1
00:00:24,769 --> 00:00:19,630
I

2
00:00:27,409 --> 00:00:24,779
left lieutenant-colonel Eileen kid

3
00:00:28,909 --> 00:00:27,419
Collins United States Air Force and she

4
00:00:30,470 --> 00:00:28,919
was a real pleasure to work with over

5
00:00:32,259 --> 00:00:30,480
the past year and a half I hope to work

6
00:00:36,110 --> 00:00:32,269
with her and again in the near future

7
00:00:39,020 --> 00:00:36,120
and it was great flying with her it was

8
00:00:41,270 --> 00:00:39,030
her expertise that enabled us to hit the

9
00:00:42,860 --> 00:00:41,280
timing task to the exact second she was

10
00:00:44,740 --> 00:00:42,870
giving the guidance commands he was the

11
00:00:46,970 --> 00:00:44,750
policewoman during the running booze

12
00:00:49,430 --> 00:00:46,980
making sure that we were doing

13
00:00:51,049 --> 00:00:49,440

everything according to the schedule and

14
00:00:54,710 --> 00:00:51,059
she performed all of the burns on this

15
00:00:57,229 --> 00:00:54,720
on the Spartan retrieval she went to

16
00:00:59,090 --> 00:00:57,239
Syracuse University in 1978 graduated

17
00:01:01,490 --> 00:00:59,100
with the math and economics major as a

18
00:01:04,999 --> 00:01:01,500
master's degree from Stanford and

19
00:01:06,679 --> 00:01:05,009
Webster she flew c-141s in the Air Force

20
00:01:10,399 --> 00:01:06,689
and was a professor of math at the Air

21
00:01:12,260 --> 00:01:10,409
Force Academy the kid was not a rookie

22
00:01:14,270 --> 00:01:12,270
when the SRBs ignited she was right

23
00:01:15,710 --> 00:01:14,280
there with us as a as a veteran she's

24
00:01:18,920 --> 00:01:15,720
the perfect choice for Americans first

25
00:01:21,590 --> 00:01:18,930
woman pilot in space on her left dr.

