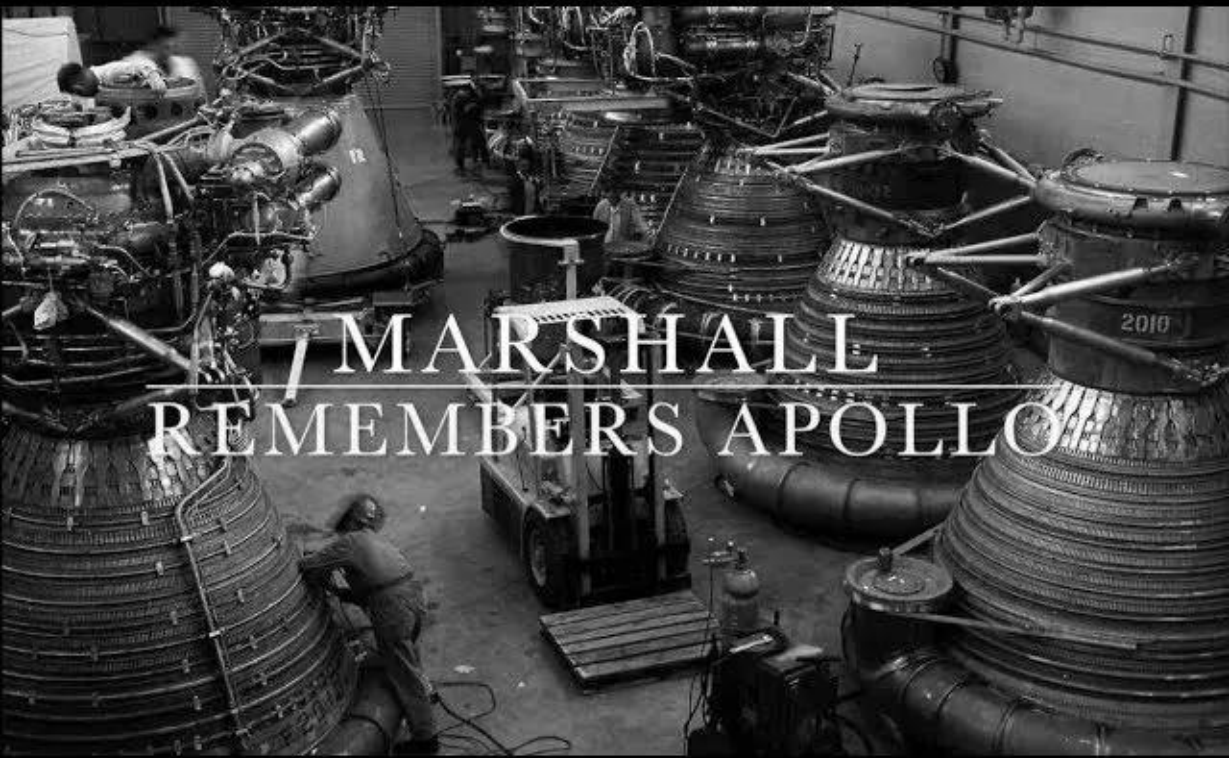
MARSHALL
REMEMBERS APOLLO

1
00:00:22,160 --> 00:00:17,900
[Music]

