1
00:00:38,979 --> 00:00:34,990
I wish we could stay up there are 50

2
00:00:40,840 --> 00:00:38,989
names so from a personal viewpoint I was

3
00:00:52,000 --> 00:00:40,850
happening that we went from five to nine

4
00:00:54,789 --> 00:00:52,010
days okay a big team to launch something

5
00:00:57,160 --> 00:00:54,799
like the teacher saw us complex they're

6
00:00:58,780 --> 00:00:57,170
used in communications of the shuttle to

7
00:01:01,450 --> 00:00:58,790
the shoulder are in orbit and it also

8
00:01:03,340 --> 00:01:01,460
used process data from a lot of the NASA

9
00:01:21,580 --> 00:01:03,350
satellites such as the Hubble Space

10
00:01:25,490 --> 00:01:23,690
there's been a lot of things said about

11
00:01:27,380 --> 00:01:25,500
the ozone layer and what displays it

12
00:01:29,569 --> 00:01:27,390
what doesn't certainly I think it's well

13
00:01:31,669 --> 00:01:29,579

documented that it can be destroyed both

14
00:01:33,980 --> 00:01:31,679
by natural phenomena and man-made

15
00:01:36,199 --> 00:01:33,990
phenomena but the extent of the damage

16
00:01:38,809 --> 00:01:36,209
and how those things play against

17
00:01:54,320 --> 00:01:38,819
natural cycles in the ozone layer is not

18
00:01:58,940 --> 00:01:56,090
lower body negative pressure in

19
00:02:00,260 --> 00:01:58,950
conjunction with fluid voting has proved

20
00:02:03,500 --> 00:02:00,270
to be a more effective countermeasure

21
00:02:05,240 --> 00:02:03,510
than food loading by itself with regard

22
00:02:06,710 --> 00:02:05,250
to orthostatic intolerance what that

23
00:02:14,110 --> 00:02:06,720
will cause is a stress on the heart

24
00:02:22,030 --> 00:02:19,089
I don't consider Mike the rookie on this

25
00:02:24,850 --> 00:02:22,040
back he's very knowledgeable person has

26
00:02:27,910 --> 00:02:24,860
been around the system and made very

27
00:02:30,690 --> 00:02:27,920
large contributions and I feel like he's

28
00:02:47,000 --> 00:02:30,700
won two or three times

29
00:02:53,400 --> 00:02:50,220
this was taxing end of the ramp our

30
00:02:57,120 --> 00:02:53,410
second launch attempt getting ready to

31
00:02:59,370 --> 00:02:57,130
go for a mission and again as you saw

32
00:03:01,740 --> 00:02:59,380
there by that little bit of a lead in a

33
00:03:03,480 --> 00:03:01,750
lot of things go on leading up to a

34
00:03:05,070 --> 00:03:03,490
flight a lot of training and that was a

35
00:03:07,440 --> 00:03:05,080
little bit of a summary of it just to

36
00:03:17,040 --> 00:03:07,450
try to capitulate that time frame of the

37
00:03:24,030 --> 00:03:21,510
this is about 7am we're getting our

38
00:03:25,710 --> 00:03:24,040

launch and entry suits on and get them

39
00:03:46,050 --> 00:03:25,720
all checked out before we go out to the

40
00:03:50,550 --> 00:03:48,089
it's going out to the crew van I think

41
00:03:55,920 --> 00:03:50,560
if I could remember the time about I'd

42
00:03:58,110 --> 00:03:55,930
say 750 in the morning out on the pad

43
00:04:00,059 --> 00:03:58,120
and about this time during the count you

44
00:04:03,620 --> 00:04:00,069
really start putting your thinking hat

45
00:04:06,180 --> 00:04:03,630
on because you got to go to work and

46
00:04:08,250 --> 00:04:06,190
main engines start running and we run

47
00:04:09,600 --> 00:04:08,260
them for about six seconds the computers

48
00:04:11,070 --> 00:04:09,610
make sure they're good and all the smart

49
00:04:13,350 --> 00:04:11,080
people figured out how to make all that

50
00:04:14,790 --> 00:04:13,360
work and that's amazing to me that we

51
00:04:19,530 --> 00:04:14,800
have people in our country and how to do

52
00:04:21,180 --> 00:04:19,540
that and bang boosters light up for

53
00:04:23,340 --> 00:04:21,190
those people talk all have been doing a

54
00:04:25,260 --> 00:04:23,350
great job as far as I'm concerned with

55
00:04:27,450 --> 00:04:25,270
all our new processing techniques and

56
00:04:29,940 --> 00:04:27,460
all our new safety inspections in fact I

57
00:04:32,580 --> 00:04:29,950
think the first two minutes ten seconds

58
00:04:34,170 --> 00:04:32,590
of this ride is the safest time during

59
00:04:35,879 --> 00:04:34,180
that time frame it doesn't bother me at

60
00:04:39,300 --> 00:04:35,889
all I've watched those people Thiokol

61
00:04:45,480 --> 00:04:39,310
really proud of them and we sure had a

62
00:04:46,860 --> 00:04:45,490
good ride here right right now it's

63
00:04:49,110 --> 00:04:46,870

probably about a minute and a half into

64
00:04:51,450 --> 00:04:49,120
essent getting ready for the solid

65
00:04:52,650 --> 00:04:51,460
rocket motors to separate it's kind of a

66
00:04:54,870 --> 00:04:52,660
nice shot here you can see the shock

67
00:04:59,010 --> 00:04:54,880
waves on the orbiter and on the external

68
00:05:00,570 --> 00:04:59,020
tank we we push the limits this time a

69
00:05:02,130 --> 00:05:00,580
little bit more of the envelope went to

70
00:05:08,159 --> 00:05:02,140
a higher dynamic pressure than we've

71
00:05:10,140 --> 00:05:08,169
been to before at this point it's

72
00:05:11,969 --> 00:05:10,150
probably about 2 g's two to two and a

73
00:05:15,029 --> 00:05:11,979
half GS the right is a little bit rough

74
00:05:16,320 --> 00:05:15,039
on the sides it smoothes out quite a bit

75
00:05:23,250 --> 00:05:16,330
once you get rid of the solid rocket

76
00:05:27,210 --> 00:05:23,260
