154
00:08:15,840 --> 00:08:21,569
Well, for-for the Challenger mission, uh,
the O-ring failed and-and let-and let, uh,

155
00:08:21,569 --> 00:08:27,070
the gas of the-of the solid rocket booster
propellant escape at the one of these field

156
00:08:27,070 --> 00:08:28,070
joints.

157
00:08:28,070 --> 00:08:30,879
At one of the joints that we put together
in the Vehicle Assembly Building.

158
00:08:30,879 --> 00:08:35,930
And a-and a jet-- a fire jet came out the
side of the solid rocket booster and penetrated

159
00:08:35,930 --> 00:08:38,100
the-the, uh, external tank.

160
00:08:38,100 --> 00:08:44,540
And-and, uh, at the same time the-the SRB
pivoted because it lost its aft attach-point.

161
00:08:44,540 --> 00:08:51,380
And, uh, the hydrogen tank at the bottom of
the external fuel tank ruptured at about the

162
00:08:51,380 --> 00:08:56,080
same time as-as the top of the solid rocket
booster collapsed into the-into the liquid

163
00:08:56,080 --> 00:08:59,080
oxygen tank at the top of the external fuel
tank.

164
00:08:59,080 --> 00:09:04,470
Those two things combined caused the-the massive
conflagration that we saw on TV that was unsurvivable.

165
00:09:04,470 --> 00:09:08,330
Jesse Moore: With the explosion of the space
shuttle Challenger, approximately a minute

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00:09:08,330 --> 00:09:14,440
and a half after launch from here at the Kennedy Space Center...

167
00:09:14,440 --> 00:09:22,000
I regret that I have to report that, based on very preliminary searches of the ocean

168
00:09:22,000 --> 00:09:27,880
where the Challenger impacted this morning, these searches have not revealed any evidence

169
00:09:27,880 --> 00:09:32,340
that the crew of Challenger survived.

170
00:09:32,340 --> 00:09:39,150
Host: So, from a cultural perspective, what-what's going on with NASA at that point in time?

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00:09:39,150 --> 00:09:46,450
Obviously, we are in '86, so we're five years into the Shuttle program after a, uh, nine

172
00:09:46,450 --> 00:09:49,670
year break from the Saturn V program?

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00:09:49,670 --> 00:09:54,350
Um, the Apollo program to the Shuttle program, um, things seem to be going well, but, is

174
00:09:54,350 --> 00:09:57,460
there-- are there-are there things happening behind the scenes that are creating problems

175
00:09:57,460 --> 00:09:58,460
for us?

176
00:09:58,460 --> 00:10:02,150
Michael Leinbach: Well, that's-that's a great question, and the answer is very much "yes."

177
00:10:02,150 --> 00:10:07,330
Uh, at-at that point in-in America's space
flight history, all-all of America's launches

178
00:10:07,330 --> 00:10:10,060
were going to go off of the-the space shuttle
system.

179
00:10:10,060 --> 00:10:16,040
We were going to retire the Atlases and the
Titans and the Delta rockets-- all the expendable

180
00:10:16,040 --> 00:10:17,040
launch vehicles.

181
00:10:17,040 --> 00:10:19,050
They were all gonna be retired.

182
00:10:19,050 --> 00:10:22,140
Every launch that America conducted was gonna
be on the shuttle.

183
00:10:22,140 --> 00:10:26,920
And, uh, this-- the Challenger accident was
the 25th shuttle flight.

184
00:10:26,920 --> 00:10:31,640
Uh, and so we were still in the process of
proving the system, even though we had declared

185
00:10:37,710 --> 00:10:33,190
it operational.

186
00:10:37,710 --> 00:10:42,940
But-but all-all of our launch capability was
gonna be devoted to the shuttle, and, uh,

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00:10:42,940 --> 00:10:46,910

the Department of Defense owned and-- paid-paid
for and owned Discovery.

188
00:10:46,910 --> 00:10:51,680
And they were gonna launch Discovery by themselves
out at the Vandenberg Air Force Base.

189
00:10:51,680 --> 00:10:58,730
It was gonna be their shuttle, and-- and-and
so, from-from-from a-from a big picture perspective,

190
00:10:58,730 --> 00:11:01,760
the shuttle system almost had to succeed.

191
00:11:01,760 --> 00:11:07,180
Because we were going down this path of retiring
all the other expendable launch vehicles,

192
00:11:07,180 --> 00:11:09,520
in-in-in-in favor of just the shuttle.

193
00:11:09,520 --> 00:11:14,540
And so there was-there was tremendous, um,
desire, and-and I would say some pressure

194
00:11:14,540 --> 00:11:18,650
to make sure the shuttle system worked, and-and
worked well.

195
00:11:18,650 --> 00:11:23,490
And that-and that had something to do with
the decision to, uh, to, uh, to bury the debris,

196
00:11:23,490 --> 00:11:24,490
I believe.

197
00:11:24,490 --> 00:11:27,930
And just put that accident behind us as-as
much as we could.

198
00:11:27,930 --> 00:11:31,910
Tragic as it was, the loss of seven astronauts
and the orbiter itself.

199
00:11:31,910 --> 00:11:36,080
But the mood was, that was a one-time failure
of the shuttle system.

200
00:11:36,080 --> 00:11:40,950
It's a good system, it almost has to succeed,
because of the-the posture we were putting

201
00:11:40,950 --> 00:11:43,210
ourselves in, with our launch capability.

202
00:11:43,210 --> 00:11:51,550
And, um… and so the decision was to-to press
on with the shuttle and, um, and bury the-the

203
00:11:51,550 --> 00:11:54,180
Challenger debris, and-and-and not look back.

204
00:11:54,180 --> 00:11:58,810
And it was a-- it was-it was just not the
right decision.

205
00:11:58,810 --> 00:12:00,890
In hindsight it was not the right decision.

206
00:12:00,890 --> 00:12:05,150
At the point in time in America's space flight
history, that's what the leaders decided to

207
00:12:05,150 --> 00:12:06,150
do.

208
00:12:06,150 --> 00:12:08,190
So that-- at the time it was the right decision.

209
00:12:08,190 --> 00:12:10,061
Looking back, I-- you know, we can second guess it.

210
00:12:10,061 --> 00:12:14,780
Speaker: They were not only the crew of Challenger, they were friends and co-workers.

211
00:12:14,780 --> 00:12:25,790
That brave crew of Dick Scobee, Mike Smith, Ron McNair, Ellison Onizuka, Judy Resnik,

212
00:12:25,790 --> 00:12:34,440
Greg Jarvis, and Christa McAuliffe will always be in our memories.

213
00:12:34,440 --> 00:12:38,680
Michael Ciannilli : We have a new program called The Apollo Challenger Columbia Lessons

214
00:12:38,680 --> 00:12:40,180
Learned Program.

215
00:12:40,180 --> 00:12:43,800
And how this really started is, um, we're looking at where we are in our history, right?

216
00:12:43,800 --> 00:12:48,720
So, uh, NASA's in a very unique place where we are many years out from Shuttle now.

217
00:12:48,720 --> 00:12:51,980
We're about seven years and counting, out from the last loss of the space shuttle program.

218
00:12:51,980 --> 00:12:53,780
And we're developing new systems.

219
00:12:53,780 --> 00:12:56,120

So we got, um, brand new systems coming online.

220
00:12:56,120 --> 00:12:58,480
New vehicles, new designs coming.

221
00:12:58,480 --> 00:13:01,220
And we got a-a brand new workforce that's
being brought on board.

222
00:13:01,220 --> 00:13:05,720
A lot of our shuttle folks have retired or
moved on, so we've got a lot of, uh, brand

223
00:13:05,720 --> 00:13:07,560
new talent, which is exciting and great.

224
00:13:07,560 --> 00:13:08,730
Um, new systems, which is great.

225
00:13:08,730 --> 00:13:10,140
New missions, which is great.

226
00:13:10,140 --> 00:13:13,790
But with that comes a lot of challenges, um,
to make sure we're successful.

227
00:13:13,790 --> 00:13:18,290
And, so we wanna make sure there's a way to
transfer what we call "the tribal knowledge."

228
00:13:18,290 --> 00:13:20,790
All the folks that were, um, that came before
us.

229
00:13:20,790 --> 00:13:24,760
All the Mercury, Gemini, Apollo, Skylab folks,
and, of course, Shuttle now.

230
00:13:24,760 --> 00:13:30,100

And take that knowledge, which we lost a lot during the Shuttle layoffs, and trying to-to

231
00:13:30,100 --> 00:13:31,340
rebuild some of that.

232
00:13:31,340 --> 00:13:33,330
Um, why we do certain things the way we do.

233
00:13:33,330 --> 00:13:34,330
Right, so history teaches that.

234
00:13:34,330 --> 00:13:36,220
We learned that from our ancestors.

235
00:13:36,220 --> 00:13:39,550
Um, so we try to transfer that to the next generation workforce.

236
00:13:39,550 --> 00:13:41,150
So that's the goal of this new program.

237
00:13:41,150 --> 00:13:45,550
Host: So, thinking about kind of the Challenger era-- did we learn all of our lessons?

238
00:13:45,550 --> 00:13:50,120
Michael Leinbach: Well, let's see, there-there are two major lessons learned from the Challenger

239
00:13:50,120 --> 00:13:51,120
accident.

240
00:13:51,120 --> 00:13:53,400
One was the-the technical cause of the failure.

241
00:13:53,400 --> 00:13:58,360
And that was the-the O-ring burned through, and-- and I should say that in-in the-in the

242
00:13:58,360 --> 00:14:02,970
flights before Challenger there were several
missions where we saw scorching on the O-ring

243
00:14:02,970 --> 00:14:06,920
and didn't-and didn't, uh, redesign at that
point in time.