2
00:00:24,740 --> 00:00:22,170
I met dr. von Braun in person by chance

3
00:00:28,819 --> 00:00:24,750
I was downtown that the old rustlers can

4
00:00:31,490 --> 00:00:28,829
hotel this was back in 1962 in the late

5
00:00:33,829 --> 00:00:31,500
winter or early spring of 62 I was

6
00:00:36,229 --> 00:00:33,839
teaching school I'd come to to

7
00:00:38,600 --> 00:00:36,239
Huntsville to teach math and science at

8
00:00:40,479 --> 00:00:38,610
Madison Academy and I was just down to

9
00:00:43,759 --> 00:00:40,489
get a haircut and this was before

10
00:00:45,410 --> 00:00:43,769
Research Park existed and all the growth

11
00:00:47,719 --> 00:00:45,420
that's taking place it was a small town

12
00:00:50,509 --> 00:00:47,729
then and it's typical of southern towns

13
00:00:53,030 --> 00:00:50,519

there's always a barber shop in the

14
00:00:54,920 --> 00:00:53,040
hotel that was always close to the to

15
00:00:56,420 --> 00:00:54,930
the courthouse square and I was just

16
00:00:59,119 --> 00:00:56,430
saying getting a haircut on a Saturday

17
00:01:01,399 --> 00:00:59,129
morning and he walked in with his hat

18
00:01:03,170 --> 00:01:01,409
his briefcase and the barber shop was

19
00:01:06,260 --> 00:01:03,180
just about full there was a lot to talk

20
00:01:09,770 --> 00:01:06,270
about what price of cotton and Alabama

21
00:01:11,570 --> 00:01:09,780
football prospects and all that so there

22
00:01:14,030 --> 00:01:11,580
weren't many empty seats and he came in

23
00:01:17,060 --> 00:01:14,040
and happy to sit down next to me and of

24
00:01:19,130 --> 00:01:17,070
course I was in all of him but I didn't

25
00:01:22,790 --> 00:01:19,140
he did not know me from anybody

26
00:01:24,980 --> 00:01:22,800
so I its my ordinary practice I don't

27
00:01:26,840 --> 00:01:24,990
when I see somebody I think of as a

28
00:01:29,210 --> 00:01:26,850
celebrity I don't bother to give them

29
00:01:32,000 --> 00:01:29,220
their privacy and after a while he

30
00:01:34,220 --> 00:01:32,010
finished what he was doing and put the

31
00:01:36,620 --> 00:01:34,230
papers back in his briefcase and he

32
00:01:38,480 --> 00:01:36,630
turned and smiled and he had one of

33
00:01:40,970 --> 00:01:38,490
those smiles that just light up a room

34
00:01:42,440 --> 00:01:40,980
and spoke to me and said well what are

35
00:01:44,660 --> 00:01:42,450
you doing and I told him that I was

36
00:01:46,040 --> 00:01:44,670
teaching school and he said something in

37
00:01:48,590 --> 00:01:46,050
fact well that's wonderful when these

38
00:01:52,370 --> 00:01:48,600

school teachers what do you teach and I

39
00:01:54,620 --> 00:01:52,380
said math and science is it Oh Oh what

40
00:01:58,010 --> 00:01:54,630
is your background what is your degree

41
00:02:00,110 --> 00:01:58,020
and I could remember I just graduated

42
00:02:03,200 --> 00:02:00,120
the preceding spring and I still had a

43
00:02:05,180 --> 00:02:03,210
double major in math and physics and he

44
00:02:08,180 --> 00:02:05,190
said oh that's what I majored in

45
00:02:10,850 --> 00:02:08,190
some math and physics what what classes

46
00:02:13,640 --> 00:02:10,860
did you take and I mean he went through

47
00:02:15,500 --> 00:02:13,650
every class I could remember and they

48
00:02:17,780 --> 00:02:15,510
wanted to know what it covered and he

49
00:02:19,580 --> 00:02:17,790
wanted to know what great I'd pay and at

50
00:02:21,170 --> 00:02:19,590
the end he asked if I and

51
00:02:23,330 --> 00:02:21,180
interesting working in the space program

52
00:02:26,780 --> 00:02:23,340
of course the space program had just

53
00:02:28,309 --> 00:02:26,790
begun shortly before that and I told him

54
00:02:30,080 --> 00:02:28,319
that I was fascinated with but I'd not

55
00:02:32,150 --> 00:02:30,090
thought about working at it frankly I

56
00:02:35,420 --> 00:02:32,160
didn't feel qualified because I didn't

57
00:02:37,610 --> 00:02:35,430
go to MIT or Caltech or any of the

58
00:02:39,740 --> 00:02:37,620
big-name engineering schools I went to

59
00:02:41,750 --> 00:02:39,750
University of Central Missouri and which

60
00:02:44,869 --> 00:02:41,760
really had its origins as Teachers

61
00:02:47,030 --> 00:02:44,879
College so I didn't feel qualified but

62
00:02:47,630 --> 00:02:47,040
he said well if you ever changed your

63
00:02:49,789 --> 00:02:47,640

mind

64
00:02:53,270 --> 00:02:49,799
talk to personnel and tell them that

65
00:02:54,650 --> 00:02:53,280
you're not talked on this day and I said

66
00:02:57,699 --> 00:02:54,660
I thought there was a place for you at

67
00:03:00,020 --> 00:02:57,709
Marshall and so that's what I did and

68
00:03:03,170 --> 00:03:00,030
they set me up with a series of

69
00:03:05,240 --> 00:03:03,180
interviews and and a map how to get to

70
00:03:07,789 --> 00:03:05,250
each one of the offices the first one I

71
00:03:10,670 --> 00:03:07,799
went to was that I talked to a gentleman

72
00:03:13,130 --> 00:03:10,680
named Helmut Bauer who was a

73
00:03:14,630 --> 00:03:13,140
second-generation German and he

74
00:03:16,819 --> 00:03:14,640
explained to me what they were doing

75
00:03:19,880 --> 00:03:16,829
what he was working on and it was

76
00:03:22,400 --> 00:03:19,890
absolutely fascinating to me and at the

77
00:03:25,849 --> 00:03:22,410
end of that we he pulled into the

78
00:03:28,610 --> 00:03:25,859
dynamic test facility he explained that

79
00:03:32,509 --> 00:03:28,620
the that they had lost a large number of

80
00:03:34,550 --> 00:03:32,519
the a4 rockets which became the z2 but

81
00:03:37,220 --> 00:03:34,560
it was deployed a4 when it was being

82
00:03:40,099 --> 00:03:37,230
developed because they didn't understand

83
00:03:42,620 --> 00:03:40,109
the relation between controlling the

84
00:03:44,960 --> 00:03:42,630
vehicle and the bending of the vehicle

85
00:03:47,690 --> 00:03:44,970
which is they look rigid but they're not

86
00:03:50,659 --> 00:03:47,700
actually rigid they're flexible enough

87
00:03:53,089 --> 00:03:50,669
to wear our sensor picks up a little bit

88
00:03:55,099 --> 00:03:53,099

of bending it interprets that as an

89
00:03:56,539 --> 00:03:55,109
error and tries to correct it and if

90
00:03:59,599 --> 00:03:56,549
they don't understand how that all works

91
00:04:01,789 --> 00:03:59,609
together the bending and excites the

92
00:04:04,809 --> 00:04:01,799
propellant slosh and propellant slosh

93
00:04:07,879 --> 00:04:04,819
excites the bending and it could go very

94
00:04:11,000 --> 00:04:07,889
you start with the vehicle oscillating

95
00:04:12,500 --> 00:04:11,010
pretty soon it is a major oscillation

96
00:04:15,050 --> 00:04:12,510
either goes out of control or breaks

97
00:04:17,029 --> 00:04:15,060
apart and they lost a large number of

98
00:04:18,920 --> 00:04:17,039
those vehicles till they understood that

99
00:04:21,020 --> 00:04:18,930
and there were a lot of people have

100
00:04:24,350 --> 00:04:21,030
thought the biggest technical issue to

101
00:04:26,330 --> 00:04:24,360
building the Saturn 5 this little a4

102
00:04:29,029 --> 00:04:26,340
only had about 50,000 pounds of

103
00:04:30,980 --> 00:04:29,039
propellant the Saturn 5 weighed six

104
00:04:31,420 --> 00:04:30,990
million pounds and five million pounds

105
00:04:35,230 --> 00:04:31,430
of that

106
00:04:37,750 --> 00:04:35,240
propellent it was 363 feet long so the

107
00:04:40,030 --> 00:04:37,760
bending was very significant in a

108
00:04:41,680 --> 00:04:40,040
relative sense and the large tanks were

109
00:04:43,570 --> 00:04:41,690
that amount of propellant sloshing and

110
00:04:46,360 --> 00:04:43,580
they were it was being controlled by

111
00:04:47,770 --> 00:04:46,370
moving four of the five f1 inches and

112
00:04:50,680 --> 00:04:47,780
each one of those engines weighed

113
00:04:52,420 --> 00:04:50,690

eighteen thousand four hundred pounds so

114
00:04:54,250 --> 00:04:52,430
there was a lot of dynamics cool and a

115
00:04:56,500 --> 00:04:54,260
lot of people felt that they would have

116
00:04:59,110 --> 00:04:56,510
a very difficult time if they could ever

117
00:05:00,730 --> 00:04:59,120
get it controlled and that was his job

118
00:05:03,120 --> 00:05:00,740
and that's why they built that dynamic

119
00:05:06,280 --> 00:05:03,130
