



1
00:00:15,340 --> 00:00:12,770
this is a story about mission 33 a

2
00:00:21,410 --> 00:00:15,350
military mission flown on discovery in

3
00:00:25,429 --> 00:00:21,420
November 1989 I'm Fred Gregory the

4
00:00:29,089 --> 00:00:25,439
commander i'm john blaha was the pilot

5
00:00:32,720 --> 00:00:29,099
of the flight i'm kathy thornton i was

6
00:00:36,650 --> 00:00:32,730
mission specialist three story Musgrave

7
00:00:39,979 --> 00:00:36,660
as aim is to I'm Sonny Carter I was the

8
00:00:41,690 --> 00:00:39,989
you miss Warren this is about three

9
00:00:43,580 --> 00:00:41,700
hours before launch when we get in our

10
00:00:45,410 --> 00:00:43,590
suits and now we're leaving the building

11
00:00:47,450 --> 00:00:45,420
about two and a half hours to get in a

12
00:00:49,639 --> 00:00:47,460
crew van about four thirty in the

13
00:00:55,610 --> 00:00:49,649

afternoon it's just on my lunch yeah

14

00:00:57,889 --> 00:00:55,620

it's just before sunset discovery is

15

00:00:59,330 --> 00:00:57,899

sitting out on the pad waiting for us it

16

00:01:03,049 --> 00:00:59,340

was one of those exceptionally clear

17

00:01:05,870 --> 00:01:03,059

nights down in Florida everything went

18

00:01:08,570 --> 00:01:05,880

pretty smoothly right afternoon we had a

19

00:01:10,480 --> 00:01:08,580

little hold as we were counting down but

20

00:01:13,280 --> 00:01:10,490

essentially we launched right on time

21

00:01:15,530 --> 00:01:13,290

when those main engines started it felt

22

00:01:17,179 --> 00:01:15,540

like some electric motors back there but

23

00:01:18,679 --> 00:01:17,189

when those solid Rockets ignite it there

24

00:01:25,190 --> 00:01:18,689

was no doubt this thing was going to

25

00:01:26,899 --> 00:01:25,200

space there's people in the front seat

26
00:01:28,520 --> 00:01:26,909
we're looking at the front windows those

27
00:01:30,999 --> 00:01:28,530
of us in the back we're looking at the

28
00:01:33,109 --> 00:01:31,009
back windows that's where the view was

29
00:01:36,010 --> 00:01:33,119
and those of us on the mid-deck we're

30
00:01:38,480 --> 00:01:36,020
looking at the gallery in the lockers

31
00:01:40,160 --> 00:01:38,490
award is mirror on my wrist and looked

32
00:01:41,960 --> 00:01:40,170
at the rear windows you can see the

33
00:01:45,609 --> 00:01:41,970
whole of Florida lit up like a flanch

34
00:01:48,679 --> 00:01:45,619
boat this is a lot like training to me

35
00:01:51,080 --> 00:01:48,689
it was like riding a train kind of a

36
00:01:54,469 --> 00:01:51,090
rumbling until the solids fell off it

37
00:01:56,959 --> 00:01:54,479
was you listening I never made a night

38
00:01:58,910 --> 00:01:56,969

launch before but when those SRBs

39

00:02:01,249 --> 00:01:58,920

separated from the orbiter as you looked

40

00:02:02,630 --> 00:02:01,259

out through the front window at the

41

00:02:05,990 --> 00:02:02,640

separation motors it looked as though

42

00:02:07,789 --> 00:02:06,000

you were looking into a furnace and then

43

00:02:10,309 --> 00:02:07,799

the three main engines kept pushing us

44

00:02:12,559 --> 00:02:10,319

towards space and it's kind of neat they

45

00:02:15,679 --> 00:02:12,569

go from zero speed on the pad

46

00:02:21,800 --> 00:02:15,689

a half minutes later you're doing 17,500

47

00:02:24,080 --> 00:02:21,810

miles per hour space is just about as

48

00:02:25,910 --> 00:02:24,090

beautiful as you can imagine look it

49

00:02:31,220 --> 00:02:25,920

looks like black velvet with diamonds on

50

00:02:32,750 --> 00:02:31,230

it it's kind of a game of

51
00:02:35,149 --> 00:02:32,760
ring-around-the-rosie between the

52
00:02:37,569 --> 00:02:35,159
mid-deck and the flight deck it's really