244
00:14:06,920 --> 00:14:09,460
So we knew we had an issue with those O-rings.

245
00:14:09,460 --> 00:14:12,620
Um, and-and chose to press on anyway.

246
00:14:12,620 --> 00:14:15,080
Um, the technical cause, we fixed.

247
00:14:15,080 --> 00:14:20,240
You know, we put in another, uh, [INDISTINCT
] solution to the joint problem.

248
00:14:20,240 --> 00:14:21,240
Kinda technical, but--

249
00:14:21,240 --> 00:14:22,240
Host: Sure.

250
00:14:22,240 --> 00:14:24,040
Michael Leinbach: We fixed the technical problem.

251
00:14:24,040 --> 00:14:30,820
The management problem that-that really--
I would say was even a-a bigger culprit in

252
00:14:30,820 --> 00:14:35,620
the Challenger-- the loss of the astronauts
and Challenger was-- you know, the night before

253
00:14:35,620 --> 00:14:41,470
the lift-off of Challenger, there were people,
engineers from the Marshall Space Flight Center,

254
00:14:41,470 --> 00:14:46,160
who were responsible for the design of the
solid rocket booster, lobbying not to launch

255
00:14:46,160 --> 00:14:49,390
the next morning because they knew it was
gonna be too cold for the O-ring.

256
00:14:49,390 --> 00:14:54,430
Because it was gonna be very stiff, and-and
wouldn't bend with the joint, so to speak,

257
00:14:54,430 --> 00:14:59,070
and-and flex with the joint as-as it was designed
to do a little bit.

258
00:14:59,070 --> 00:15:01,630
And these engineers were lobbying not to launch.

259
00:15:01,630 --> 00:15:07,940
But their-their management overrode that-that
technical concern, and chose to press on with

260
00:15:07,940 --> 00:15:09,020
launch anyway.

261
00:15:09,020 --> 00:15:13,640
Newscaster: The ice inspection team, the red
crew out at the pad, has reported to the,

262
00:15:13,640 --> 00:15:20,020
uh, test conductors that, uh, there is no,
uh, solid ice buildup, uh, in those bags on

263
00:15:20,020 --> 00:15:21,120

the mobile launch platform.

264
00:15:21,120 --> 00:15:25,980
And, in fact, have characterized the contents
of those bags as "mush."

265
00:15:25,980 --> 00:15:29,960
Uh, it's been determined that that is not
a constraint for launch at this time.

266
00:15:29,960 --> 00:15:34,100
Michael Leinbach: That discussion the night
before the Challenger loss never made it to

267
00:15:34,100 --> 00:15:35,260
the launch director.

268
00:15:35,260 --> 00:15:40,480
Gene Thomas, rest his soul, never knew anything
about that discussion until after the accident.

269
00:15:40,480 --> 00:15:41,480
Host: Hmm... wow.

270
00:15:41,480 --> 00:15:45,821
Michael Leinbach: And-and-and so the technical
issue never made it to-to launch decision-makers.

271
00:15:45,821 --> 00:15:54,751
Host: Thinking about the-the written and unwritten
requirements of a launch, for instance, is

272
00:15:54,751 --> 00:15:59,080
it likely that we would try and accommodate
every single thing we can think of?

273
00:15:59,080 --> 00:16:03,030
Like, if the temperature falls below 20 degrees,
don't launch?

274
00:16:03,030 --> 00:16:06,790
And-and if that's-- if that's not appropriate
to do that, how do you deal with challenges

275
00:16:06,790 --> 00:16:07,820
like that?

276
00:16:07,820 --> 00:16:11,500
Where you have these experts saying, "we shouldn't
launch tomorrow, it's too cold."

277
00:16:11,500 --> 00:16:13,490
Michael Leinbach: Yeah, Josh, I'm glad you
asked that.

278
00:16:13,490 --> 00:16:17,690
That-that is the key management lesson learned
from the Challenger accident.

279
00:16:17,690 --> 00:16:22,420
Wh-wh-where there's a whole issue of undocumented
reasons to stay on the ground.

280
00:16:22,420 --> 00:16:27,790
Uh, the-the space shuttle system, we had 22,000
parameters that had to be correct to launch

281
00:16:27,790 --> 00:16:28,790
the shuttle.

282
00:16:28,790 --> 00:16:29,790
Host: Golly!

283
00:16:29,790 --> 00:16:31,880
Michael Leinbach: Twenty-two thousand temperatures,
pressures, voltages, all that-- the weather.

284
00:16:31,880 --> 00:16:33,110
All those things.

285
00:16:33,110 --> 00:16:34,110
Host: Wow.

286
00:16:34,110 --> 00:16:38,240
Michael Leinbach: But beyond that there-there could always be something we didn't think

287
00:16:38,240 --> 00:16:42,310
about, or something that couldn't be automated, that you needed the-the human in the loop

288
00:16:42,310 --> 00:16:45,230
to say, "well, here's a reason we shouldn't launch today."

289
00:16:45,230 --> 00:16:50,900
I re-- one-one launch countdown we had a train about to penetrate the launch danger area.

290
00:16:50,900 --> 00:16:53,870
Well, that-that wasn't in our-- it wasn't computerized!

291
00:16:53,870 --> 00:16:56,610
We had to deal with that train.

292
00:16:56,610 --> 00:16:57,610
[LAUGHING]

293
00:16:57,610 --> 00:17:01,430
The issue that-that came out of Challenger being too cold the night before, and that

294
00:17:01,430 --> 00:17:05,280
discussion, that was an undocumented reason not to fly.

295
00:17:05,280 --> 00:17:06,829

It-it didn't turn out that way.

296
00:17:06,829 --> 00:17:07,829
It-it--

297
00:17:07,829 --> 00:17:08,829
Host: Right.

298
00:17:08,829 --> 00:17:10,449
Michael Leinbach: It never made it to the
launch decision authority.

299
00:17:10,449 --> 00:17:11,449
Host: Right.

300
00:17:11,449 --> 00:17:13,550
Michael Leinbach: But the thing that did come
out of that was the creation of the Mission

301
00:17:13,550 --> 00:17:14,550
Management Team.

302
00:17:14,550 --> 00:17:15,550
Host: Gotcha.

303
00:17:15,550 --> 00:17:18,480
Michael Leinbach: And it was a group of-of
senior managers from all the different elements--

304
00:17:18,480 --> 00:17:22,250
the orbiter, the external tank, and the solid
rocket boosters, and the ground systems, and

305
00:17:22,250 --> 00:17:27,470
the safety and payloads-- everybody who would-who'd
needed to weigh in on launch day and say,

306
00:17:27,470 --> 00:17:31,250
"I don't know of any other reason out there

to stay on the ground today.

307
00:17:31,250 --> 00:17:35,160
As long as you, the launch director, have
met your 22,000, we're good to go."

308
00:17:35,160 --> 00:17:42,120
However, that-- the, uh, the example of-of
the-the-the temperature of the night before

309
00:17:42,120 --> 00:17:44,620
Challenger, that was a reason to stay on the
ground.

310
00:17:44,620 --> 00:17:50,280
It wasn't in documented procedures, but it
was a-absolutely a valid reason not to launch

311
00:17:50,280 --> 00:17:51,410
the next day.

312
00:17:51,410 --> 00:17:56,560
The creation of the Mission Management Team
after-after Challenger solved that problem.

313
00:17:56,560 --> 00:17:59,310
And it worked beautifully throughout the remainder
of the Shuttle program.

314
00:17:59,310 --> 00:18:05,080
I had to get a go from the Mission Management
Team chairman on launch day to-to verify there

315
00:18:05,080 --> 00:18:08,270
were no other issues that were-- that was
bothering anybody...

316
00:18:08,270 --> 00:18:09,270
Host: Great.

317
00:18:09,270 --> 00:18:12,360
Michael Leinbach: ...above and beyond the-the
documented reasons not to fly.

318
00:18:12,360 --> 00:18:13,360
So you have both.

319
00:18:13,360 --> 00:18:16,380
And-and that-and that-- I would argue that's
one of the reasons you're always gonna have

320
00:18:16,380 --> 00:18:18,510
to have a-a-- the human in the loop.

321
00:18:18,510 --> 00:18:23,060
'Cause you-you cannot foresee all possible
reasons not to fly.

322
00:18:23,060 --> 00:18:25,420
You can't-you can't computerize it all.

323
00:18:25,420 --> 00:18:29,470
You need the human in the loop to-to rule
on those things you just didn't think about

324
00:18:29,470 --> 00:18:30,470
before.

325
00:18:30,470 --> 00:18:35,860
Um, so we-we-we fixed-we fixed the technical
issue on the solid rocket booster and we fixed

326
00:18:35,860 --> 00:18:40,390
the management issue of being open with our
discussions and-and listening to dissenting

327
00:18:40,390 --> 00:18:41,390
opinions.

328
00:18:41,390 --> 00:18:46,800
And I would say that worked well, uh, for
about, um, I don't know the number of missions,

329
00:18:46,800 --> 00:18:48,590
but it worked well right after Challenger.

330
00:18:48,590 --> 00:18:53,090
And it-and it kind of eroded over time and
we got ourselves in the-- in-in-in a similar

331
00:18:53,090 --> 00:18:54,900
situation for Columbia.

332
00:18:54,900 --> 00:18:57,160
And I-- we'll get to Columbia, I know.

333
00:18:57,160 --> 00:19:03,511
But the-but the management issues surrounding
the Columbia accident were very similar, from

334
00:19:03,511 --> 00:19:06,390
a decision-making authority, as-as they were
to Challenger.

335
00:19:06,390 --> 00:19:07,390
And that-that's troubling.