motors there they go another close-up

77
00:05:28,950 --> 00:05:27,220
shot of the SRB Sep and make sure front

78
00:05:32,279 --> 00:05:28,960
windows in front of aches and i go

79
00:05:39,620 --> 00:05:32,289
opaque they literally just go pink very

80
00:05:42,420 --> 00:05:39,630
bright flash when they come off another

81
00:05:45,029 --> 00:05:42,430
of course the Rocketdyne engines keep on

82
00:05:47,790 --> 00:05:45,039
running and boy those motors are complex

83
00:05:51,090 --> 00:05:47,800
and I see all those people and they do a

84
00:05:53,670 --> 00:05:51,100
great job making those engines run our

85
00:05:54,930 --> 00:05:53,680
major activity on the first flight day

86
00:05:57,600 --> 00:05:54,940
besides the launch

87
00:06:00,150 --> 00:05:57,610
was to launch the tea dress I us complex

88
00:06:03,150 --> 00:06:00,160

here we are we're up at 58 degrees and

89
00:06:04,650 --> 00:06:03,160
getting ready for the deployed inside

90
00:06:06,330 --> 00:06:04,660
the cockpit there's a lot of activity it

91
00:06:08,250 --> 00:06:06,340
takes off I've clue people working

92
00:06:10,860 --> 00:06:08,260
together to launch something like this

93
00:06:13,680 --> 00:06:10,870
Jim and I were the primary people that

94
00:06:15,780 --> 00:06:13,690
were involved in checking to uh I us

95
00:06:20,340 --> 00:06:15,790
systems making sure everything was ready

96
00:06:22,890 --> 00:06:20,350
for deploy and Mike's job was to make

97
00:06:25,050 --> 00:06:22,900
sure that the shuttle was in the proper

98
00:06:26,370 --> 00:06:25,060
attitude for the deployed David was the

99
00:06:28,080 --> 00:06:26,380
person that did all the fine photography

100
00:06:31,140 --> 00:06:28,090
and it's his work that we're looking at

101
00:06:32,430 --> 00:06:31,150
right this minute and then John's job

102
00:06:36,210 --> 00:06:32,440
was just to make sure all the rest of us

103
00:06:37,500 --> 00:06:36,220
were doing our jobs and when we actually

104
00:06:39,000 --> 00:06:37,510
did the deploy it looks like it's coming

105
00:06:41,850 --> 00:06:39,010
out sort of in slow motion it's not

106
00:06:43,560 --> 00:06:41,860
that's real time and the thing that

107
00:06:45,030 --> 00:06:43,570
always surprises you is how close it

108
00:06:46,560 --> 00:06:45,040
gets to the vehicle we're all looking

109
00:06:49,290 --> 00:06:46,570
out and commented on how close it was

110
00:06:51,750 --> 00:06:49,300
the vehicle and then John puts in some

111
00:06:53,370 --> 00:06:51,760
impulses to move the shuttle away from

112
00:06:57,210 --> 00:06:53,380
the IUS you can see this in just a

113
00:06:59,520 --> 00:06:57,220

minute as we begin to move away now to

114
00:07:01,590 --> 00:06:59,530
do a deploy involves not only the crew

115
00:07:03,000 --> 00:07:01,600
people inside the shuttle but involves

116
00:07:05,520 --> 00:07:03,010
all the people Mission Control that

117
00:07:08,310 --> 00:07:05,530
order monitoring systems it also

118
00:07:09,990 --> 00:07:08,320
involves people out at Sunnyvale who are

119
00:07:11,640 --> 00:07:10,000
monitoring the IUS systems involves

120
00:07:15,510 --> 00:07:11,650
people a Boeing involves the people up

121
00:07:18,060 --> 00:07:15,520
at Goddard who are looking at the teatro

122
00:07:20,670 --> 00:07:18,070
systems so you can see it's a huge

123
00:07:21,990 --> 00:07:20,680
teamwork of people a big network of

124
00:07:23,370 --> 00:07:22,000
people all across the United States

125
00:07:28,530 --> 00:07:23,380
they're involved in launching something

126
00:07:30,920 --> 00:07:28,540
like this satellite now our job in the

127
00:07:33,480 --> 00:07:30,930
shuttle crew ended as soon as we got the

128
00:07:35,280 --> 00:07:33,490
satellite out of the bay and then a

129
00:07:37,440 --> 00:07:35,290
little bit later as we backed away from

130
00:07:40,409 --> 00:07:37,450
it but then people had to continue to

131
00:07:42,120 --> 00:07:40,419
monitor as the IUS was bringing the tea

132
00:07:44,130 --> 00:07:42,130
dress on up to geosynchronous orbit I

133
00:07:45,900 --> 00:07:44,140
actually got rid of our major payload

134
00:07:48,390 --> 00:07:45,910
then the activity sort of focused down

135
00:07:49,530 --> 00:07:48,400
in the mid deck we sort of looked at the

136
00:07:51,180 --> 00:07:49,540
mid-deck as a place where we do our

137
00:07:53,730 --> 00:07:51,190
eating in our sleeping it's also on

138
00:07:59,550 --> 00:07:53,740

laboratory that we have on orbit and

139
00:08:02,950 --> 00:07:59,560
Here I am working with a biomedical

140
00:08:05,590 --> 00:08:02,960
manufacturing module

141
00:08:07,480 --> 00:08:05,600
and this module we flown before and it's

142
00:08:10,689 --> 00:08:07,490
going to fly several more times and it

143
00:08:13,839 --> 00:08:10,699
has several syringes and then you can

144
00:08:15,370 --> 00:08:13,849
put in different samples in the samples

145
00:08:19,629 --> 00:08:15,380
we had we were growing different types

146
00:08:21,909 --> 00:08:19,639
of cells and cell culture to see if they

147
00:08:25,600 --> 00:08:21,919
would manufacture different amounts of

148
00:08:29,200 --> 00:08:25,610
enzymes that would be of use and a later

149
00:08:30,939 --> 00:08:29,210
type of manufacturing process and the

150
00:08:32,709 --> 00:08:30,949
mid-deck is a very very valuable asset

151
00:08:41,680 --> 00:08:32,719
asset that we as a country have to do

