1
00:00:29,030 --> 00:00:26,150
we launched in the middle of the night

2
00:00:30,320 --> 00:00:29,040
on a night when when we were kind of

3
00:00:32,570 --> 00:00:30,330
wondering whether we're gonna go fly or

4
00:00:34,460 --> 00:00:32,580
not we finally got to go ahead and suit

5
00:00:37,450 --> 00:00:34,470
up this is my favorite piece of gear to

6
00:00:43,040 --> 00:00:37,460
put on very very comfortable

7
00:00:45,049 --> 00:00:43,050
here's Borneo putting it on his suit for

8
00:00:47,350 --> 00:00:45,059
his first flight you see John Grunsfeld

9
00:00:51,229 --> 00:00:47,360
on the right everybody is raring to go

10
00:00:52,850 --> 00:00:51,239
we had a sort of a marginal call from

11
00:00:55,790 --> 00:00:52,860
the weather guys for those of you that

12
00:00:57,139 --> 00:00:55,800
followed it Sam on the left and Ron on

13
00:00:58,880 --> 00:00:57,149

the right and we're all kind of thinking

14
00:01:00,319 --> 00:00:58,890
that this is sort of a dress rehearsal

15
00:01:03,260 --> 00:01:00,329
for the real launch day which would

16
00:01:07,490 --> 00:01:03,270
probably be the next day Tammy putting

17
00:01:10,790 --> 00:01:07,500
her suit on and Wendy sue texted just a

18
00:01:12,020 --> 00:01:10,800
marvelous job I think we may be one of

19
00:01:13,609 --> 00:01:12,030
the last flights that actually where's

20
00:01:17,810 --> 00:01:13,619
the L es as we get ready to go into the

21
00:01:20,060 --> 00:01:17,820
ASA suits but we were all fired up and

22
00:01:23,870 --> 00:01:20,070
ready to go and lo and behold we went to

23
00:01:26,749 --> 00:01:23,880
fly here we are starting the main engine

24
00:01:28,460 --> 00:01:26,759
seven seconds before a launch of course

25
00:01:30,620 --> 00:01:28,470
a little over a million pounds of thrust

26
00:01:32,390 --> 00:01:30,630
there to SRBs

27
00:01:34,120 --> 00:01:32,400
you see the 20 maneuvers Steve in the

28
00:01:36,410 --> 00:01:34,130
left window to s Survey's lighting

29
00:01:37,640 --> 00:01:36,420
basically four and a half million pounds

30
00:01:40,310 --> 00:01:37,650
of weight and eight million pounds of

31
00:01:42,530 --> 00:01:40,320
thrust pushing us upwards instant

32
00:01:44,690 --> 00:01:42,540
daylight obviously you can see how well

33
00:01:46,700 --> 00:01:44,700
we illuminated things John and Wendy

34
00:01:49,340 --> 00:01:46,710
were able to actually see the launch pad

35
00:01:52,580 --> 00:01:49,350
the smoke plume and the coast by looking

36
00:01:54,469 --> 00:01:52,590
back through a mirror and obviously a

37
00:01:59,320 --> 00:01:54,479
majestic sight for everyone as we

38
00:02:02,390 --> 00:01:59,330

quickly disappear from sight here and

39
00:02:04,700 --> 00:02:02,400
approximately two minutes we approached

40
00:02:06,950 --> 00:02:04,710
SRB Sep which of course gave us a

41
00:02:09,800 --> 00:02:06,960
beautiful view of the forward rockets as

42
00:02:16,759 --> 00:02:09,810
they separate it inside and we're on our

43
00:02:18,530 --> 00:02:16,769
way to orbit here we are a little over

44
00:02:20,180 --> 00:02:18,540
an hour into the flight just a

45
00:02:22,640 --> 00:02:20,190
witnessing this beautiful view of the

46
00:02:25,190 --> 00:02:22,650
earth but flight day one is extremely

47
00:02:28,430 --> 00:02:25,200
busy and so we needed to get to work we

48
00:02:31,670 --> 00:02:28,440
opened our payload bay doors a little

49
00:02:34,520 --> 00:02:31,680
over an hour into the flight and then

50
00:02:37,580 --> 00:02:34,530