test our was so that he would have the

120
00:05:08,140 --> 00:05:06,290
data on how the vehicle bent what his

121
00:05:09,820 --> 00:05:08,150
first mode second mode third mode and

122
00:05:12,880 --> 00:05:09,830
they went up through I think six modes

123
00:05:15,070 --> 00:05:12,890
of the vehicle and it's subsequently

124
00:05:17,380 --> 00:05:15,080
higher frequencies and then he had

125
00:05:19,180 --> 00:05:17,390
propellant testing done all over the

126
00:05:21,840 --> 00:05:19,190
country and they were getting that so we

127
00:05:25,060 --> 00:05:21,850
had to build a mathematical model that

128
00:05:28,000 --> 00:05:25,070
represented the bending and the slushing

129
00:05:30,220 --> 00:05:28,010
of the vehicle that could be used in to

130
00:05:32,860 --> 00:05:30,230
do the dynamics analysis to get the

131
00:05:35,110 --> 00:05:32,870
stability when response loads and that

132
00:05:37,630 --> 00:05:35,120
kind of thing we gave that then to the

133
00:05:39,250 --> 00:05:37,640
Astra Onix laboratory and the

134
00:05:41,650 --> 00:05:39,260
astronautics laboratory then built the

135
00:05:44,590 --> 00:05:41,660
actual flight computer to try to match

136
00:05:46,960 --> 00:05:44,600
the gain and phase requirements that we

137
00:05:48,760 --> 00:05:46,970
had had given them and he asked me if

138
00:05:49,990 --> 00:05:48,770

I'd like to work in that I said I can't

139
00:05:52,330 --> 00:05:50,000
imagine anything more interesting than

140
00:06:00,390 --> 00:05:52,340
this so I went to work here on July the

141
00:06:04,080 --> 00:06:02,160
what he would do is he would he was

142
00:06:07,410 --> 00:06:04,090
require weekly notes from all of his

143
00:06:09,629 --> 00:06:07,420
direct reports every Friday afternoon he

144
00:06:12,030 --> 00:06:09,639
would take those home and over the

145
00:06:14,490 --> 00:06:12,040
weekend he would go through every single

146
00:06:16,409 --> 00:06:14,500
one of them and he would make annotation

147
00:06:18,390 --> 00:06:16,419
it's what he wanted done about whatever

148
00:06:21,750 --> 00:06:18,400
was being reported and he didn't want

149
00:06:23,940 --> 00:06:21,760
just report that from people saying well

150
00:06:25,500 --> 00:06:23,950
we had this meeting and like most of the

151
00:06:28,140 --> 00:06:25,510
weekly help since you see in recent

152
00:06:31,290 --> 00:06:28,150
years he wanted detailed information on

153
00:06:33,750 --> 00:06:31,300
a gyroscope that didn't work or a test

154
00:06:35,700 --> 00:06:33,760
that didn't in how they were working he

155
00:06:37,770 --> 00:06:35,710
would make his notes and on Monday

156
00:06:40,110 --> 00:06:37,780
morning he would bring those in and

157
00:06:42,450 --> 00:06:40,120
would dump those on Bonnie's desk and

158
00:06:44,909 --> 00:06:42,460
she would get the annotated note to each

159
00:06:47,460 --> 00:06:44,919
one of the cinders of what his

160
00:06:52,350 --> 00:06:47,470
instructions were how to address the

161
00:06:57,420 --> 00:06:54,809
well they wanted all the information

162
00:06:59,309 --> 00:06:57,430
that they could possibly get that they

163
00:07:02,399 --> 00:06:59,319

talked you didn't necessarily have to go

164
00:07:04,469 --> 00:07:02,409
through chain of command they wanted to

165
00:07:07,140 --> 00:07:04,479
talk to everybody that had any

166
00:07:10,290 --> 00:07:07,150
information von Braun personally he was

167
00:07:11,760 --> 00:07:10,300
known to show up they were doing a lot

168
00:07:15,930 --> 00:07:11,770
of work you know they were literally

169
00:07:17,520 --> 00:07:15,940
working 24/7 on various things and he

170
00:07:19,680 --> 00:07:17,530
would sometimes show up in the middle of

171
00:07:22,499 --> 00:07:19,690
the night and talk to the people that

172
00:07:23,999 --> 00:07:22,509
were working on a piece of hardware it

173
00:07:25,980 --> 00:07:24,009
asking what they were doing how it was

174
00:07:27,540 --> 00:07:25,990
going but the problem for going

175
00:07:29,430 --> 00:07:27,550
completely around the chain of command

176
00:07:31,830 --> 00:07:29,440
all of them were very interested in

177
00:07:34,709 --> 00:07:31,840
getting the job done they fought and

178
00:07:36,629 --> 00:07:34,719
they argued and they disagreed violently

179
00:07:38,809 --> 00:07:36,639
but in the end they would make a

180
00:07:41,490 --> 00:07:38,819
decision and once the decision was made

181
00:07:43,860 --> 00:07:41,500
there was no further discussion of it

182
00:07:46,740 --> 00:07:43,870
once it was decided then even the people

183
00:07:49,589 --> 00:07:46,750
who didn't like it were were inclined to

184
00:07:51,809 --> 00:07:49,599
do exactly what everybody had agreed to

185
00:07:53,100 --> 00:07:51,819
and there was no you know what I told

186
00:07:56,180 --> 00:07:53,110
you you shouldn't have done none of that

187
00:07:58,469 --> 00:07:56,190
it was always a season he would listen

188
00:08:00,240 --> 00:07:58,479

all of the manager that way and find

189
00:08:03,209 --> 00:08:00,250
Braun in particular they would listen as

190
00:08:05,610 --> 00:08:03,219
long as you had date him when they

191
00:08:08,129 --> 00:08:05,620
wanted to hear all the data once the

192
00:08:09,330 --> 00:08:08,139
data ended and you started an opinion

193
00:08:11,879 --> 00:08:09,340
they were no longer interested they were

194
00:08:14,370 --> 00:08:11,889
interested in the information and once

195
00:08:15,390 --> 00:08:14,380
the decision was made then it became the

196
00:08:17,969 --> 00:08:15,400
decision and there was no

197
00:08:19,680 --> 00:08:17,979
second-guessing they were a good group

198
00:08:25,110 --> 00:08:19,690
to work with I found him to be

199
00:08:30,450 --> 00:08:27,480
one of the big issues of course was was

200
00:08:33,840 --> 00:08:30,460
loading what kind of loads the vehicles

201
00:08:38,220 --> 00:08:33,850
gonna say and how you represented those

202
00:08:39,810 --> 00:08:38,230
loads in the analysis bill vaanu we just

203
00:08:42,960 --> 00:08:39,820
just talked with what was responsible

204
00:08:45,390 --> 00:08:42,970
for for the environment through which

205
00:08:47,870 --> 00:08:45,400
the vehicle is going to fly and they

206
00:08:52,290 --> 00:08:47,880
developed something that they called a

207
00:08:54,990 --> 00:08:52,300
synthetic profile for design purposes

208
00:08:57,510 --> 00:08:55,000
they they came up with we didn't have

209
00:08:59,670 --> 00:08:57,520
the capability in those days to fly the

210
00:09:00,540 --> 00:08:59,680
vehicle through a large database of

211
00:09:03,030 --> 00:09:00,550
winds

212
00:09:05,370 --> 00:09:03,040
we were the computational capability at

213
00:09:06,990 --> 00:09:05,380

that time was relatively slow and we

214
00:09:09,510 --> 00:09:07,000
just didn't have that game they do that

215
00:09:12,360 --> 00:09:09,520
today but what he would do was analyze

216
00:09:15,480 --> 00:09:12,370
all those winds and determine

217
00:09:18,720 --> 00:09:15,490
percentiles of what the likelihood was

218
00:09:20,850 --> 00:09:18,730
and then they would superimpose a gust

219
00:09:23,250 --> 00:09:20,860
on it so they would start out with with

220
00:09:26,130 --> 00:09:23,260
the what that was the 95 percentile of

221
00:09:28,860 --> 00:09:26,140
the highest wind and then they would use

222
00:09:31,950 --> 00:09:28,870
a build up to that that's called the

223
00:09:35,100 --> 00:09:31,960
wind shear and they take 99% of the wind

224
00:09:37,950 --> 00:09:35,110
shear and then they would superimpose on

225
00:09:39,930 --> 00:09:37,960
that a square wave gust right at the

226
00:09:44,510 --> 00:09:39,940
worst possible time and that's what we

227
00:09:48,150 --> 00:09:44,520
designed - and we ran the with the

228
00:09:50,070 --> 00:09:48,160
analysis that we did for that was done

229
00:09:52,470 --> 00:09:50,080
in in my ear in the Aero ballistics

230
00:09:56,550 --> 00:09:52,480
laboratory we we took the data from the

231
00:09:58,890 --> 00:09:56,560
dynamic test hour we then built mode

232
00:10:00,780 --> 00:09:58,900
shapes from that what they what the

233
00:10:04,380 --> 00:10:00,790
Mende looked like determined the

234
00:10:06,450 --> 00:10:04,390
frequencies and the generalized mass did