336
00:19:07,390 --> 00:19:13,620
Host: I wanna kinda step back a second, because
I am convinced that no one would make a decision

337
00:19:13,620 --> 00:19:17,630
to launch with the knowledge that it was gonna
cost people their lives.

338
00:19:17,630 --> 00:19:20,010
Michael Leinbach: It's called "normalization
of deviance."

339
00:19:20,010 --> 00:19:21,010
Host: Hmm.

340
00:19:21,010 --> 00:19:23,540
Michael Leinbach: We had-we had problems in
flights leading up to Challenger.

341
00:19:23,540 --> 00:19:25,840
Never-never the big problem.

342
00:19:25,840 --> 00:19:33,150
And therefore, uh, they-they normalize that
and assume that it was gonna be okay for Challenger.

343
00:19:33,150 --> 00:19:34,900
Launch Dialogue: TLT, OTC.

344
00:19:34,900 --> 00:19:36,210
Clear caution/warning memory.

345
00:19:36,210 --> 00:19:37,960
Verify no unexpected errors.

346
00:19:37,960 --> 00:19:38,960
OTC, TLT.

347
00:19:38,960 --> 00:19:40,140
That didn't work.

348
00:19:40,140 --> 00:19:42,330
We see no unexpected errors.

349
00:19:42,330 --> 00:19:47,960
Michael Leinbach: We had a specification saying
that you should never scorch an O-ring.

350
00:19:47,960 --> 00:19:48,960

Host: Interesting.

351
00:19:48,960 --> 00:19:52,410
Michael Leinbach: And-and yet we did, and--
but it never caused the big problem, and-and

352
00:19:52,410 --> 00:19:58,800
so we accepted minor scorching to O-rings
as-as-as the new normal.

353
00:19:58,800 --> 00:20:00,320
Fast forward to Columbia.

354
00:20:00,320 --> 00:20:06,601
Uh, we had a specification in the shuttle
program to never impact a tile during ascent--

355
00:20:06,601 --> 00:20:07,900
or landing, for that matter.

356
00:20:07,900 --> 00:20:14,730
But in particular, during ascent, um, we impacted
tiles all the time, but it never got us in-in

357
00:20:14,730 --> 00:20:15,730
trouble.

358
00:20:15,730 --> 00:20:16,790
And-and so we normalized that-that problem.

359
00:20:16,790 --> 00:20:17,790
Host: Yeah.

360
00:20:17,790 --> 00:20:21,990
Michael Leinbach: We had a specification for
zero impact, and we hit tiles all the time.

361
00:20:21,990 --> 00:20:24,240
Host: That-that just, that seems a little

crazy to me.

362
00:20:24,240 --> 00:20:27,960
Like, if there's something else going on too,
other than just like the normalization of

363
00:20:27,960 --> 00:20:28,960
deviance-- there's gotta be.

364
00:20:28,960 --> 00:20:32,840
Michael Leinbach: Well, there-- subconsciously
we were accepting, you know, failure, minor

365
00:20:32,840 --> 00:20:36,890
failures that never turned into the major
failure.

366
00:20:36,890 --> 00:20:40,000
Um, it happened all the time.

367
00:20:40,000 --> 00:20:44,820
Um, there-there were people-- you know, we
discussed [INDISTINCT] tile hits on-on,

368
00:20:44,820 --> 00:20:49,430
uh, missions prior to Columbia, and-and just
accepted the fact that minor hits were-were

369
00:20:49,430 --> 00:20:53,980
just a-a maintenance issue and a turnaround
issue, something, you know, we could handle

370
00:20:53,980 --> 00:20:58,930
back here at KSC, but it would never really
cause a major-a major problem, and-and we

371
00:20:58,930 --> 00:20:59,930
were wrong.

372

00:20:59,930 --> 00:21:01,940
Now, I don't-I don't wanna indict the whole shuttle system.

373
00:21:01,940 --> 00:21:02,940
Host: Sure.

374
00:21:02,940 --> 00:21:05,281
Michael Leinbach: There were other-there were other problems on the shuttle that we-that

375
00:21:05,281 --> 00:21:09,700
we stood down for and fixed, like wire shorts inside the orbiter.

376
00:21:09,700 --> 00:21:10,700
Host: Mm-hmm.

377
00:21:10,700 --> 00:21:13,650
Michael Leinbach: Uh, that-that caused the main engine controller to go out during ascent.

378
00:21:13,650 --> 00:21:19,240
We-we stood down for almost a year and-and fixed tens of thousands of minor little wire

379
00:21:23,410 --> 00:21:20,240
problems.

380
00:21:23,410 --> 00:21:28,750
We didn't fix the O-ring 'til it was too late, and we didn't fix the tile impact issue 'til

381
00:21:28,750 --> 00:21:29,750
it was too late.

382
00:21:29,750 --> 00:21:34,360
Michael Ciannilli : And Mike does a wonderful job explaining that, um, normal-normalization

383
00:21:34,360 --> 00:21:35,550
of deviance.

384
00:21:35,550 --> 00:21:37,400
Um, it's hard, right?

385
00:21:37,400 --> 00:21:41,030
It sounds, in retrospect, easy, right, to
identify something that's different.

386
00:21:41,030 --> 00:21:44,540
I think one thing that makes it hard is life
is constantly changing, right?

387
00:21:44,540 --> 00:21:48,080
That's the only constant, they say, in life
is change you can guarantee-- so-so life is

388
00:21:48,080 --> 00:21:49,200
constantly changing.

389
00:21:49,200 --> 00:21:53,150
We're-we're changing our opinions, our perspectives,
our viewpoints on certain issues.

390
00:21:53,150 --> 00:21:55,000
Our systems are changing.

391
00:21:55,000 --> 00:21:58,140
So-so change is normal, and change is often
good.

392
00:21:58,140 --> 00:22:02,400
I think what makes, uh, normalization of deviance
insidious and difficult to identify at times

393
00:22:02,400 --> 00:22:04,630
is it kinda sneaks behind the good stuff,
right?

394
00:22:04,630 --> 00:22:07,940
So you got-you got change that's normal, and
then you got these little small things that

395
00:22:07,940 --> 00:22:11,340
kinda piggyback or get behind you, and they
kinda creep in.

396
00:22:11,340 --> 00:22:12,340
Host: Yeah, that's really good.

397
00:22:12,340 --> 00:22:16,370
Michael Ciannilli : And-and as people, I humbly
would say our-- in our DNA, we're kind of--

398
00:22:16,370 --> 00:22:19,070
it's kinda goin' against us, right, 'cause
we kind of accept that.

399
00:22:19,070 --> 00:22:20,070
Host: Sure.

400
00:22:20,070 --> 00:22:21,070
Michael Ciannilli : I think all of us can--

401
00:22:21,070 --> 00:22:22,070
Host: We're taught to accept that.

402
00:22:22,070 --> 00:22:23,980
Michael Ciannilli : We're taught to accept
that, and I think all of us can-- and I speak

403
00:22:23,980 --> 00:22:27,770
for myself-- I mean, um, I've had a-- you
know, the point where we call it the-- you

404
00:22:27,770 --> 00:22:30,080
know, the light on your dashboard-- the idiot

light, whatever you wanna call it.

405
00:22:30,080 --> 00:22:31,200
That's been on, right?

406
00:22:31,200 --> 00:22:34,620
And then you-you drive with it for so long,
and then one day that light goes out-- it's

407
00:22:34,620 --> 00:22:35,800
like, well, that's crazy.

408
00:22:35,800 --> 00:22:36,800
The light's out.

409
00:22:36,800 --> 00:22:38,160
Why is the light out?

410
00:22:38,160 --> 00:22:41,730
Well, I would humbly suggest that nobody bought
the car with the light on in the first place,

411
00:22:41,730 --> 00:22:42,730
right?

412
00:22:42,730 --> 00:22:43,730
Host: I hope not.

413
00:22:43,730 --> 00:22:44,730
Michael Ciannilli : But you get so-- I hope
not.

414
00:22:44,730 --> 00:22:46,860
You know, typically that wouldn't happen.

415
00:22:46,860 --> 00:22:47,860
Or that thump in the tire.

416

00:22:47,860 --> 00:22:48,950
The little noise in the engine.

417
00:22:48,950 --> 00:22:53,410
Or something a little off-nominal, but we
get so conditioned and used to as people that

418
00:22:53,410 --> 00:22:54,530
we accept that.

419
00:22:54,530 --> 00:22:56,720
So, um, so it's very sneaky.

420
00:22:56,720 --> 00:23:01,180
So we-we have to apply what-what Mike was
saying, is that strong vigilance to watching

421
00:23:01,180 --> 00:23:06,430
for what is off-nominal, what's that little
bit of difference, recognize it from the normal.

422
00:23:06,430 --> 00:23:10,290
Um, it can be hard over time, um, to identify
that.

423
00:23:10,290 --> 00:23:14,340
Michael Leinbach: And-and it's very difficult
to, uh, to take a-a problem that hasn't caused

424
00:23:14,340 --> 00:23:20,460
a big issue and stand down, in our case, the
shuttle fleet to repair something that hasn't

425
00:23:20,460 --> 00:23:22,590
caused a major problem.

426
00:23:22,590 --> 00:23:23,590
We did it for wires.

427

00:23:23,590 --> 00:23:25,010
We didn't do it for tiles.

428
00:23:25,010 --> 00:23:28,520
Remember, we were in the business to launch,
not-- we weren't in the business to stay on

429
00:23:28,520 --> 00:23:29,520
the launch pad.

430
00:23:29,520 --> 00:23:34,350
We were in the business to launch, and-and
so a-a-as much as-as-- no one would launch

431
00:23:34,350 --> 00:23:37,390
in the face of a known issue that they would
cause loss of life.