soon we'll be activating our space lab

51
00:02:39,619 --> 00:02:37,590
pallet and activating our instrument

52
00:02:43,070 --> 00:02:39,629
system all of which is done from the a

53
00:02:45,199 --> 00:02:43,080
flight deck once we attach our

54
00:02:48,199 --> 00:02:45,209
telescopes to the instrument pointing

55
00:02:52,059 --> 00:02:48,209
system we deploy that IPS and

56
00:02:54,619 --> 00:02:52,069
instruments to the upright position and

57
00:02:56,600 --> 00:02:54,629
then a little bit later on we'll be

58
00:02:59,270 --> 00:02:56,610
doing a thorough check out of the IPS

59
00:03:02,030 --> 00:02:59,280
and also a check out of all our

60
00:03:04,460 --> 00:03:02,040
ultraviolet telescopes in preparation

61
00:03:18,869 --> 00:03:04,470
for the next 15 days of astronomical

62
00:03:24,330 --> 00:03:21,750
on from the left-hand side I worked the

63
00:03:26,789 --> 00:03:24,340

IPS side and Sam on the right-hand side

64
00:03:36,149 --> 00:03:26,799
is doing the in speed instrument

65
00:03:38,069 --> 00:03:36,159
checkout we were able to very quickly

66
00:03:39,899 --> 00:03:38,079
settle into the routine I was

67
00:03:41,960 --> 00:03:39,909
responsible for making sure the orbiter

68
00:03:44,339 --> 00:03:41,970
was pointed at the right part of the sky

69
00:03:47,490 --> 00:03:44,349
Tammy was responsible for fine tuning

70
00:03:49,289 --> 00:03:47,500
with the instrument pointing system and

71
00:03:51,390 --> 00:03:49,299
then the telescope's would lock on to

72
00:03:52,530 --> 00:03:51,400
the target and he might be wondering why

73
00:03:54,539 --> 00:03:52,540
we're looking at the earth but we're

74
00:03:56,099 --> 00:03:54,549
currently rolling to the right attitude

75
00:03:58,679 --> 00:03:56,109
the idea was that we would pick up a

76
00:04:01,050 --> 00:03:58,689
star as it rose above the Earth's limb

77
00:04:02,699 --> 00:04:01,060
and then Sam would go to work making

78
00:04:05,369 --> 00:04:02,709
sure the experiments were ready to start

79
00:04:06,929 --> 00:04:05,379
the observation and quickly we have the

80
00:04:09,839 --> 00:04:06,939
Astro star tracker on the left

81
00:04:14,369 --> 00:04:09,849
uit Hut is right in the middle and

82
00:04:16,740 --> 00:04:14,379
whoopee is on the right hand side a very

83
00:04:20,610 --> 00:04:16,750
very capable package of telescopes and

84
00:04:22,580 --> 00:04:20,620
really did an outstanding job we had a

85
00:04:24,930 --> 00:04:22,590
number of tools onboard to help us

86
00:04:26,189 --> 00:04:24,940
evaluate how we were doing we

87
00:04:28,800 --> 00:04:26,199
communicated to the telescope's

88
00:04:31,110 --> 00:04:28,810

primarily through the small laptop

89
00:04:32,580 --> 00:04:31,120
computers I'm issuing commands directly

90
00:04:34,469 --> 00:04:32,590
to the telescope and you saw Tammy

91
00:04:37,589 --> 00:04:34,479
issuing commands to the instrument

92
00:04:39,060 --> 00:04:37,599
pointing system this is what we would

93
00:04:40,560 --> 00:04:39,070
see through the Hopkins ultraviolet

94
00:04:41,399 --> 00:04:40,570
telescope it had a TV camera that

95
00:04:43,980 --> 00:04:41,409
actually looked out through the

96
00:04:46,320 --> 00:04:43,990
telescope and here you see an

97
00:04:48,240 --> 00:04:46,330
acquisition of the planet Jupiter we're

98
00:04:50,760 --> 00:04:48,250
actually looking at the space around

99
00:04:53,510 --> 00:04:50,770
Jupiter and displayed below that was a

100
00:04:56,010 --> 00:04:53,520
spectrum that we're actually acquiring

101
