



1
00:00:14,289 --> 00:00:12,280
I had participated in the launch of the

2
00:00:18,220 --> 00:00:14,299
other launch vehicle and being on the

3
00:00:20,140 --> 00:00:18,230
Marshall team obviously once the the

4
00:00:22,330 --> 00:00:20,150
crew was in orbit we'd kind of finished

5
00:00:23,620 --> 00:00:22,340
our launch exercises and got to come

6
00:00:26,290 --> 00:00:23,630
home

7
00:00:30,519 --> 00:00:26,300
I was actually back in Huntsville at the

8
00:00:33,670 --> 00:00:30,529
time of the of the landing and watched

9
00:00:37,840 --> 00:00:33,680
it all as it was happening on on

10
00:00:39,700 --> 00:00:37,850
television it was certainly to say it

11
00:00:43,600 --> 00:00:39,710
was exciting would be a total

12
00:00:45,430 --> 00:00:43,610
understatement of the fact I think that

13
00:00:49,600 --> 00:00:45,440

one of the things that I do remember

14

00:00:52,630 --> 00:00:49,610

very vividly well soon after the landing

15

00:00:55,810 --> 00:00:52,640

walking out and looking at the moon and

16

00:01:00,430 --> 00:00:55,820

and knowing that there were people there

17

00:01:04,570 --> 00:01:00,440

that that I had known knowing that I had

18

00:01:06,609 --> 00:01:04,580

had a opportunity to participate in that

19

00:01:09,670 --> 00:01:06,619

program from literally from the very

20

00:01:12,400 --> 00:01:09,680

beginning of it up to that point in time

21

00:01:15,059 --> 00:01:12,410

and looking at the moon and knowing that

22

00:01:18,520 --> 00:01:15,069

was probably one of the most humbling

23

00:01:21,339 --> 00:01:18,530

experiences that I can recall ever

24

00:01:25,419 --> 00:01:21,349

having because it was a not only a sense

25

00:01:30,460 --> 00:01:25,429

of personal satisfaction it was a sense

26

00:01:32,230 --> 00:01:30,470

of I think also national pride that all

27

00:01:34,600 --> 00:01:32,240

of us that were associated with that

28

00:01:37,660 --> 00:01:34,610

program were needless to say you were

29

00:01:43,810 --> 00:01:37,670

very pleased with at the time and I

30

00:01:50,470 --> 00:01:47,320

at the time the of the lunar landing I

31

00:01:53,230 --> 00:01:50,480

was associated with the Apollo launch

32

00:01:55,900 --> 00:01:53,240

vehicle here at Marshall more

33

00:01:58,990 --> 00:01:55,910

specifically I was in charge of

34

00:02:02,080 --> 00:01:59,000

engineering and testing from the project

35

00:02:04,870 --> 00:02:02,090

office side of the second stage which

36

00:02:08,170 --> 00:02:04,880

was built by rock wall out in Seal Beach

37

00:02:10,960 --> 00:02:08,180

California I had been through the early

38

00:02:14,350 --> 00:02:10,970

development of that that launch vehicle

39

00:02:16,150 --> 00:02:14,360

the early design testing building of the

40

00:02:19,960 --> 00:02:16,160

flight articles and then the early

41

00:02:23,350 --> 00:02:19,970

flights of the Apollo vehicle so I had

42

00:02:26,080 --> 00:02:23,360

seen that the program basically from an

43

00:02:30,900 --> 00:02:26,090

idea up through the up through those

44

00:02:38,820 --> 00:02:35,730

when I look back at the that basically

45

00:02:40,710 --> 00:02:38,830

the industry and the capability that we

46

00:02:44,540 --> 00:02:40,720

were building at that time and all of

47

00:02:47,310 --> 00:02:44,550

the infrastructure that that went into

48

00:02:50,310 --> 00:02:47,320

being able to accommodate the Apollo

49

00:02:53,460 --> 00:02:50,320

program and namely the facilities the

50

00:02:56,670 --> 00:02:53,470

manufacturing facilities but also had we

51
00:02:59,370 --> 00:02:56,680
had the computational capability then we

52
00:03:03,120 --> 00:02:59,380
have now that job would have been

53
00:03:05,640 --> 00:03:03,130
significantly easier we might have

54
00:03:09,750 --> 00:03:05,650
sharpened our pencil too much had we had

55
00:03:13,190 --> 00:03:09,760
it then we we at Marshall were were