235
00:10:10,290 --> 00:10:06,460
the same thing with the slosh and built

236
00:10:13,260 --> 00:10:10,300
all that into a of equations that we can

237
00:10:15,420 --> 00:10:13,270
then expand into what was called the

238
00:10:17,760 --> 00:10:15,430

characteristic equation and we would

239
00:10:19,800 --> 00:10:17,770
solve that characteristic equation and

240
00:10:21,930 --> 00:10:19,810
find where the where the roots for it

241
00:10:24,060 --> 00:10:21,940
was a new technique it's common today

242
00:10:25,820 --> 00:10:24,070
but it was new then most of the

243
00:10:28,790 --> 00:10:25,830
techniques we were doing we were

244
00:10:30,920 --> 00:10:28,800
develop as we went but it's called root

245
00:10:33,410 --> 00:10:30,930
locus and we were determined where the

246
00:10:34,520 --> 00:10:33,420
where the various routes were and that

247
00:10:36,890 --> 00:10:34,530
would determine whether you were in a

248
00:10:39,650 --> 00:10:36,900
range of stability and you could vary

249
00:10:41,600 --> 00:10:39,660
the gains and vary the phase and with

250
00:10:44,300 --> 00:10:41,610
that you were able to determine how much

251
00:10:46,750 --> 00:10:44,310
margin you had of each and that's how we

252
00:10:50,120 --> 00:10:46,760
solve that problem we also then

253
00:10:52,190 --> 00:10:50,130
calculated the loads when we had the

254
00:10:54,170 --> 00:10:52,200
Antonia over there we developed the

255
00:10:56,240 --> 00:10:54,180
equations that would allow us to analyze

256
00:10:58,880 --> 00:10:56,250
what the bending moment on the vehicle

257
00:11:01,160 --> 00:10:58,890
would be at every station on it and make

258
00:11:03,860 --> 00:11:01,170
sure that the structure was capable of

259
00:11:05,420 --> 00:11:03,870
standing the bending moment so it's a

260
00:11:07,100 --> 00:11:05,430
pretty complex thing and it was took a

261
00:11:08,930 --> 00:11:07,110
lot of interaction between the

262
00:11:11,870 --> 00:11:08,940
laboratory I was in terrible istic s--

263
00:11:15,680 --> 00:11:11,880

and the avionics lab we worked together

264
00:11:22,020 --> 00:11:15,690
to get that analysis out and we we never

265
00:11:26,700 --> 00:11:24,450
well the vehicle itself of course was

266
00:11:29,340 --> 00:11:26,710
very very large and at the time that

267
00:11:31,710 --> 00:11:29,350
that facility was built it was the

268
00:11:33,900 --> 00:11:31,720
tallest self-supporting structure in the

269
00:11:37,410 --> 00:11:33,910
state of Alabama I think there may be

270
00:11:39,240 --> 00:11:37,420
one or two bank buildings in Birmingham

271
00:11:42,390 --> 00:11:39,250
that may be taller than that today but

272
00:11:45,630 --> 00:11:42,400
at that time it was about 400 feet

273
00:11:47,790 --> 00:11:45,640
higher the vehicles 363 feet and it

274
00:11:49,920 --> 00:11:47,800
towered a little above that we could put

275
00:11:53,250 --> 00:11:49,930
the entire stack in there and they

276
00:11:56,190 --> 00:11:53,260
attached shakers to it and so they could

277
00:11:58,530 --> 00:11:56,200
literally vary the frequency and and

278
00:12:00,390 --> 00:11:58,540
measure what the vehicle was doing how

279
00:12:02,700 --> 00:12:00,400
it was responding that sound they would

280
00:12:06,510 --> 00:12:02,710
find where the natural frequencies of

281
00:12:07,800 --> 00:12:06,520
the of the vehicle work and so when what

282
00:12:10,400 --> 00:12:07,810
they were doing was putting an actual

283
00:12:13,560 --> 00:12:10,410
vehicle in and actually dynamically

284
00:12:15,750 --> 00:12:13,570
measuring what the vehicle did when it

285
00:12:18,630 --> 00:12:15,760
was shaken and they even put in

286
00:12:20,990 --> 00:12:18,640
propellant in the in the tanks and got

287
00:12:23,280 --> 00:12:21,000
the combined effects of propellant slosh

288
00:12:25,710 --> 00:12:23,290

along with the vehicle's structural

289
00:12:27,900 --> 00:12:25,720
bending and that then fed into the

290
00:12:34,100 --> 00:12:27,910
equations that with ended in the

291
00:12:41,450 --> 00:12:38,840
ese 501 was they was designation we use

292
00:12:47,480 --> 00:12:41,460
for the first one and that happened in

293
00:12:50,240 --> 00:12:47,490
late 1967 and it was a almost flawless

294
00:12:53,269 --> 00:12:50,250
test it was amazing how perfectly

295
00:12:57,650 --> 00:12:53,279
everything performed on that the

296
00:13:02,900 --> 00:12:57,660
following April in April of 1968 we had

297
00:13:05,480 --> 00:13:02,910
a different day as 502 and that was not

298
00:13:09,980 --> 00:13:05,490
the same we had many many problems with

299
00:13:12,829 --> 00:13:09,990
it that we had not anticipated and it it

300
00:13:14,530 --> 00:13:12,839
did how we fixed it and what we did with

301
00:13:18,050 --> 00:13:14,540
it to me was one of the most interesting

302
00:13:20,329 --> 00:13:18,060
experiences I had in NASA during the

303
00:13:23,060 --> 00:13:20,339
first stage they got something that is

304
00:13:23,600 --> 00:13:23,070
called Pogo effect and it's like a pogo

305
00:13:25,550 --> 00:13:23,610
stick

306
00:13:27,590 --> 00:13:25,560
you know it's oscillating the thrust

307
00:13:29,480 --> 00:13:27,600
builds up then it drops off and it

308
00:13:33,290 --> 00:13:29,490
shakes the vehicle much like a pogo

309
00:13:36,440 --> 00:13:33,300
stick does and that had they had

310
00:13:38,810 --> 00:13:36,450
anticipated that they might have a pogo

311
00:13:40,250 --> 00:13:38,820
issue and they had made provisions to

312
00:13:43,310 --> 00:13:40,260
put in accumulators if they were

313
00:13:45,050 --> 00:13:43,320

necessary but they not did not showed up

314
00:13:47,030 --> 00:13:45,060
on the first one so they felt pretty

315
00:13:49,790 --> 00:13:47,040
good about it but they got it in a big

316
00:13:52,430 --> 00:13:49,800
way on the second one then in the second

317
00:13:56,900 --> 00:13:52,440
stage flight that was an s-1 see flight

318
00:14:00,110 --> 00:13:56,910
during s2 flight they they got a signal

319
00:14:04,430 --> 00:14:00,120
that one of the parameters that they

320
00:14:06,019 --> 00:14:04,440
monitored on one of the five engines and

321
00:14:07,760 --> 00:14:06,029
crossed the red line I can't remember

322
00:14:09,769 --> 00:14:07,770
now if it was tipped here or pressure

323
00:14:11,750 --> 00:14:09,779
but one of the red lines that it

324
00:14:14,780 --> 00:14:11,760
shouldn't cross so they wanted to make

325
00:14:17,269 --> 00:14:14,790
sure that that the that the engine did

326
00:14:20,480 --> 00:14:17,279
not fail catastrophically and blow up

327
00:14:23,840 --> 00:14:20,490
the vehicle so they made the decision to

328
00:14:26,060 --> 00:14:23,850
shut down that engine and when they did

329
00:14:28,910 --> 00:14:26,070
that they said a command and it shut the

330
00:14:31,370 --> 00:14:28,920
engine down but as we had a backup for

331
00:14:34,460 --> 00:14:31,380
nearly everything at that time and they

332
00:14:36,829 --> 00:14:34,470
sent a second command to make sure that

333
00:14:40,069 --> 00:14:36,839
the engine was shut down unfortunately

334
00:14:43,910 --> 00:14:40,079
there was a miss wiring problem and they

335
00:14:46,310 --> 00:14:43,920
shut down the opposite engine so instead

336
00:14:47,420 --> 00:14:46,320
of having one engine out we had two

337
00:14:49,550 --> 00:14:47,430
inches out

338
00:14:51,110 --> 00:14:49,560

but it still kept going and it was

339
00:14:56,680 --> 00:14:51,120
enough to think it still make it to

340
00:14:58,940 --> 00:14:56,690
orbit the third stage the because of a

341
00:15:01,220 --> 00:14:58,950
propellant line that shaken loose

342
00:15:03,860 --> 00:15:01,230
probably related to that Pogo problem

343
00:15:06,130 --> 00:15:03,870
but because of that they were unable to

344
00:15:11,360 --> 00:15:06,140
do a restart ordinarily the Saturn 5

345
00:15:13,970 --> 00:15:11,370
they'd had to 5j to its engines in the

346
00:15:16,610 --> 00:15:13,980
second stage at a single j2s engine in

347
00:15:18,650 --> 00:15:16,620
the third stage the liquid hydrogen each

348
00:15:21,350 --> 00:15:18,660
and then they were identical engines

349
00:15:23,660 --> 00:15:21,360
except the one in the third stage had a

350
00:15:26,960 --> 00:15:23,670