26
00:01:23,210 --> 00:01:21,600
bernard harris pulled together all of

27
00:01:25,520 --> 00:01:23,220
the science for me on this flight he was

28
00:01:27,130 --> 00:01:25,530
my payload commander and was his

29
00:01:30,890 --> 00:01:27,140
expertise that enabled us to

30
00:01:32,480 --> 00:01:30,900
reprioritize and replan and get all the

31
00:01:36,140 --> 00:01:32,490
extra experiments from space head for

32
00:01:38,270 --> 00:01:36,150
combined into space m3 and he went to

33
00:01:40,130 --> 00:01:38,280
the University of Houston 1978 graduate

34
00:01:42,110 --> 00:01:40,140
the biology degree has a doctorate and

35
00:01:44,510 --> 00:01:42,120
medicine from Texas Tech did his

36
00:01:47,240 --> 00:01:44,520
residency work at the Mayo Clinic worked

37
00:01:50,180 --> 00:01:47,250
at NASA Ames he's on for faculty

38
00:01:52,850 --> 00:01:50,190

appointments he flew and STS 55 on

39
00:01:53,960 --> 00:01:52,860
Columbia he has great bedside manner but

40
00:01:56,410 --> 00:01:53,970
I'm not going to let him take any more

41
00:01:58,969 --> 00:01:56,420
blood for me

42
00:02:00,740 --> 00:01:58,979
dr. C Michael fall Esquire from

43
00:02:02,660 --> 00:02:00,750
Cambridge England before the flight I

44
00:02:04,430 --> 00:02:02,670
said he had the unofficial title of

45
00:02:06,440 --> 00:02:04,440
world's smartest man I saw a lot of the

46
00:02:07,999 --> 00:02:06,450
world and I'd like to upgrade that to

47
00:02:09,260 --> 00:02:08,009
the official title he is the world's

48
00:02:12,350 --> 00:02:09,270
smartest man at least of the world that

49
00:02:14,150 --> 00:02:12,360
I could see he's a computer whiz from

50
00:02:17,390 --> 00:02:14,160
the University of Cambridge has a PhD in

51
00:02:18,650 --> 00:02:17,400
astrophysics I worked at NASA's Mission

52
00:02:21,530 --> 00:02:18,660
Control Center before joining the

53
00:02:25,010 --> 00:02:21,540
astronaut office he flew on STS 45 and

54
00:02:26,930 --> 00:02:25,020
STS 56 Johann Kepler never guided

55
00:02:31,970 --> 00:02:26,940
100-ton vehicles together in space and

56
00:02:34,550 --> 00:02:31,980
he has dr. Janice Voss ms3 from Rockford

57
00:02:39,110 --> 00:02:34,560
Illinois did a superb job on the arm

58
00:02:41,990 --> 00:02:39,120
during the grapple of Spartan she went

59
00:02:45,020 --> 00:02:42,000
to Purdue University has a PhD in MIT

60
00:02:49,729 --> 00:02:45,030
from MIT in estero not accept here at

61
00:02:51,170 --> 00:02:49,739
JSC also and she flew and STS 57 she's

62
00:02:52,460 --> 00:02:51,180
the commander's dream she just went up

63
00:02:55,580 --> 00:02:52,470

there and did every job that she was

64
00:02:57,229 --> 00:02:55,590
given to expertly and was a pleasure to

65
00:02:59,350 --> 00:02:57,239
fly with and i hope the flyer her again

66
00:03:01,850 --> 00:02:59,360
i hope to play with all of them again

67
00:03:04,280 --> 00:03:01,860
we're teen how to see through my very

68
00:03:07,160 --> 00:03:04,290
good friend Colonel Vladimir yogi it's

69
00:03:10,250 --> 00:03:07,170
Tito of from Russia lat another CRO of

70
00:03:12,800 --> 00:03:10,260
me he's a very cool if you've seen the

71
00:03:15,259 --> 00:03:12,810
his second launch attempt you'll know

72
00:03:16,789 --> 00:03:15,269
what I'm talking about you should have

73
00:03:18,380 --> 00:03:16,799
seen him on the arm during this flight I

74
00:03:20,240 --> 00:03:18,390
said pre-flight that we were going to

75
00:03:23,780 --> 00:03:20,250
watch him we did and we did learn a lot

76
00:03:26,000 --> 00:03:23,790
about space flight from Vladimir he was

77
00:03:28,009 --> 00:03:26,010
very cool on the arm he waved the folks

78
00:03:32,720 --> 00:03:28,019
around on the on the end of the arm and

79
00:03:35,330 --> 00:03:32,730
did an outstanding job we would like to

80
00:03:39,140 --> 00:03:35,340
roll the movie and after the movie will

81
00:03:40,849 --> 00:03:39,150
show our slides of course the toughest

82
00:03:42,440 --> 00:03:40,859
part about training is designing the

83
00:03:45,560 --> 00:03:42,450
patch and once you do that then you're

84
00:03:48,740 --> 00:03:45,570
ready to go fly here we are on suit up

85
00:03:50,720 --> 00:03:48,750
morning putting on the Asus suit four of

86
00:03:53,630 --> 00:03:50,730
us head the new suit it's a very good

87
00:03:56,500 --> 00:03:53,640
design worked very well if we ever need

88
00:04:00,050 --> 00:03:56,510

it for a depressurization system system

89
00:04:01,640 --> 00:04:00,060
I'm sure it's going to work very well we

90
00:04:03,710 --> 00:04:01,650
also had the liquid cooling garment was

91
00:04:05,770 --> 00:04:03,720
kept us very cool on a scent and during

92
00:04:08,270 --> 00:04:05,780
the entry that's also a new improvement

93
00:04:09,860 --> 00:04:08,280
many people helped us over the year

94
00:04:11,960 --> 00:04:09,870
getting ready to go

95
00:04:14,960 --> 00:04:11,970
launched into space and it was great

96
00:04:17,060 --> 00:04:14,970
when we walked out to see some of the

97
00:04:21,199 --> 00:04:17,070
smiling faces the folks that have helped

98
00:04:23,540 --> 00:04:21,209
us over the previous year and a half and

99
00:04:25,670 --> 00:04:23,550
it was nice to to wave at them and give

100
00:04:32,060 --> 00:04:25,680
them a smile as we departed for the

101
00:04:33,650 --> 00:04:32,070
launch pad of course is your approach

102
00:04:35,030 --> 00:04:33,660
it's the first time you've seen them the

103
00:04:37,460 --> 00:04:35,040
launch pad when there aren't very many

104
00:04:38,840 --> 00:04:37,470
people around this is a moment that

105
00:04:40,909 --> 00:04:38,850
takes me back to when I was about six

106
00:04:42,740 --> 00:04:40,919
years old and I first decided I wanted

107
00:04:45,290 --> 00:04:42,750
to be a national this is looking up at

108
00:04:47,540 --> 00:04:45,300
your rocket and this sent shivers down

109
00:04:48,860 --> 00:04:47,550
my spine every time I think about it and

110
00:04:53,629 --> 00:04:48,870
it was a special feeling as we went up

111
00:04:55,340 --> 00:04:53,639
the elevator the main engines ignite six

112
00:04:57,320 --> 00:04:55,350
seconds prior to liftoff and then of

113
00:05:00,140 --> 00:04:57,330

course the SRBs ignite when you see the

114
00:05:01,969 --> 00:05:00,150
launch from a distance in person or on

115
00:05:04,850 --> 00:05:01,979
cameras it looks like the vehicle is

116
00:05:06,260 --> 00:05:04,860
climbing very slowly and stately we are

117
00:05:09,439 --> 00:05:06,270
here to assure you that there's nothing

118
00:05:11,840 --> 00:05:09,449
slow about it it's a power and speed are

119
00:05:14,180 --> 00:05:11,850
the two words that come to mind when the

120
00:05:18,050 --> 00:05:14,190
SRBs ignite it's a pretty rough ride a

121
00:05:20,120 --> 00:05:18,060
lot of vibrations shakin goin on of

122
00:05:21,730 --> 00:05:20,130
course 7 million pounds of thrust and

123
00:05:24,529 --> 00:05:21,740
you can feel every one of those pounds

124
00:05:26,420 --> 00:05:24,539
the first rendezvous maneuver is done

125
00:05:27,770 --> 00:05:26,430
right here on the wash pad we wait until

126
00:05:29,629 --> 00:05:27,780
the launch pad is in plane with the

127
00:05:32,240 --> 00:05:29,639
mirror and then we quickly launch that

128
00:05:37,850 --> 00:05:32,250
occurred shortly after midnight and so

129
00:05:40,640 --> 00:05:37,860
it was a night launch pretty exciting

130
00:05:44,180 --> 00:05:40,650
going uphill I especially like the the

131
00:05:45,950 --> 00:05:44,190
view that we see after we land it was

132
00:05:47,779 --> 00:05:45,960
great seeing the view in the cockpit but

133
00:05:50,420 --> 00:05:47,789
of course we're working the systems and

134
00:05:58,380 --> 00:05:50,430
making sure everything is working SRB

135
00:06:03,780 --> 00:06:01,770
once we get on orbit we have a nice

136
00:06:05,700 --> 00:06:03,790
external look of the space have which is

137
00:06:08,220 --> 00:06:05,710
the module has all the experiments in

138
00:06:11,940 --> 00:06:08,230

fact 23 different experiments here you

139
00:06:15,060 --> 00:06:11,950
see myself and veloce has a camera as we

140
00:06:17,010 --> 00:06:15,070
open the hatch to space hand the

141
00:06:18,810 --> 00:06:17,020
investigations included a variety of

142
00:06:24,210 --> 00:06:18,820
things from crystal growth the plant

143
00:06:28,740 --> 00:06:24,220
growth we even did the famous taste test

144
00:06:29,970 --> 00:06:28,750
that you heard about the experiments on

145
00:06:31,410 --> 00:06:29,980
board pretty mature and the entire

146
00:06:33,990 --> 00:06:31,420
complement of the kinds of experiments

147
00:06:35,910 --> 00:06:34,000
we do in space this is a protein crystal

148
00:06:38,010 --> 00:06:35,920
growth experiment that uses a vapor

149
00:06:39,900 --> 00:06:38,020
diffusion apparatus these trays are full

150
00:06:42,030 --> 00:06:39,910
of little vials of protein crystals

151
00:06:43,110 --> 00:06:42,040
dissolved in a solution you pull the

152
00:06:44,550 --> 00:06:43,120
trades out you can see the little

153
00:06:46,560 --> 00:06:44,560
chambers little round circles in the

154
00:06:48,540 --> 00:06:46,570
center of the screen each one has a

155
00:06:50,640 --> 00:06:48,550
little droplet that contains the

156
00:06:52,910 --> 00:06:50,650
solution and during the flight these

157
00:06:54,990 --> 00:06:52,920
droplets the Halfmoon shapes you see

158
00:06:56,340 --> 00:06:55,000
evaporate leaving a protein crystal

159
00:06:59,040 --> 00:06:56,350
behind and hopefully they get very large

160
00:07:00,960 --> 00:06:59,050
crystals from this experiment we also

161
00:07:04,050 --> 00:07:00,970
had some other life sciences experiments

162
00:07:06,000 --> 00:07:04,060
onboard back in the module this is vadim

163
00:07:09,000 --> 00:07:06,010

erty Tov working on the Astra culture

164
00:07:10,350 --> 00:07:09,010
experiment growing plants in a sort of