00:04:57,899 --> 00:04:56,020
here you see the Wisconsin ultraviolet

102
00:05:00,420 --> 00:04:57,909
photopolymer imager experiment in the

103
00:05:02,310 --> 00:05:00,430
foreground and this is the type of image

104
00:05:05,070 --> 00:05:02,320
we would get from the whoopi instrument

105
00:05:07,770 --> 00:05:05,080
this shows a star in the acquisition

106
00:05:10,170 --> 00:05:07,780
camera and in addition we had spectral

107
00:05:11,399 --> 00:05:10,180
data from whoopi also to evaluate the

108
00:05:12,870 --> 00:05:11,409
target to make sure that we're looking

109
00:05:16,080 --> 00:05:12,880
at the right target and the data was

110
00:05:20,700 --> 00:05:16,090
good well what ended up being a very

111
00:05:22,499 --> 00:05:20,710
very short checkout period we got into

112
00:05:25,379 --> 00:05:22,509
the routine of observing target after

113
00:05:29,290 --> 00:05:25,389

target fir'd for the rest of the mission

114
00:05:33,010 --> 00:05:29,300
John and I were the redshift

115
00:05:35,619 --> 00:05:33,020
back into the bus operators with borneo

116
00:05:37,360 --> 00:05:35,629
in the front and we would do a borneo

117
00:05:40,360 --> 00:05:37,370
would do a maneuver of the orbiter john

118
00:05:42,999 --> 00:05:40,370
would maneuver the IPS to the correct

119
00:05:44,950 --> 00:05:43,009
attitude and turned the manual pointing

120
00:05:49,029 --> 00:05:44,960
controller over to me after the IPS

121
00:05:52,540 --> 00:05:49,039
maneuver was done and I would do the the

122
00:05:55,930 --> 00:05:52,550
target acquisition on the CCTV displays

123
00:05:59,200 --> 00:05:55,940
and the telescope's would be set off on

124
00:06:01,960 --> 00:05:59,210
their way observing the the object and

125
00:06:03,580 --> 00:06:01,970
here again you see the CCTV displays

126
00:06:08,800 --> 00:06:03,590
that we had on board to make sure we had

127
00:06:09,969 --> 00:06:08,810
the right target all the scientists on

128
00:06:11,589 --> 00:06:09,979
the ground and there was a huge team

129
00:06:13,270 --> 00:06:11,599
working at Marshall as well as all the

130
00:06:15,460 --> 00:06:13,280
folks here in Mission Control working

131
00:06:17,379 --> 00:06:15,470
and here we see our alternate payload

132
00:06:19,390 --> 00:06:17,389
specialist Scott Hagen and we're in

133
00:06:21,159 --> 00:06:19,400
regular communication with the APS and

134
00:06:23,559 --> 00:06:21,169
the other folks at Marshall working the

135
00:06:28,180 --> 00:06:23,569
telescopes every day they'd send us up a

136
00:06:30,010 --> 00:06:28,190
few pages of new information new targets

137
00:06:32,200 --> 00:06:30,020
and and target procedures and also all

138
00:06:34,540 --> 00:06:32,210

the orbiter procedures and information

139
00:06:36,129 --> 00:06:34,550
and so that was part of our duties on

140
00:06:38,260 --> 00:06:36,139
board to incorporate that into the

141
00:06:41,260 --> 00:06:38,270
rolodex and that can be helping me out

142
00:06:44,589 --> 00:06:41,270
there that was a part of our daily

143
00:06:46,180 --> 00:06:44,599
activities we also had as I mentioned

144
00:06:49,360 --> 00:06:46,190
the mid-deck active control experiment

145
00:06:50,709 --> 00:06:49,370
and here you see it with the disturbance

146
00:06:52,180 --> 00:06:50,719
at the far end on the right there

147
00:06:53,409 --> 00:06:52,190
disturbing the whole structure and

148
00:06:54,610 --> 00:06:53,419
that's free-floating or near

149
00:06:55,899 --> 00:06:54,620
free-floating the mid-deck

150