restart capability and they would burn

351
00:15:29,750 --> 00:15:26,970
these s1c stage it would fall into the

352
00:15:31,340 --> 00:15:29,760
ocean then they would burn thee as to

353
00:15:33,980 --> 00:15:31,350
stage and it would fall into the ocean

354
00:15:36,440 --> 00:15:33,990
off the coast of Africa much further and

355
00:15:38,690 --> 00:15:36,450
then they would light the s4b third

356
00:15:41,000 --> 00:15:38,700
stage for its first burn and it would

357
00:15:43,880 --> 00:15:41,010
burn into orbit and the intent was that

358
00:15:45,680 --> 00:15:43,890
she would stay in orbit until you

359
00:15:48,380 --> 00:15:45,690
checked out all the systems and had the

360
00:15:52,130 --> 00:15:48,390
proper alignment to go to the moon then

361
00:15:54,500 --> 00:15:52,140
they would restart the the j2 engine of

362
00:15:57,380 --> 00:15:54,510
the third stage and it would do the

363
00:15:59,630 --> 00:15:57,390

translunar injection burns tli that

364
00:16:01,850 --> 00:15:59,640
would send the spacecraft on its way to

365
00:16:03,740 --> 00:16:01,860
the moon and which time the Saturn had

366
00:16:08,960 --> 00:16:03,750
done its job and he got him on the way

367
00:16:12,110 --> 00:16:08,970
and because of all that vibration a line

368
00:16:14,930 --> 00:16:12,120
had come loose and as a result of that

369
00:16:17,300 --> 00:16:14,940
they were not able to do a restart so

370
00:16:19,640 --> 00:16:17,310
they made it to orbit but they couldn't

371
00:16:23,720 --> 00:16:19,650
restart it they also had a failure of

372
00:16:26,180 --> 00:16:23,730
one of the the the slaw panels the

373
00:16:30,380 --> 00:16:26,190
service limit after panels which is that

374
00:16:33,500 --> 00:16:30,390
kind of truncated area you see above the

375
00:16:34,970 --> 00:16:33,510
when it transitions from the diameter of

376
00:16:37,010 --> 00:16:34,980
the s4b

377
00:16:41,210 --> 00:16:37,020
down to the diameter of the service

378
00:16:43,580 --> 00:16:41,220
module on the spacecraft that they that

379
00:16:46,130 --> 00:16:43,590
was a frustum of a cone and that's where

380
00:16:49,460 --> 00:16:46,140
they where they kept the the lunar

381
00:16:52,970 --> 00:16:49,470
lander was in was in there and on the

382
00:16:56,150 --> 00:16:52,980
later on the actual missions and one of

383
00:16:58,880 --> 00:16:56,160
those panels actually structurally

384
00:16:59,600 --> 00:16:58,890
failed when they had a meeting following

385
00:17:02,120 --> 00:16:59,610
that

386
00:17:05,809 --> 00:17:02,130
and here at Marshall von Braun the

387
00:17:09,049 --> 00:17:05,819
associate administrator for Space Flight

388
00:17:10,850 --> 00:17:09,059

the the head of the Apollo program in

389
00:17:13,579 --> 00:17:10,860
headquarters and all the senior managers

390
00:17:16,340 --> 00:17:13,589
here and from Houston we're all here to

391
00:17:19,250 --> 00:17:16,350
discuss where do we go from here and

392
00:17:20,809 --> 00:17:19,260
that was a very very big thing they they

393
00:17:23,150 --> 00:17:20,819
got the vehicle to orbit but it had

394
00:17:26,030 --> 00:17:23,160
nearly failed at every point along the

395
00:17:28,460 --> 00:17:26,040
way and so this this group analyzed that

396
00:17:32,090 --> 00:17:28,470
and they felt they understood it they

397
00:17:34,549 --> 00:17:32,100
the reason that they had a failure in

398
00:17:36,860 --> 00:17:34,559
the first stage that poco effect was

399
00:17:38,390 --> 00:17:36,870
they did not have the accumulators in

400
00:17:40,610 --> 00:17:38,400
that they thought they would need so

401
00:17:42,710 --> 00:17:40,620
they could put them in and take care of

402
00:17:44,539 --> 00:17:42,720
that problem the second stage or

403
00:17:48,970 --> 00:17:44,549
anything wrong with the engine they

404
00:17:50,990 --> 00:17:48,980
simply an a a sensor was bad and sent

405
00:17:53,570 --> 00:17:51,000
indication that they needed to shut it

406
00:17:55,940 --> 00:17:53,580
down and the wiring was just a Mis wired

407
00:17:58,700 --> 00:17:55,950
problem so there wasn't anything other

408
00:18:00,770 --> 00:17:58,710
than to make sure that you you always

409
00:18:02,810 --> 00:18:00,780
know that sensors can't fail and just be

410
00:18:04,789 --> 00:18:02,820
sure that that they're there thoroughly

411
00:18:07,159 --> 00:18:04,799
checked and make sure the wires right

412
00:18:09,710 --> 00:18:07,169
and that took care of that in the third

413
00:18:12,080 --> 00:18:09,720

stage they they found out the reason

414
00:18:14,510 --> 00:18:12,090
that they had never encountered any kind

415
00:18:18,020 --> 00:18:14,520
of a problem with the vibration in the

416
00:18:20,510 --> 00:18:18,030
in the feed line was that when they

417
00:18:22,370 --> 00:18:20,520
tested it it was on the ground and there

418
00:18:25,280 --> 00:18:22,380
was moisture and as soon as they ran the

419
00:18:28,010 --> 00:18:25,290
hydrogen fuel into the line immediately

420
00:18:30,740 --> 00:18:28,020
it was coated with ice but in space

421
00:18:33,350 --> 00:18:30,750
there was no moisture therefore there

422
00:18:35,390 --> 00:18:33,360
was no ice and so the line needed to be

423
00:18:37,340 --> 00:18:35,400
stabilized and so all they had to do was

424
00:18:39,980 --> 00:18:37,350
add some stability brackets to it and

425
00:18:42,560 --> 00:18:39,990
they understood that there was actually

426
00:18:45,080 --> 00:18:42,570
a design flaw in the slaw panels and

427
00:18:47,480 --> 00:18:45,090
that was easy to redesign so they felt

428
00:18:50,539 --> 00:18:47,490
that they understood everything about

429
00:18:53,060 --> 00:18:50,549
what had gone wrong and they but there

430
00:18:55,370 --> 00:18:53,070
was another Apollo flight planned later

431
00:18:57,200 --> 00:18:55,380
that summer wouldn't be a Saturn 5 B of

432
00:19:01,490 --> 00:18:57,210
Saturn wouldn't be but that would give

433
00:19:04,310 --> 00:19:01,500
them the chance to to test the the s4b

434
00:19:06,860 --> 00:19:04,320
because it was a second stage of the

435
00:19:09,470 --> 00:19:06,870
Saturn 1b and it was the third stage of

436
00:19:11,659 --> 00:19:09,480
Saturn 5 so they could take it check it

437
00:19:13,280 --> 00:19:11,669
then and they would be able to check

438
00:19:15,320 --> 00:19:13,290

those slot panels

439
00:19:17,570 --> 00:19:15,330
make sure that was right and if they

440
00:19:19,550 --> 00:19:17,580
didn't find anything there and in the

441
00:19:21,410 --> 00:19:19,560
subsequent test didn't find anything

442
00:19:25,460 --> 00:19:21,420
they decided that they could fly the

443
00:19:27,020 --> 00:19:25,470
next one as a manned flight and that was

444
00:19:28,460 --> 00:19:27,030
important because it was costing a lot

445
00:19:31,160 --> 00:19:28,470
of money

446
00:19:33,680 --> 00:19:31,170
even in those days it was they were

447
00:19:35,480 --> 00:19:33,690
disputes about Pattie count the money

448
00:19:37,430 --> 00:19:35,490
just like on the shuttle no one would

449
00:19:39,560 --> 00:19:37,440
ever agree exactly what a shuttle cost

450
00:19:42,860 --> 00:19:39,570
but it was a hundred to three hundred

451
00:19:45,200 --> 00:19:42,870
million dollars and that was in 1960s

452
00:19:46,550 --> 00:19:45,210
top dollars and so that would be you

453
00:19:49,130 --> 00:19:46,560
know probably over a billion dollars

454
00:19:51,350 --> 00:19:49,140
today's cost and so they didn't want to

455
00:19:53,330 --> 00:19:51,360
make any additional flights if they

456
00:19:55,730 --> 00:19:53,340
didn't have to and they made the

457
00:19:57,920 --> 00:19:55,740
decision that they understood all the

458
00:20:00,710 --> 00:19:57,930
problems and the problems had all been

459
00:20:01,430 --> 00:20:00,720
if they were all and say with further

460
00:20:03,770 --> 00:20:01,440
testing

461
00:20:05,450 --> 00:20:03,780
they'd confirmed what they decided that

462
00:20:09,020 --> 00:20:05,460
there was no reason that they couldn't

463
00:20:11,660 --> 00:20:09,030

fly the next one manned and that became

464
00:20:12,860 --> 00:20:11,670
the third Saturn five flight and we know

465
00:20:15,290 --> 00:20:12,870
it as Apollo eight

466
00:20:20,120 --> 00:20:15,300
I'd say Apollo eight in many ways was my

467