152
00:08:43,839 --> 00:08:41,690
all these types of experiments shannon

153
00:08:45,190 --> 00:08:43,849
has indicated we've we turned the

154
00:08:48,010 --> 00:08:45,200
shuttle into a laboratory flying

155
00:08:50,620 --> 00:08:48,020
laboratory after we deployed the i ust

156
00:08:52,750 --> 00:08:50,630
drew satellite and here you're you're

157
00:08:55,329 --> 00:08:52,760
seeing us perform Shannon and I are

158
00:08:57,460 --> 00:08:55,339
performing one of about a dozen physical

159
00:09:00,130 --> 00:08:57,470
science type experiments we had about an

160
00:09:02,350 --> 00:09:00,140
equal number of medical supplementary

161
00:09:05,710 --> 00:09:02,360
objectives or experiments on board this

162
00:09:07,680 --> 00:09:05,720
particular one is a setup for an optical

163
00:09:10,150 --> 00:09:07,690

coupler that that actually transmit

164
00:09:13,600 --> 00:09:10,160
transmits video and audio signals

165
00:09:15,699 --> 00:09:13,610
through fiber optics and through through

166
00:09:19,510 --> 00:09:15,709
video couplers in the windows that you

167
00:09:23,350 --> 00:09:19,520
see here this is really a test to find

168
00:09:27,340 --> 00:09:23,360
out if if it's practical to use fiber

169
00:09:30,519 --> 00:09:27,350
optic technology to transmit audio and

170
00:09:33,670 --> 00:09:30,529
and video type signals in and out of the

171
00:09:38,650 --> 00:09:33,680
cargo bay from the crew compartment of

172
00:09:40,949 --> 00:09:38,660
the shuttle you're seeing a whole maze

173
00:09:43,569 --> 00:09:40,959
of fiber-optic cables here that I'm

174
00:09:44,980 --> 00:09:43,579
manipulating there and and also the

175
00:09:46,600 --> 00:09:44,990
audio and video signals that come from

176
00:09:48,810 --> 00:09:46,610
the TV monitors and go to the video

177
00:09:51,040 --> 00:09:48,820
tapes that we have on board the shuttle

178
00:09:54,600 --> 00:09:51,050
Shannon and I did a series of

179
00:09:58,660 --> 00:09:54,610
experiments using this equipment and

180
00:10:01,510 --> 00:09:58,670
took about an equivalent of about three

181
00:10:04,150 --> 00:10:01,520
hours of data on videotapes to bring

182
00:10:06,400 --> 00:10:04,160
back for analysis to find out how good a

183
00:10:08,019 --> 00:10:06,410
quality we could maintain and what the

184
00:10:10,720 --> 00:10:08,029
practicality is of doing this in the

185
00:10:15,519 --> 00:10:10,730
shuttle this is another experiment where

186
00:10:16,790 --> 00:10:15,529
we undertook to analyze the the

187
00:10:19,269 --> 00:10:16,800
propagation of flame

188
00:10:21,889 --> 00:10:19,279

grunts in solid materials in this case

189
00:10:25,310 --> 00:10:21,899
ashless filter paper that's inside a

190
00:10:28,070 --> 00:10:25,320
containment I'm igniting it here with my

191
00:10:30,350 --> 00:10:28,080
push button you see the flashing light

192
00:10:32,630 --> 00:10:30,360
in a moment you'll see the flame you'll

193
00:10:34,610 --> 00:10:32,640
notice that the flame is round it

194
00:10:37,610 --> 00:10:34,620
doesn't point up like a candle flame and

195
00:10:40,600 --> 00:10:37,620
zero gravity a flame forms a sort of a

196
00:10:42,980 --> 00:10:40,610
ball flame front as the paper burns

197
00:10:45,920 --> 00:10:42,990
we've got a series of thermocouples

198
00:10:47,960 --> 00:10:45,930
attached to the filter paper above and

199
00:10:50,060 --> 00:10:47,970
on the paper to determine what the

200
00:10:58,490 --> 00:10:50,070
nature of flame propagation is in zero

201
00:11:00,740 --> 00:10:58,500
gravity okay this is a view of the

202
00:11:04,579 --> 00:11:00,750
payload Bay and on the right side you

203
00:11:07,190 --> 00:11:04,589
can see share sure was the space station

204
00:11:09,560 --> 00:11:07,200
heat pipe advance radiator element it's

205
00:11:11,329 --> 00:11:09,570
a mouthful but we took that up and

206
00:11:16,310 --> 00:11:11,339
consists of two heat pipes which you can

207
00:11:19,220 --> 00:11:16,320
see here that we tested for use on space

208
00:11:21,470 --> 00:11:19,230
station instead would reject heat on

209
00:11:24,340 --> 00:11:21,480
space station you could use many of

210
00:11:26,510 --> 00:11:24,350
these elements in in a row basically and

211
00:11:29,360 --> 00:11:26,520
the advantages that there's no moving

212
00:11:31,639 --> 00:11:29,370
parts no pumps involved if they were to

213
00:11:34,579 --> 00:11:31,649

take a meteorite hit the whole system

214
00:11:36,310 --> 00:11:34,589
would still work unlike the systems that

215
00:11:39,230 --> 00:11:36,320
we now use on the shuttle for instance

216
00:11:43,579 --> 00:11:39,240
the results of the tests were excellent

217
00:11:44,630 --> 00:11:43,589
it worked just as expected you know one

218
00:11:46,100 --> 00:11:44,640
of the experiments that we did for the

219
00:11:48,199 --> 00:11:46,110
space station was evaluating different

220
00:11:50,780 --> 00:11:48,209
kinds of cursor control devices for use

221
00:11:53,090 --> 00:11:50,790
on board the management system on Space

222
00:11:54,319 --> 00:11:53,100
Station we used to macintosh computer

223
00:11:57,350 --> 00:11:54,329
and for different kinds of cursor

224
00:11:58,760 --> 00:11:57,360
control devices Jim Adamson Shannon

225
00:12:04,160 --> 00:11:58,770
lucid and myself evaluated those

226
00:12:06,530 --> 00:12:04,170
throughout the mission one of the

227