432
00:23:37,390 --> 00:23:39,150
That's crazy to even think.

433
00:23:39,150 --> 00:23:42,830
But it's these other issues that-that-- they're
insidious.

434
00:23:42,830 --> 00:23:44,860
That's the best word I've heard.

435
00:23:44,860 --> 00:23:47,870
It-it-it-- they're insidious, and-and twice
it got us in trouble.

436
00:23:47,870 --> 00:23:48,870
Host: Yeah.

437
00:23:48,870 --> 00:23:51,050
Michael Leinbach: A few times it didn't because
we-we listened to the hardware and fixed it

438

00:23:51,050 --> 00:23:52,050
first.

439
00:23:52,050 --> 00:23:53,050
Host: Yeah.

440
00:23:53,050 --> 00:23:58,910
Chachi, you mentioned the idea of fresh workforces,
uh, who may not have memory of Challenger.

441
00:23:58,910 --> 00:24:04,390
And we've kind of talked briefly, kind of
alluded to Columbia, a much more, uh, recent

442
00:24:04,390 --> 00:24:05,490
tragedy for us.

443
00:24:05,490 --> 00:24:10,200
Mike, obviously this is a huge deal for you,
'cause you were launch director at the time,

444
00:24:10,200 --> 00:24:11,200
right?

445
00:24:11,200 --> 00:24:15,090
Michael Leinbach: Well, we'd had, uh, as I
mentioned, we'd had issues with-with impacting

446
00:24:15,090 --> 00:24:20,740
foam and-and, um, different areas of the-of
the launch system during ascent and during

447
00:24:20,740 --> 00:24:26,290
landing, and, uh, and normalized all that
as-as just the-- as the new normal, as the

448
00:24:26,290 --> 00:24:29,320
new norm for-for this-for this vehicle.

449

00:24:29,320 --> 00:24:30,320
This particular launch, it was a, uh, January
morning.

450
00:24:30,320 --> 00:24:31,320
Beautiful launch.

451
00:24:31,320 --> 00:24:32,320
Launch Dialogue: We have booster ignition
and lift-off of Space Shuttle Columbia, with

452
00:24:32,320 --> 00:24:38,780
a multitude of national and international
space research experiments.

453
00:24:38,780 --> 00:24:46,750
Michael Leinbach: We lifted off, and a-a piece
of foam broke off of the external fuel tank

454
00:24:46,750 --> 00:24:52,820
about the size of a carry-on suitcase you
take on-take into a-into an aircraft.

455
00:24:52,820 --> 00:24:57,190
And it hit the leading edge, somewhere-- the
leading edge of the wing, in between the leading

456
00:24:57,190 --> 00:24:59,580
edge and maybe the first row of tiles, something
like that.

457
00:24:59,580 --> 00:25:03,860
We're not quite sure, because we've never
had really good video of where it actually

458
00:25:03,860 --> 00:25:04,860
hit.

459
00:25:04,860 --> 00:25:05,860
Host: Right.

460
00:25:05,860 --> 00:25:08,920
Michael Leinbach: But caused some sort of
a breach in the thermal protection system

461
00:25:08,920 --> 00:25:11,550
that we didn't know how bad it was until reentry.

462
00:25:11,550 --> 00:25:17,240
I mean, we-we talked about that piece of foam
hitting the orbiter throughout the mission,

463
00:25:17,240 --> 00:25:20,360
and accepted that it was going to be a-a turnaround
issue.

464
00:25:20,360 --> 00:25:23,940
We knew we'd probably damage the orbiter to
a certain extent.

465
00:25:23,940 --> 00:25:28,120
We didn't think we'd damage it nearly as-as
badly as we did, obviously, or-or we would've

466
00:25:28,120 --> 00:25:30,160
done something different.

467
00:25:30,160 --> 00:25:35,940
Um, and then during reentry, the-the hot plasma
gas in the upper atmosphere, uh, got inside

468
00:25:35,940 --> 00:25:39,410
the wing and melted the wing from the inside
out.

469
00:25:39,410 --> 00:25:42,770
And-and the astronauts lost control, and-and
the vehicle broke up.

470

00:25:42,770 --> 00:25:44,700
Columbia Comm Dialogue: Flight, INCO.

471
00:25:44,700 --> 00:25:53,740
I didn't expect, uh, this bad of a hit on
comm.

472
00:25:53,740 --> 00:25:55,710
Columbia, Houston.

473
00:25:55,710 --> 00:25:57,670
Comm check.

474
00:25:57,670 --> 00:25:59,640
Columbia, Houston.

475
00:25:59,640 --> 00:26:02,590
UHF comm check.

476
00:26:02,590 --> 00:26:04,559
Columbia, Houston.

477
00:26:04,559 --> 00:26:07,520
UHF comm check.

478
00:26:07,520 --> 00:26:12,440
FDO, when you expecting tracking?

479
00:26:12,440 --> 00:26:16,370
One minute ago, Flight.

480
00:26:16,370 --> 00:26:18,340
GC, Flight.

481
00:26:18,340 --> 00:26:23,260
Flight, GC.
Lock the doors.

482

00:26:23,260 --> 00:26:24,260
Copy.

483
00:26:24,260 --> 00:26:30,850
Michael Leinbach: So we-we knew we had-we
had hit the orbiter with a-with a significant

484
00:26:30,850 --> 00:26:32,810
impact of foam.

485
00:26:32,810 --> 00:26:39,470
Um, people on the ground, engineers that had-had--
it was their job to study ascent film and

486
00:26:39,470 --> 00:26:45,110
video and look for issues, um, their mouths
dropped open.

487
00:26:45,110 --> 00:26:46,640
They knew it was a big hit.

488
00:26:46,640 --> 00:26:52,429
And they tried to get the attention of management
and-and-and to do more about it than we did.

489
00:26:52,429 --> 00:27:00,350
Um, and so sort of like Challenger, where
the engineering teams were overridden, almost--

490
00:27:00,350 --> 00:27:04,820
it was almost that bad, um, for Columbia.

491
00:27:04,820 --> 00:27:09,890
The-the engineering-level folks knew there
were issues, and just couldn't get the attention

492
00:27:09,890 --> 00:27:16,490
of-of management to, uh, to do something extraordinary
in-in the-in the face of the unknown.

493
00:27:16,490 --> 00:27:17,490
And that's what it was.

494
00:27:17,490 --> 00:27:21,429
We didn't know how bad Columbia was-was damaged.

495
00:27:21,429 --> 00:27:25,600
We made a bad assumption that it wasn't damaged
too badly for reentry.

496
00:27:25,600 --> 00:27:28,670
Host: But some people will-will listen to
this and say, "well-well, Mike's the launch

497
00:27:28,670 --> 00:27:29,670
director.

498
00:27:29,670 --> 00:27:31,360
Like, does this fall back on him?"

499
00:27:31,360 --> 00:27:34,691
Can you talk about kind of personally like,
where did you fit in the picture of this,

500
00:27:34,691 --> 00:27:35,691
um, this mission?

501
00:27:35,691 --> 00:27:41,830
Michael Leinbach: Yeah, well, the-the shuttle
system was a-was a-- had a very, very large

502
00:27:41,830 --> 00:27:46,960
management team, and it was basically split
into two: the pre-launch folks and then the

503
00:27:46,960 --> 00:27:49,210
on orbit mission folks.

504

00:27:49,210 --> 00:27:55,090
And-and, um, so we were responsible here at
the Kennedy Space Center to prepare the orbiters

505
00:27:55,090 --> 00:27:59,160
and the external tank and the solid rocket
boosters for launch.

506
00:27:59,160 --> 00:28:02,350
I was responsible for giving the final go
for launch.

507
00:28:02,350 --> 00:28:07,730
Um, as soon as we lifted off on launch day,
then responsibility for the mission shifted

508
00:28:07,730 --> 00:28:11,780
to the Johnson Space Center and the flight
control team out of JSC.

509
00:28:11,780 --> 00:28:17,049
Launch Dialogue: Houston now controlling the
flight of Columbia, the international research

510
00:28:17,049 --> 00:28:18,370
mission, finally underway.

511
00:28:18,370 --> 00:28:23,210
Michael Leinbach: And at that shift in responsibility,
the folks here at KSC, we were done.

512
00:28:23,210 --> 00:28:27,390
We were done with Columbia's mission, essentially,
and we were looking forward to its next mission.

513
00:28:27,390 --> 00:28:31,470
We were going to modify Columbia after it
came home to be able to fly 'til 2020.

514
00:28:31,470 --> 00:28:32,470

Host: Wow, wow.

515
00:28:32,470 --> 00:28:35,840
Michael Leinbach: So we were lookin' forward
to Columbia comin' home and flying, uh, a

516
00:28:35,840 --> 00:28:38,030
good number of more years.

517
00:28:38,030 --> 00:28:45,799
Um, so with that shift in-in technical responsibility
for the-for the-for the mission came a shift

518
00:28:45,799 --> 00:28:49,730
in management responsibility as well, and
that-and that-- this group called the Mission

519
00:28:49,730 --> 00:28:56,090
Management team, we met, uh, pre-launch here
to-to study issues, make sure we were good

520
00:28:56,090 --> 00:28:57,950
to fly in the first place.

521
00:28:57,950 --> 00:29:02,060
And then during the mission, they met, and
it was some-some of the same people, but different

522
00:29:02,060 --> 00:29:04,840
people as well on the Mission Management team.

523
00:29:04,840 --> 00:29:10,420
They would review issues during the mission
and resolve issues as best they could while

524
00:29:10,420 --> 00:29:13,130
the orbiter is-is circling the Earth.