53
00:02:39,709 --> 00:02:37,579
our first experience in zero-g up there

54
00:02:42,229 --> 00:02:39,719
hey you can see what happens to your

55
00:02:49,550 --> 00:02:42,239
hair up there in space and sure takes on

56
00:02:54,699 --> 00:02:49,560
a different style this is dr. Carter

57
00:03:02,000 --> 00:02:57,259
you see what I told you about your hair

58
00:03:07,610 --> 00:03:02,010
up there that's dr. Musgrave with all

59
00:03:13,520 --> 00:03:07,620
his degrees mr. Spock here comes John

60
00:03:14,869 --> 00:03:13,530
doing outside loop in it yeah I'm

61
00:03:16,520 --> 00:03:14,879
strapped to the wall there and stories

62
00:03:19,819 --> 00:03:16,530
going to going to use this phenomena

63
00:03:21,170 --> 00:03:19,829

here to see what the pressure is in my

64

00:03:22,759 --> 00:03:21,180

eyeball it's one of the medical

65

00:03:25,939 --> 00:03:22,769

experience we were doing and you get

66

00:03:29,179 --> 00:03:25,949

story taps that on you know right on my

67

00:03:31,189 --> 00:03:29,189

cornea and it reads a reading that we

68

00:03:34,399 --> 00:03:31,199

can then record he doesn't hurt at all

69

00:03:36,170 --> 00:03:34,409

now I've switched a story and I'm just

70

00:03:39,649 --> 00:03:36,180

kind of showing you the method although

71

00:03:41,119 --> 00:03:39,659

i'm not touching stories cornea here the

72

00:03:43,009 --> 00:03:41,129

reason we're doing this is because we're

73

00:03:48,080 --> 00:03:43,019

very interested in how the body changes

74

00:03:49,550 --> 00:03:48,090

and adapter quickly to microgravity this

75

00:03:52,069 --> 00:03:49,560

is a holter monitor and these are the

76

00:03:54,229 --> 00:03:52,079

leads that that it's like a cardiogram

77

00:03:57,740 --> 00:03:54,239

that continually records my heart rate

78

00:03:59,929 --> 00:03:57,750

and it's in its form and when i close

79

00:04:01,309 --> 00:03:59,939

the door it'll start here and I've and

80

00:04:02,869 --> 00:04:01,319

I've connected the leads and I'm just

81

00:04:05,030 --> 00:04:02,879

showing you what it records here and

82

00:04:09,840 --> 00:04:05,040

then I wore this underneath my suit all

83

00:04:14,510 --> 00:04:11,820

John would you think this experiment

84

00:04:17,880 --> 00:04:14,520

well this was another experiment where

85

00:04:20,270 --> 00:04:17,890

Sonny was was measuring data on all of

86

00:04:22,320 --> 00:04:20,280

us and central venous pressure and I

87

00:04:24,300 --> 00:04:22,330

really didn't know much about it I was

88

00:04:25,800 --> 00:04:24,310

just a participant that's a transducer

89

00:04:27,720 --> 00:04:25,810

I've got there and what I do is put that

90

00:04:30,090 --> 00:04:27,730

over the external jugular vein on John's

91

00:04:31,890 --> 00:04:30,100

neck and John then blows into that piece

92

00:04:35,190 --> 00:04:31,900

that you saw in his mouth and creates a

93

00:04:37,530 --> 00:04:35,200

pressure and that occludes the sound

94

00:04:39,000 --> 00:04:37,540

that I can receive through the

95

00:04:40,440 --> 00:04:39,010

transducer and I'm listening to it on

96

00:04:42,210 --> 00:04:40,450

those earphones and we record what

97

00:04:44,340 --> 00:04:42,220

pressure it takes to occlude that pulse

98

00:04:47,490 --> 00:04:44,350

and by that we can indirectly see what

99

00:04:49,380 --> 00:04:47,500

central venous pressure is this is an

100

00:04:51,750 --> 00:04:49,390

eye doctor in a box experiment there are

101
00:04:53,940 --> 00:04:51,760
eight different eye tests in the box and

102
00:04:56,690 --> 00:04:53,950
we're looking at how vision and visual

103
00:05:00,630 --> 00:04:56,700
acuity might change when you go into