00:12:08,930 --> 00:12:06,540
privileges that we had on this mission

228
00:12:10,699 --> 00:12:08,940
was to fly some new software and some

229
00:12:12,230 --> 00:12:10,709
new computers the first time that the

230
00:12:14,449 --> 00:12:12,240
combination had ever flown together in

231
00:12:16,730 --> 00:12:14,459
the space shuttle we've upgraded both

232
00:12:18,530 --> 00:12:16,740
systems and among the software changes

233
00:12:20,930 --> 00:12:18,540
that we've made as a new digital auto

234
00:12:23,990 --> 00:12:20,940
pilot for flying on orbit called an

235
00:12:27,290 --> 00:12:24,000
alternate digital auto pilot and in this

236
00:12:30,440 --> 00:12:27,300
particular scene i'm working with john

237
00:12:32,840 --> 00:12:30,450
to do a series of 22 flight

238
00:12:35,150 --> 00:12:32,850

on the digital auto pilot and to find

239
00:12:38,780 --> 00:12:35,160
out what kind of response is it provides

240
00:12:41,510 --> 00:12:38,790
for the vehicle this is just a little

241
00:12:44,480 --> 00:12:41,520
view up on the flight deck that I put in

242
00:12:46,850 --> 00:12:44,490
just to show you a three really great

243
00:12:48,170 --> 00:12:46,860
people working on orbit this is in

244
00:12:49,520 --> 00:12:48,180
between while I had different clocks

245
00:12:51,620 --> 00:12:49,530
running on different things they're

246
00:12:53,120 --> 00:12:51,630
doing I catch them like this every now

247
00:12:55,850 --> 00:12:53,130
and then so I thought I'd capture this

248
00:12:59,360 --> 00:12:55,860
once on film but it's really a neat

249
00:13:02,030 --> 00:12:59,370
thing to see all these human beings

250
00:13:04,160 --> 00:13:02,040
working in space so well with the ground

251
00:13:07,580 --> 00:13:04,170
trying to get everything accomplished

252
00:13:09,080 --> 00:13:07,590
and I just think a lot of that and think

253
00:13:11,150 --> 00:13:09,090
a lot of that capability that we have in

254
00:13:12,740 --> 00:13:11,160
the country is it another demonstration

255
00:13:14,030 --> 00:13:12,750
of some physical principles in

256
00:13:15,470 --> 00:13:14,040
zero-gravity you can see a pair of long

257
00:13:17,330 --> 00:13:15,480
nose pliers there that are very stable

258
00:13:18,470 --> 00:13:17,340
in that mode when you open them up a

259
00:13:19,940 --> 00:13:18,480
little bit you can see that they've got

260
00:13:21,200 --> 00:13:19,950
to stable modes you can see even

261
00:13:24,200 --> 00:13:21,210
flipping back and forth between those

262
00:13:31,460 --> 00:13:24,210
two so David do this one so I told him I

263
00:13:34,430 --> 00:13:31,470

had to get that on film this is a gym

264
00:13:37,010 --> 00:13:34,440
working on the app flight deck for SSB

265
00:13:40,580 --> 00:13:37,020
UV his space shuttle solar backscatter

266
00:13:43,820 --> 00:13:40,590
UV experiment or data collector actually

267
00:13:48,080 --> 00:13:43,830
it took both of us essentially to work

268
00:13:50,000 --> 00:13:48,090
this secondary payload that's in a gas

269
00:13:53,000 --> 00:13:50,010
can out in the payload Bay I would

270
00:13:54,950 --> 00:13:53,010
maneuver the orbiter to either earth

271
00:13:57,650 --> 00:13:54,960
viewing attitude or solar viewing

272
00:13:59,590 --> 00:13:57,660
attitude and Jim would operate the APC

273
00:14:03,260 --> 00:13:59,600
to open and close the lid and start two

274
00:14:05,090 --> 00:14:03,270
different modes of the SSP UV sparrows

275
00:14:06,740 --> 00:14:05,100
housing which what we call a gas can

276
00:14:09,830 --> 00:14:06,750
which stands for get away special and

277
00:14:12,140 --> 00:14:09,840
you can see the mechanical lid that we

278
00:14:14,690 --> 00:14:12,150
actually actually activated from inside

279
00:14:19,850 --> 00:14:14,700
the crew compartment using a little

280
00:14:21,740 --> 00:14:19,860
computer and entering inputs very

281
00:14:24,050 --> 00:14:21,750
fascinating experiment not exact not

282
00:14:25,700 --> 00:14:24,060
designed to measure the ozone layer but

283
00:14:26,990 --> 00:14:25,710
actually to calibrate other satellites

284
00:14:29,000 --> 00:14:27,000
and instruments that do measure the

285
00:14:30,740 --> 00:14:29,010
ozone layer what we would do is is

286
00:14:34,310 --> 00:14:30,750
actually measure the backscatter

287
00:14:36,470 --> 00:14:34,320
ultraviolet rays directly emitted from

288
00:14:38,480 --> 00:14:36,480

the Sun and also then back scattered off

289
00:14:39,710 --> 00:14:38,490
the earth so we would actually look at

290
00:14:41,960 --> 00:14:39,720
the Sun with the experian and then turn

291
00:14:43,670 --> 00:14:41,970
around and look at the earth this was

292
00:14:46,480 --> 00:14:43,680
the battelle materials

293
00:14:48,680 --> 00:14:46,490
for commercial development of space

294
00:14:50,860 --> 00:14:48,690
investigation of polymer membrane

295
00:14:53,090 --> 00:14:50,870
processing the bottom line is

296
00:14:57,100 --> 00:14:53,100
microgravity they can get some idea to

297
00:15:01,900 --> 00:14:57,110
physical and characteristics of

298
00:15:05,630 --> 00:15:01,910
materials and as a result develop

299
00:15:09,320 --> 00:15:05,640
improved membranes here on the planet to

300
00:15:17,010 --> 00:15:09,330
be used for to help better filters for

301
00:15:21,720 --> 00:15:19,440
I think this is a that was a sunrise and

302
00:15:23,070 --> 00:15:21,730