525
00:29:13,130 --> 00:29:20,200

Um, and so I don't-I don't wanna cast any
kind of-any kind of responsibility, um, aspersions

526
00:29:20,200 --> 00:29:21,820
here at all.

527
00:29:21,820 --> 00:29:28,610
Um, the management process failed, and too
many people assumed that the damage wasn't

528
00:29:28,610 --> 00:29:30,340
as bad as it was.

529
00:29:30,340 --> 00:29:34,610
And we concluded so, and told the commander,
"you're gonna be fine to come home."

530
00:29:34,610 --> 00:29:41,530
And we just-we just, as a group, made a wrong
decision, a wrong assumption, and it-it cost

531
00:29:41,530 --> 00:29:42,530
us.

532
00:29:42,530 --> 00:29:43,680
It cost seven folks.

533
00:29:43,680 --> 00:29:50,920
Speaker: Today we honor and remember seven
of my friends.

534
00:29:50,920 --> 00:30:03,070
Rick Husband, Willie McCool, Mike Anderson,
Laurel Clark, Dave Brown, Ilan Ramon, and

535
00:30:03,070 --> 00:30:06,810
Kalpana Chawla, or KC.

536
00:30:06,810 --> 00:30:13,870

Host: Chachi, I'm sure this, like a number
of tragic events in human history, is one

537
00:30:13,870 --> 00:30:17,549
of those moments, especially for the NASA
family, where you know where you were.

538
00:30:17,549 --> 00:30:19,500
Uh, you remember that moment vividly.

539
00:30:19,500 --> 00:30:25,440
Um, so where-where are you at your career
in this time, um, kind of with our NASA family?

540
00:30:25,440 --> 00:30:27,760
Michael Ciannilli : I was, uh, working for
United Space Alliance.

541
00:30:27,760 --> 00:30:28,880
It was before I joined NASA.

542
00:30:28,880 --> 00:30:31,450
And, uh, was actually, uh, working on Columbia.

543
00:30:31,450 --> 00:30:33,550
I was on Columbia's team, engineering team.

544
00:30:33,550 --> 00:30:38,440
Um, so my role back then, um, I was getting
ready to receive Columbia.

545
00:30:38,440 --> 00:30:41,470
So as Mike said, you know, the vehicles were-were
different states.

546
00:30:41,470 --> 00:30:44,700
Um, I was looking forward to Columbia coming
home after the mission.

547

00:30:44,700 --> 00:30:48,300
Um, it was gonna be rolling in to the Orbiter
Processing Facility, which is our big garage.

548
00:30:48,300 --> 00:30:51,940
So when we-we get her home, uh, we process
the vehicle and, you know, get all the fuels

549
00:30:51,940 --> 00:30:54,780
off and get her turned around to get ready
for its next flight.

550
00:30:54,780 --> 00:30:59,020
So I was actually, um, uh, pre-staging a sleep
pattern 'cause I had to work throughout the

551
00:30:59,020 --> 00:31:04,350
following night to help offload the cryogenics
off the vehicle, um, and the fuel cell systems.

552
00:31:04,350 --> 00:31:06,160
So I was preparing for that.

553
00:31:06,160 --> 00:31:07,200
It was, um, shock.

554
00:31:07,200 --> 00:31:09,370
I mean, it was shock in a lot of ways.

555
00:31:09,370 --> 00:31:11,790
There was discussions I had heard, a bunch
of us heard.

556
00:31:11,790 --> 00:31:15,790
Um, of course, we're at KSC, as Mike had mentioned,
at Kennedy Space Center, so perhaps a little

557
00:31:15,790 --> 00:31:19,990
removed from some of the conversations, but
I do remember conversations of a foam strike.

558
00:31:19,990 --> 00:31:24,640
Um, and you know, this is such an amazing
team, such a diverse team.

559
00:31:24,640 --> 00:31:26,179
Different folks are workin' different problems.

560
00:31:26,179 --> 00:31:31,270
So-so our focus was not only on getting Columbia
ready to come home, but we also had Discovery,

561
00:31:31,270 --> 00:31:32,490
Endeavor and Atlantis to work on.

562
00:31:32,490 --> 00:31:33,490
Host: Yeah.

563
00:31:33,490 --> 00:31:34,490
Michael Ciannilli : So they're getting ready.

564
00:31:34,490 --> 00:31:35,490
Host: Yeah.

565
00:31:35,490 --> 00:31:39,040
Michael Ciannilli : So our focus is-is multi-focus
on different vehicles, so it wasn't-- didn't

566
00:31:39,040 --> 00:31:40,040
appear any different.

567
00:31:40,040 --> 00:31:42,460
Columbia's coming home tonight-- or coming
home this morning.

568
00:31:42,460 --> 00:31:47,060
Uh, we're gonna start processing her tonight,
and we're gonna run to a-a full launch, uh,

569
00:31:47,060 --> 00:31:48,309
for the vehicle, hopefully.

570
00:31:48,309 --> 00:31:53,179
So, um, so when this tragic moment happened--
I can speak personally-- it was a tremendous

571
00:31:53,179 --> 00:31:55,920
shock, um, shock to the system.

572
00:31:55,920 --> 00:31:59,160
It-it-it's met with something I'll never wanna
experience again.

573
00:31:59,160 --> 00:32:01,010
Um, it's a horrific feeling.

574
00:32:01,010 --> 00:32:07,210
Um, it's an emotional experience, uh, that
you go through, um, and you go through a lot

575
00:32:07,210 --> 00:32:08,600
of emotional feelings.

576
00:32:08,600 --> 00:32:13,520
Um, you know, you go through your pain, you
go through, uh, the devastating loss.

577
00:32:13,520 --> 00:32:16,280
Um, Mike touched on it very well-- for responsibility.

578
00:32:16,280 --> 00:32:18,770
I think all of us felt responsible.

579
00:32:18,770 --> 00:32:21,510
Um, I kept thinking of what didn't I sign?

580
00:32:21,510 --> 00:32:23,570

What paper did I sign that I shouldn't have?

581
00:32:23,570 --> 00:32:24,570
What did I do?

582
00:32:24,570 --> 00:32:25,730
And-and I think that was pretty systemic.

583
00:32:25,730 --> 00:32:29,790
We all loved the crew, we all loved the vehicles,
and treat them as our family members.

584
00:32:29,790 --> 00:32:35,790
So when this happened, our first responsibility,
I think, we felt was what did we do wrong?

585
00:32:35,790 --> 00:32:37,390
What could we have done better?

586
00:32:37,390 --> 00:32:42,980
That's the sense of bonding that the program
and the team has for what they do.

587
00:32:42,980 --> 00:32:48,880
Host: So you would say that the immediate
response is not whose job was this to get

588
00:32:48,880 --> 00:32:51,080
this right-- it's like, where did I mess up?

589
00:32:51,080 --> 00:32:52,080
Michael Ciannilli : Right, right.

590
00:32:52,080 --> 00:32:53,660
Host: And that's commonplace for people in
this moment?

591
00:32:53,660 --> 00:32:56,150
Michael Ciannilli : You know, I can speak

from my experience and talking to others.

592
00:32:56,150 --> 00:32:58,210
I think it was pretty widely felt.

593
00:32:58,210 --> 00:33:02,140
I mean, there's such a sense of ownership
of responsibility, and love.

594
00:33:02,140 --> 00:33:03,560
I mean, you think about this.

595
00:33:03,560 --> 00:33:04,780
We know the crews.

596
00:33:04,780 --> 00:33:05,890
We get to know the crews.

597
00:33:05,890 --> 00:33:08,260
Um, they become part of our extended family.

598
00:33:08,260 --> 00:33:12,010
And in a way-- and this may sound a little
bit unusual, but, um, anybody that works on

599
00:33:12,010 --> 00:33:15,000
hardware can probably attest to this-- the
vehicles became part of our family.

600
00:33:15,000 --> 00:33:20,470
I mean, I probably spent more time with Columbia,
um, onboard Columbia and living with Columbia,

601
00:33:20,470 --> 00:33:22,680
than I did with members of my own family at
times.

602
00:33:22,680 --> 00:33:23,680
Host: Yeah.

603
00:33:23,680 --> 00:33:25,720
Michael Ciannilli : I mean, you were there
working the vehicle.

604
00:33:25,720 --> 00:33:27,370
Um, it was part of your family.

605
00:33:27,370 --> 00:33:33,390
And it was-it was part-- so you felt a tremendous
sense of not only loss, but ownership of it's

606
00:33:33,390 --> 00:33:34,390
me, it's me.

607
00:33:34,390 --> 00:33:37,679
And I think that's what-- one of the things
that makes this team so amazing, is that sense

608
00:33:37,679 --> 00:33:40,940
of ownership of I'm gonna do my job the best
I can.

609
00:33:40,940 --> 00:33:46,130
I'm gonna take responsibility and a sense
of p-pride and-and ownership of doing the

610
00:33:46,130 --> 00:33:47,130
right thing.

611
00:33:47,130 --> 00:33:49,929
Michael Leinbach: You know, the-the people
that worked on the-on the orbiters, and the

612
00:33:49,929 --> 00:33:55,410
tank, and the boosters, and the ground systems--
an amazing group of people.

613
00:33:55,410 --> 00:34:00,290

And-and they-they would do anything they could
to make the crew as safe as they possibly

614
00:34:00,290 --> 00:34:01,290
could be.

615
00:34:01,290 --> 00:34:05,140
And-and the astronauts would walk around and
shake hands and talk about their kids.

616
00:34:05,140 --> 00:34:06,140
Host: Cool, awesome.

617
00:34:06,140 --> 00:34:09,960
Michael Leinbach: And what college did they
go to, and-and, uh, you know, "let's go out

618
00:34:09,960 --> 00:34:12,869
for a beer tonight after work," and things
like that.