00:20:23,780 --> 00:20:20,130
favorite of all of the missions 1968 was

468
00:20:26,090 --> 00:20:23,790
a very traumatic year in in this country

469
00:20:31,340 --> 00:20:26,100
it's hard to overstate how traumatic it

470
00:20:34,850 --> 00:20:31,350
was in April Martin Luther King dr. King

471
00:20:36,890 --> 00:20:34,860
was assassinated in Memphis and there

472
00:20:39,710 --> 00:20:36,900
were riots in the streets following that

473
00:20:43,820 --> 00:20:39,720
it was a very difficult time it was a

474
00:20:46,220 --> 00:20:43,830
very difficult president Johnson decided

475
00:20:48,890 --> 00:20:46,230
not to seek another term and there was a

476
00:20:51,680 --> 00:20:48,900
lot of competition for who was going to

477
00:20:53,420 --> 00:20:51,690
be the Democratic candidate Robert F

478
00:20:56,240 --> 00:20:53,430
Kennedy looked like he was surging into

479
00:21:01,310 --> 00:20:56,250
the lead and in June he was assassinated

480
00:21:03,710 --> 00:21:01,320
in Los Angeles at a hotel after he had

481
00:21:05,420 --> 00:21:03,720
had a very successful day and it looked

482
00:21:09,020 --> 00:21:05,430
like he was going to be the the

483
00:21:11,300 --> 00:21:09,030
candidate he was shot there and and died

484
00:21:13,370 --> 00:21:11,310
the net early the next morning and so it

485
00:21:15,970 --> 00:21:13,380
had those two terrible things happened

486
00:21:18,980 --> 00:21:15,980
and then in July the Democrats had their

487
00:21:23,420 --> 00:21:18,990
there a convention that year in Chicago

488
00:21:24,970 --> 00:21:23,430

and there was massive protest and Mayor

489
00:21:29,180 --> 00:21:24,980
Daley

490
00:21:32,030 --> 00:21:29,190
he basically I would characterize his

491
00:21:34,789 --> 00:21:32,040
response has been almost brutal he had

492
00:21:36,610 --> 00:21:34,799
police on horses with nightsticks and

493
00:21:39,500 --> 00:21:36,620
they were literally beating people

494
00:21:41,900 --> 00:21:39,510
severely beating them and that was going

495
00:21:44,720 --> 00:21:41,910
on outside the convention when they were

496
00:21:47,180 --> 00:21:44,730
doing the nominating process so that was

497
00:21:49,220 --> 00:21:47,190
a that was a very ugly scene and all of

498
00:21:52,340 --> 00:21:49,230
these things had made this a very

499
00:21:55,669 --> 00:21:52,350
dramatic and traumatic year about

500
00:21:57,440 --> 00:21:55,679
September NASA management and that was

501
00:21:59,720 --> 00:21:57,450
well above my pay grade senior

502
00:22:02,110 --> 00:21:59,730
management learned that the Russians

503
00:22:05,539 --> 00:22:02,120
were planning to do a circumnavigation

504
00:22:08,200 --> 00:22:05,549
flight around circumlunar flight and go

505
00:22:14,090 --> 00:22:08,210
around the moon well they had beat us

506
00:22:16,280 --> 00:22:14,100
two into space with their Sputnik then

507
00:22:19,520 --> 00:22:16,290
they later the next one that carried up

508
00:22:23,960 --> 00:22:19,530
a little dog Lakha who only lived a few

509
00:22:28,960 --> 00:22:23,970
hours and then your gig Erin had become

510
00:22:32,870 --> 00:22:28,970
the first person for the first human to

511
00:22:34,280 --> 00:22:32,880
go into orbit and he had done that ahead

512
00:22:39,799 --> 00:22:34,290
of us he had done that I believe in

513
00:22:41,570 --> 00:22:39,809

April of 1961 and so it was a you know

514
00:22:43,669 --> 00:22:41,580
they had beat us to the punch every time

515
00:22:45,350 --> 00:22:43,679
and I think there was a pretty strong

516
00:22:47,240 --> 00:22:45,360
feeling that they were not gonna beat us

517
00:22:49,520 --> 00:22:47,250
to the moon that's the whole reason the

518
00:22:51,950 --> 00:22:49,530
lunar program was started was to show

519
00:22:55,400 --> 00:22:51,960
that we could start out from behind and

520
00:22:57,799 --> 00:22:55,410
capitalism was superior to communism and

521
00:22:59,810 --> 00:22:57,809
then we catch up and go ahead and we

522
00:23:02,840 --> 00:22:59,820
were not about to let him do that so the

523
00:23:06,110 --> 00:23:02,850
courageous decision was made to launch

524
00:23:09,230 --> 00:23:06,120
the Apollo 8 that would would be a man

525
00:23:12,020 --> 00:23:09,240
flight a circumlunar flight and that was

526
00:23:14,480 --> 00:23:12,030
that made it very very dramatic and you

527
00:23:18,110 --> 00:23:14,490
just couldn't make this stuff up they

528
00:23:23,000 --> 00:23:18,120
arrived in lunar orbit December the 24th

529
00:23:26,720 --> 00:23:23,010
of 1968 which was a you know to arrive

530
00:23:30,070 --> 00:23:26,730
on Christmas Eve and that night they

531
00:23:33,470 --> 00:23:30,080
literally took turned and they read the

532
00:23:35,390 --> 00:23:33,480
first 10 verses of the book of Genesis

533
00:23:38,299 --> 00:23:35,400
in the beginning and

534
00:23:41,630 --> 00:23:38,309
explain the biblical account of how

535
00:23:44,480 --> 00:23:41,640
creation took took place and they took

536
00:23:46,400 --> 00:23:44,490
turns reading that no one protested

537
00:23:49,640 --> 00:23:46,410
except well there was one well-known aja

538
00:23:51,740 --> 00:23:49,650

so that day Madalyn Murray O'Hair and

539
00:23:55,549 --> 00:23:51,750
she protested but in general there was

540
00:23:57,860 --> 00:23:55,559
no outcry that flight was a just exactly

541
00:24:01,250 --> 00:23:57,870
the lift that the country needed at that

542
00:24:03,110 --> 00:24:01,260
time after it ended the year on such a

543
00:24:06,530 --> 00:24:03,120
positive note when it had been such a

544
00:24:08,660 --> 00:24:06,540
negative year up until then and of

545
00:24:10,190 --> 00:24:08,670
course it was an important thing for not

546
00:24:12,260 --> 00:24:10,200
only demonstrates that it would work

547
00:24:15,380 --> 00:24:12,270
that we can do that they couldn't land

548
00:24:17,120 --> 00:24:15,390
but they they were went into orbit and

549
00:24:19,580 --> 00:24:17,130
they maneuvered and they saw two sites

550
00:24:22,570 --> 00:24:19,590
that no human eyes had ever seen before

551
00:24:25,610 --> 00:24:22,580
they saw the backside of the moon and

552
00:24:28,160 --> 00:24:25,620
that had never been seen before we'd

553
00:24:29,690 --> 00:24:28,170
seen pictures of it from satellites but

554
00:24:31,640 --> 00:24:29,700
no one had actually seen it because the

555
00:24:34,190 --> 00:24:31,650
moon as you know is gravity gradient

556
00:24:36,110 --> 00:24:34,200
stabilized which means it's he keeps the

557
00:24:39,500 --> 00:24:36,120
same orientation toward the earth all

558
00:24:42,530 --> 00:24:39,510
the time whether it's regardless of the

559
00:24:45,080 --> 00:24:42,540
phase that's in whether it's bright or

560
00:24:47,930 --> 00:24:45,090
whether it's dark the same face always

561
00:24:50,210 --> 00:24:47,940
is toward the earth and no one had ever

562
00:24:51,890 --> 00:24:50,220
seen the backside of it except pictures

563
00:24:54,650 --> 00:24:51,900

of it well they actually saw the

564
00:24:57,520 --> 00:24:54,660
backside of the moon and maybe even more

565
00:25:01,610 --> 00:24:57,530
dramatic than that when they came around

566
00:25:02,360 --> 00:25:01,620
they saw something that no human eye had

567
00:25:04,040 --> 00:25:02,370
ever seen

568
00:25:07,669 --> 00:25:04,050
I guess no one even given much thought

569
00:25:10,160 --> 00:25:07,679
to it but they saw Earth's rise and they

570
00:25:12,169 --> 00:25:10,170
they were all taking pictures of it but

571
00:25:14,660 --> 00:25:12,179
the picture I think that Jim Lovell take

572
00:25:17,419 --> 00:25:14,670
took was the one that actually they

573
00:25:20,049 --> 00:25:17,429
teased each other and appearances about

574
00:25:23,060 --> 00:25:20,059
who it was that actually took the

575
00:25:25,040 --> 00:25:23,070
picture that everyone has seen it was

576
00:25:26,870 --> 00:25:25,050
actually Jim Lovell but the hell each of

577
00:25:28,760 --> 00:25:26,880
them claims that they did it it's all in

578
00:25:30,740 --> 00:25:28,770
good natured fun they all understand and

579
00:25:33,010 --> 00:25:30,750
accept that lovell's picture did it

580
00:25:35,390 --> 00:25:33,020
that's the most popular picture in

581
00:25:38,090 --> 00:25:35,400
NASA's history and one of the most