this is up on the flight deck it's just

303
00:15:26,970 --> 00:15:23,080
a nice picture of the flight deck in

304
00:15:29,760 --> 00:15:26,980
space me looking at the flight plan

305
00:15:31,650 --> 00:15:29,770
there and and it was something I did a

306
00:15:33,960 --> 00:15:31,660
lot and so somebody took this picture of

307
00:15:35,210 --> 00:15:33,970
me once and we thought we needed a

308
00:15:37,260 --> 00:15:35,220
picture of John being the commander

309
00:15:38,550 --> 00:15:37,270
keeping track of all of us doing our

310
00:15:40,400 --> 00:15:38,560
thing and making sure we stayed on the

311
00:15:44,250 --> 00:15:40,410
timeline is great great man to work for

312
00:15:46,080 --> 00:15:44,260
this is down in the mid deck again you'd

313
00:15:48,690 --> 00:15:46,090

see this a lot different people trying

314
00:15:52,350 --> 00:15:48,700
to get different types of work done all

315
00:15:55,230 --> 00:15:52,360
in parallel and so just busy place on

316
00:15:58,380 --> 00:15:55,240
the mid-back Shannon in the medical kit

317
00:16:00,090 --> 00:15:58,390
here I asked her to get me some sleeping

318
00:16:02,220 --> 00:16:00,100
pills why she was getting them I thought

319
00:16:09,720 --> 00:16:02,230
I'd take a picture of her getting them

320
00:16:11,190 --> 00:16:09,730
for me you can ask her about so will the

321
00:16:12,630 --> 00:16:11,200
experiments that with the medical

322
00:16:14,700 --> 00:16:12,640
experiments that we did had to do with

323
00:16:17,910 --> 00:16:14,710
assessing the cardiovascular systems

324
00:16:20,790 --> 00:16:17,920
this particular one was called blood

325
00:16:22,560 --> 00:16:20,800
pressure variability in which we donned

326
00:16:24,660 --> 00:16:22,570
an automatic blood pressure cuff and a

327
00:16:27,230 --> 00:16:24,670
holter monitor you can see we were wired

328
00:16:29,450 --> 00:16:27,240
for sound right there and for 24 hours

329
00:16:31,710 --> 00:16:29,460
three different times during the flight

330
00:16:36,690 --> 00:16:31,720
we had our heart rates and our blood

331
00:16:38,550 --> 00:16:36,700
pressures taking constantly base John

332
00:16:40,350 --> 00:16:38,560
and I all did that in fact we had to do

333
00:16:42,030 --> 00:16:40,360
that pre-flight several two or three

334
00:16:44,310 --> 00:16:42,040
times and we all and we've also done

335
00:16:46,110 --> 00:16:44,320
that post like two or three times John's

336
00:16:47,730 --> 00:16:46,120
a given a sign language there to say

337
00:17:01,470 --> 00:16:47,740
that that's as its measuring his heart

338
00:17:06,270 --> 00:17:04,490

now another one of the cardiovascular

339
00:17:08,220 --> 00:17:06,280
medical experiments that we did was

340
00:17:09,569 --> 00:17:08,230
running on the treadmill John and I did

341
00:17:11,490 --> 00:17:09,579
that virtually every day for about 30

342
00:17:13,020 --> 00:17:11,500
minutes per day when we did this we

343
00:17:15,150 --> 00:17:13,030
donned a heart rate monitor that went

344
00:17:18,929 --> 00:17:15,160
around our chest we also had a watch on

345
00:17:20,579 --> 00:17:18,939
our wrist there that contained a readout

346
00:17:23,970 --> 00:17:20,589
of what our heart rate was as well as a

347
00:17:25,620 --> 00:17:23,980
time and during this 30 minutes every 10

348
00:17:28,590 --> 00:17:25,630
minutes we would attempt to step our

349
00:17:32,880 --> 00:17:28,600
heart rate up to a different a higher

350
00:17:34,919 --> 00:17:32,890
level there again Jon and I both did

351
00:17:36,900 --> 00:17:34,929
that on orbit jim was a control subject

352
00:17:39,060 --> 00:17:36,910
he did it on the ground and so we've got

353
00:17:43,710 --> 00:17:39,070
some some good date of all three of us

354
00:17:45,900 --> 00:17:43,720
pre and post flight I'm going to see

355
00:17:47,010 --> 00:17:45,910
David enter the scene here while I was

356
00:17:49,350 --> 00:17:47,020
running down there and looked around

357
00:17:50,789 --> 00:17:49,360
once and saw this and I thought I was

358
00:17:52,380 --> 00:17:50,799
quite amazing he was trying to beat me

359
00:17:54,870 --> 00:17:52,390
running around the world I think this

360
00:17:56,070 --> 00:17:54,880
was our hamster experiment it's much

361
00:17:58,620 --> 00:17:56,080
easier to run on that without these

362
00:18:00,120 --> 00:17:58,630
straps probably the biggest medical

363
00:18:02,539 --> 00:18:00,130

experiment that we had was called lower

364
00:18:06,750 --> 00:18:02,549
body negative pressure in this

365
00:18:08,789 --> 00:18:06,760
experiment bakes and I would would slide

366
00:18:10,740 --> 00:18:08,799
inside that can there if you will which

367
00:18:12,690 --> 00:18:10,750
had a waste seal that would come up and

368
00:18:15,539 --> 00:18:12,700
seal around our waist and we could lower

369
00:18:18,390 --> 00:18:15,549
the pressure inside that bag to about

370
00:18:19,710 --> 00:18:18,400
minus 50 millimeters of mercury which is

371
00:18:24,450 --> 00:18:19,720
equivalent stress on your heart of

372
00:18:26,840 --> 00:18:24,460
standing up in 1g again this took took

373
00:18:30,120 --> 00:18:26,850
place during four separate days on orbit

374
00:18:31,680 --> 00:18:30,130
and as you can see here with the lower

375
00:18:33,720 --> 00:18:31,690
body negative pressure device there it

376
00:18:36,360 --> 00:18:33,730
took three people took up virtually the

377