619
00:34:12,869 --> 00:34:17,040
And so, when Chachi says we got to know the
crew and love them, that is absolutely the

620
00:34:17,040 --> 00:34:18,040
truth.

621
00:34:18,040 --> 00:34:23,339
And-and it-it created that atmosphere around
the space center of we would do-- we would

622
00:34:23,339 --> 00:34:27,919
go to the-to the extreme to make sure that
vehicle's as best as it could be.

623
00:34:27,919 --> 00:34:28,919
Host: Yeah.

624

00:34:28,919 --> 00:34:31,829
Michael Leinbach: And then when we lost Columbia,
we were just empty.

625
00:34:31,829 --> 00:34:34,179
I mean, I was standin' next to the runway.

626
00:34:34,179 --> 00:34:38,349
And-- as my job as the launch director, I
was one of the few lucky folks who got to

627
00:34:38,349 --> 00:34:41,629
greet the crew when they came off the orbiter,
and shake their hands, and welcome 'em back

628
00:34:41,629 --> 00:34:46,089
to Earth, and, you know, put my arm around
'em and steady 'em a little bit, and-and-and

629
00:34:46,089 --> 00:34:50,159
there we were, waiting for Columbia to come
home, and it just didn't come home.

630
00:34:50,159 --> 00:34:52,010
And we didn't know where it was.

631
00:34:52,010 --> 00:34:56,649
We-we just didn't know where it was, and-and
the emptiness-- and it couldn't have landed

632
00:34:56,649 --> 00:34:59,539
in anywhere else safely, and-and intellectually,
we knew that.

633
00:34:59,539 --> 00:35:00,539
Host: Right.

634
00:35:00,539 --> 00:35:03,210
Michael Leinbach: And so we knew the worst
had happened.

635
00:35:03,210 --> 00:35:09,400
Um, but we just didn't have any information
about what had happened at first.

636
00:35:09,400 --> 00:35:15,319
And it was just a totally empty feeling.

637
00:35:15,319 --> 00:35:24,859
Host: So as we look at things like the future
with reusable hardware, are we creeping towards

638
00:35:24,859 --> 00:35:26,609
the same kind of failure, or are we smarter?

639
00:35:26,609 --> 00:35:27,609
Are we better?

640
00:35:27,609 --> 00:35:32,869
Michael Leinbach: From my perspective, the
problem we fell into in the shuttle program

641
00:35:32,869 --> 00:35:38,650
is the normalization of deviance-- was-was
based as much in human nature as-as it was

642
00:35:38,650 --> 00:35:39,970
the hardware itself.

643
00:35:39,970 --> 00:35:44,349
We-we got to a point where we got comfortable
with our success.

644
00:35:44,349 --> 00:35:47,509
We got, to a degree, overconfident.

645
00:35:47,509 --> 00:35:48,509
We got complacent.

646
00:35:48,509 --> 00:35:57,309
And-and those-those, um, traits, those feelings,
those issues, those, uh, characteristics,

647
00:35:57,309 --> 00:35:59,619
they-they-they're not unique to the shuttle
program.

648
00:35:59,619 --> 00:36:01,650
They're not unique to the Apollo program.

649
00:36:01,650 --> 00:36:04,410
They-they're not unique to Challenger or Columbia.

650
00:36:04,410 --> 00:36:09,730
They are human traits that the new entrants
are gonna have to deal with.

651
00:36:09,730 --> 00:36:10,730
Host: Yeah.

652
00:36:10,730 --> 00:36:15,410
Michael Leinbach: There are-there are people
that are re-flying hardware now, and they're

653
00:36:15,410 --> 00:36:21,440
gonna have to deal with these issues of-of,
uh, minor problems-- re-flying minor problems

654
00:36:21,440 --> 00:36:24,420
and assuming they're gonna be a minor problem
the next time.

655
00:36:24,420 --> 00:36:26,190
They're gonna have to deal with that.

656
00:36:26,190 --> 00:36:28,650
That's-that's the nature of hardware.

657
00:36:28,650 --> 00:36:33,440
The nature of the people dealing with it--
you've got to dig deep and-and make sure that

658
00:36:33,440 --> 00:36:37,960
when you give a go, or-or you disposition
a problem as not a major issue, that you've

659
00:36:37,960 --> 00:36:43,619
thought of everything possible-- all the different
ways it could fail, beyond the way it-it just--

660
00:36:43,619 --> 00:36:45,349
the way it just failed this time.

661
00:36:45,349 --> 00:36:49,089
You have to prove these-these vehicles are
safe to fly.

662
00:36:49,089 --> 00:36:50,089
Host: Yeah.

663
00:36:50,089 --> 00:36:53,840
Michael Leinbach: Every time you-you go to
a-a review, whether it's a minor review or

664
00:36:53,840 --> 00:36:58,859
a major review, you have to prove it's safe
to fly-- not prove it's unsafe to fly.

665
00:36:58,859 --> 00:37:00,460
You have to prove it's safe to fly.

666
00:37:00,460 --> 00:37:06,930
And by-and by insisting on that mindset, it
makes you delve into the systems and the problems

667
00:37:06,930 --> 00:37:12,849
even more deeply, and it makes you think about,

well, what-what could go wrong if this-if

668
00:37:12,849 --> 00:37:15,900
this minor problem occurred again?

669
00:37:15,900 --> 00:37:18,010
How-how could it manifest itself on the next
flight?

670
00:37:18,010 --> 00:37:22,119
Could it be the major problem, or will it
be the same outcome that you just experienced?

671
00:37:22,119 --> 00:37:28,729
You-you have to prove it's safe to fly, and-and
in doing so, it makes you dive into every-every

672
00:37:28,729 --> 00:37:34,140
system as deeply on the third flight of a-of
a vehicle, or the tenth flight of a vehicle,

673
00:37:34,140 --> 00:37:35,960
or the first flight of a vehicle.

674
00:37:35,960 --> 00:37:38,760
You-you-you just need to prove it's safe to
go every time.

675
00:37:38,760 --> 00:37:39,760
Launch Dialogue: You're clear to launch.

676
00:37:39,760 --> 00:37:40,760
I copy that.

677
00:37:40,760 --> 00:37:41,760
Thank you, sir.

678
00:37:41,760 --> 00:37:42,760
And attention, all personnel.

679
00:37:42,760 --> 00:37:46,499
The countdown clock will resume in 30 seconds.

680
00:37:46,499 --> 00:37:52,229
Host: Is there a sense to where becoming emotionally
attached to a vehicle-- does that make you

681
00:37:52,229 --> 00:37:54,450
smarter, does that make you sharper?

682
00:37:54,450 --> 00:37:56,789
Or does that-does that cloud your judgment?

683
00:37:56,789 --> 00:37:58,920
Michael Leinbach: Hmm, that's a great question.

684
00:37:58,920 --> 00:37:59,920
Um...

685
00:37:59,920 --> 00:38:02,820
Host: Might be a little bit ambiguous, kinda
existential question.

686
00:38:02,820 --> 00:38:04,960
Michael Leinbach: No, I-I get it.

687
00:38:04,960 --> 00:38:07,520
It probably hurts more than helps.

688
00:38:07,520 --> 00:38:13,460
I mean, we-we described how much we loved
the-the orbiters, and that's true, but we

689
00:38:13,460 --> 00:38:17,450
also-- it probably clouds our-our vision a
bit.

690

00:38:17,450 --> 00:38:22,130
I-I-I-- you should stand back-- when-when
you're looking at a space flight and putting

691
00:38:22,130 --> 00:38:27,289
astronaut lives on the line, you need to-you
need to separate the emotions out and look

692
00:38:27,289 --> 00:38:31,109
at the technical aspects and make sure you
have done absolutely everything you could

693
00:38:31,109 --> 00:38:35,770
possibly do to make it safe, regardless of
how-how cool it is, or how-how much you like

694
00:38:35,770 --> 00:38:37,049
the machine or anything else.

695
00:38:37,049 --> 00:38:39,119
You've gotta prove it's safe to go every time.

696
00:38:39,119 --> 00:38:44,769
I think getting into the emotion of-of-of
loving the machines and working with the machines,

697
00:38:44,769 --> 00:38:46,729
that-that's just j-- that's more job satisfaction.

698
00:38:46,729 --> 00:38:47,729
Host: Hmm, sure.

699
00:38:47,729 --> 00:38:50,740
Michael Leinbach: When it comes down to it,
you've got to-you've got to give a go or no

700
00:38:50,740 --> 00:38:52,030
go based on-on data.

701

00:38:52,030 --> 00:38:53,030
Host: Yeah.

702
00:38:53,030 --> 00:38:55,089
Michael Leinbach: And then, ultimately, machines
can break.

703
00:38:55,089 --> 00:39:00,400
I mean, and you can-you can have all the best
processes and management reviews and hardware

704
00:39:00,400 --> 00:39:03,609
in the world, and ultimately it's a machine
and it can break.

705
00:39:03,609 --> 00:39:07,829
And in that-in that circumstance, well, you
did all you could, and-and-and there you are.

706
00:39:07,829 --> 00:39:08,829
Host: Sure.

707
00:39:08,829 --> 00:39:12,320
Michael Ciannilli : Yeah, and Mike said it
very well-- I mean, I think a sense of humility,

708
00:39:12,320 --> 00:39:17,660
uh, into what we're doing-- I mean, you know,
when you think about it, um, and Mike alluded

709
00:39:17,660 --> 00:39:19,170
to this before, it's like a-a ship.

710
00:39:19,170 --> 00:39:20,979
You know, ships weren't made to sit in port.

711
00:39:20,979 --> 00:39:24,559
The only place-- safe place for a ship is
to sit in port at the dock.