165
00:07:12,000 --> 00:07:10,360
equipment that hopefully we can use on

166
00:07:14,940 --> 00:07:12,010
Space Station in the future to grow

167
00:07:16,950 --> 00:07:14,950
things for astronauts to eat this is a

168
00:07:18,510 --> 00:07:16,960
robot we had on board called Charlotte

169
00:07:20,640 --> 00:07:18,520
you can see at the bottom right corner

170
00:07:22,470 --> 00:07:20,650
of the screen a cable there are eight

171
00:07:24,420 --> 00:07:22,480
tables like that attached to the corners

172
00:07:26,700 --> 00:07:24,430
of Charlotte which allows it to fly

173
00:07:28,860 --> 00:07:26,710
around like Charlotte in Charlotte's Web

174
00:07:31,350 --> 00:07:28,870
it can turn switches as you see it

175
00:07:33,660 --> 00:07:31,360
during doing here it can punch buttons

176
00:07:35,880 --> 00:07:33,670
it has a camera this view is from the

177
00:07:36,840 --> 00:07:35,890
camera onboard Charlotte so it can send

178
00:07:38,970 --> 00:07:36,850
pictures to the ground of how the

179
00:07:40,980 --> 00:07:38,980
experiments are performing in space so

180
00:07:42,780 --> 00:07:40,990
it can be used to work experiments on a

181
00:07:43,980 --> 00:07:42,790
crew members not available what you're

182
00:07:46,530 --> 00:07:43,990
about to see here is the odor acts

183
00:07:48,810 --> 00:07:46,540
deploy three spheres and three dipoles

184
00:07:52,440 --> 00:07:48,820
were launched there was one another

185
00:07:54,690 --> 00:07:52,450
sphere in the dipole the purpose of this

186
00:07:56,880 --> 00:07:54,700
was to calibrate the ground radar so in

187
00:07:59,190 --> 00:07:56,890
the future they can better track orbital

188
00:08:01,410 --> 00:07:59,200

debris you all know about our jet

189
00:08:02,730 --> 00:08:01,420
problem we work this pretty hard the

190
00:08:05,420 --> 00:08:02,740
first couple days of the flight we

191
00:08:08,430 --> 00:08:05,430
thought we were going to go into 33 feet

192
00:08:10,940 --> 00:08:08,440
here you ok there's the oxidizer spewing

193
00:08:12,680 --> 00:08:10,950
out and you can

194
00:08:14,780 --> 00:08:12,690
it's very well at the terminator passes

195
00:08:16,850 --> 00:08:14,790
but we thought were going to go into 33

196
00:08:18,020 --> 00:08:16,860
feet but with the leaking jet we knew

197
00:08:19,310 --> 00:08:18,030
that they'd be a possibility we'd be

198
00:08:22,610 --> 00:08:19,320
limited to four hundred feet or maybe

199
00:08:24,980 --> 00:08:22,620
even a thousand feet here's the first

200
00:08:31,010 --> 00:08:24,990
time you saw station approximately 50

201
00:08:33,050 --> 00:08:31,020
miles from us and the video Syria this

202
00:08:36,590 --> 00:08:33,060
time we receive message from station Mir

203
00:08:39,800 --> 00:08:36,600
about we have decision about 30 feet

204
00:08:41,480 --> 00:08:39,810
approach this is the first time we've

205
00:08:43,310 --> 00:08:41,490
been able to show you how dramatic the

206
00:08:44,870 --> 00:08:43,320
speed looks on orbit we're traveling in

207
00:08:46,160 --> 00:08:44,880
over five miles a second it's the first

208
00:08:47,660 --> 00:08:46,170
time we've had other human beings in

209
00:08:49,700 --> 00:08:47,670
another spacecraft able to take our

210
00:08:51,500 --> 00:08:49,710
picture we fly underneath the mere

211
00:08:53,240 --> 00:08:51,510
slightly faster and then climb up in

212
00:08:57,200 --> 00:08:53,250
front of mere ko altitude where we

213
00:08:58,550 --> 00:08:57,210

eventually slow down and flacco speed we

214
00:09:00,320 --> 00:08:58,560
fly the first third of the rendezvous

215
00:09:02,600 --> 00:09:00,330
from the front part of the cockpit just

216
00:09:04,900 --> 00:09:02,610
like they do in the enterprise you do

217
00:09:07,190 --> 00:09:04,910
air all the burns with the computers

218
00:09:09,110 --> 00:09:07,200
computer guided and automatically

219
00:09:11,060 --> 00:09:09,120
controlled and then we fly to the float

220
00:09:13,580 --> 00:09:11,070
to the back of the vehicle turn around

221
00:09:17,030 --> 00:09:13,590
look aft and fly the remaining portion

222
00:09:18,950 --> 00:09:17,040
of it manually this is valery polyakov

223
00:09:21,440 --> 00:09:18,960
he's the cosmonaut who's been up there

224
00:09:24,410 --> 00:09:21,450
over a year now and will soon set a

225
00:09:26,900 --> 00:09:24,420
record this is elena konnikova speaking

226
00:09:29,120 --> 00:09:26,910
to us on the shuttle in fact all the

227
00:09:32,540 --> 00:09:29,130
astronauts got a chance to speak on our

228
00:09:35,870 --> 00:09:32,550
VHF radio to the cosmonauts on near it

229
00:09:38,330 --> 00:09:35,880
was very motivating as Jim climbed up

230
00:09:40,400 --> 00:09:38,340
towards the v-bar that's basically the

231
00:09:42,950 --> 00:09:40,410
horizontal line tangent to the earth

232
00:09:44,870 --> 00:09:42,960
where we going to meet up with me I was

233
00:09:46,730 --> 00:09:44,880
ranging with the laser and meanwhile

234
00:09:47,990 --> 00:09:46,740
they were looking at us coming up and

235
00:09:49,910 --> 00:09:48,000
this is something we only saw when we

236
00:09:52,460 --> 00:09:49,920
came back and we appreciate how dramatic

237
00:09:55,310 --> 00:09:52,470
it is in fact what you're seeing here is

238
00:09:58,370 --> 00:09:55,320

sped up twice normal speed just so that

239
00:10:02,690 --> 00:09:58,380
we can show it quickly but I think even

240
00:10:05,090 --> 00:10:02,700
so you can feel how dramatic that is in

241
00:10:07,010 --> 00:10:05,100
the foreground that you see the dark

242
00:10:09,110 --> 00:10:07,020
metal ring that's a an adapter on the

243
00:10:10,700 --> 00:10:09,120
MIR for scientific instruments and then

244
00:10:22,999 --> 00:10:10,710
at the bottom right that's a scientific

245
00:10:28,369 --> 00:10:26,009
once we're at about 400 feet Jim

246
00:10:31,319 --> 00:10:28,379
arrested the approach to the mayor and

247
00:10:33,030 --> 00:10:31,329
we basically station kept there for a

248
00:10:37,379 --> 00:10:33,040
few minutes before we started our time

249
00:10:40,199 --> 00:10:37,389
to approach once that time we came up we

250
00:10:44,189 --> 00:10:40,209
basically had a window to make and

251
00:10:46,439 --> 00:10:44,199
Arlene kept us straight we were flying a

252
00:10:47,730 --> 00:10:46,449
range rate commands using another laser

253
00:10:51,059 --> 00:10:47,740
tracking system the trajectory control

254
00:10:52,319 --> 00:10:51,069
sensor in the middle of the bay ranging

255
00:10:53,819 --> 00:10:52,329
off the docking port here which is the

256
00:10:56,069 --> 00:10:53,829
white cross and Jim will tell you what

257
00:10:58,139 --> 00:10:56,079
he's doing there this is a view taken

258
00:11:01,049 --> 00:10:58,149
from one of the payload Bay cameras in

259
00:11:02,819 --> 00:11:01,059
it shows how stable the orbiter is as it

260
00:11:05,670 --> 00:11:02,829
approaches to the target and very few

261
00:11:07,259 --> 00:11:05,680
inputs were required we saw no motion

262
00:11:09,629 --> 00:11:07,269
from the solar rays you see the solar

263
00:11:12,769 --> 00:11:09,639

arrays slewing we were in the lowsee

264
00:11:14,939 --> 00:11:12,779
mode essentially not pluming the station

265
00:11:17,670 --> 00:11:14,949
we of course didn't want to damage

266
00:11:20,040 --> 00:11:17,680
something this beautiful and again you

267
00:11:22,019 --> 00:11:20,050
can see how precise the orbiter is we

268
00:11:23,610 --> 00:11:22,029
didn't do very much it just stayed in

269
00:11:25,319 --> 00:11:23,620
the right place it's a little bit easier

270
00:11:29,670 --> 00:11:25,329
to fight in the simulators and that's

271
00:11:31,980 --> 00:11:29,680
good this is the view out of the window

272
00:11:34,319 --> 00:11:31,990
at about 37 feet and you can see

273
00:11:35,610 --> 00:11:34,329
Vladimir and I are both crashing into

274
00:11:43,319 --> 00:11:35,620
each other trying to get as good as

275
00:11:44,999 --> 00:11:43,329
short as the other this is a pan that

276
00:11:46,860 --> 00:11:45,009
Vladimir made and you can see the

277
00:11:49,679 --> 00:11:46,870
windows there's of anaconda Koba with a

278
00:11:55,499 --> 00:11:49,689
knee yes Elena Konerko and me and you

279
00:11:58,619 --> 00:11:55,509
wave each other and for you of course I

280
00:12:01,319 --> 00:11:58,629
don't know who was it this is somebody

281
00:12:05,009 --> 00:12:01,329
know a new conversation this is valery

282
00:12:08,179 --> 00:12:05,019
polyakov and this is commander Alexandra

283
00:12:15,569 --> 00:12:08,189
Bianca all of the time with camera and

284
00:12:21,210 --> 00:12:15,579
shows the movie make movie it is his

285
00:12:23,040 --> 00:12:21,220
picture from station near again it shows

286
00:12:26,850 --> 00:12:23,050
how well the vehicle has been designed

287
00:12:32,599 --> 00:12:26,860
after we remained in our closest point

288
00:12:36,749 --> 00:12:32,609

of approach for about 10 minutes with

289
00:12:38,249 --> 00:12:36,759
the my crew member is helping me to make

290
00:12:41,189 --> 00:12:38,259
sure that we didn't go one inch closer

291
00:12:44,849 --> 00:12:41,199
than the flavor limit of 10 meters you

292
00:12:47,150 --> 00:12:44,859
can see the solar array slewing again no

293
00:12:50,369 --> 00:12:47,160
motion at all from our jets we saw no

294
00:12:55,019 --> 00:12:50,379
interaction after 10 minutes we backed

295
00:12:57,719 --> 00:12:55,029
away and proceeded out to 450 feet and

296
00:12:59,759 --> 00:12:57,729
initiated a fly around as a photo survey

297
00:13:01,739 --> 00:12:59,769
in fact this is one of the heart of

298
00:13:04,169 --> 00:13:01,749
things for Jim and items will talk about

299
00:13:06,299 --> 00:13:04,179
in the cockpit as we back two way mirror

300
00:13:08,400 --> 00:13:06,309
maneuvered so that we no longer had a

301
00:13:11,099 --> 00:13:08,410
center line towards the docking port and

302