104
00:05:02,940 --> 00:05:00,640
zero-g I also notice the pen it takes

105
00:05:04,680 --> 00:05:02,950
rookies a while to learn that they can

106
00:05:08,460 --> 00:05:04,690
let go of things and expect to find them

107
00:05:10,530 --> 00:05:08,470
somewhere near where they left them it's

108
00:05:12,630 --> 00:05:10,540
another experiment we did on board I was

109
00:05:14,580 --> 00:05:12,640
looking at the shuttle glow through a

110
00:05:16,800 --> 00:05:14,590
spectrometer when the orbiter is

111
00:05:18,900 --> 00:05:16,810
crashing through the atomic oxygen which

112
00:05:20,820 --> 00:05:18,910
is that probably less than 160 nautical

113
00:05:23,460 --> 00:05:20,830

miles you'd see a glow on the windward

114

00:05:24,900 --> 00:05:23,470

side of the orbiter and there are people

115

00:05:30,360 --> 00:05:24,910

trying to figure out the mechanism that

116

00:05:32,130 --> 00:05:30,370

causes that most of the time I spent in

117

00:05:35,700 --> 00:05:32,140

the commander's seat looking out of the

118

00:05:37,650 --> 00:05:35,710

window we create our own electricity on

119

00:05:39,240 --> 00:05:37,660

board we combine hydrogen and oxygen one

120

00:05:40,920 --> 00:05:39,250

of the byproducts is water and when we

121

00:05:43,170 --> 00:05:40,930

dump that water overboard it immediately

122

00:05:48,780 --> 00:05:43,180

freezes and this is the blizzard that

123

00:05:50,190 --> 00:05:48,790

you see from the window this is a test

124

00:05:52,170 --> 00:05:50,200

that we did on board trying to

125

00:05:56,160 --> 00:05:52,180

demonstrate that we could take marks on

126

00:05:59,010 --> 00:05:56,170

stars and planets by moving the space

127

00:06:01,200 --> 00:05:59,020

ship around and align our navigation

128

00:06:08,059 --> 00:06:01,210

state by doing that and we demonstrated

129

00:06:12,899 --> 00:06:10,409

another thing we did was record the

130

00:06:14,189 --> 00:06:12,909

radiation that we were dosage that we

131

00:06:16,199 --> 00:06:14,199

were receiving this little box

132

00:06:18,509 --> 00:06:16,209

calculates it in tissue equivalence and

133

00:06:20,339 --> 00:06:18,519

we would record in each day and change

134

00:06:26,009 --> 00:06:20,349

out a memory module that actually

135

00:06:28,350 --> 00:06:26,019

recorded it by the minute this is the

136

00:06:31,439 --> 00:06:28,360

way Houston sends a message is up to us

137

00:06:41,399 --> 00:06:31,449

on a teleprinter and then somebody

138

00:06:45,419 --> 00:06:43,889

on my right side up here what I'm doing

139

00:06:49,290 --> 00:06:45,429

is changing out the lithium hydroxide

140

00:06:51,449 --> 00:06:49,300

canisters that's a chemical at the cabin

141

00:06:53,429 --> 00:06:51,459

fans blow air over and that absorbs a

142

00:06:55,769 --> 00:06:53,439

carbon dioxide from our respiration

143

00:07:00,119 --> 00:06:55,779

otherwise the carbon dioxide we build up

144

00:07:02,639 --> 00:07:00,129

in the cabin we breathe an atmosphere of

145

00:07:04,769 --> 00:07:02,649

air twenty percent oxygen eighty percent

146

00:07:10,320 --> 00:07:04,779

nitrogen of course we exhale carbon

147

00:07:12,929 --> 00:07:10,330

dioxide we recycle our air on orbit you

148

00:07:16,529 --> 00:07:12,939

do this twice a day in their eyes yep

149

00:07:21,629 --> 00:07:16,539

once after once after getting up and

150

00:07:23,009 --> 00:07:21,639

once before going to bed the text and

151
00:07:25,409 --> 00:07:23,019
graphics system here wasn't operating

152
00:07:31,350 --> 00:07:25,419
just right so kathina attempted to clear

153
00:07:34,229 --> 00:07:31,360
a jam that was in there who carried

154