582
00:25:41,720 --> 00:25:38,100
popular ever it's absolutely beautiful

583
00:25:44,720 --> 00:25:41,730
and they I think that Frank Borman and

584
00:25:46,549 --> 00:25:44,730
Lovell and Anders on that flight they

585
00:25:49,190 --> 00:25:46,559
saw the earth

586
00:25:51,769 --> 00:25:49,200
in a different way than anyone ever had

587
00:25:55,340 --> 00:25:51,779
before and I think they were were quite

588
00:25:57,019 --> 00:25:55,350

moved by how fragile everything looked I

589
00:25:59,029 --> 00:25:57,029
think a lot of people believe that was

590
00:26:01,999 --> 00:25:59,039
sort of the start of the environmental

591
00:26:04,460 --> 00:26:02,009
movement he saw how fragile it was he

592
00:26:06,830 --> 00:26:04,470
talked about the good earth and and it

593
00:26:09,409 --> 00:26:06,840
was it was very moving now for me

594
00:26:13,759 --> 00:26:09,419
personally that was a and especially

595
00:26:18,799 --> 00:26:13,769
neat thing I'm married in August of that

596
00:26:22,039 --> 00:26:18,809
year of August in 1968 and so I was 30

597
00:26:25,730 --> 00:26:22,049
and my young bride was 20 and we went to

598
00:26:27,799 --> 00:26:25,740
her home in Kansas City and sitting with

599
00:26:30,710 --> 00:26:27,809
all the family together watching on

600
00:26:33,279 --> 00:26:30,720
television when Apollo 8 when that whole

601
00:26:39,830 --> 00:26:33,289
that took place so it had a particular

602
00:26:44,750 --> 00:26:42,320
it was a small city when I came here I

603
00:26:47,420 --> 00:26:44,760
think at that point it was up to about

604
00:26:51,770 --> 00:26:47,430
30,000 people or so it had been like

605
00:26:53,360 --> 00:26:51,780
10,000 when Redstone Arsenal was

606
00:26:55,550 --> 00:26:53,370
reactivated Redstone Arsenal and

607
00:26:56,570 --> 00:26:55,560
Huntsville Arsenal both existed during

608
00:26:58,640 --> 00:26:56,580
World War two

609
00:27:03,190 --> 00:26:58,650
both were closed at the end of the war

610
00:27:08,420 --> 00:27:03,200
there was a big push to get the

611
00:27:11,450 --> 00:27:08,430
something to replace them in our economy

612
00:27:13,970 --> 00:27:11,460
the Germans had deployed a a jet fighter

613
00:27:17,000 --> 00:27:13,980

at the end of the war it came in too

614
00:27:18,710 --> 00:27:17,010
late to to really do anything it can

615
00:27:21,350 --> 00:27:18,720
only stop for a little while and and

616
00:27:24,500 --> 00:27:21,360
wasn't especially maneuverable but it

617
00:27:28,640 --> 00:27:24,510
entered it showed that the next aircraft

618
00:27:31,520 --> 00:27:28,650
propulsion was going to be the jet jet

619
00:27:33,470 --> 00:27:31,530
propulsion and they wanted the nation

620
00:27:37,390 --> 00:27:33,480
needed a large tunnel so that they could

621
00:27:40,040 --> 00:27:37,400
test full-size jet fighters in it and

622
00:27:42,650 --> 00:27:40,050
there was a lot of competition Alabama

623
00:27:43,730 --> 00:27:42,660
was competing for it and Tennessee was

624
00:27:46,370 --> 00:27:43,740
competing for it

625
00:27:48,440 --> 00:27:46,380
and in those days this was it was a

626
00:27:51,980 --> 00:27:48,450
solid Democratic South this was before

627
00:27:54,440 --> 00:27:51,990
the civil rights movement in 1950 and

628
00:27:56,960 --> 00:27:54,450
this was solid Democratic territory in

629
00:27:59,270 --> 00:27:56,970
those days all the senators stayed as

630
00:28:00,680 --> 00:27:59,280
long as they wanted to stay they they

631
00:28:02,570 --> 00:28:00,690
basically was considered almost

632
00:28:05,690 --> 00:28:02,580
unpatriotic to run against them in the

633
00:28:07,130 --> 00:28:05,700
primary and the other party didn't

634
00:28:09,440 --> 00:28:07,140
bother to run against him in the fall

635
00:28:11,690 --> 00:28:09,450
because it wouldn't it wasn't worth the

636
00:28:13,550 --> 00:28:11,700
effort there they couldn't win and so we

637
00:28:15,830 --> 00:28:13,560
had senator Sparkman could have been in

638
00:28:21,320 --> 00:28:15,840

for a long time very powerful Georgia

639
00:28:23,330 --> 00:28:21,330
had sinister Griffin and they he stayed

640
00:28:27,950 --> 00:28:23,340
in for a very very long time

641
00:28:30,470 --> 00:28:27,960
Tennessee had Estes Kefauver and Al Gore

642
00:28:33,880 --> 00:28:30,480
senior they had powerful senator Stennis

643
00:28:36,470 --> 00:28:33,890
had our Mississippi had senator Stennis

644
00:28:39,170 --> 00:28:36,480
Louisiana had senator DeLong and all

645
00:28:41,720 --> 00:28:39,180
these people would stay 20 30 years and

646
00:28:42,980 --> 00:28:41,730
they had control of all the money then

647
00:28:45,170 --> 00:28:42,990
controlled every committee there

648
00:28:46,700 --> 00:28:45,180
controlled everything and so they kind

649
00:28:48,190 --> 00:28:46,710
of worked it out among themselves

650
00:28:50,830 --> 00:28:48,200
well Tennessee and Alabama

651
00:28:53,649 --> 00:28:50,840
were competing to get that wind tunnel

652
00:28:56,320 --> 00:28:53,659
and in the end Tennessee got it

653
00:28:59,049 --> 00:28:56,330
so as somewhat as a consolation prize

654
00:29:01,779 --> 00:28:59,059
they had already kind of wanted to get

655
00:29:03,730 --> 00:29:01,789
all the missile work together they they

656
00:29:06,490 --> 00:29:03,740
brought this group that had come over

657
00:29:08,980 --> 00:29:06,500
under Operation Paperclip they were out

658
00:29:11,500 --> 00:29:08,990
in white sands and then we had other

659
00:29:13,330 --> 00:29:11,510
missile war going in other places they

660
00:29:17,080 --> 00:29:13,340
looked at the facility here at Redstone

661
00:29:19,600 --> 00:29:17,090
Arsenal had almost 60 square miles it

662
00:29:22,690 --> 00:29:19,610
had the river for good transportation it

663
00:29:24,759 --> 00:29:22,700

had rail it was a good climate there

664
00:29:26,710 --> 00:29:24,769
were a lot of things going for it and in

665
00:29:30,070 --> 00:29:26,720
the end we got that as a consolation

666
00:29:32,649 --> 00:29:30,080
prize tella homeowner was about 10,000

667
00:29:35,500 --> 00:29:32,659
to 15,000 people when they got the wind

668
00:29:39,310 --> 00:29:35,510
tunnel it's 10 to 15 thousand people

669
00:29:41,649 --> 00:29:39,320
today houseful when we got that was

670
00:29:43,360 --> 00:29:41,659
about ten thousand people today its

671
00:29:46,600 --> 00:29:43,370
approaching two hundred thousand people

672
00:29:49,720 --> 00:29:46,610
and in the next census we'll probably be

673
00:29:51,730 --> 00:29:49,730
the second largest and when census after

674
00:29:54,519 --> 00:29:51,740
that partner to be the largest city in

675
00:30:01,830 --> 00:29:54,529
Alabama so enough the consolation prize

676
00:30:09,279 --> 00:30:06,580
my work on Apollo on Saturn 5 had been

677
00:30:11,799 --> 00:30:09,289
with respect to the design the dynamic

678
00:30:12,310 --> 00:30:11,809
stability the wind loads that kind of

679
00:30:14,980 --> 00:30:12,320
thing

680
00:30:18,009 --> 00:30:14,990
I had no operational role in it at all

681
00:30:21,039 --> 00:30:18,019
and dr. von Braun was very very good to

682
00:30:23,620 --> 00:30:21,049
make sure that people who had worked on

683
00:30:26,649 --> 00:30:23,630
the Saturn 5 that were not involved with

684
00:30:29,110 --> 00:30:26,659
its operation had the opportunity to see

685
00:30:33,070 --> 00:30:29,120
history made so he he made it possible

686
00:30:36,159 --> 00:30:33,080
for us all to to go down and to and to

687
00:30:41,230 --> 00:30:36,169
see it so I was able to when I when I

688
00:30:44,830 --> 00:30:41,240

married in August of 68 my office that I

689
00:30:48,340 --> 00:30:44,840
was working with they they gave me a the

690
00:30:50,799 --> 00:30:48,350
newest technology super 8 movie camera

691
00:30:52,840 --> 00:30:50,809
projector screen and all that and of

692
00:30:54,970 --> 00:30:52,850
course super 8 was an improvement over

693
00:30:57,940 --> 00:30:54,980
eight millimeter or six sixteen

694
00:31:00,279 --> 00:30:57,950
millimeter but it was not like videos

695
00:31:03,159 --> 00:31:00,289
today that are digital it was still film

696
00:31:05,409 --> 00:31:03,169
but I had that and we took it down and

697
00:31:07,539 --> 00:31:05,419
pinion I went to that went to that

698