00:13:14,099 --> 00:13:11,109
at 450 feet we started to climb up above

303
00:13:15,689 --> 00:13:14,109
it and behind it in our orbit plane so

304
00:13:17,969 --> 00:13:15,699
that we would do a full circle around it

305
00:13:20,340 --> 00:13:17,979
basically trying to stay at 450 feet

306
00:13:22,259 --> 00:13:20,350
during this time however using the laser

307
00:13:23,939 --> 00:13:22,269
which was the handheld laser which is

308
00:13:26,429 --> 00:13:23,949
the thing that a traffic cop would use

309
00:13:28,319 --> 00:13:26,439
to catch e for speeding we basically

310
00:13:31,889 --> 00:13:28,329
couldn't find many reflective items on

311
00:13:33,269 --> 00:13:31,899
the mirror to get a range off and so we

312
00:13:34,859 --> 00:13:33,279
basically had to move out a little bit

313
00:13:36,869 --> 00:13:34,869

further than we first planned because of

314
00:13:39,569 --> 00:13:36,879
that uncertainty but it was no problem i

315
00:13:41,759 --> 00:13:39,579
think the gym if anyone has any doubts

316
00:13:43,199 --> 00:13:41,769
about what we're doing in the future let

317
00:13:45,389 --> 00:13:43,209
us assure you that we were on the right

318
00:13:46,979 --> 00:13:45,399
track and you can't help but see a

319
00:13:50,129 --> 00:13:46,989
vehicle like this that's been up since

320
00:13:53,340 --> 00:13:50,139
1986 just stunning just breathtaking and

321
00:13:54,659 --> 00:13:53,350
ended it really tells us that we're

322
00:13:56,549 --> 00:13:54,669
doing the right thing we had met the

323
00:13:57,659 --> 00:13:56,559
Russian people before we launched and

324
00:14:00,119 --> 00:13:57,669
they're very proud of their space

325
00:14:01,499 --> 00:14:00,129
program they know a lot about our space

326
00:14:04,409 --> 00:14:01,509
program and we're of course are very

327
00:14:06,359 --> 00:14:04,419
proud of our space program and it's time

328
00:14:11,639 --> 00:14:06,369
to join our forces and make both of our

329
00:14:27,639 --> 00:14:11,649
programs better this is about 17,500

330
00:14:31,269 --> 00:14:29,710
we have payload bay lights on board the

331
00:14:33,639 --> 00:14:31,279
shuttle that help eliminate the mirror

332
00:14:35,230 --> 00:14:33,649
we could see it at 600 feet and you'll

333
00:14:37,389 --> 00:14:35,240
see in the next shop you watch the top

334
00:14:39,819 --> 00:14:37,399
upper right corner of the screen you'll

335
00:14:41,290 --> 00:14:39,829
see the jets on the mirror firing we can

336
00:14:43,389 --> 00:14:41,300
see there's all the structure and things

337
00:14:45,340 --> 00:14:43,399
very clearly at night without any help

338
00:14:48,519 --> 00:14:45,350

look up right up in there top right

339
00:14:50,679 --> 00:14:48,529
corner what's going on there is it's d

340
00:14:51,999 --> 00:14:50,689
state it's they have gyroscopes

341
00:14:53,829 --> 00:14:52,009
basically on the MIR to give it attitude

342
00:14:55,929 --> 00:14:53,839
control and at some point they become

343
00:15:03,519 --> 00:14:55,939
saturated in the fire jets to desaturate

344
00:15:05,109 --> 00:15:03,529
the gyros this is a parting shot and it

345
00:15:06,730 --> 00:15:05,119
was a pretty sad moment I think we had a

346
00:15:09,009 --> 00:15:06,740
long day was busy but one of the most

347
00:15:10,540 --> 00:15:09,019
exciting days in my life I must say the

348
00:15:12,790 --> 00:15:10,550
second major activity we had on this

349
00:15:15,129 --> 00:15:12,800
flight was the Spartan satellite it had

350
00:15:17,079 --> 00:15:15,139
an ultraviolet telescope that's on the

351
00:15:19,509 --> 00:15:17,089
right side of the box of the gold box

352
00:15:21,910 --> 00:15:19,519
you saw in that picture on flight day

353
00:15:24,189 --> 00:15:21,920
two we took it out of its station the

354
00:15:25,900 --> 00:15:24,199
payload Bay to look at the shuttle it's

355
00:15:28,389 --> 00:15:25,910
looking at the ultra violet glow on the

356
00:15:29,710 --> 00:15:28,399
surface of the tail of the shuttle by

357
00:15:31,389 --> 00:15:29,720
the murti top you can see at the

358
00:15:33,790 --> 00:15:31,399
controls on the robot arm here he's

359
00:15:35,019 --> 00:15:33,800
flying the Spartan up above the nose of

360
00:15:37,720 --> 00:15:35,029
the shuttle so it can look back at the

361
00:15:41,019 --> 00:15:37,730
tail and it Jets on the tail to fire and

362
00:15:42,579 --> 00:15:41,029
watch their glow on fight day 5 we

363
00:15:45,369 --> 00:15:42,589

released Spartan so it could go look at

364
00:15:47,019 --> 00:15:45,379
some stellar objects again buddy mighty

365
00:15:48,669 --> 00:15:47,029
tough is flying the arm here we let the

366
00:15:50,049 --> 00:15:48,679
Spartan go and then we watch it to make

367
00:15:52,660 --> 00:15:50,059
sure its attitude control system is

368
00:15:54,999 --> 00:15:52,670
working properly when that's all been

369
00:15:57,460 --> 00:15:55,009
checked out Jim flies the shuttle way at

370
00:15:59,590 --> 00:15:57,470
about one foot per second which allows

371
00:16:01,449 --> 00:15:59,600
Spartan to drift about 40 miles in front

372
00:16:03,400 --> 00:16:01,459
of the shuttle where it can perform its

373
00:16:06,699 --> 00:16:03,410
observations undisturbed by the shuttle

374
00:16:09,069 --> 00:16:06,709
environment the ultraviolet telescope

375
00:16:11,799 --> 00:16:09,079
will be looking at diffuse nebulae and

376
00:16:15,009 --> 00:16:11,809
other intergalactic objects which can be

377
00:16:17,860 --> 00:16:15,019
easily observed from the ground you can

378
00:16:19,600 --> 00:16:17,870
see us doing ranging marks and looking

379
00:16:21,489 --> 00:16:19,610
at the Spartan to make sure all the

380
00:16:22,539 --> 00:16:21,499
deploy is going well you see it in the

381
00:16:27,249 --> 00:16:22,549
center of the screen that little black

382
00:16:29,949 --> 00:16:27,259
square is Spartan on its way this is

383
00:16:31,840 --> 00:16:29,959
Mike and I preparing for our big event

384
00:16:35,289 --> 00:16:31,850
at least it was my favorite thing on the

385
00:16:38,049 --> 00:16:35,299
mission and I was e VA we have to pump

386
00:16:39,700 --> 00:16:38,059
the suits up without anybody's in it to

387
00:16:43,120 --> 00:16:39,710
make sure it's not leaking and then

388
00:16:45,310 --> 00:16:43,130

get ready for prep here i'm attaching

389
00:16:47,320 --> 00:16:45,320
electrodes to my chest both Bernardo my

390
00:16:48,910 --> 00:16:47,330
wore these during the EBA it said that

391
00:16:51,400 --> 00:16:48,920
our flight surgeons can monitor our

392
00:16:53,050 --> 00:16:51,410
heartbeats during the spacewalk and here

393
00:16:55,660 --> 00:16:53,060
we are getting ready for our four-hour

394
00:16:58,830 --> 00:16:55,670
hang on the wall while we get to look at

395
00:17:01,540 --> 00:16:58,840
each other and tell each other stories

396
00:17:03,070 --> 00:17:01,550
after they waved goodbye to us we had to

397
00:17:05,230 --> 00:17:03,080
get right back on getting Spartan

398
00:17:06,850 --> 00:17:05,240
retrieved jim was flying the rendezvous

399
00:17:08,890 --> 00:17:06,860
here and you can see Spartan coming up

400
00:17:10,570 --> 00:17:08,900
the robot arm is in the bottom center of

401
00:17:13,360 --> 00:17:10,580
the screen I'm performing the retrieve

402
00:17:14,650 --> 00:17:13,370
at this point I'm using the camera on

403
00:17:17,079 --> 00:17:14,660
the robot arm which is the view that you

404
00:17:20,050 --> 00:17:17,089
see here to get a good eye on how

405
00:17:21,280 --> 00:17:20,060
Spartan is coming close that's me at the

406
00:17:22,570 --> 00:17:21,290
robot arm you see the trajectory at the

407
00:17:24,850 --> 00:17:22,580
bottom right corner of the screen there

408
00:17:26,590 --> 00:17:24,860
that's the approach that we flew the

409
00:17:28,060 --> 00:17:26,600
part I'm trying to grab is actually the

410
00:17:29,500 --> 00:17:28,070
bottom center of the screen i'm using

411
00:17:32,140 --> 00:17:29,510
the target in the middle of the screen

412
00:17:33,820 --> 00:17:32,150
in order to aim and adjust my attitude

413
00:17:35,980 --> 00:17:33,830

properly so i can get ahold of Spartan

414
00:17:37,810 --> 00:17:35,990
that all went very smoothly job did it

415
00:17:41,170 --> 00:17:37,820
Tim did a superb job of setting me up

416
00:17:42,370 --> 00:17:41,180
for this grapple once we got a hold of

417
00:17:44,710 --> 00:17:42,380
Spartan we then put it back in the

418
00:17:46,600 --> 00:17:44,720
payload bay there had been some concern

419
00:17:47,920 --> 00:17:46,610
before the flight because earlier

420
00:17:50,470 --> 00:17:47,930
flights had had some problems with the

421
00:17:51,730 --> 00:17:50,480
latching mechanism they had changed the

422
00:17:53,050 --> 00:17:51,740
hardware before this flight and we were

423
00:17:55,090 --> 00:17:53,060
hoping it all went well and indeed it

424
00:17:56,740 --> 00:17:55,100
did it went right down into the guides

425
00:17:59,110 --> 00:17:56,750
and latched up on the first attempt

426
00:18:00,670 --> 00:17:59,120
which was good news for the EBA guys

427
00:18:03,760 --> 00:18:00,680
champing at the bit to get in the

428
00:18:04,900 --> 00:18:03,770
payload bay and chomping we were but not

429
00:18:07,450 --> 00:18:04,910
and I kept on looking at each other as

430
00:18:08,770 --> 00:18:07,460
they are ms slowly did its thing but

431
00:18:10,990 --> 00:18:08,780
here we are we got outside we were very

432
00:18:13,240 --> 00:18:11,000
happy we wave to the camera and started

433
00:18:15,340 --> 00:18:13,250
our thermal evaluation well I was the

434
00:18:17,050 --> 00:18:15,350
first guy on the arm I got in with no

435
00:18:19,900 --> 00:18:17,060
problem you see the arm is outfitted

436
00:18:21,700 --> 00:18:19,910
with a pad and once I got safely in I

437
00:18:24,760 --> 00:18:21,710
grabbed a hold to Mike and by the way

438
00:18:27,640 --> 00:18:24,770