56
00:03:15,770 --> 00:03:13,200
accused of building our launch vehicles

57
00:03:18,330 --> 00:03:15,780
much stronger than they needed to be

58
00:03:20,690 --> 00:03:18,340
that turned out before the Apollo

59
00:03:23,280 --> 00:03:20,700
program was over to been a real asset

60
00:03:25,110 --> 00:03:23,290
because we were able to carry heavier

61
00:03:28,110 --> 00:03:25,120
weights we were ever carry or longer

62
00:03:32,100 --> 00:03:28,120
vehicles and it made the vehicles

63
00:03:34,980 --> 00:03:32,110

extremely more more versatile and more

64

00:03:38,940 --> 00:03:34,990

accommodating to win conditions weather

65

00:03:40,560 --> 00:03:38,950

conditions and this type today we we

66

00:03:43,860 --> 00:03:40,570

tend to want to sharpen our pencils

67

00:03:47,070 --> 00:03:43,870

probably too much but if I look back at

68

00:03:49,680 --> 00:03:47,080

that point in time we literally were

69

00:03:52,050 --> 00:03:49,690

having to build the standards the

70

00:03:56,010 --> 00:03:52,060

equipment that that we were using to

71

00:03:58,800 --> 00:03:56,020

test in many cases was as complicated as

72

00:04:00,390 --> 00:03:58,810

was the the parts or the engine

73

00:04:02,040 --> 00:04:00,400

components or the engines or the

74

00:04:05,040 --> 00:04:02,050

structural components that we were

75

00:04:07,470 --> 00:04:05,050

trying to build so there was a lot

76

00:04:10,890 --> 00:04:07,480

learned because we didn't have all of

77

00:04:12,690 --> 00:04:10,900

the fine tools we have today and as a as

78

00:04:13,920 --> 00:04:12,700

a young engineer that was probably the

79

00:04:16,530 --> 00:04:13,930

best thing could have happened to

80

00:04:20,400 --> 00:04:16,540

literally hundreds of thousands of us

81

00:04:23,580 --> 00:04:20,410

around the in the government as well as

82

00:04:26,160 --> 00:04:23,590

in industry if we happen to build the

83

00:04:28,350 --> 00:04:26,170

tools as long long worth building the

84

00:04:30,330 --> 00:04:28,360

products I guess in summary I would say

85

00:04:34,140 --> 00:04:30,340

I would have loved to have had some of

86

00:04:38,070 --> 00:04:34,150

the computational tools back then we

87

00:04:42,090 --> 00:04:38,080

have now back then a freedom was uh was

88

00:04:47,920 --> 00:04:42,100

uh almost a status symbol and side rules

89

00:04:53,770 --> 00:04:50,950

I think there were two very fundamental

90

00:04:56,020 --> 00:04:53,780

things that were that were at work we

91

00:04:58,210 --> 00:04:56,030

had a national commitment we had a

92

00:04:59,620 --> 00:04:58,220

congressional commitment and more

93

00:05:03,340 --> 00:04:59,630

importantly we had a presidential

94

00:05:05,350 --> 00:05:03,350

commitment the second thing that in my

95

00:05:07,719 --> 00:05:05,360

judgment made it possible and certainly

96

00:05:10,810 --> 00:05:07,729

the part that centered here in

97

00:05:11,370 --> 00:05:10,820

Huntsville was the leadership of dr. von

98

00:05:17,050 --> 00:05:11,380

Braun

99

00:05:21,810 --> 00:05:17,060

he was a master leader he was a superb

100

00:05:24,719 --> 00:05:21,820

engineer he was a visionary and he was a

101
00:05:28,150 --> 00:05:24,729
probably one of the best technical

102
00:05:32,379 --> 00:05:28,160
coordinators and that's almost an unfair

103
00:05:35,230 --> 00:05:32,389
statement to to manage people to manage

104
00:05:39,010 --> 00:05:35,240
large programs and to assist in the

105
00:05:41,950 --> 00:05:39,020
management of large contractors the fact

106
00:05:45,129 --> 00:05:41,960
that we had to literally build an

107
00:05:47,890 --> 00:05:45,139
industry we had to build a almost a

108
00:05:51,100 --> 00:05:47,900
complete infrastructure relative to test

109
00:05:54,909 --> 00:05:51,110
and manufacturing facilities launch

110
00:05:57,430 --> 00:05:54,919
facilities to be able to do all of that