712
00:39:24,559 --> 00:39:26,460
Uh, but we don't do that, right?

713
00:39:26,460 --> 00:39:28,890
Our-our car in our garage is the safest place
for it.

714
00:39:28,890 --> 00:39:31,489
Well, we-we take the car every day and go
to the grocery store and places.

715
00:39:31,489 --> 00:39:36,240
So-so we're meant to use vehicles to explore
and to go places, and-and, uh, discover things.

716
00:39:36,240 --> 00:39:38,950
So-so we have to accept that risk.

717
00:39:38,950 --> 00:39:42,849
And-and Mike also touched on a thing which
was very poignant, was the, um, the fact that

718
00:39:42,849 --> 00:39:44,589
it's-it's the people equation.

719
00:39:44,589 --> 00:39:45,589
It's in our DNA.

720
00:39:45,589 --> 00:39:49,930
Our DNA, um, you know, we have good flaws,
and we have potential challenges in our DNA.

721
00:39:49,930 --> 00:39:53,489
We have to realize that, um, to get through
it.

722
00:39:53,489 --> 00:39:57,720
Michael Leinbach: And I get asked a lot, "what--
Mike, what are-what are-what are the major

723
00:39:57,720 --> 00:39:59,619
lessons learned from the space shuttle program?"

724
00:39:59,619 --> 00:40:03,079
And I kinda boil it down to-to two.

725
00:40:03,079 --> 00:40:08,650
Um, one is-is kind of-kind of just technical--
it-it-it taught us how to live and work in

726
00:40:08,650 --> 00:40:11,380
low Earth orbit for two weeks at a time.

727
00:40:11,380 --> 00:40:16,059
Um, it was-it was the next evolutionary step
in America's manned space flight program to

728
00:40:16,059 --> 00:40:19,430
an international space station, and then eventually
beyond.

729
00:40:19,430 --> 00:40:23,430
But it-it was the first vehicle that taught
us how to live and work in low-Earth orbit

730
00:40:23,430 --> 00:40:25,349
for two weeks at a time.

731
00:40:25,349 --> 00:40:29,589
More so than that, it was the first reusable
spacecraft in the world.

732
00:40:29,589 --> 00:40:34,849
Um, you look back to Mercury, Gemini and Apollo--
every astronaut that flew those vehicles flew

733
00:40:34,849 --> 00:40:37,869
in a brand new spacecraft on a brand new rocket.

734
00:40:37,869 --> 00:40:39,029
One time use each, period.

735
00:40:39,029 --> 00:40:40,029
Host: Yeah.

736
00:40:40,029 --> 00:40:41,349
Michael Leinbach: Shuttle changed all that.

737
00:40:41,349 --> 00:40:44,869
We-we-we dealt with reusability for the first
time.

738
00:40:44,869 --> 00:40:49,809
And we dealt with it extremely well in s--
in most circumstances, and we-and we dealt

739
00:40:49,809 --> 00:40:52,960
with it poorly in-in at least two major circumstances.

740
00:40:52,960 --> 00:40:58,880
And-and we have all those lessons learned
and, uh, experiences to pass on to the next-the

741
00:40:58,880 --> 00:41:01,290
next generation of-of space flight providers.

742
00:41:01,290 --> 00:41:03,519
And I-I just hope they ask us.

743
00:41:03,519 --> 00:41:05,589
And I know they are, to an extent.

744
00:41:05,589 --> 00:41:11,309
Um, I-- we have a lot to share, and, uh, we
ought to share it all together, not just in

745

00:41:11,309 --> 00:41:15,441
the-in the United States, but internationally,
as Chachi says, and you know, we-we-we owe

746
00:41:15,441 --> 00:41:19,470
it to the astronauts to do everything we possibly
can to make their flight safe.

747
00:41:19,470 --> 00:41:23,990
And-and that-- part of that is talking about
problems with other systems, and-and, uh,

748
00:41:23,990 --> 00:41:28,759
and-and understanding what-- how other systems
got themselves in the-- in binds along the

749
00:41:28,759 --> 00:41:30,450
way.

750
00:41:30,450 --> 00:41:36,299
And I just-I just really hope we can share
both with the-with the-- our corporate partners

751
00:41:36,299 --> 00:41:38,460
here in America and internationally.

752
00:41:38,460 --> 00:41:43,091
It's-- there's-there's no- there's no better
lesson learned than-than sharing the lessons

753
00:41:43,091 --> 00:41:47,719
learned we have from shuttle, and-and the
rest of America's space flight history.

754
00:41:47,719 --> 00:41:52,700
Host: Chachi, I wanna ask you, kinda thinking
about the future, as we're kinda talking through

755
00:41:52,700 --> 00:41:58,099
these challenges, how are you, as part of

this program you're working on, conveying

756
00:41:58,099 --> 00:42:04,790
this necessity of-of evaluating good and bad
change to people?

757
00:42:04,790 --> 00:42:09,829
Working SLS, Space Launch System, and the
commercial crew program, as well as our commercial

758
00:42:09,829 --> 00:42:16,789
crew partners, because now we're expanding
beyond NASA people into other companies, where

759
00:42:16,789 --> 00:42:20,670
we can't dictate culture, we can't dictate
a lot of what they do.

760
00:42:20,670 --> 00:42:25,469
Uh, we have specific requirements, but we
have to influence more than-than control.

761
00:42:25,469 --> 00:42:28,779
So how-how are you kind of approaching that
with the people you speak with?

762
00:42:28,779 --> 00:42:32,910
Michael Ciannilli : You pose a great question,
Josh, is how do you reach out to industry?

763
00:42:32,910 --> 00:42:36,039
It's a new relationship with NASA, it's a
new future with us, with-- you know, it's-it's

764
00:42:36,039 --> 00:42:37,039
their rocket.

765
00:42:37,039 --> 00:42:38,089
We're buying services on it.

766
00:42:38,089 --> 00:42:43,700
Um, so we, of course, have, um, we have a
relationship with them through our commercial

767
00:42:43,700 --> 00:42:44,700
crew offices.

768
00:42:44,700 --> 00:42:46,790
Um, so we have input, to some degrees.

769
00:42:46,790 --> 00:42:51,460
Um, but what we try to do is saying, "we wanna
share our past with you.

770
00:42:51,460 --> 00:42:54,010
We wanna share the good stuff, we wanna share
the bad stuff.

771
00:42:54,010 --> 00:42:57,849
We humbly suggest you don't do the bad stuff,
but you do the good stuff."

772
00:42:57,849 --> 00:42:58,849
And we have a lot to give.

773
00:42:58,849 --> 00:43:01,410
You know, NASA has this amazing history of--

774
00:43:01,410 --> 00:43:02,410
Host: Yeah.

775
00:43:02,410 --> 00:43:03,710
Michael Ciannilli : A massive amount of knowledge.

776
00:43:03,710 --> 00:43:06,940
We wanna share that with the folks, 'cause
you want all these companies to be so successful

777

00:43:06,940 --> 00:43:08,880
they take us even further.

778
00:43:08,880 --> 00:43:11,910
So it's more of a here's what we have to offer
for you.

779
00:43:11,910 --> 00:43:15,900
We're not asking anything in return, except
for take the good stuff, don't take the bad

780
00:43:15,900 --> 00:43:17,729
stuff, and go further than we went.

781
00:43:17,729 --> 00:43:18,819
That's our hope.

782
00:43:18,819 --> 00:43:24,339
Host: --about competition between partners,
between commercial and government.

783
00:43:24,339 --> 00:43:26,749
The way you speak about it, this doesn't sound
like a competition.

784
00:43:26,749 --> 00:43:29,390
How-how do you evaluate the current state
of things?

785
00:43:29,390 --> 00:43:33,429
Michael Ciannilli : Well, um… you know,
that's a good question.

786
00:43:33,429 --> 00:43:34,429
[LAUGHTER]

787
00:43:34,429 --> 00:43:35,450
Michael Leinbach: Yeah, Chachi.

788

00:43:35,450 --> 00:43:38,499
Michael Ciannilli : You know-- thanks for
that one, Josh.

789
00:43:38,499 --> 00:43:39,849
Um, Mike, you wanna-- no.

790
00:43:39,849 --> 00:43:40,849
Michael Leinbach: No.

791
00:43:40,849 --> 00:43:44,299
Michael Ciannilli : Um, well, to be perfectly
honest, you know, there's different providers

792
00:43:44,299 --> 00:43:46,410
that wanna provide different services, right?

793
00:43:46,410 --> 00:43:51,869
So-so NASA wants to provide a service-- exploration,
deep exploration, deep space exploration.

794
00:43:51,869 --> 00:43:55,609
Of course, if you're providing a rocket service,
you wanna be the rocket provider on record,

795
00:43:55,609 --> 00:43:56,609
right?

796
00:43:56,609 --> 00:43:58,819
They wanna sell their services and provide
a service to the nation.

797
00:43:58,819 --> 00:44:03,420
Um, so I don't know if one could say, um--
you know, in a perfect world, we wouldn't

798
00:44:03,420 --> 00:44:08,740
see it as competition, um, but being-- but
looking at the world the way it is, we're

799
00:44:08,740 --> 00:44:11,759
tryin' to say, hey, we want a-a rising tide
lifts all boats approach.

800
00:44:11,759 --> 00:44:12,759
Host: Sure, yeah.

801
00:44:12,759 --> 00:44:16,489
Michael Ciannilli : Where if we can help this
company A, company B's going to help, and

802
00:44:16,489 --> 00:44:20,730
if company A opens up about some challenges
they're having, company B would be successful,

803
00:44:20,730 --> 00:44:22,160
and vice versa, right?