we're we are tethered shortly after that

439
00:18:29,950 --> 00:18:27,650
balochi lifted us both up about 30 feet

440
00:18:32,230 --> 00:18:29,960
above the cargo bay for the cold soak

441
00:18:34,240 --> 00:18:32,240
and during this time frame actually

442
00:18:37,060 --> 00:18:34,250
neither Bernardo myself thought

443
00:18:38,860 --> 00:18:37,070
particularly cold anywhere it was only

444
00:18:40,510 --> 00:18:38,870
when we started to unbirth the Spartan

445
00:18:42,400 --> 00:18:40,520
and we moved into darkness at the same

446
00:18:44,410 --> 00:18:42,410
time here you see me on the end of the

447
00:18:45,880 --> 00:18:44,420
RMS moving it a little bit closer to

448
00:18:48,070 --> 00:18:45,890
Bernard so he can grab ahold of it with

449
00:18:50,410 --> 00:18:48,080
a small handing tool and perform his

450
00:18:52,260 --> 00:18:50,420
mass handling evaluation during this

451
00:18:55,420 --> 00:18:52,270
time I had full control

452
00:18:57,670 --> 00:18:55,430
once my candidate off to me it was my

453
00:18:59,740 --> 00:18:57,680
job to take this almost 3,000 pound

454
00:19:02,130 --> 00:18:59,750
object satellite and wave it back and

455
00:19:05,680 --> 00:19:02,140
forth in the air not only weigh about

456
00:19:08,590 --> 00:19:05,690
250 pounds and our 205 pounds i should

457
00:19:10,330 --> 00:19:08,600
say he's getting laughing all the time I

458
00:19:13,510 --> 00:19:10,340
don't weigh 250 pounds they wouldn't let

459
00:19:16,210 --> 00:19:13,520
me go in the shuttle so it was a as not

460
00:19:17,500 --> 00:19:16,220
as an easy test as you may think even

461
00:19:20,500 --> 00:19:17,510
though it doesn't weigh anything it does

462
00:19:23,050 --> 00:19:20,510
have a lot of mass and you can see here

463
00:19:26,290 --> 00:19:23,060

my initial starts and stops I did not

464
00:19:28,240 --> 00:19:26,300
have the satellite very square and it

465
00:19:30,910 --> 00:19:28,250
was sort of a steep learning curve at

466
00:19:34,000 --> 00:19:30,920
the very beginning after a while I got

467
00:19:36,880 --> 00:19:34,010
the hang of it and then it became pretty

468
00:19:39,060 --> 00:19:36,890
pretty easy but the only way you can

469
00:19:44,440 --> 00:19:39,070
move masses like this is very very

470
00:19:46,330 --> 00:19:44,450
slowly I must say Bernard did it

471
00:19:47,920 --> 00:19:46,340
extremely well initially he said he had

472
00:19:49,570 --> 00:19:47,930
a lot of concern about doing it even

473
00:19:52,300 --> 00:19:49,580
slower than we had practiced on the air

474
00:19:54,280 --> 00:19:52,310
bearing floor but as far as I could tell

475
00:19:55,900 --> 00:19:54,290
he moved it without cross-coupling

476
00:19:57,760 --> 00:19:55,910
anything towards the end of his mouth

477
00:19:59,890 --> 00:19:57,770
handing evaluation I was steadily

478
00:20:02,770 --> 00:19:59,900
getting cold while watching him and so

479
00:20:04,660 --> 00:20:02,780
we ended up birthing the Spartan because

480
00:20:06,720 --> 00:20:04,670
of specifically very cold hands on my

481
00:20:09,700 --> 00:20:06,730
part and I think when I had cold feet

482
00:20:11,290 --> 00:20:09,710
after we've been told to do the birth

483
00:20:16,060 --> 00:20:11,300
Bernard was able to practice his thermal

484
00:20:19,270 --> 00:20:16,070
emittance evaluation after I did that

485
00:20:21,880 --> 00:20:19,280
then it was Mike's turn on the RMS yeah

486
00:20:25,570 --> 00:20:21,890
he had been up there freezing his toes

487
00:20:27,790 --> 00:20:25,580
and hands off at this point and he did

488
00:20:29,170 --> 00:20:27,800

actually did a close pass over IMAX

489
00:20:30,520 --> 00:20:29,180
camera that we had in the payload Bay so

490
00:20:32,560 --> 00:20:30,530
you'll see some nice footage to that

491
00:20:34,210 --> 00:20:32,570
later one of the things we do on every

492
00:20:36,040 --> 00:20:34,220
flight is look out the windows and take

493
00:20:38,290 --> 00:20:36,050
pictures for earth observations folks

494
00:20:39,940 --> 00:20:38,300
one of our important jobs in the space

495
00:20:42,340 --> 00:20:39,950
program is to monitor the Earth's

496
00:20:45,040 --> 00:20:42,350
environment you can see glaciers here in

497
00:20:46,720 --> 00:20:45,050
the southern Andes Patagonia area it's

498
00:20:48,100 --> 00:20:46,730
an area that we don't see very often on

499
00:20:49,750 --> 00:20:48,110
shuttle flights because we don't go to

500
00:20:52,900 --> 00:20:49,760
the high inclination that we had we were

501
00:20:54,010 --> 00:20:52,910
at 51.6 degrees this kind of terrain is

502
00:20:55,330 --> 00:20:54,020
a very enters to the Russian

503
00:20:57,610 --> 00:20:55,340
co-investigators on this flight because

504
00:21:00,160 --> 00:20:57,620
of the glaciers and watching the water

505
00:21:01,480 --> 00:21:00,170
runoff but we do eventually have to come

506
00:21:03,400 --> 00:21:01,490
home ours was an eight-day flight

507
00:21:05,629 --> 00:21:03,410
morning a flight day nine we packed up

508
00:21:07,310 --> 00:21:05,639
to go home we had one last chance

509
00:21:08,989 --> 00:21:07,320
say goodbye to the MIR Space Station

510
00:21:11,329 --> 00:21:08,999
you'll see it in the center of this

511
00:21:13,549 --> 00:21:11,339
frame and then you'll see a meteorite go

512
00:21:17,359 --> 00:21:13,559
by shell has unique experience of having

513
00:21:19,699 --> 00:21:17,369

meteorites go below it if you think a

514
00:21:21,680 --> 00:21:19,709
scent is exciting or the mirror on eva

515
00:21:23,659 --> 00:21:21,690
is exciting you wouldn't believe entry

516
00:21:26,209 --> 00:21:23,669
the only way to take out the energy that

517
00:21:28,060 --> 00:21:26,219
we have put into the vehicle and liftoff

518
00:21:30,709 --> 00:21:28,070
is to come slamming into the atmosphere

519
00:21:32,659 --> 00:21:30,719
there are not many molecules up high but

520
00:21:34,819 --> 00:21:32,669
the ones that are there are screaming

521
00:21:36,739 --> 00:21:34,829
hot and when you hit them and you see

522
00:21:39,049 --> 00:21:36,749
the pink glow outside the windows the

523
00:21:42,169 --> 00:21:39,059
flash is caused by the attitude control

524
00:21:45,589 --> 00:21:42,179
Jets firing you'll see a scene looking

525
00:21:47,690 --> 00:21:45,599
back aft on this 25 mile trailing plume

526
00:21:49,909 --> 00:21:47,700
of fire as we come flying into the

527
00:21:54,019 --> 00:21:49,919
atmosphere now it was pretty dramatic

528
00:21:56,810 --> 00:21:54,029
for us because it was a night entry we

529
00:22:00,529 --> 00:21:56,820
saw the Sun as we approach the hack just

530
00:22:02,869 --> 00:22:00,539
briefly the large turning circle so most

531
00:22:04,489 --> 00:22:02,879
of the entry was at night the Sun peeked

532
00:22:07,249 --> 00:22:04,499
its little head above the horizon and

533
00:22:08,810 --> 00:22:07,259
then dipped below again as we descended

534
00:22:10,999 --> 00:22:08,820
in our hundred-ton glider with a lifted

535
00:22:14,449 --> 00:22:11,009
drag ratio of worse than four to one and

536
00:22:16,909 --> 00:22:14,459
reverse flight path control but the

537
00:22:19,969 --> 00:22:16,919
system is very very smooth you see the

538
00:22:22,690 --> 00:22:19,979

turbulence from inside the 20,000,000

539
00:22:24,769 --> 00:22:22,700
candlepower xenon lamps down the runway

540
00:22:27,459 --> 00:22:24,779
illuminating the runway of course from

541
00:22:31,519 --> 00:22:27,469
where we were it looked like daytime

542
00:22:33,440 --> 00:22:31,529
early morning you'll see again flying

543
00:22:35,449 --> 00:22:33,450
over the threshold of the runway you see

544
00:22:37,279 --> 00:22:35,459
some of the turbulence but the vehicle

545
00:22:39,649 --> 00:22:37,289
handles it very well it takes out all of

546
00:22:41,479 --> 00:22:39,659
the gusts and turbulence you see some of

547
00:22:43,759 --> 00:22:41,489
the trailing edge vortices coming up in

548
00:22:47,899 --> 00:22:43,769
the wingtips in the next shot as we roll

549
00:22:50,329 --> 00:22:47,909
down the runway and lean will deploy the

550
00:22:53,299 --> 00:22:50,339
drag chute and the dis reefs just prior

551
00:22:55,190 --> 00:22:53,309
to nosewheel touchdown which helps to

552
00:23:00,799 --> 00:22:55,200
reduce the loading on the main wheels

553
00:23:05,449 --> 00:23:00,809
and the nose gear see the shuttle chase

554
00:23:07,190 --> 00:23:05,459
airplane flying by Mike said he could

555
00:23:08,509 --> 00:23:07,200
see some of the flashbulbs going off on

556
00:23:10,200 --> 00:23:08,519
the side I wasn't looking in that

557
00:23:12,030 --> 00:23:10,210
direction

558
00:23:14,430 --> 00:23:12,040
Jim always told us not to look out the

559
00:23:15,750 --> 00:23:14,440
window but I blew it I might now that

560
00:23:17,640 --> 00:23:15,760
you feel quite heavy after her coming

561
00:23:19,500 --> 00:23:17,650
back to earth Spang over a week in zero

562
00:23:23,660 --> 00:23:19,510
gravity when I took my helmet off it

563
00:23:26,910 --> 00:23:23,670

felt like it weighed almost 75 pounds

564
00:23:28,200 --> 00:23:26,920
after Eileen get rid of the direct sheet

565
00:23:33,080 --> 00:23:28,210
was the first time we had used the

566
00:23:35,370 --> 00:23:33,090
brakes the system is so good we will

567
00:23:36,750 --> 00:23:35,380
show our slides at this time and then

568
00:23:40,710 --> 00:23:36,760
we'd love to answer any questions that

569
00:23:44,790 --> 00:23:40,720
you may have again this is a spectacular

570
00:23:47,430 --> 00:23:44,800
night and launch with all that thrust in

571
00:23:49,680 --> 00:23:47,440
power underneath the system worked very

572
00:23:52,170 --> 00:23:49,690
well we had no problems until after we

573
00:23:53,670 --> 00:23:52,180
got in orbit and that's a testament to

574
00:23:56,450 --> 00:23:53,680
all the folks who worked on the on the

575
00:24:02,520 --> 00:23:56,460
system's here at JSC and around the NASA