111
00:06:01,120 --> 00:05:57,440
in the timeframe that we did it

112
00:06:03,909 --> 00:06:01,130
was still in my judgment almost a

113
00:06:06,129 --> 00:06:03,919

significant a feat as the fact of going

114

00:06:08,129 --> 00:06:06,139

to the moon of just getting all of those

115

00:06:10,770 --> 00:06:08,139

facilities and all of those teams

116

00:06:14,529 --> 00:06:10,780

because literally we were building an

117

00:06:17,620 --> 00:06:14,539

industry a very new industry that had

118

00:06:21,779 --> 00:06:17,630

only started just a few like 10 to 15

119

00:06:25,930 --> 00:06:21,789

years earlier than the lunar landing so

120

00:06:28,749 --> 00:06:25,940

to me those were the key things that had

121

00:06:31,779 --> 00:06:28,759

to happen and fortunately we had the

122

00:06:35,170 --> 00:06:31,789

leadership in the country in Congress

123

00:06:37,629 --> 00:06:35,180

and and in the program with which to to

124

00:06:40,180 --> 00:06:37,639

make that happen and certainly we had an

125

00:06:43,240 --> 00:06:40,190

excellent administrator and James Webb

126
00:06:48,520 --> 00:06:43,250
too to help lead that industrial team

127
00:06:56,770 --> 00:06:52,950
he was the to me one of the most

128
00:07:01,150 --> 00:06:56,780
intellectual people but yet one of the

129
00:07:03,880 --> 00:07:01,160
most real and down-to-earth people I had

130
00:07:06,370 --> 00:07:03,890
the opportunity to to work with him I

131
00:07:09,550 --> 00:07:06,380
had the opportunity to travel with him a

132
00:07:12,700 --> 00:07:09,560
lot and for a young engineer that was in

133
00:07:17,050 --> 00:07:12,710
his late 20s early 30s at that time

134
00:07:20,470 --> 00:07:17,060
frame I considered probably one of the

135
00:07:24,280 --> 00:07:20,480
luckiest probably events of my life was

136
00:07:28,290 --> 00:07:24,290
being able to to know the man and to

137
00:07:33,730 --> 00:07:28,300
work for him and to to travel with him

138
00:07:36,640 --> 00:07:33,740

he loved to fly as much as probably any

139

00:07:39,610 --> 00:07:36,650

person I've ever seen if he had a second

140

00:07:42,310 --> 00:07:39,620

hobby short of boating and his family it

141

00:07:46,360 --> 00:07:42,320

would probably be weather and its

142

00:07:48,790 --> 00:07:46,370

association with flying I'll never

143

00:07:51,880 --> 00:07:48,800

forget we were flying back from the west

144

00:07:54,520 --> 00:07:51,890

coast one time and this was when

145

00:07:56,710 --> 00:07:54,530

Learjets had just just come out there

146

00:08:00,730 --> 00:07:56,720

were only a few of them you know in the

147

00:08:02,620 --> 00:08:00,740

southeast and we had had one we had gone

148

00:08:05,590 --> 00:08:02,630

to the west coast and back it we had to

149

00:08:07,510 --> 00:08:05,600

do in a very short time as we were

150

00:08:11,200 --> 00:08:07,520

flying back we were at about forty

151
00:08:15,610 --> 00:08:11,210
forty-one thousand feet and we came upon

152
00:08:18,430 --> 00:08:15,620
an absolute classic anvil cloud and this

153
00:08:21,010 --> 00:08:18,440
cloud towered probably another eight ten

154
00:08:25,350 --> 00:08:21,020
thousand feet above us and we just

155
00:08:28,840 --> 00:08:25,360
circled right around just under the the

156
00:08:31,810 --> 00:08:28,850
the trailing edge of the anvil of that

157
00:08:35,320 --> 00:08:31,820
cloud and the two of us at there and he

158
00:08:37,930 --> 00:08:35,330
gave me a description of every air

159
00:08:42,100 --> 00:08:37,940
current every phenomena that was going

160
00:08:44,410 --> 00:08:42,110
on in that particular weather cell he'd

161
00:08:45,940 --> 00:08:44,420
literally took that cloud that literally

162
00:08:49,180 --> 00:08:45,950
went all the way from the ground up to

163
00:08:51,970 --> 00:08:49,190

probably forty-eight forty-nine thousand

164

00:08:55,540 --> 00:08:51,980