804
00:44:22,160 --> 00:44:24,769
Somebody else has a bad day, and they help
somebody else out.

805
00:44:24,769 --> 00:44:29,680
So, um, it's an approach of we all help each
other be successful, 'cause the bottom line,

806
00:44:29,680 --> 00:44:33,999
I'd humbly suggest, what NASA really wants
to do is we want America to be successful,

807
00:44:33,999 --> 00:44:34,999
right?

808
00:44:34,999 --> 00:44:35,999
Host: Yeah, absolutely.

809
00:44:35,999 --> 00:44:38,349
Michael Ciannilli : And our international
partners, so we want all of us to do great

810
00:44:38,349 --> 00:44:42,720
things in space, um, and that's our mission
with the program, is NASA plus commercial.

811
00:44:42,720 --> 00:44:46,880
You know, when we look back and-and look at
some of the accidents that the, um, the Russians

812
00:44:46,880 --> 00:44:52,670
had in the '60s, and we look back at some
of the incidents we had, in retrospect-- it

813
00:44:52,670 --> 00:44:55,890
would've been wonderful at the time, right--
it was a different situation with the Cold

814
00:44:55,890 --> 00:44:56,890
War, but--

815
00:44:56,890 --> 00:44:57,890
Host: Sure.

816
00:44:57,890 --> 00:44:58,960
Michael Ciannilli : It would've been wonderful
if we had some insight into what the Russians

817
00:44:58,960 --> 00:44:59,960
were facing.

818
00:44:59,960 --> 00:45:00,960
Host: Right.

819
00:45:00,960 --> 00:45:03,349
Michael Ciannilli : Some of the face-- the
issues we face on Apollo 1, they had seen

820
00:45:03,349 --> 00:45:05,239
similar things during their programs.

821
00:45:05,239 --> 00:45:06,239
Host: Wow.

822
00:45:06,239 --> 00:45:08,210
Michael Ciannilli : So we could've learned
a lot and vice versa-- we probably could've

823
00:45:08,210 --> 00:45:11,019
supplied information to them-- of course,
that wasn't the environment.

824
00:45:11,019 --> 00:45:13,259
So now we're not in, uh, that type of environment.

825
00:45:13,259 --> 00:45:15,910
So we're tryin' to show-- everybody helps
each other out.

826
00:45:15,910 --> 00:45:17,970
Host: So we're just about out of time.

827
00:45:17,970 --> 00:45:19,660
Uh, appreciate you guys being here.

828
00:45:19,660 --> 00:45:25,690
We've got some of the best and brightest minds
working on human space flight systems.

829
00:45:25,690 --> 00:45:26,690
How do you guys feel about that?

830
00:45:26,690 --> 00:45:29,829
Are you guys optimistic about us pressing
on for exploration?

831
00:45:29,829 --> 00:45:35,160
Michael Leinbach: Personally, extremely optimistic
about it, and-and-and I sit back and I watch

832
00:45:35,160 --> 00:45:38,309
the great things goin' on out here at the
Kennedy Space Center and around the country

833
00:45:38,309 --> 00:45:43,219
with the-with, uh, both the NASA launch systems
and the commercial launch systems, and we're

834
00:45:43,219 --> 00:45:47,190
about ready to start flying astronauts back
to the international space station on American

835
00:45:47,190 --> 00:45:49,529
rockets off American soil again.

836
00:45:49,529 --> 00:45:54,700
I'm extremely confident that that will occur
safely, and I'm very optimistic about it.

837
00:45:54,700 --> 00:46:00,140
Y-you know, the thing that's true about-about
failure is you learn a lot from failures.

838
00:46:00,140 --> 00:46:02,349
And-and we did, in the space shuttle program.

839
00:46:02,349 --> 00:46:08,069
And, um, a-as long as we keep our eyes open
and-and don't repeat the same failures we

840
00:46:08,069 --> 00:46:14,469
had in the past, we're-we're that much closer
to having a-a-a much safer system, and, uh--

841
00:46:14,469 --> 00:46:19,299
and with the designs of the new systems being
less complicated and inherently safer, and

842

00:46:19,299 --> 00:46:22,499
with escapability, man, I-I'm all over it.

843
00:46:22,499 --> 00:46:26,619
They're-they're-they're gonna do great things,
and I'm-I'm gonna be the first one to cheer

844
00:46:26,619 --> 00:46:29,849
when we have a lift-off and a safe-- and a
safe landing of the next crews.

845
00:46:29,849 --> 00:46:31,109
Host: Yeah, I'll be with you.

846
00:46:31,109 --> 00:46:32,290
Michael Ciannilli : And I concur with Mike.

847
00:46:32,290 --> 00:46:35,619
I think, um, we got a beautiful opportunity
ahead of us.

848
00:46:35,619 --> 00:46:36,619
Um, exciting future.

849
00:46:36,619 --> 00:46:39,559
Um, you know, the president just said we're
going back to the Moon.

850
00:46:39,559 --> 00:46:40,559
We're going to stay.

851
00:46:40,559 --> 00:46:41,559
I think that's exciting.

852
00:46:41,559 --> 00:46:42,890
From, there, we're going on to Mars.

853
00:46:42,890 --> 00:46:47,480
I mean, there's just so many cool things coming

down the pike, um, that we're very excited

854
00:46:47,480 --> 00:46:48,480
about.

855
00:46:48,480 --> 00:46:52,829
And even-- you know, this is a very difficult
conversation we've had today, but I-I'd humbly

856
00:46:52,829 --> 00:46:57,130
suggest there's also a beautiful silver lining
in the conversation as well, because, uh,

857
00:46:57,130 --> 00:47:01,309
Mike and I, along with, you know, thousands
of other folks, lived through a very dark

858
00:47:01,309 --> 00:47:02,309
time.

859
00:47:02,309 --> 00:47:04,289
And we still have those-those dark feelings
and moments.

860
00:47:04,289 --> 00:47:10,210
But, um, I think of the-the Challenger story
now, and the Columbia story, even Apollo,

861
00:47:10,210 --> 00:47:13,089
uh, in many ways as a-as a bright new story.

862
00:47:13,089 --> 00:47:20,009
And that may sound str-- may sound strange
to say, but I truly believe the crews of Challenger

863
00:47:20,009 --> 00:47:26,630
and the crews of Columbia and Apollo are still
workin' for us.

864

00:47:26,630 --> 00:47:30,770
We teach the lessons every single day with
new people, and I can see the look in their

865
00:47:30,770 --> 00:47:35,380
eyes when they get it, when they see the lessons
that we're sharing with them, why it's important,

866
00:47:35,380 --> 00:47:39,559
why they should go back to their-their jobs
and do the very best they can.

867
00:47:39,559 --> 00:47:42,009
Um, I've seen-- by thousands of folks.

868
00:47:42,009 --> 00:47:45,749
Um, and when I travel around the country,
having the honor to speak to folks, as I'm

869
00:47:45,749 --> 00:47:49,270
sure Mike has as well, um, you see it, you
can feel it.

870
00:47:49,270 --> 00:47:53,561
The comments you get back are, um, they're
inspired based on what's happened in the past,

871
00:47:53,561 --> 00:47:55,720
and never let the darkness happen again.

872
00:47:55,720 --> 00:47:56,720
Host: Yeah.

873
00:47:56,720 --> 00:48:00,130
Michael Ciannilli : So I think if you, um,
the American people, um, give us the honor

874
00:48:00,130 --> 00:48:04,660
to, uh, unleash the talents of what this team
can do, um, you're gonna be surprised how

875
00:48:04,660 --> 00:48:05,660
far we can go.

876
00:48:05,660 --> 00:48:06,660
Host: Awesome.

877
00:48:06,660 --> 00:48:07,839
Michael Leinbach: Very well put.

878
00:48:07,839 --> 00:48:08,839
Host: Awesome, yeah.

879
00:48:08,839 --> 00:48:13,180
Mike Leinbach, Michael "Chachi" Ciannilli
, appreciate you guys being in here today.

880
00:48:13,180 --> 00:48:14,490
Uh, this is phenomenal.

881
00:48:14,490 --> 00:48:17,309
Appreciate your honesty and forthrightness
talkin' about this.

882
00:48:17,309 --> 00:48:19,440
It's a tough subject, but it's one that we
need to talk about.

883
00:48:19,440 --> 00:48:20,440
Michael Leinbach: Sure, you bet.

884
00:48:20,440 --> 00:48:21,440
Michael Ciannilli : Thank you so much.

885
00:48:21,440 --> 00:48:22,440
Michael Leinbach: We learn-we learn from our
past.

886

00:48:22,440 --> 00:48:27,089
Host: To learn more about NASA's plans for
human space flight, visit NASA.gov/HumansInSpace.

887
00:48:27,089 --> 00:48:34,450
A special thanks to our guest, former shuttle
launch director Michael Leinbach, and Columbia

888
00:48:34,450 --> 00:48:39,119
Research and Preservation Office curator and
"Happy Days" star look-alike Mike "Chachi"

889
00:48:39,119 --> 00:48:43,190
Ciannilli As always, we have a fabulous crew
here at the Rocket Ranch.

890
00:48:43,190 --> 00:48:47,289
Our sound men, Glenn Benson and Dan Casper,
Amber Jean Watson for her archival research,

891
00:48:47,289 --> 00:48:52,499
our episode editor, Michelle Stone, producer,
Jessica Landa, and the surely sleep deprived

892
00:48:52,499 --> 00:48:54,319
Joshua Santora.

893
00:48:54,319 --> 00:48:59,739
If you're a fan of the Rocket Ranch, then
tell a friend, and subscribe already!

894
00:48:59,739 --> 00:49:02,589
Next month, we'll have a rocket roundup, y'all,
with special guests who will break down today's