576
00:24:04,080 --> 00:24:02,530
centers lunch plane in our high

577
00:24:05,790 --> 00:24:04,090
inclination dictate that we had only a

578
00:24:07,080 --> 00:24:05,800
five minute launch window these are the

579
00:24:08,700 --> 00:24:07,090
kind of things that we'll be doing every

580
00:24:15,960 --> 00:24:08,710
time we fly Tamir will have just a

581
00:24:18,750 --> 00:24:15,970
five-minute launch window again I'd like

582
00:24:22,350 --> 00:24:18,760
to thank my crew for helping me end this

583
00:24:23,940 --> 00:24:22,360
mission I simply did what they told me

584
00:24:26,370 --> 00:24:23,950
to do and the vehicle was so good that

585
00:24:32,300 --> 00:24:26,380
it was all pretty easy we should have no

586
00:24:37,140 --> 00:24:34,620
again setting up for the rendezvous we

587
00:24:38,910 --> 00:24:37,150
do the first portion of it up in the

588
00:24:40,800 --> 00:24:38,920

front cockpit this is the commander seat

589
00:24:43,050 --> 00:24:40,810
on the left for the second rendezvous we

590
00:24:44,760 --> 00:24:43,060
switched the roles and Eileen took over

591
00:24:46,350 --> 00:24:44,770
the commander seat and did the end I

592
00:24:48,570 --> 00:24:46,360
should add that during this time we were

593
00:24:50,730 --> 00:24:48,580
kept on trying to make Jim feel better

594
00:24:53,220 --> 00:24:50,740
about the Jet Li this is a topic of

595
00:24:55,290 --> 00:24:53,230
conversation almost every night day

596
00:24:57,180 --> 00:24:55,300
transition in our orbit we've been

597
00:25:00,030 --> 00:24:57,190
looking out the back when it and say is

598
00:25:02,250 --> 00:25:00,040
it still leaking we go yes Jim he'd try

599
00:25:03,950 --> 00:25:02,260
and smile and I guess he's running smart

600
00:25:07,770 --> 00:25:03,960
here too

601
00:25:09,840 --> 00:25:07,780
of the 44 steering jets that we have on

602
00:25:12,570 --> 00:25:09,850
the orbiter we had problems with three

603
00:25:15,090 --> 00:25:12,580
of them one of them had failed off and

604
00:25:16,830 --> 00:25:15,100
two of them were leaking there was a

605
00:25:18,510 --> 00:25:16,840
forward jet that started leaking on

606
00:25:21,060 --> 00:25:18,520
flight day two and this is a procedure

607
00:25:23,610 --> 00:25:21,070
that I'm working here that one we were

608
00:25:25,110 --> 00:25:23,620
able to heal fortunately because it was

609
00:25:27,990 --> 00:25:25,120
a required jet to do the rendezvous

610
00:25:30,330 --> 00:25:28,000
inside of a thousand feet we cycled the

611
00:25:31,860 --> 00:25:30,340
manifold once and ran this procedure we

612
00:25:33,180 --> 00:25:31,870
hot fire the jet three times and we

613
00:25:34,710 --> 00:25:33,190

managed to heal that leak so you

614
00:25:37,440 --> 00:25:34,720
probably didn't hear much about that on

615
00:25:39,150 --> 00:25:37,450
the ground um and also this would be a

616
00:25:40,620 --> 00:25:39,160
good point for me to to mention all the

617
00:25:43,049 --> 00:25:40,630
great support that we got from our

618
00:25:44,669 --> 00:25:43,059
flight controllers and our engineers

619
00:25:46,620 --> 00:25:44,679
here on the ground and also the managers

620
00:25:49,200 --> 00:25:46,630
that worked very hard in very long hours

621
00:25:50,580 --> 00:25:49,210
working over in Russia with our Russian

622
00:25:52,890 --> 00:25:50,590
colleagues everybody wanted this

623
00:25:55,169 --> 00:25:52,900
approach to happen the Russians and the

624
00:25:58,470 --> 00:25:55,179
Americans alike and we did everything we

625
00:26:00,299 --> 00:25:58,480
could and and of course the crew worked

626
00:26:01,350 --> 00:26:00,309
hard but we have great thanks to pass on

627
00:26:03,510 --> 00:26:01,360
to the people here on the ground that

628
00:26:08,510 --> 00:26:03,520
allowed this mission to go all the way

629
00:26:14,370 --> 00:26:11,700
first radio contact we had with station

630
00:26:16,409 --> 00:26:14,380
we had on distance approximately five

631
00:26:20,370 --> 00:26:16,419
hundred fifty thousand feet from the

632
00:26:23,159 --> 00:26:20,380
shuttle the connection was table and the

633
00:26:25,980 --> 00:26:23,169
first time they saw the station then it

634
00:26:28,500 --> 00:26:25,990
was about 50 miles from us before the

635
00:26:31,680 --> 00:26:28,510
sunset was so in a bright star in the

636
00:26:34,620 --> 00:26:31,690
direction of our West director and first

637
00:26:38,850 --> 00:26:34,630
we had a discussion on if it was the

638
00:26:43,650 --> 00:26:38,860

planet Jupiter station but in that

639
00:26:46,680 --> 00:26:43,660
period of time we were not sure but

640
00:26:49,470 --> 00:26:46,690
after the sunset sister disappeared and

641
00:26:54,240 --> 00:26:49,480
which mean what it was station and we

642
00:26:57,210 --> 00:26:54,250
were approaching it and I would be able

643
00:26:59,070 --> 00:26:57,220
to see my space home on this picture you

644
00:27:02,340 --> 00:26:59,080
can see the station which is located

645
00:27:05,130 --> 00:27:02,350
about 400 feet from the shadow shuttle

646
00:27:08,340 --> 00:27:05,140
before the sunset and the final approach

647
00:27:13,350 --> 00:27:08,350
of Tara heater started during the with

648
00:27:15,570 --> 00:27:13,360
orbital night and when we began at

649
00:27:16,899 --> 00:27:15,580
approach I must say personally it was

650
00:27:18,460 --> 00:27:16,909
hard to real

651
00:27:19,599 --> 00:27:18,470
what we were actually doing you know

652
00:27:21,789 --> 00:27:19,609
approaching the marriage such a

653
00:27:23,560 --> 00:27:21,799
spectacular sight and yet we had a

654
00:27:25,810 --> 00:27:23,570
pretty technical job to do it this time

655
00:27:28,299 --> 00:27:25,820
so I would concentrate with the handheld

656
00:27:29,680 --> 00:27:28,309
laser at pointing straight at the

657
00:27:32,080 --> 00:27:29,690
docking port as you see it in the lower

658
00:27:35,080 --> 00:27:32,090
part of the scene there and call out

659
00:27:37,149 --> 00:27:35,090
ranges and range rates to gym while he

660
00:27:41,680 --> 00:27:37,159
very carefully maintained a corridor and

661
00:27:43,299 --> 00:27:41,690
fluid in this is the target you see the

662
00:27:45,849 --> 00:27:43,309
standoff cross in the center of the

663
00:27:48,669 --> 00:27:45,859

picture which we use for angular

664
00:27:51,129 --> 00:27:48,679
alignment and translational alignment we

665
00:27:53,739 --> 00:27:51,139
fly the approach with the attitude

666
00:27:56,080 --> 00:27:53,749
control system and automatic pilot and

667
00:27:58,359 --> 00:27:56,090
we fly manually the translational

668
00:28:02,139 --> 00:27:58,369
control system again it was very stable

669
00:28:04,659 --> 00:28:02,149
and fairly easy easy to do even in the

670
00:28:11,049 --> 00:28:04,669
lowsee mode which reduces the plume on

671
00:28:14,139 --> 00:28:11,059
mirror this picture is made from the

672
00:28:16,419 --> 00:28:14,149
distance of approximately 35 feet in the

673
00:28:19,989 --> 00:28:16,429
window station you can see the face of

674
00:28:23,049 --> 00:28:19,999
dr. valery polyakov i had some

675
00:28:25,930 --> 00:28:23,059
experience working with him for four

676
00:28:29,289 --> 00:28:25,940
months during my year flight but now he

677
00:28:31,180 --> 00:28:29,299
got so brave that the heav'n beat the

678
00:28:34,239 --> 00:28:31,190
record of the launch of space flight

679
00:28:38,889 --> 00:28:34,249
with my flight engineer and i set it in

680
00:28:42,099 --> 00:28:38,899
1988 it has just been a little over 13

681
00:28:45,700 --> 00:28:42,109
months of him working in space and on

682
00:28:48,430 --> 00:28:45,710
stop this side of me represents the eyes

683
00:28:51,909 --> 00:28:48,440
of the station because this is the place

684
00:28:54,070 --> 00:28:51,919
where the main windows allocated this is

685
00:28:56,680 --> 00:28:54,080
the place where video activity is

686
00:28:59,710 --> 00:28:56,690
located and where the crew can watched

687
00:29:04,960 --> 00:28:59,720
the earth on the top of the station and

688
00:29:11,080 --> 00:29:04,970

middle it is some top one moment this

689
00:29:13,690 --> 00:29:11,090
one you can see a green color circle but

690
00:29:16,330 --> 00:29:13,700
like looks like a window but it is not

691
00:29:18,879 --> 00:29:16,340
like not window with this a hedge of the

692
00:29:20,889 --> 00:29:18,889
IRA log with a small iron log which the

693
00:29:25,479 --> 00:29:20,899
crew used for performing experience

694
00:29:30,040 --> 00:29:25,489
outside the stating stating it is also

695
00:29:36,150 --> 00:29:30,050
used for stress geez disposal if it

696
00:29:39,700 --> 00:29:36,160
Syrian after we had spent some time

697
00:29:41,290 --> 00:29:39,710
close-up Tamir and we talked a lot on

698
00:29:43,540 --> 00:29:41,300
the radio and had taken many pictures

699
00:29:45,040 --> 00:29:43,550
that we then had to start the second

700
00:29:49,480 --> 00:29:45,050
part which was the fly around and Jim

701
00:29:53,590 --> 00:29:49,490
backed away to 450 feet and then started

702
00:29:56,140 --> 00:29:53,600
a slow climb around the the mere up and

703
00:30:04,930 --> 00:29:56,150
over during this time I think Janice was

704
00:30:07,270 --> 00:30:04,940
taking some IMAX film footage that IMAX

705
00:30:08,530 --> 00:30:07,280
film footage that Mike mentioned will be

706
00:30:11,650 --> 00:30:08,540
ready in a couple of weeks and it's

707
00:30:14,260 --> 00:30:11,660
going to be beautiful my job during this

708
00:30:16,600 --> 00:30:14,270
whole rendezvous was to be in the

709
00:30:18,940 --> 00:30:16,610
Spacehab with cameras at both sides

710
00:30:21,220 --> 00:30:18,950
firing pictures as fast as I could we

711
00:30:23,050 --> 00:30:21,230
have a lot of beautiful photos and I

712
00:30:25,270 --> 00:30:23,060
have to tell you that the the photos

713
00:30:27,660 --> 00:30:25,280

don't do the beauty of this station