00:07:36,449 --> 00:07:34,239
quite a complement of cameras with us

155
00:07:39,059 --> 00:07:36,459
this was a 16 millimeter I think we were

156
00:07:41,879 --> 00:07:39,069
trying to attach to the orbital the

157
00:07:43,709 --> 00:07:41,889
orbiter electrical system it didn't run

158
00:07:45,629 --> 00:07:43,719
very well on the battery so we used a

159
00:07:47,969 --> 00:07:45,639
what we call a breakout box to change

160
00:07:51,029 --> 00:07:47,979
the voltage of the spacecraft to the

161
00:07:53,519 --> 00:07:51,039
voltage required by the camera this did

162
00:08:02,090 --> 00:07:53,529
get it working the background of the

163
00:08:05,780 --> 00:08:03,920

I'd never noticed but looking out the

164

00:08:10,580 --> 00:08:05,790

window you can hardly see any motion on

165

00:08:12,980 --> 00:08:10,590

the earth below yeah this is the

166

00:08:18,260 --> 00:08:12,990

Namibian desert southwest coast of

167

00:08:23,570 --> 00:08:18,270

Africa and we're crossing Africa west to

168

00:08:26,540 --> 00:08:23,580

east looking across Kalahari Desert up

169

00:08:28,550 --> 00:08:26,550

over to the east coast of the African

170

00:08:32,990 --> 00:08:28,560

continent and then upon the horizon of

171

00:08:34,610 --> 00:08:33,000

the earth there yes South Africa would

172

00:08:42,650 --> 00:08:34,620

be to your right and goal it to your

173

00:08:44,600 --> 00:08:42,660

left this is the flight deck and this is

174

00:08:48,290 --> 00:08:44,610

sunny looking out of one of the overhead

175

00:08:52,760 --> 00:08:48,300

windows down at the earth looking down

176
00:08:57,440 --> 00:08:52,770
at the Red Sea and Yemen and Saudi

177
00:09:01,190 --> 00:08:57,450
Arabia Ethiopia Egypt up to the upper

178
00:09:03,380 --> 00:09:01,200
left and Iraq on the upper right moving

179
00:09:05,000 --> 00:09:03,390
at about five miles a second but from

180
00:09:12,860 --> 00:09:05,010
that altitude it appears to so you

181
00:09:14,360 --> 00:09:12,870
merely creeping across the earth at

182
00:09:16,700 --> 00:09:14,370
several different types of cameras and

183
00:09:20,390 --> 00:09:16,710
we would shoot a few shots with one and

184
00:09:22,340 --> 00:09:20,400
then pass it off to someone else it's so

185
00:09:24,050 --> 00:09:22,350
funny when you try to do that when you

186
00:09:26,420 --> 00:09:24,060
get on the ground everybody is so

187
00:09:29,140 --> 00:09:26,430
surprised that things immediately crash

188
00:09:33,590 --> 00:09:29,150

to the floor instead of floating gently

189

00:09:36,710 --> 00:09:33,600

this is Lake Kariba in South East Africa

190

00:09:39,410 --> 00:09:36,720

if you remember in 1965 there was the

191

00:09:41,290 --> 00:09:39,420

operation Noah in that area to save the

192

00:09:44,360 --> 00:09:41,300

animals and so we were able to

193

00:09:46,970 --> 00:09:44,370

photograph that for some geologists that

194

00:09:50,780 --> 00:09:46,980

were interested in it less part of the

195

00:09:53,030 --> 00:09:50,790

African Rift yesterday just like being a

196

00:09:54,410 --> 00:09:53,040

tourist except you're out in space

197

00:09:57,970 --> 00:09:54,420

you've got cameras and you've got a

198

00:10:00,500 --> 00:09:57,980

window and you take things which are

199

00:10:04,130 --> 00:10:00,510

maybe scientific but also things that

200

00:10:05,840 --> 00:10:04,140

appeal to the eye this is India at the

201
00:10:08,720 --> 00:10:05,850
top of the picture China and the bottom

202
00:10:11,820 --> 00:10:08,730
and the Himalayas where the former

203
00:10:16,740 --> 00:10:11,830
continent of India has collided into the

204
00:10:18,240 --> 00:10:16,750
of Asia creating those mountains you

205