00:18:39,260 --> 00:18:36,370
entire mid-deck whenever we did this you

378
00:18:41,820 --> 00:18:39,270
can see Shannon lucid was taking some

379
00:18:44,220 --> 00:18:41,830
ultrasonic images of our hearts while we

380
00:18:45,990 --> 00:18:44,230
were in that she's got a American flight

381
00:18:47,370 --> 00:18:46,000
echocardiographic machine that is

382
00:18:49,289 --> 00:18:47,380
actually recording that data there

383
00:18:50,580 --> 00:18:49,299
you've got the subject in the bag and

384
00:18:52,169 --> 00:18:50,590
then you've got another person that is

385
00:18:55,350 --> 00:18:52,179
operating the controls down on the lower

386
00:18:57,120 --> 00:18:55,360
end there and entering the data the

387
00:19:03,299 --> 00:18:57,130
heart rate and blood pressure data on

388
00:19:09,220 --> 00:19:06,610

and again this took up the major portion

389
00:19:17,750 --> 00:19:09,230
of our days for four separate days while

390
00:19:21,830 --> 00:19:19,760
as I'm looking at this I'm just thinking

391
00:19:23,990 --> 00:19:21,840
I'll comment the Space Shuttle is an

392
00:19:28,190 --> 00:19:24,000
absolutely incredible machine I mean it

393
00:19:29,930 --> 00:19:28,200
has tremendous flexibility and so you

394
00:19:31,910 --> 00:19:29,940
know as you've seen here we deployed a

395
00:19:33,980 --> 00:19:31,920
satellite on the first day and then a

396
00:19:36,200 --> 00:19:33,990
tremendous amount of scientific and

397
00:19:39,050 --> 00:19:36,210
medical research for the rest of the the

398
00:19:41,210 --> 00:19:39,060
mission and a real national treasure

399
00:19:44,600 --> 00:19:41,220
fact the only thing in the world it that

400
00:19:46,550 --> 00:19:44,610
has this kind of capability so for

401
00:19:54,080 --> 00:19:46,560
Americans ought to be very proud of this

402
00:19:55,900 --> 00:19:54,090
system you might add also that I flew

403
00:19:58,040 --> 00:19:55,910
this on sts 32 and they've made some

404
00:20:00,050 --> 00:19:58,050
some great improvements both in the

405
00:20:02,120 --> 00:20:00,060
comfort of the device as well as the the

406
00:20:09,170 --> 00:20:02,130
hardware itself it's more automated and

407
00:20:11,990 --> 00:20:09,180
easier to use now it's a picture on the

408
00:20:13,700 --> 00:20:12,000
flight deck in between experiments you'd

409
00:20:16,610 --> 00:20:13,710
catch different people with different

410
00:20:20,870 --> 00:20:16,620
cameras here baixe has a telephoto

411
00:20:23,210 --> 00:20:20,880
hasselblad lens camera and Jim had an IR

412
00:20:24,350 --> 00:20:23,220
filter on different people trying to

413
00:20:27,590 --> 00:20:24,360

take different pictures for

414
00:20:28,880 --> 00:20:27,600
oceanographers meteorologists geologists

415
00:20:31,700 --> 00:20:28,890
all around the world are different

416
00:20:34,280 --> 00:20:31,710
requirements this is a beautiful scene

417
00:20:36,650 --> 00:20:34,290
of our planet that's just a big blue

418
00:20:40,880 --> 00:20:36,660
white bowl basically blue planets a good

419
00:20:42,560 --> 00:20:40,890
description from the IMAX movie it's a

420
00:20:46,340 --> 00:20:42,570
little sequence where I caught Mike

421
00:20:48,800 --> 00:20:46,350
taking some pictures out of the pilots

422
00:20:50,750 --> 00:20:48,810
window this is looking in the North

423
00:20:57,170 --> 00:20:50,760
Africa you see the earth limb there at

424
00:20:58,970 --> 00:20:57,180
the top Morocco Algeria Libya the

425
00:21:01,700 --> 00:20:58,980
Mediterranean Sea really quite beautiful

426
00:21:04,490 --> 00:21:01,710
our planet and of course these pictures

427
00:21:07,820 --> 00:21:04,500
don't do it any justice but they're the

428
00:21:11,750 --> 00:21:07,830
best we can return to you absolutely

429
00:21:13,520 --> 00:21:11,760
beautiful this planet makes you realize

430
00:21:14,690 --> 00:21:13,530
or no international boundaries because I

431
00:21:18,260 --> 00:21:14,700
don't see the boundaries of any of those

432
00:21:21,560 --> 00:21:18,270
countries there and in a real nice place

433
00:21:24,680 --> 00:21:21,570
we need to take care of it there's a

434
00:21:31,320 --> 00:21:28,410
Red Sea down into the Nile River Delta

435
00:21:36,390 --> 00:21:31,330
they're really beautiful coming out of

436
00:21:42,450 --> 00:21:36,400
Cairo and announce out toward the

437
00:21:46,680 --> 00:21:42,460
towards the Aswan Dam Lake Nasser come

438
00:21:48,960 --> 00:21:46,690

into the scene here in a second no

439
00:21:50,880 --> 00:21:48,970
reason I'm showing you that is I'd flown

440
00:21:55,230 --> 00:21:50,890
on to other missions and I never saw the

441
00:21:57,120 --> 00:21:55,240
Aswan this time i did as china's

442
00:21:59,540 --> 00:21:57,130
insinuated earth observation is one of

443
00:22:02,490 --> 00:21:59,550
the favorite pastimes on orbit for

444
00:22:04,650 --> 00:22:02,500
astronauts flying in space and i think

445
00:22:06,500 --> 00:22:04,660
one of the things that that impresses me

446
00:22:09,180 --> 00:22:06,510
the most about it is that since i was a

447
00:22:11,550 --> 00:22:09,190
young man going to high school the

448
00:22:12,780 --> 00:22:11,560
geology books as a result of the space

449
00:22:14,580 --> 00:22:12,790
program have been almost totally

450
00:22:16,650 --> 00:22:14,590
rewritten and the whole concept of plate

451
00:22:20,090 --> 00:22:16,660
tectonics and shifting continental