714
00:30:31,270 --> 00:30:27,670
justice at all it really is gorgeous

715
00:30:33,370 --> 00:30:31,280
this is the station as we're doing our

716
00:30:38,230 --> 00:30:33,380
separation burn and getting ready to

717
00:30:39,580 --> 00:30:38,240
leave mir space have as we mentioned in

718
00:30:41,520 --> 00:30:39,590
the film was one of our other major

719
00:30:44,860 --> 00:30:41,530
activities on the flight this is the AFT

720
00:30:46,810 --> 00:30:44,870
port end of the space hab module you can

721
00:30:49,240 --> 00:30:46,820
see the general setup with the lockers

722
00:30:50,920 --> 00:30:49,250
that contain experiments and the wall to

723
00:30:53,590 --> 00:30:50,930
the right of the slide that has things

724
00:30:56,230 --> 00:30:53,600
like procedures in our trash areas this

725
00:30:59,670 --> 00:30:56,240
is a budding dirty Tov working on one of

726
00:31:01,480 --> 00:30:59,680
our life sciences experiments on board

727
00:31:03,040 --> 00:31:01,490
there were a variety of different

728
00:31:04,990 --> 00:31:03,050
experiments both in the module on the

729
00:31:06,880 --> 00:31:05,000
mid-deck this is an example of a class

730
00:31:08,890 --> 00:31:06,890
of experiments that we did a radiation

731
00:31:11,740 --> 00:31:08,900
monitoring experiment that Jim our chief

732
00:31:14,680 --> 00:31:11,750
scientist on board was operating he

733
00:31:19,600 --> 00:31:14,690
loved that title we made we made Jim and

734
00:31:21,400 --> 00:31:19,610
honorary scientists on this flight there

735
00:31:23,290 --> 00:31:21,410
were also a large number of experiments

736
00:31:24,610 --> 00:31:23,300
on the mid-deck they even though they

737
00:31:26,110 --> 00:31:24,620
are spaced have experiments they're

738
00:31:28,990 --> 00:31:26,120

stowed on the mid-deck so they can have

739
00:31:30,400 --> 00:31:29,000
easy access for change out of chemicals

740
00:31:31,750 --> 00:31:30,410
right before we launch it's much easier

741
00:31:33,940 --> 00:31:31,760
to get in the mid deck then all the way

742
00:31:36,010 --> 00:31:33,950
back into the space hab module and this

743
00:31:38,920 --> 00:31:36,020
shows a variety of different experiments

744
00:31:41,500 --> 00:31:38,930
the silver boxes are refrigerators the

745
00:31:42,620 --> 00:31:41,510
top center one holds a protein crystal

746
00:31:44,780 --> 00:31:42,630
growth experiment

747
00:31:46,340 --> 00:31:44,790
the middle right one is the vapor

748
00:31:48,410 --> 00:31:46,350
diffusion apparatus that we saw earlier

749
00:31:50,870 --> 00:31:48,420
the gold boxes in the center of the

750
00:31:53,360 --> 00:31:50,880
screen are accelerometers that we use to

751
00:31:54,890 --> 00:31:53,370
measure the environment of the spatial

752
00:31:56,510 --> 00:31:54,900
to help people better understand what

753
00:31:59,480 --> 00:31:56,520
kind of experiments can best be done on

754
00:32:02,150 --> 00:31:59,490
board the third major area we had on

755
00:32:05,180 --> 00:32:02,160
board was the Spartan satellite this was

756
00:32:06,890 --> 00:32:05,190
the attached tops on flight day to where

757
00:32:09,140 --> 00:32:06,900
we're using the telescope that you can

758
00:32:11,990 --> 00:32:09,150
see on the right-hand side of the box

759
00:32:13,670 --> 00:32:12,000
the gold box to monitor the shuttle

760
00:32:19,040 --> 00:32:13,680
environment the glow on the tail and the

761
00:32:22,280 --> 00:32:19,050
RCS Jets firing then on flight day 5 of

762
00:32:23,930 --> 00:32:22,290
ID muti Tov deployed Spartan as we saw

763
00:32:28,460 --> 00:32:23,940

in the film it drifted away for a couple

764
00:32:31,100 --> 00:32:28,470
of days and went back to pick it up this

765
00:32:33,560 --> 00:32:31,110
is me on the retrieved a flight day 7 at

766
00:32:35,270 --> 00:32:33,570
the robot arm controls as I'm getting

767
00:32:37,550 --> 00:32:35,280
ready to grab a hold of Spartan and put

768
00:32:41,270 --> 00:32:37,560
it back in the bay for our anxiously

769
00:32:44,450 --> 00:32:41,280
awaiting EBA guys my nights and white

770
00:32:46,760 --> 00:32:44,460
armor I mentioned in the movie that

771
00:32:47,540 --> 00:32:46,770
Bernard and I try to avoid looking each

772
00:32:48,950 --> 00:32:47,550
other in telling each other stories

773
00:32:51,620 --> 00:32:48,960
because we'd already heard a lot of our

774
00:32:52,910 --> 00:32:51,630
stories before then in fact for four

775
00:32:56,210 --> 00:32:52,920
hours we're having to do a pre breathe

776
00:32:58,430 --> 00:32:56,220
the cabin was kept at 14 point 7 pounds

777
00:32:59,840 --> 00:32:58,440
per square inch atmospheric pressure so

778
00:33:01,340 --> 00:32:59,850
it wouldn't disturb the experiments and

779
00:33:03,320 --> 00:33:01,350
for that reason we had to get rid of the

780
00:33:06,920 --> 00:33:03,330
nitrogen in our bloodstream by breathing

781
00:33:09,260 --> 00:33:06,930
pure o2 for four hours it was actually

782
00:33:11,930 --> 00:33:09,270
not as bad as I expected you're more

783
00:33:15,170 --> 00:33:11,940
comfortable in space speak for yourself

784
00:33:16,490 --> 00:33:15,180
I did those that were not try to sleep

785
00:33:19,820 --> 00:33:16,500
more than I did during this period of

786
00:33:22,910 --> 00:33:19,830
time on my left arm there I'm in the

787
00:33:24,260 --> 00:33:22,920
lower left on my left arm there's a boxy

788
00:33:26,270 --> 00:33:24,270

looking at contraption called the

789
00:33:28,070 --> 00:33:26,280
electronic cuff checklist and it's a

790
00:33:30,290 --> 00:33:28,080
device that basically let's just pull up

791
00:33:32,210 --> 00:33:30,300
with menus the activities we're going to

792
00:33:34,640 --> 00:33:32,220
perform during the EBA and also some

793
00:33:36,740 --> 00:33:34,650
contingency procedures and I spent my

794
00:33:39,320 --> 00:33:36,750
time bothering bernard going through all

795
00:33:42,350 --> 00:33:39,330
of our EV a flight plan by walking with

796
00:33:44,720 --> 00:33:42,360
that checklist we also monitored their

797
00:33:47,150 --> 00:33:44,730
conversation on one of our loops this

798
00:33:49,310 --> 00:33:47,160
was during the Spartan retrieval in

799
00:33:54,220 --> 00:33:49,320
these guys just cracked me up

800
00:33:57,620 --> 00:33:54,230
I think I talked about this on the movie

801
00:33:59,659 --> 00:33:57,630
when we first came out we had a major

802
00:34:01,789 --> 00:33:59,669
task and that was the outfit the RMS

803
00:34:04,279 --> 00:34:01,799
with this pad what we call pad and

804
00:34:07,610 --> 00:34:04,289
contraption here and there's a special

805
00:34:10,190 --> 00:34:07,620
device which we hooked to the RMS and

806
00:34:12,500 --> 00:34:10,200
then we then put a portable foot

807
00:34:14,710 --> 00:34:12,510
restraint on and then we had a thermal

808
00:34:17,930 --> 00:34:14,720
cube that measured ambient temperature

809
00:34:19,010 --> 00:34:17,940
the objective of this this evaa we had

810
00:34:20,960 --> 00:34:19,020
several objectives but the major

811
00:34:23,359 --> 00:34:20,970
objective was a thermal evaluation and

812
00:34:26,119 --> 00:34:23,369
that was we were told go outside guys

813
00:34:28,849 --> 00:34:26,129

turn your heat all the way up and stay

814
00:34:31,129 --> 00:34:28,859
out there and do you get cold and if you

815
00:34:34,669 --> 00:34:31,139
followed us we got cold fairly quickly

816
00:34:36,409 --> 00:34:34,679
and that's not hard to do when you're

817
00:34:38,540 --> 00:34:36,419
facing beeps space and we're talking

818
00:34:43,430 --> 00:34:38,550
about temperatures of an excess of

819
00:34:47,720 --> 00:34:43,440
people mike is holly meyer 2.7 kelvin i

820
00:34:50,649 --> 00:34:47,730
have no idea what that is it's very cold

821
00:34:53,839 --> 00:34:50,659
but it's very cold it's greater than

822
00:34:56,809 --> 00:34:53,849
about the 100 minus 130 degrees

823
00:35:00,559 --> 00:34:56,819
fahrenheit now that I do understand we

824
00:35:02,089 --> 00:35:00,569
have some preliminary temperatures from

825
00:35:04,880 --> 00:35:02,099
the sensors that we had in our gloves

826
00:35:07,490 --> 00:35:04,890
and it shows that it was lower than 20

827
00:35:13,190 --> 00:35:07,500
degrees inside our gloves in the suit so

828
00:35:16,370 --> 00:35:13,200
pretty cold this is a picture I tried to

829
00:35:19,220 --> 00:35:16,380
take or took with the hasselblad while I

830
00:35:21,710 --> 00:35:19,230
was basically floating free Bernard had

831
00:35:23,390 --> 00:35:21,720
a hold of me with one hand and it was

832
00:35:26,059 --> 00:35:23,400
surprisingly stable much more stable

833
00:35:27,950 --> 00:35:26,069
than the water tank I was trying to take

834
00:35:30,980 --> 00:35:27,960
shots one-handed with the hasselblad and

835
00:35:35,270 --> 00:35:30,990
unfortunately I got his feet

836
00:35:39,350 --> 00:35:35,280
those are my feet right and they're big

837
00:35:41,210 --> 00:35:39,360
too but could there was a tremendous

838
00:35:43,520 --> 00:35:41,220

view for me and Bernard while we were

839
00:35:46,880 --> 00:35:43,530
doing this particularly with the earth

840
00:35:48,800 --> 00:35:46,890
behind Bernard I will always remember

841
00:35:51,170 --> 00:35:48,810
this for the rest of my life just how

842
00:35:53,060 --> 00:35:51,180
breathtaking that was because we were

843
00:35:56,120 --> 00:35:53,070
still in earth light we were not getting

844
00:35:58,580 --> 00:35:56,130
as cold as we had pumped ourselves up to

845
00:36:00,140 --> 00:35:58,590
think we would be and in fact I was

846
00:36:02,270 --> 00:36:00,150
starting to get overconfident about this

847
00:36:03,920 --> 00:36:02,280
I guess when they thought about bringing

848
00:36:06,170 --> 00:36:03,930
us down at the end of this 15-minute

849
00:36:08,180 --> 00:36:06,180
evaluation we both gave ratings I think

850
00:36:10,760 --> 00:36:08,190
of the order of just slightly cool or