00:06:57,820 --> 00:06:55,909
and in just a second you'll see the

151
00:06:59,740 --> 00:06:57,830
control take over and the left-hand

152
00:07:01,779 --> 00:06:59,750
gimble suddenly locks in even though the

153
00:07:02,980 --> 00:07:01,789
right hand is still disturbing and this

154
00:07:05,830 --> 00:07:02,990
was the way it worked most of the time

155
00:07:07,059 --> 00:07:05,840
quite well here's a case where the left

156
00:07:09,640 --> 00:07:07,069
hand side is supposed to be pointing

157
00:07:13,209 --> 00:07:09,650
inertia lis in space but obviously this

158
00:07:14,709 --> 00:07:13,219
is a oscillatory divergent case where

159
00:07:16,120 --> 00:07:14,719
the control wasn't quite enough and you

160
00:07:18,540 --> 00:07:16,130
wouldn't if this were a space station I

161
00:07:21,119 --> 00:07:18,550
don't think you'd want to be aboard

162
00:07:22,680 --> 00:07:21,129
and these were fun to watch but by far

163
00:07:24,510 --> 00:07:22,690

the minority and this was just a great

164
00:07:26,879 --> 00:07:24,520
interactive experiment as you can see by

165
00:07:30,020 --> 00:07:26,889
the expression on our commander's face

166
00:07:31,740 --> 00:07:30,030
and corneal build to the left

167
00:07:33,779 --> 00:07:31,750
fortunately the other mid-deck

168
00:07:35,159 --> 00:07:33,789
experiments were rather benign we just

169
00:07:36,689 --> 00:07:35,169
spent most of our time cleaning the

170
00:07:38,999 --> 00:07:36,699
filters on the protein crystal growth

171
00:07:41,540 --> 00:07:39,009
experiments you can see John here

172
00:07:44,249 --> 00:07:41,550
participating in a medical DSO that was

173
00:07:46,740 --> 00:07:44,259
determining the function of the eyes and

174
00:07:48,839 --> 00:07:46,750
the head your gaze on orbit

175
00:07:52,050 --> 00:07:48,849
he's definitely wired for sound in this

176
00:07:55,230 --> 00:07:52,060
scene and again dr. SAR x also known as

177
00:07:57,600 --> 00:07:55,240
ron talking to with with one of the many

178
00:07:59,670 --> 00:07:57,610
school contacts we spoke to schools

179
00:08:02,999 --> 00:07:59,680
literally around the world India South

180
00:08:04,980 --> 00:08:03,009
Africa as well as throughout the United

181
00:08:06,749 --> 00:08:04,990
States that was really again as John

182
00:08:08,969 --> 00:08:06,759
said one of the more enjoyable aspects

183
00:08:11,939 --> 00:08:08,979
and of course we'd had to include bill

184
00:08:13,379 --> 00:08:11,949
on the bike he had to arm wrestle the

185
00:08:15,029 --> 00:08:13,389
rest of us for time though he didn't

186
00:08:17,070 --> 00:08:15,039
live on the bike we actually made him

187
00:08:18,930 --> 00:08:17,080
work but as I said before it was a great

188
00:08:20,420 --> 00:08:18,940

way to get some exercise and relax while

189
00:08:23,370 --> 00:08:20,430
you're on orbit

190
00:08:25,050 --> 00:08:23,380
well that exercise is likely to make

191
00:08:27,510 --> 00:08:25,060
anybody hungry and some of us were

192
00:08:30,149 --> 00:08:27,520
hungrier than others so we see Borneo

193
00:08:32,040 --> 00:08:30,159
here was first in line at the galley the

194
00:08:34,440 --> 00:08:32,050
red shift usually had dinner together we

195
00:08:36,300 --> 00:08:34,450
usually had a cocktail hour first where

196
00:08:40,290 --> 00:08:36,310
we all had a shrimp cocktail or here you

197
00:08:41,579 --> 00:08:40,300
see a blue shift person coming in here

198
00:08:45,750 --> 00:08:41,589
probably didn't have enough breakfast

199