452
00:22:23,100 --> 00:22:20,100
shelves have has really been totally

453
00:22:25,560 --> 00:22:23,110
rethought as a result of observations

454
00:22:27,930 --> 00:22:25,570
made in space the senior sand right here

455
00:22:31,110 --> 00:22:27,940
is one of the bad things that's all

456
00:22:34,140 --> 00:22:31,120
equator oil fires burning running south

457
00:22:35,610 --> 00:22:34,150
down into Saudi Arabia and when I saw

458
00:22:37,650 --> 00:22:35,620
that and as murky as it looks there

459
00:22:39,720 --> 00:22:37,660
that's just was the contrast that we saw

460
00:22:42,240 --> 00:22:39,730
in orbit I mean the planet is beautiful

461
00:22:43,820 --> 00:22:42,250
and you got to that area and what it

462
00:22:46,950 --> 00:22:43,830
looked like the planet was out of focus

463
00:22:48,480 --> 00:22:46,960

there's no question aquiel Fowler fires

464
00:22:50,820 --> 00:22:48,490
are putting a lot of stuff into the

465
00:22:53,190 --> 00:22:50,830
environment affecting the lives of five

466
00:22:55,790 --> 00:22:53,200
billion people and billions of animals

467
00:23:03,710 --> 00:22:55,800
and plants all over this planet and

468
00:23:09,870 --> 00:23:07,730
you're not seeing this real good but

469
00:23:11,340 --> 00:23:09,880
you're looking into the velocity vector

470
00:23:13,470 --> 00:23:11,350
people always say what does it look like

471
00:23:14,970 --> 00:23:13,480
on orbit as if you're on a space vehicle

472
00:23:17,610 --> 00:23:14,980
where you're looking right down the

473
00:23:24,299 --> 00:23:17,620
velocity vector here approaching the

474
00:23:27,000 --> 00:23:24,309
Northwest portion of Australia quite

475
00:23:29,720 --> 00:23:27,010
beautiful you're moving at 17,500 miles

476
00:23:32,880 --> 00:23:29,730
an hour and that's what it looks like

477
00:23:34,620 --> 00:23:32,890
one morning I was up eating breakfast

478
00:23:37,350 --> 00:23:34,630
amala was eating breakfast this is what

479
00:23:39,389 --> 00:23:37,360
i was looking at and I thought boy what

480
00:23:45,419 --> 00:23:39,399
a lucky person I am to be able to see

481
00:23:47,580 --> 00:23:45,429
this scene really a very beautiful

482
00:23:54,630 --> 00:23:47,590
planet except when you see a scene like

483
00:23:58,560 --> 00:23:54,640
we saw there and wait it's another

484
00:24:01,980 --> 00:23:58,570
flight deck picture of some people

485
00:24:03,990 --> 00:24:01,990
taking pictures here of the hurricane

486
00:24:06,659 --> 00:24:04,000
that we saw Mike you may wanna talk

487
00:24:08,700 --> 00:24:06,669
about that you saw what we saw actually

488
00:24:12,149 --> 00:24:08,710

saw about four hurricanes on on our

489
00:24:13,320 --> 00:24:12,159
flight this was a hurricane FIFA and we

490
00:24:15,930 --> 00:24:13,330
had the opportunity to fly right over

491
00:24:20,549 --> 00:24:15,940
the eye which was really quite

492
00:24:22,740 --> 00:24:20,559
spectacular first the river so that we

493
00:24:24,990 --> 00:24:22,750
saw this hurricane the I was not really

494
00:24:27,000 --> 00:24:25,000
well developed and then when we timing

495
00:24:28,680 --> 00:24:27,010
was perfect for us as soon as we as the

496
00:24:31,380 --> 00:24:28,690
IE became developed that we flew right

497
00:24:33,510 --> 00:24:31,390
over it you keep your eyes on the top

498
00:24:36,029 --> 00:24:33,520
left of the screen you'll see a shooting

499
00:24:37,399 --> 00:24:36,039
star just went by it's kind of

500
00:24:39,840 --> 00:24:37,409
interesting to see that from space

501
00:24:43,409 --> 00:24:39,850
because you're looking down on it sit up

502
00:24:45,149 --> 00:24:43,419
at it solve different stars there on the

503
00:24:48,149 --> 00:24:45,159
bottom of space and the planet of

504
00:24:49,799 --> 00:24:48,159
courses dominates the upper 78 to that

505
00:24:54,899 --> 00:24:49,809
picture and this is a bunch of lightning

506
00:24:56,399 --> 00:24:54,909
storms going on people always ask what

507
00:24:57,570 --> 00:24:56,409
do they look like from space so I

508
00:25:01,950 --> 00:24:57,580
thought but throw a little of that in

509
00:25:03,899 --> 00:25:01,960
this time and I think this is the

510
00:25:05,519 --> 00:25:03,909
sunrise here and we're getting ready for

511
00:25:08,669 --> 00:25:05,529
entry day and you're going to see the

512
00:25:10,320 --> 00:25:08,679
payload bay doors coming closed I think

513
00:25:12,430 --> 00:25:10,330

David came up with the camcorder and got

514
00:25:14,230 --> 00:25:12,440
a pretty good sequence of German Shannon

515
00:25:16,060 --> 00:25:14,240
but not in progress on the left side

516
00:25:21,490 --> 00:25:16,070
there the payload bay doors starting to

517
00:25:24,400 --> 00:25:21,500
close every time I see all this i wonder

518
00:25:36,140 --> 00:25:24,410
how how does it work so much complexity

519
00:25:40,160 --> 00:25:38,480
it's about two hours before the deorbit

520
00:26:04,050 --> 00:25:40,170
burn roughly about the time to close

521
00:26:09,480 --> 00:26:07,320
this is the entry timeframe and we're

522
00:26:11,610 --> 00:26:09,490
about two hundred fifty thousand feet

523
00:26:13,520 --> 00:26:11,620
here and out the front windows you can

524
00:26:16,890 --> 00:26:13,530
really see the globe come up with a fire

525
00:26:19,860 --> 00:26:16,900
and it's quite an amazing right every

526
00:26:21,840 --> 00:26:19,870