851
00:36:14,440 --> 00:36:10,770
normal before we were brought down to

852
00:36:16,700 --> 00:36:14,450
the bay for the mass handing evaluation

853
00:36:20,090 --> 00:36:16,710
it was shortly after we were brought

854
00:36:22,340 --> 00:36:20,100
down in the bay I got off the RMS and

855
00:36:25,910 --> 00:36:22,350
then Mike got into the RMS and then you

856
00:36:29,090 --> 00:36:25,920
see me here to the right side of Spartan

857
00:36:30,950 --> 00:36:29,100
we had foot restraints on each side of

858
00:36:34,430 --> 00:36:30,960
these and those are always on the

859
00:36:36,830 --> 00:36:34,440
Spartan impasse just in case people like

860
00:36:38,930 --> 00:36:36,840
Janis ability have trouble birthing it

861
00:36:41,450 --> 00:36:38,940
then we can do an EBA and actually birth

862
00:36:44,300 --> 00:36:41,460
it shortly after that Mike was sort of

863
00:36:47,420 --> 00:36:44,310

hanging freely we went into a night pass

864
00:36:50,300 --> 00:36:47,430
and that's when it really got cold at

865
00:36:52,099 --> 00:36:50,310
that point I was I had the Spartan in

866
00:36:53,770 --> 00:36:52,109
hand and actually going through the mass

867
00:36:57,080 --> 00:36:53,780
handling that I described in the movie

868
00:36:59,390 --> 00:36:57,090
and I guess that whole sequence was

869
00:37:02,240 --> 00:36:59,400
around 10 or 15 minutes into the night

870
00:37:04,220 --> 00:37:02,250
pass when we both started noticing that

871
00:37:07,280 --> 00:37:04,230
their fingers and feet we're getting

872
00:37:09,650 --> 00:37:07,290
colder and colder and it's about that

873
00:37:13,490 --> 00:37:09,660
time that we asked Eileen to move us to

874
00:37:16,310 --> 00:37:13,500
a colder a warmer attitude that is but

875
00:37:21,410 --> 00:37:16,320
in space at night there is no warmer

876
00:37:23,510 --> 00:37:21,420
attitude how do you see me basically

877
00:37:25,010 --> 00:37:23,520
doing one of the experiments I was

878
00:37:27,080 --> 00:37:25,020
working on in the mid decks the solid

879
00:37:31,310 --> 00:37:27,090
surface combustion experiment it's

880
00:37:33,349 --> 00:37:31,320
basically to cinema basically moving

881
00:37:34,940 --> 00:37:33,359
machines that take pictures of a flame

882
00:37:36,830 --> 00:37:34,950
propagating a crop across the solid

883
00:37:38,570 --> 00:37:36,840
surface and this is a very simple

884
00:37:44,740 --> 00:37:38,580
experiment for me to do appropriate to

885
00:37:50,570 --> 00:37:48,890
this is an experiment I'm not going to

886
00:37:52,370 --> 00:37:50,580
go into telling you exactly what it is

887
00:37:55,670 --> 00:37:52,380
but look at all this contraption look at

888
00:37:58,420 --> 00:37:55,680

all this as a medical doctor I was glad

889
00:38:01,339 --> 00:37:58,430
that I wasn't the subject in this

890
00:38:02,900 --> 00:38:01,349
because it had so many wires and gadgets

891
00:38:04,760 --> 00:38:02,910
that I had to connect to these guys who

892
00:38:06,980 --> 00:38:04,770
took a while to get him outfitted he did

893
00:38:08,690 --> 00:38:06,990
it to Vladimir too but the good news is

894
00:38:09,859 --> 00:38:08,700
while he's working madly trying to go

895
00:38:12,830 --> 00:38:09,869
those wires connect and I'm just

896
00:38:15,410 --> 00:38:12,840
floating there having a great time this

897
00:38:19,220 --> 00:38:15,420
actually this device in short basically

898
00:38:22,550 --> 00:38:19,230
was in electoral via gram which actually

899
00:38:24,320 --> 00:38:22,560
place electrodes over the muscles to get

900
00:38:26,570 --> 00:38:24,330
an idea of how they respond to

901
00:38:27,950 --> 00:38:26,580
microgravity so you can actually remove

902
00:38:30,440 --> 00:38:27,960
your arm you can actually look at the

903
00:38:33,200 --> 00:38:30,450
waveform so it's a very sophisticated

904
00:38:34,970 --> 00:38:33,210
device very portable the thing that

905
00:38:36,859 --> 00:38:34,980
doesn't show up on here is Janice is

906
00:38:38,359 --> 00:38:36,869
also wearing some nice little ski boots

907
00:38:40,910 --> 00:38:38,369
at least that's what they look like and

908
00:38:43,880 --> 00:38:40,920
these were to apply some pressure to the

909
00:38:47,180 --> 00:38:43,890
bottom of her feet to simulate standing

910
00:38:53,150 --> 00:38:47,190
on the earth and we're still waiting on

911
00:38:55,960 --> 00:38:53,160
the data to come back on that even in

912
00:38:57,980 --> 00:38:55,970
space you can't get away from paperwork

913
00:39:01,010 --> 00:38:57,990

actually the system worked out pretty

914
00:39:03,890 --> 00:39:01,020
good this is our fax machine and we call

915
00:39:06,050 --> 00:39:03,900
it tips and every morning Mission

916
00:39:08,210 --> 00:39:06,060
Control would send messages up to us

917
00:39:11,480 --> 00:39:08,220
mainly changes to our flight plan

918
00:39:14,660 --> 00:39:11,490
updates to procedures we got messages to

919
00:39:16,700 --> 00:39:14,670
cheer us up and is one example of the

920
00:39:19,609 --> 00:39:16,710
other types of messages we get the Earth

921
00:39:22,940 --> 00:39:19,619
Observation people would send us

922
00:39:24,440 --> 00:39:22,950
information on that day and ground

923
00:39:26,210 --> 00:39:24,450
scenes that we'd be passing over that

924
00:39:28,460 --> 00:39:26,220
they'd like to see pictures of along

925
00:39:32,300 --> 00:39:28,470
with what camera and what f-stop we

926
00:39:34,430 --> 00:39:32,310
should use a lot of our flight was over

927
00:39:36,290 --> 00:39:34,440
water but we did get some nice shots of

928
00:39:37,849 --> 00:39:36,300
things over the land this is the blue

929
00:39:40,849 --> 00:39:37,859
and white nile is coming together the

930
00:39:43,160 --> 00:39:40,859
white nile is the wider river to the

931
00:39:45,050 --> 00:39:43,170
left of the screen and the area in the

932
00:39:46,730 --> 00:39:45,060
middle all the little dark trying

933
00:39:48,500 --> 00:39:46,740
rectangles that you see in the center

934
00:39:48,940 --> 00:39:48,510
bottom of the screen is cotton growing

935
00:39:51,370 --> 00:39:48,950
area

936
00:39:54,069 --> 00:39:51,380
this is the city of cartoon which spans

937
00:39:56,560 --> 00:39:54,079
the Blue Nile on the right side of the

938
00:40:02,230 --> 00:39:56,570

screen and this is one of the largest

939
00:40:04,270 --> 00:40:02,240
cotton growing areas in the world these

940
00:40:06,730 --> 00:40:04,280
glaciers was so impressive to is that we

941
00:40:09,550 --> 00:40:06,740
decided we'd add another picture in our

942
00:40:11,200 --> 00:40:09,560
slideshow while you can see one right

943
00:40:14,010 --> 00:40:11,210
here in the middle emptying into a lake

944
00:40:16,720 --> 00:40:14,020
and also down here in the bottom

945
00:40:19,569 --> 00:40:16,730
emptying into a lake and they actually

946
00:40:22,480 --> 00:40:19,579
start from an altitude of over 10,000

947
00:40:26,410 --> 00:40:22,490
feet again this is in Chile and

948
00:40:28,180 --> 00:40:26,420
Argentina South America and if you look

949
00:40:30,329 --> 00:40:28,190
at the history of these areas if you go

950
00:40:32,290 --> 00:40:30,339
back thousands and thousands of years

951
00:40:35,140 --> 00:40:32,300
the scientists tell us that these

952
00:40:37,240 --> 00:40:35,150
glaciers actually flowed into where the

953
00:40:39,579 --> 00:40:37,250
lake is and the lakes were formed by the

954
00:40:40,870 --> 00:40:39,589
glaciers and you know flying on the

955
00:40:43,270 --> 00:40:40,880
shuttle and taking these pictures in

956
00:40:45,069 --> 00:40:43,280
both the visual and infrared range we

957
00:40:47,050 --> 00:40:45,079
can really get a lot of information to

958
00:40:55,210 --> 00:40:47,060
the scientists and learn about the

959
00:40:57,190 --> 00:40:55,220
history of earth it's this island called

960
00:41:00,790 --> 00:40:57,200
the heard island which is approximately

961
00:41:05,109 --> 00:41:00,800
51 52 degrees cells this is maybe a

962
00:41:08,170 --> 00:41:05,119
thousand island in the Indian Ocean all

963
00:41:12,180 --> 00:41:08,180

of the time this island and the

964
00:41:15,900 --> 00:41:12,190
Kerguelen island under the cloudy and

965
00:41:19,599 --> 00:41:15,910
this picture interesting you can see

966
00:41:23,319 --> 00:41:19,609
cloudy waves and gravity waves and the

967
00:41:26,410 --> 00:41:23,329
beginnings of von Karman vortex Cyril up

968
00:41:34,540 --> 00:41:26,420
here in the structure cloud deck and

969
00:41:38,380 --> 00:41:34,550
downwind of the snow caped Island and

970
00:41:43,030 --> 00:41:38,390
this is a picture of South African it

971
00:41:47,579 --> 00:41:43,040
looks like part of the ok now I can see

972
00:41:50,740 --> 00:41:47,589
this is actually Cape Town and this is

973
00:41:52,510 --> 00:41:50,750
Robben Island and that island happens to

974
00:41:55,900 --> 00:41:52,520
be the island at NASA Mandela was in

975
00:41:59,319 --> 00:41:55,910
prison for for all those years and it's

976
00:42:01,570 --> 00:41:59,329
really when I look at this it really is

977
00:42:09,490 --> 00:42:01,580
a beautiful scene

978
00:42:11,350 --> 00:42:09,500
but also a symbol of Independence again

979
00:42:15,520 --> 00:42:11,360
the system that we have is a very good

980
00:42:17,740 --> 00:42:15,530
one you may have heard that we left the

981
00:42:22,000 --> 00:42:17,750
system in Auto we flew such a wide hack

982
00:42:24,460 --> 00:42:22,010
a large heading alignment cone left in

983
00:42:26,050 --> 00:42:24,470
an auto and it went a little bit low as

984
00:42:29,200 --> 00:42:26,060
expected we all knew it was going to

985
00:42:32,770 --> 00:42:29,210
happen and there's we think it's a great

986
00:42:36,190 --> 00:42:32,780
system on the final approach and landing

987
00:42:37,570 --> 00:42:36,200
I was happy to show Vladimir how we do

988
00:42:39,130 --> 00:42:37,580

it hopefully the landing was a little