00:10:20,670 --> 00:10:18,250
have to shoot pretty fast you don't ask

206
00:10:22,830 --> 00:10:20,680
questions at 300 miles a minute you need

207
00:10:25,770 --> 00:10:22,840
to get the photograph and ask later what

208
00:10:29,010 --> 00:10:25,780
you took there's a lot of room up there

209
00:10:30,660 --> 00:10:29,020
to get everybody in the windows Oh looks

210
00:10:32,010 --> 00:10:30,670
like a small area but you can you can

211
00:10:33,840 --> 00:10:32,020
get the entire crew up there taking

212
00:10:36,780 --> 00:10:33,850
pictures all at the same time if you

213
00:10:39,540 --> 00:10:36,790

wanted to this is the Namibian coast

214

00:10:41,730 --> 00:10:39,550

again and this time we're on up and

215

00:10:44,490 --> 00:10:41,740

sending pass through Africa so we're

216

00:10:46,380 --> 00:10:44,500

going through Angola those are two

217

00:10:48,210 --> 00:10:46,390

different kinds of clouds there I mean

218

00:10:49,830 --> 00:10:48,220

easily see north there I mean one's kind

219

00:10:51,930 --> 00:10:49,840

of a sea fog at the bottom left and the

220

00:10:54,240 --> 00:10:51,940

other were kind of the wispy cumulus

221

00:10:57,410 --> 00:10:54,250

class John took a lot of pictures and

222

00:11:01,440 --> 00:10:57,420

every time he took a picture he said

223

00:11:03,870 --> 00:11:01,450

boom every time watch his lips here

224

00:11:08,640 --> 00:11:03,880

watch this much done he's talking about

225

00:11:15,830 --> 00:11:08,650

here we go you can watch the camera move

226

00:11:22,180 --> 00:11:18,230

these are the Indonesian islands that we

227

00:11:24,800 --> 00:11:22,190

had a past west to east across them and

228

00:11:26,960 --> 00:11:24,810

normally this part of the world is very

229

00:11:30,110 --> 00:11:26,970

covered with clouds but on our mission

230

00:11:31,730 --> 00:11:30,120

it was clear and so we were able to get

231

00:11:34,490 --> 00:11:31,740

some beautiful pictures coming across

232

00:11:37,310 --> 00:11:34,500

the Indonesian islands thankfully it's

233

00:11:39,580 --> 00:11:37,320

mostly volcanic we were learning quite a

234

00:11:42,020 --> 00:11:39,590

lot about our world by looking down at

235

00:11:43,520 --> 00:11:42,030

parts such as this but it's so

236

00:11:46,250 --> 00:11:43,530

interesting to look down at the oceans

237

00:11:49,820 --> 00:11:46,260

from the altitude with the with the

238

00:11:54,170 --> 00:11:49,830

proper Sun angles you get pretty good

239

00:11:58,250 --> 00:11:54,180

insight on the dynamics of the oceans

240

00:12:01,400 --> 00:11:58,260

down there this is a beautiful infrared

241

00:12:06,770 --> 00:12:01,410

picture the canteen took the Irrawaddy

242

00:12:14,570 --> 00:12:06,780

River Delta she really did a good job at

243

00:12:18,110 --> 00:12:14,580

the infrared this is off on the east

244

00:12:20,960 --> 00:12:18,120

side of Madagascar an island that has

245

00:12:23,840 --> 00:12:20,970

two beautiful volcanoes in it Reunion

246

00:12:29,000 --> 00:12:23,850

Island again an infrared photography of

247

00:12:36,750 --> 00:12:29,010

it geologists were very interested in

248

00:12:40,200 --> 00:12:38,820

this is chao call for thanksgiving

249

00:12:43,410 --> 00:12:40,210

dinner we launched to the day before

250

00:12:45,450 --> 00:12:43,420

thanksgiving in eighteen eighty nine and

251
00:12:49,230 --> 00:12:45,460
so we had our turkey and potatoes and

252
00:12:52,860 --> 00:12:49,240
broccoli on orbit probably a day later

253
00:12:54,540 --> 00:12:52,870
than people on this planet but you get a

254
00:12:56,520 --> 00:12:54,550
little confused about what time of day

255
00:12:59,640 --> 00:12:56,530