time you do it you say wow what an

527
00:26:24,860 --> 00:26:21,850
amazing vehicle and what a beautiful

528
00:26:27,210 --> 00:26:24,870
ride coming in Jim took this photography

529
00:26:29,850 --> 00:26:27,220
as John has indicated you spend most

530
00:26:34,140 --> 00:26:29,860
your time in orbit falling around the

531
00:26:37,260 --> 00:26:34,150
earth at about 17,500 feet a second and

532
00:26:38,850 --> 00:26:37,270
in order to get back to earth the trick

533
00:26:40,080 --> 00:26:38,860
is to take some of that velocity out of

534
00:26:42,390 --> 00:26:40,090
your over it and actually slow down

535
00:26:44,670 --> 00:26:42,400
which causes you to fall back into the

536
00:26:46,650 --> 00:26:44,680
gravity field of the earth and in doing

537
00:26:47,790 --> 00:26:46,660
so you generate an awful lot of heat and

538
00:26:49,500 --> 00:26:47,800

some of the fire that you've seen

539
00:26:53,370 --> 00:26:49,510
shooting up over the top of the vehicle

540
00:26:55,410 --> 00:26:53,380
is symbol of that here we're going

541
00:26:57,450 --> 00:26:55,420
subsonic come on over atop the Kennedy

542
00:26:59,430 --> 00:26:57,460
Space Center and getting ready to turn

543
00:27:02,390 --> 00:26:59,440
on to the heading alignment circle

544
00:27:04,920 --> 00:27:02,400
that's about 90 degrees a turn to go

545
00:27:07,230 --> 00:27:04,930
when I looking out the far left window

546
00:27:08,550 --> 00:27:07,240
it was clear blue down there and by the

547
00:27:11,850 --> 00:27:08,560
time I got to the front window I thought

548
00:27:17,610 --> 00:27:11,860
it was going into the la smog that's

549
00:27:20,510 --> 00:27:17,620
just what it looked like roll down on

550
00:27:23,880 --> 00:27:20,520
final boil or shuttle training aircraft

551
00:27:26,460 --> 00:27:23,890
training we get all of our training in

552
00:27:28,370 --> 00:27:26,470
the kc-135 and all that really pays off

553
00:27:32,760 --> 00:27:28,380
here you feel like you're right at home

554
00:27:34,740 --> 00:27:32,770
biggs put the gear down and why would a

555
00:27:36,300 --> 00:27:34,750
beautiful beautiful flying machine to me

556
00:27:38,610 --> 00:27:36,310
it's easiest airplane to fly in the

557
00:27:40,500 --> 00:27:38,620
world in this timeframe but again we get

558
00:27:45,129 --> 00:27:40,510
a lot of excellent training that makes

559
00:27:50,509 --> 00:27:47,330
it's kind of incredible to think that

560
00:27:52,999 --> 00:27:50,519
that vehicle lifts off on top of a bunch

561
00:27:56,269 --> 00:27:53,009
of rocket engine pushing it out into

562
00:27:58,249 --> 00:27:56,279
space you do all that stuff and then it

563
00:28:00,619 --> 00:27:58,259

comes back in it lands like this like an

564
00:28:01,879 --> 00:28:00,629
airplane unbelievable I don't know where

565
00:28:06,680 --> 00:28:01,889
we got all the people that knew how to

566
00:28:11,749 --> 00:28:06,690
make that work but we do quite an

567
00:28:13,610 --> 00:28:11,759
amazing machine with tremendous

568
00:28:15,470 --> 00:28:13,620
flexibility to do many different

569
00:28:17,899 --> 00:28:15,480
missions and of course we tell you about

570
00:28:20,869 --> 00:28:17,909
that every time you hear about a

571
00:28:22,340 --> 00:28:20,879
definition a lot of people wonder why it

572
00:28:24,820 --> 00:28:22,350
takes the crew so long to get out of the

573
00:28:26,570 --> 00:28:24,830
vehicle after we land and of course

574
00:28:27,889 --> 00:28:26,580
going through the re-entry and

575
00:28:29,299 --> 00:28:27,899
everything we need some sort of cooling

576
00:28:31,700 --> 00:28:29,309
on board for all the avionics and once

577
00:28:33,950 --> 00:28:31,710
we close the payload bay doors we don't

578
00:28:35,330 --> 00:28:33,960
have the radiators anymore so one of the

579
00:28:38,330 --> 00:28:35,340
things we used to cool the vehicle here

580
00:28:40,129 --> 00:28:38,340
is ammonia boilers and the ammonia being

581
00:28:42,169 --> 00:28:40,139
given off by the ammonia boilers creates

582
00:28:43,970 --> 00:28:42,179
a kind of a cloud around the vehicle and

583
00:28:45,139 --> 00:28:43,980
in this particular mission we had to

584
00:28:47,210 --> 00:28:45,149
wait a little while to get out because

585
00:28:48,639 --> 00:28:47,220
there was a lot of ammonia outside

586
00:28:51,109 --> 00:28:48,649
blowing out of the ammonia boilers and

587
00:28:52,220 --> 00:28:51,119
so it was pretty smelly trying to get

588
00:28:55,129 --> 00:28:52,230

out of the vehicle so we had to wait a

589
00:28:56,989 --> 00:28:55,139
bit for that to clear this little senior

590
00:28:58,909 --> 00:28:56,999
shown you the crew working on that

591
00:29:00,830 --> 00:28:58,919
flight deck after landing there we've

592
00:29:02,419 --> 00:29:00,840
got to do a bunch of little things and I

593
00:29:06,200 --> 00:29:02,429
don't know if you've seen that before so

594
00:29:10,669 --> 00:29:06,210
we thought would throw it in coming out

595
00:29:13,100 --> 00:29:10,679
of the vehicle here again I feel very

596
00:29:16,239 --> 00:29:13,110
privileged to have had such a great team

597
00:29:18,830 --> 00:29:16,249
of people to work with up an orbit I

598
00:29:20,779 --> 00:29:18,840
wish them luck in any of their future

599
00:29:25,129 --> 00:29:20,789
endeavors they were really a super group

600
00:29:27,460 --> 00:29:25,139
of people and here's just a scene of the