feet and he dissected it vertically and

165

00:08:57,880 --> 00:08:55,550

then dissected it horizontally and he

166

00:09:00,250 --> 00:08:57,890

could point it out where the hail was

167

00:09:02,320 --> 00:09:00,260

being generated in the backside and the

168

00:09:04,480 --> 00:09:02,330

air currents and how they would sweep

169

00:09:07,780 --> 00:09:04,490

the rain particles up into the colder

170

00:09:10,540 --> 00:09:07,790

air and keep that circulation going

171

00:09:13,120 --> 00:09:10,550

until a large hail was generated and

172

00:09:18,540 --> 00:09:13,130

then it would fall out to the earth and

173

00:09:22,360 --> 00:09:18,550

I remember to this day exactly how that

174

00:09:25,710 --> 00:09:22,370

those weather phenomenons work only

175

00:09:29,040 --> 00:09:25,720

because that he was such an articulate

176

00:09:32,650 --> 00:09:29,050

instructor he was articulate and

177

00:09:36,370 --> 00:09:32,660

literally everything that that he did

178

00:09:41,320 --> 00:09:36,380

the extreme sense of humor he had a just

179

00:09:46,480 --> 00:09:41,330

a way of turning tense moments into into

180

00:09:50,350 --> 00:09:46,490

manageable situations so and and like I

181

00:09:55,570 --> 00:09:50,360

say he was he was just that relaxed with

182

00:10:00,790 --> 00:09:55,580

people and I've never seen him look down

183

00:10:03,550 --> 00:10:00,800

on anyone regardless of the positions

184

00:10:05,830 --> 00:10:03,560

that work with him he were done he would

185

00:10:08,590 --> 00:10:05,840

stop and talk to you you would I

186

00:10:12,790 --> 00:10:08,600

remember even before the Apollo program

187

00:10:14,800 --> 00:10:12,800

when he and general Medeiros would come

188

00:10:16,660 --> 00:10:14,810

around through the labs they would walk

189

00:10:19,510 --> 00:10:16,670

through and he would he loved to stop

190

00:10:23,620 --> 00:10:19,520

and talk to the people the technicians

191

00:10:27,580 --> 00:10:23,630

on the floor and as a as a young college

192

00:10:31,210 --> 00:10:27,590

graduate that was impressive to me to

193

00:10:35,650 --> 00:10:31,220

have him to see how warm he was with

194

00:10:41,740 --> 00:10:35,660

people but yet how genuine he was as a

195

00:10:47,440 --> 00:10:44,800

it was exhilarating to just work here

196

00:10:51,400 --> 00:10:47,450

because you just you didn't even think

197

00:10:54,460 --> 00:10:51,410

about working eight hours a day you just

198

00:10:57,580 --> 00:10:54,470

worked as long as it took to to do the

199

00:11:01,150 --> 00:10:57,590

job those of us that were young people

200

00:11:03,490 --> 00:11:01,160

there were a few older people and

201
00:11:07,360 --> 00:11:03,500
especially the Germans that we got to

202
00:11:11,020 --> 00:11:07,370
work side-by-side directly with and or

203
00:11:16,060 --> 00:11:11,030
directly under that told us an awful lot

204
00:11:20,320 --> 00:11:16,070
about solving technical problems about

205
00:11:22,390 --> 00:11:20,330
dedication to to the job but yet they

206
00:11:26,440 --> 00:11:22,400
were all very dedicated to their

207
00:11:29,200 --> 00:11:26,450
families and that made a significant

208
00:11:31,020 --> 00:11:29,210
impression the other thing that I think

209
00:11:33,490 --> 00:11:31,030
who was significant is the

210
00:11:37,300 --> 00:11:33,500
responsibilities that were given to each

211
00:11:39,460 --> 00:11:37,310
of us we were given a job you were

212
00:11:42,820 --> 00:11:39,470
allowed to make mistakes you were

213
00:11:44,740 --> 00:11:42,830

allowed to fail as long as you learn

214

00:11:47,110 --> 00:11:44,750

from your failures or learn from your

215

00:11:50,829 --> 00:11:47,120

mistakes and then went on and built

216

00:11:53,770 --> 00:11:50,839

better products as a result of that the

217

00:11:55,840 --> 00:11:53,780

fact that we had an absolute goal even

218