it is when you're up there you see

256
00:13:01,940 --> 00:12:59,650
sunrise 16 times a day it's hard to tell

257
00:13:03,780 --> 00:13:01,950
what meal you ought to be eating

258
00:13:05,700 --> 00:13:03,790
translation and attitude controller

259
00:13:07,860 --> 00:13:05,710
almost done completely with your hands

260
00:13:09,510 --> 00:13:07,870
very little very little feet they're

261
00:13:13,080 --> 00:13:09,520
accepting to maintain a position once

262
00:13:15,660 --> 00:13:13,090
you get there because you see people

263
00:13:18,570 --> 00:13:15,670

moving very slowly to they won't

264

00:13:20,880 --> 00:13:18,580

ricochet off walls but this was the

265

00:13:23,400 --> 00:13:20,890

thanksgiving meal and i think it was the

266

00:13:27,650 --> 00:13:23,410

only meal where all of us floated

267

00:13:30,090 --> 00:13:27,660

together and ate at the same time

268

00:13:31,560 --> 00:13:30,100

Katie's got the Megaton boards on there

269

00:13:32,940 --> 00:13:31,570

our class of nineteen eighty-four were

270

00:13:35,610 --> 00:13:32,950

known as the maggots affectionately

271

00:13:39,120 --> 00:13:35,620

bowel the astronaut office and we carry

272

00:13:42,240 --> 00:13:39,130

that on the missions with what y'all

273

00:13:44,280 --> 00:13:42,250

think Fred's doing here looks like his

274

00:13:48,830 --> 00:13:44,290

body's movie and yes the answer is he is

275

00:13:52,380 --> 00:13:48,840

dancing to all four tops temptations

276

00:13:55,170 --> 00:13:52,390

this is the kamagra day there's 33 tried

277

00:13:56,910 --> 00:13:55,180

our commander yes I think everybody will

278

00:13:59,340 --> 00:13:56,920

Walkman all the time and everybody had

279

00:14:04,470 --> 00:13:59,350

their own specific music that they

280

00:14:08,820 --> 00:14:04,480

listen to their a lot of soccer players

281

00:14:10,680 --> 00:14:08,830

on board john blaha coached and played

282

00:14:12,810 --> 00:14:10,690

Sonny of course was a professional

283

00:14:17,660 --> 00:14:12,820

soccer player Kathy being from the

284

00:14:23,910 --> 00:14:22,110

Virginia were national champions we need

285

00:14:26,700 --> 00:14:23,920

to get to take one or two things just a

286

00:14:28,640 --> 00:14:26,710

remind us of home and generally a plug

287

00:14:31,850 --> 00:14:28,650

for our alma mater Zyzz one of them

288

00:14:35,850 --> 00:14:31,860

picture the family is nice to him

289

00:14:39,750 --> 00:14:35,860

chapter the pictures upside down that's

290

00:14:43,120 --> 00:14:41,890

John I'm plugging his university and I

291

00:14:48,250 --> 00:14:43,130

watching kick this piece of scientific

292

00:14:50,170 --> 00:14:48,260

gear here how small College in the south

293

00:14:57,040 --> 00:14:50,180

that's the world's greatest medical

294

00:14:59,260 --> 00:14:57,050

school carried a lot of dinosaur cookies

295

00:15:02,110 --> 00:14:59,270

up there but we ate all of them except

296

00:15:04,630 --> 00:15:02,120

one skip John John a all of its right

297

00:15:05,950 --> 00:15:04,640

John ate all of them looks like a bunch

298

00:15:08,200 --> 00:15:05,960

of grown-ups playing with their food but

299

00:15:09,760 --> 00:15:08,210

actually this is a physics lesson if you

300

00:15:11,170 --> 00:15:09,770

remember the hardest thing to teach

301

00:15:13,360 --> 00:15:11,180

students and physics is the difference

302

00:15:14,680 --> 00:15:13,370

between mass and weight look there

303

00:15:17,650 --> 00:15:14,690

everything is virtually weightless

304

00:15:19,600 --> 00:15:17,660

however it still has mass if you watch

305

00:15:21,610 --> 00:15:19,610

out the gummy worms and the goldfish

306