00:08:47,880 --> 00:08:45,760
trying to get somebody's food away from

200
00:08:50,880 --> 00:08:47,890
them and of course playing with food you

201
00:08:52,740 --> 00:08:50,890
know no matter how often your mom tell

202
00:08:55,340 --> 00:08:52,750
told you not to play with your food it's

203
00:09:00,840 --> 00:08:55,350
just impossible not to do that in space

204
00:09:03,690 --> 00:09:00,850
and you see Tammy here with fluid

205
00:09:05,400 --> 00:09:03,700
physics experiment some tropical punch

206
00:09:10,500 --> 00:09:05,410
floating free in the mid-deck which he

207
00:09:12,630 --> 00:09:10,510
was able to vacuum up posthaste and of

208
00:09:16,019 --> 00:09:12,640
course we don't have a shower on board

209
00:09:17,670 --> 00:09:16,029
and that's the best you can do earth

210
00:09:19,470 --> 00:09:17,680
observations as we said was one of the

211
00:09:20,519 --> 00:09:19,480
more enjoyable things to do and also an

212
00:09:23,730 --> 00:09:20,529
important part of the shuttle program

213
00:09:27,960 --> 00:09:23,740

and here's Wendy's famous barren island

214
00:09:29,189 --> 00:09:27,970
volcano in the Andaman Islands and that

215
00:09:29,929 --> 00:09:29,199
was neat to look for that kind of stuff

216
00:09:31,849 --> 00:09:29,939
that was

217
00:09:35,389 --> 00:09:31,859
a great discovery for us to be able to

218
00:09:38,059 --> 00:09:35,399
report that to the ground again shark

219
00:09:39,769 --> 00:09:38,069
Bay this is a larger view of it and from

220
00:09:41,599 --> 00:09:39,779
day to day we could see variations both

221
00:09:43,969 --> 00:09:41,609
due to tidal differences and also from

222
00:09:45,829 --> 00:09:43,979
the rain in Australia this is looking

223
00:09:48,799 --> 00:09:45,839
towards the south up at the very left

224
00:09:50,539 --> 00:09:48,809
end of the picture is Adelaide and some

225
00:09:53,089 --> 00:09:50,549
of the dry Lakes in the airlock

226
00:09:57,589 --> 00:09:53,099
Lake Region and some of these also had

227
00:09:59,960 --> 00:09:57,599
water in and we had both color visible

228
00:10:02,119 --> 00:09:59,970
film and infrared film and we took

229
00:10:04,819 --> 00:10:02,129
sometimes pairs of pictures of the same

230
00:10:06,379 --> 00:10:04,829
region we also had an opportunity on a

231
00:10:09,109 --> 00:10:06,389
number of passes to see the Hawaiian

232
00:10:12,079 --> 00:10:09,119
Islands Tammie showed you the Oahu view

233
00:10:14,059 --> 00:10:12,089
here's a the Big Island of Hawaii and on

234
00:10:15,499 --> 00:10:14,069
the top of the picture there on the

235
00:10:18,259 --> 00:10:15,509
volcano or a number of NASA

236
00:10:21,489 --> 00:10:18,269
observatories that also do astronomy and

237
00:10:24,019 --> 00:10:21,499
we really enjoyed taking the pictures

238
00:10:26,119 --> 00:10:24,029

this is another beautiful view of a

239
00:10:27,679 --> 00:10:26,129
sunset on orbit it takes about 90

240
00:10:29,749 --> 00:10:27,689
minutes to orbit the Earth and so one

241
00:10:33,499 --> 00:10:29,759
gets to see a sunrise or sunset every 45

242
00:10:35,089 --> 00:10:33,509
minutes and this is one of the storms

243
00:10:38,179 --> 00:10:35,099
that we witnessed in the south-central

244
00:10:40,429 --> 00:10:38,189
United States you're looking North is at

245
00:10:42,889 --> 00:10:40,439
the top of the screen to the left you

246
00:10:44,569 --> 00:10:42,899
can see Louisiana all the way up to

247
00:10:46,819 --> 00:10:44,579
Atlanta actually and on the right hand

248