00:31:09,610 --> 00:31:07,549
launch and we were we were about as

699
00:31:12,580 --> 00:31:09,620
close to about three and a half miles we

700
00:31:15,460 --> 00:31:12,590
were just north of the VAB and had a

701
00:31:17,860 --> 00:31:15,470
perfect clear unrestricted view of the

702
00:31:21,129 --> 00:31:17,870
launch and I took my oh I still have my

703
00:31:22,840 --> 00:31:21,139
own pictures I took of it but the Saturn

704
00:31:25,180 --> 00:31:22,850
5 looks about that I didn't have

705
00:31:27,700 --> 00:31:25,190
telescopic lens but I do have my own

706
00:31:30,820 --> 00:31:27,710
recording of the of a launch of it and

707
00:31:33,490 --> 00:31:30,830
it was absolutely just beautiful Nicky

708
00:31:34,659 --> 00:31:33,500
the excitement of all the people that

709
00:31:36,310 --> 00:31:34,669
were that don't know how many people

710
00:31:38,950 --> 00:31:36,320
there I think there were several hundred

711
00:31:42,610 --> 00:31:38,960
thousand people who watched it in person

712
00:31:45,100 --> 00:31:42,620
and there was really wall-to-wall people

713
00:31:46,899 --> 00:31:45,110

and it was just exciting to be a part of

714
00:31:50,470 --> 00:31:46,909
it and we made it back times fall in

715
00:31:55,529 --> 00:31:50,480
time to be in our family room and we had

716
00:32:00,730 --> 00:31:55,539
a new house that we had moved into and

717
00:32:04,210 --> 00:32:00,740
we were able to to see the Senate our in

718
00:32:07,899 --> 00:32:04,220
our den and watch those ghostly pictures

719
00:32:11,250 --> 00:32:07,909
from the when they first stepped on the

720
00:32:14,520 --> 00:32:11,260
moon and so it was it was just a very

721
00:32:17,790 --> 00:32:14,530
tastic thing for me so I was I was able

722
00:32:19,890 --> 00:32:17,800
to in effect it was like we've been

723
00:32:22,910 --> 00:32:19,900
married less than a year so it was sort

724
00:32:25,830 --> 00:32:22,920
of a second honeymoon for us it was a

725
00:32:29,100 --> 00:32:25,840
wonderful time and I have incredible

726
00:32:31,080 --> 00:32:29,110
memories of what that was what that was

727
00:32:33,840 --> 00:32:31,090
like and of course the mission the idea

728
00:32:36,270 --> 00:32:33,850
of people actually landing on the moon

729
00:32:37,680 --> 00:32:36,280
they're they're skeptics today who'd

730
00:32:40,200 --> 00:32:37,690
question that we did it but that's

731
00:32:42,870 --> 00:32:40,210
ridiculous I mean our satellites could

732
00:32:45,120 --> 00:32:42,880
even take pictures of the what's of the

733
00:32:47,940 --> 00:32:45,130
where we touched down and say the

734
00:32:50,660 --> 00:32:47,950
landing stage which the landing stage on

735
00:32:54,270 --> 00:32:50,670
the Apollo was used as the launch stage

736
00:32:56,130 --> 00:32:54,280
to get to go back up and so well that

737
00:32:58,230 --> 00:32:56,140
first stage is still on the moon and you

738
00:33:00,030 --> 00:32:58,240

can still see right where it was and

739
00:33:01,860 --> 00:33:00,040
it's just ridiculous but there are

740
00:33:04,590 --> 00:33:01,870
skeptics that even today think we didn't

741
00:33:09,690 --> 00:33:04,600
that we didn't go but that was a fun

742
00:33:16,859 --> 00:33:12,989
first of all I don't think anyone at

743
00:33:18,720 --> 00:33:16,869
that time you could never got a bet that

744
00:33:21,779 --> 00:33:18,730
we wouldn't have gone on to Mars in the

745
00:33:25,739 --> 00:33:21,789
next 50 years that we would go to the

746
00:33:28,409 --> 00:33:25,749
moon we would land six times twelve

747
00:33:32,009 --> 00:33:28,419
people would walk on the moon and it

748
00:33:34,710 --> 00:33:32,019
would it would all end in in just a

749
00:33:37,590 --> 00:33:34,720
couple of years and that we would never

750
00:33:40,109 --> 00:33:37,600
go back we in fact we didn't people that

751
00:33:41,759 --> 00:33:40,119
kind of lost interested begin to we were

752
00:33:44,249 --> 00:33:41,769
so successful it almost looked for a

753
00:33:48,060 --> 00:33:44,259
team and they decided we've been very

754
00:33:50,729 --> 00:33:48,070
lucky we've had a lot of close calls but

755
00:33:53,369 --> 00:33:50,739
we've been lucky why take a chance on

756
00:33:57,330 --> 00:33:53,379
having a disaster so the flight hardware

757
00:34:02,009 --> 00:33:57,340
for Apollo 18 was built but it didn't

758
00:34:05,310 --> 00:34:02,019
fly we have the actual rover vehicle is

759
00:34:07,440 --> 00:34:05,320
out is that the in the Space and Rocket

760
00:34:09,919 --> 00:34:07,450
Center here that's not a test vehicle

761
00:34:15,780 --> 00:34:09,929
that was going to be the hardware on

762
00:34:17,970 --> 00:34:15,790
Apollo 18 and the actual saturn v launch

763
00:34:20,430 --> 00:34:17,980

vehicle is the one that is down at the

764
00:34:24,859 --> 00:34:20,440
Johnson Space Center that you can see

765
00:34:27,899 --> 00:34:24,869
the one we have out here the is is the

766
00:34:30,960 --> 00:34:27,909
dynamic that's what was in the dynamic

767
00:34:33,930 --> 00:34:30,970
test our is is what we have here and the

768
00:34:37,289 --> 00:34:33,940
propulsion test articles are what they

769
00:34:38,909 --> 00:34:37,299
have at the Kennedy Space Center but

770
00:34:40,440 --> 00:34:38,919
they all look the difference between

771
00:34:43,139 --> 00:34:40,450
that the flight hardware you can't tell

772
00:34:44,549 --> 00:34:43,149
the difference but it's it's interesting

773
00:34:47,430 --> 00:34:44,559
to see that and of course then we have

774
00:34:49,169 --> 00:34:47,440
the high fidelity mock-up it's not a

775
00:34:51,270 --> 00:34:49,179
real vehicle but it looks so much like

776
00:34:53,669 --> 00:34:51,280
it you couldn't tell that it's not

777
00:34:56,280 --> 00:34:53,679
vertical so this is the only spot alert

778
00:34:59,579 --> 00:34:56,290
that you can go see they want a Saturn 5

779
00:35:02,250 --> 00:34:59,589
looked like vertical but the fact that

780
00:35:06,120 --> 00:35:02,260
we did not go forward I think would be

781
00:35:06,690 --> 00:35:06,130
the biggest disappointment in the Apollo

782
00:35:09,839 --> 00:35:06,700
program

783
00:35:12,030 --> 00:35:09,849
I think everyone expected that the next

784
00:35:14,760 --> 00:35:12,040
step will be Mars and we had at that

785
00:35:16,799 --> 00:35:14,770
time we had a National Space Council

786
00:35:18,380 --> 00:35:16,809
chaired by the vice president as it is

787
00:35:21,490 --> 00:35:18,390
today and

788
00:35:24,440 --> 00:35:21,500

at that time it was Spiro Agnew and

789
00:35:27,140 --> 00:35:24,450
Nixon was the president and they were

790
00:35:29,960 --> 00:35:27,150
they were prepared to go forward and

791
00:35:32,630 --> 00:35:29,970
when they asked how long it would take

792
00:35:35,420 --> 00:35:32,640
they envision this being something that

793
00:35:37,880 --> 00:35:35,430
would happen during Nixon's second term

794
00:35:41,300 --> 00:35:37,890
when they found that we could not go to

795
00:35:44,180 --> 00:35:41,310
Mars that quickly then they lost

796
00:35:46,130 --> 00:35:44,190
interested and so and that's that was

797
00:35:47,830 --> 00:35:46,140
gotten the end of that program and we

798
00:35:54,240 --> 00:35:47,840
have not been back to the moon and

799
00:36:02,220 --> 00:35:58,500
and I think that a lot of people without

800
00:36:04,589 --> 00:36:02,230
anybody say that our putting landing men

801
00:36:08,730 --> 00:36:04,599
on the moon was the greatest achievement

802
00:36:11,430 --> 00:36:08,740
of the 20th century and of course it's

803
00:36:13,320 --> 00:36:11,440
not hard to convince me of that we knew

804
00:36:15,390 --> 00:36:13,330
at the time that we were making history

805
00:36:17,640 --> 00:36:15,400
what we didn't know was what kind of

806
00:36:20,130 --> 00:36:17,650
history was gonna be we weren't sure if

807
00:36:23,250 --> 00:36:20,140
it was if it was there be as it turned

808
00:36:26,010 --> 00:36:23,260
out to be a moment of great triumph or

809
00:36:28,680 --> 00:36:26,020
if it was gonna be the greatest Fiasco

810
00:36:31,500 --> 00:36:28,690
of all time killed people spent billions

811
00:36:33,030 --> 00:36:31,510
of dollars and still not get there so we

812
00:36:34,830 --> 00:36:33,040
knew we were making history one way or