00:11:58,690 --> 00:11:55,850

when we were a part of the army

219

00:12:03,010 --> 00:11:58,700

ballistic missile agency in the mid to

220

00:12:06,130 --> 00:12:03,020

late 50s up until the 60s when we moved

221

00:12:08,800 --> 00:12:06,140

over to NASA we knew exactly what our

222

00:12:11,140 --> 00:12:08,810

jobs were we knew what goals we had to

223

00:12:14,020 --> 00:12:11,150

meet when you what schedules we had to

224

00:12:17,290 --> 00:12:14,030

make and everyone believed in them and

225

00:12:20,410 --> 00:12:17,300

everyone was dedicated to to making it

226

00:12:23,950 --> 00:12:20,420

happen and the German team and and the

227

00:12:27,730 --> 00:12:23,960

leadership of von Braun that just easily

228

00:12:30,910 --> 00:12:27,740

permeated all levels of the organization

229

00:12:33,460 --> 00:12:30,920

so there was no we didn't have to worry

230

00:12:36,070 --> 00:12:33,470

about how to motivate people they were

231

00:12:38,650 --> 00:12:36,080

absolutely motivated from the top and

232

00:12:41,500 --> 00:12:38,660

Lambton national top all the way down

233

00:12:43,240 --> 00:12:41,510

through the von braun team down to those

234

00:12:50,259 --> 00:12:43,250

of us that were turning the cranks and

235

00:12:57,809 --> 00:12:54,730

we created a goal after Apollo 2 to

236

00:13:00,429 --> 00:12:57,819

build a totally reusable launch vehicle

237

00:13:04,929 --> 00:13:00,439

we studied that for a number of years

238

00:13:08,109 --> 00:13:04,939

and a few years and came up with a fully

239

00:13:11,309 --> 00:13:08,119

reusable Space Shuttle we presented that

240

00:13:14,829 --> 00:13:11,319

to Congress and the budget was too high

241

00:13:17,139 --> 00:13:14,839

we cut the budget in half we did away

242

00:13:21,340 --> 00:13:17,149

with the reusable booster and we ended

243

00:13:24,189 --> 00:13:21,350

up with a with a throwaway external tank

244

00:13:29,189 --> 00:13:24,199

and reusable solids and an orbiter as we

245

00:13:38,280 --> 00:13:33,989

we were absolutely aware of Woodstock we

246

00:13:41,939 --> 00:13:38,290

were absolutely aware of the the good

247

00:13:47,720 --> 00:13:41,949

and the bad side of the Vietnam War but

248

00:13:52,109 --> 00:13:47,730

I could not see any deterioration of our

249

00:13:55,499 --> 00:13:52,119

dedication or our ability or our

250

00:13:58,289 --> 00:13:55,509

commitment to make our obligations come

251

00:14:00,059 --> 00:13:58,299

come to fruition like I said we were

252

00:14:08,510 --> 00:14:00,069

quite aware of what was going on in the

253

00:14:14,990 --> 00:14:11,240

personal pride the satisfaction of

254

00:14:19,070 --> 00:14:15,000

seeing a job happen a very difficult job

255

00:14:20,960 --> 00:14:19,080

of major undertaking and probably one of

256

00:14:24,710 --> 00:14:20,970

the most complex things that man had

257

00:14:29,210 --> 00:14:24,720

done at that time seeing that come to a

258

00:14:31,520 --> 00:14:29,220

successful few ition was probably one of

259

00:14:36,110 --> 00:14:31,530

the most exciting things that that I

260

00:14:38,960 --> 00:14:36,120

have been apart to in in my career but

261

00:14:42,560 --> 00:14:38,970

to be almost equal to that was the fact

262

00:14:44,930 --> 00:14:42,570

that we had a national commitment we had

263

00:14:47,770 --> 00:14:44,940

a space race there was no question it

264

00:14:52,580 --> 00:14:47,780

was a race it was one that we were

265

00:14:58,130 --> 00:14:52,590

dedicated to win and did but I think

266

00:14:59,450 --> 00:14:58,140

seeing the nation pull together all the

267

00:15:02,840 --> 00:14:59,460

way from the president through the

268

00:15:05,240 --> 00:15:02,850

Congress the OMB and into the NASA

269

00:15:08,300 --> 00:15:05,250

organizations and all of the industrial

270

00:15:15,370 --> 00:15:08,310

base that supported us in doing that to