00:15:25,930 --> 00:15:21,620

moves the goldfish is less massive it's

307

00:15:28,540 --> 00:15:25,940

a amusement very quickly I had to take

308

00:15:30,790 --> 00:15:28,550

this hat on what I thought at that time

309

00:15:32,470 --> 00:15:30,800

the world's biggest Dodger fan and those

310

00:15:34,810 --> 00:15:32,480

glasses came from my daughter to

311

00:15:39,700 --> 00:15:34,820

complete the set of Los Angeles kind of

312

00:15:42,340 --> 00:15:39,710

stuff I'm glad you're described that and

313

00:15:45,400 --> 00:15:42,350

just the crew picture with a standard hi

314

00:15:53,350 --> 00:15:45,410

mom sign we forgot the one about ten

315

00:15:56,560 --> 00:15:53,360

money we D orbited and landed at Edwards

316

00:16:00,130 --> 00:15:56,570

Air Force Base just before sunset we

317

00:16:03,520 --> 00:16:00,140

landed on runway zero for a runway that

318

00:16:08,470 --> 00:16:03,530

we never used before landing the orbiter

319

00:16:10,930 --> 00:16:08,480

and we landed right on time and within

320

00:16:13,150 --> 00:16:10,940

about a inch or so of where we were

321

00:16:15,820 --> 00:16:13,160

supposed to touch down was smooth and

322

00:16:20,470 --> 00:16:15,830

rolled out just as the Sun dipped below

323

00:16:22,150 --> 00:16:20,480

the horizon Fred I think you're about a

324

00:16:24,970 --> 00:16:22,160

half an inch to the right of center line

325

00:16:32,170 --> 00:16:24,980

we'll have to do it again one mile per

326

00:16:34,690 --> 00:16:32,180

hour slow the next shot is a is a same

327

00:16:36,910 --> 00:16:34,700

approach but it's an infrared shot and

328

00:16:39,220 --> 00:16:36,920

gives an indication of the temperatures

329

00:16:42,040 --> 00:16:39,230

on the orbiter during the approach the

330

00:16:43,750 --> 00:16:42,050

whiter the surface the hotter it is but

331

00:16:45,280 --> 00:16:43,760

the very interesting thing is as the

332

00:16:47,860 --> 00:16:45,290

wheels come down they very gray

333

00:16:50,640 --> 00:16:47,870

indicating they're cool but as they

334

00:16:53,140 --> 00:16:50,650

touch down those tires really heat up

335

00:16:56,590 --> 00:16:53,150

tremendous technology that allows

336

00:16:57,880 --> 00:16:56,600

that kind of material to be built you

337

00:16:59,350 --> 00:16:57,890

see the bottom of the orbiter there is

338

00:17:01,360 --> 00:16:59,360

is so much hotter there's the wheels

339

00:17:03,610 --> 00:17:01,370

touch down and then the top and around

340

00:17:04,780 --> 00:17:03,620

the cockpit and of course the nose being

341

00:17:10,090 --> 00:17:04,790

the hottest but it's really dramatic

342

00:17:13,270 --> 00:17:10,100

difference here that's the auxiliary

343

00:17:17,590 --> 00:17:13,280

power units exhaust up near the base of

344

00:17:20,110 --> 00:17:17,600

the tail he changed the polarity this

345

00:17:21,370 --> 00:17:20,120

picture and make the hot parts dark then

346

00:17:23,020 --> 00:17:21,380

the orbiter looks just like a regular

347

00:17:27,550 --> 00:17:23,030

orbiter except you can't read discovery

348

00:17:29,620 --> 00:17:27,560

on the side we had these launch and

349

00:17:32,350 --> 00:17:29,630

entry suits on we came in and was very

350

00:17:34,060 --> 00:17:32,360

cold outside but with the suits and the

351

00:17:36,310 --> 00:17:34,070

combination of us trying to become

352

00:17:40,000 --> 00:17:36,320

earthlings again all of us were very hot

353

00:17:41,260 --> 00:17:40,010

when we came outside takes a while to

354

00:17:42,850 --> 00:17:41,270

get your earth legs back there was a lot

355

00:17:46,420 --> 00:17:42,860

of staggering going out there but that's