00:10:49,009 --> 00:10:46,829
side of course is Florida and it's a

249
00:10:56,629 --> 00:10:49,019
very graphic depiction of city lights

250
00:10:58,699 --> 00:10:56,639
and storm activity eventually we have to

251
00:11:01,489 --> 00:10:58,709
come back home this is a graphic

252
00:11:04,489 --> 00:11:01,499
visualization of the pilot dto you can

253
00:11:06,759 --> 00:11:04,499
see an actual approach here on the

254
00:11:08,929 --> 00:11:06,769
computer screen working with the

255
00:11:11,389 --> 00:11:08,939
controller which is mounted to the

256
00:11:13,879 --> 00:11:11,399
existing stick and the orbiter in

257
00:11:16,609 --> 00:11:13,889
addition to that prior to coming home we

258
00:11:18,979 --> 00:11:16,619
went ahead and did a check on the flight

259
00:11:21,589 --> 00:11:18,989
control systems and what we do is we do

260
00:11:23,239 --> 00:11:21,599
a check of all the Jets and also the

261
00:11:25,629 --> 00:11:23,249
flight control surfaces to make sure

262
00:11:29,269 --> 00:11:25,639
that the orbiter does perform as

263
00:11:31,429 --> 00:11:29,279

advertised and here the three orbiter

264
00:11:32,629 --> 00:11:31,439
folks Steve Wendy and myself are going

265
00:11:34,699 --> 00:11:32,639
through the flight control system

266
00:11:36,079 --> 00:11:34,709
checkout and you'll now see the Elavon

267
00:11:38,059 --> 00:11:36,089
moving in the background and you can

268
00:11:39,889 --> 00:11:38,069
really feel this just shake the vehicle

269
00:11:43,829 --> 00:11:39,899
as it slams back and forth against the

270
00:11:50,079 --> 00:11:47,290
and then the final step before we come

271
00:11:53,139 --> 00:11:50,089
home is to turn the orbiting observatory

272
00:11:54,369 --> 00:11:53,149
back into a flying machine and it gets

273
00:11:57,579 --> 00:11:54,379
kind of hectic there when we're trying

274
00:11:59,650 --> 00:11:57,589
to pack everything away and then put our

275
00:12:04,749 --> 00:11:59,660
launch and entry suits back on and get

276
00:12:08,429 --> 00:12:04,759
ready to re-enter here you see Ron and I

277
00:12:18,080 --> 00:12:08,439
and our suits are us logo they're

278
00:12:23,890 --> 00:12:20,480
once that's done and just before we do

279
00:12:26,630 --> 00:12:23,900
orbit we close the payload bay doors and

280
00:12:41,980 --> 00:12:26,640
seal the payload Bay so that we can

281
00:12:46,240 --> 00:12:43,449
as you're probably aware we were

282
00:12:50,019 --> 00:12:46,250
originally scheduled to land at Kennedy

283
00:12:51,400 --> 00:12:50,029
Space Center on the 17th of March which

284
00:12:53,650 --> 00:12:51,410
would have been 15 and a half days on

285
00:12:55,840 --> 00:12:53,660
orbit unfortunately the weather and in

286
00:12:58,990 --> 00:12:55,850
Florida didn't accommodate that landing

287
00:13:00,610 --> 00:12:59,000
so we put the telescope away I never did

288
00:13:02,230 --> 00:13:00,620

actually close the doors the Mission

289
00:13:04,180 --> 00:13:02,240
Control Center folks never put us in the

290
00:13:05,350 --> 00:13:04,190
suits because of weather was was so bad

291
00:13:08,500 --> 00:13:05,360
we didn't they didn't think that we had

292
00:13:11,710 --> 00:13:08,510
a chance at it the next day Saturday the

293
00:13:13,690 --> 00:13:11,720
18th we made one look at the Kennedy

294
00:13:16,210 --> 00:13:13,700
Space Center waved off on the first Rev

295
00:13:18,190 --> 00:13:16,220
and went ahead and burned to Edwards Air

296
00:13:20,620 --> 00:13:18,200
Force Base on the second deorbit

297
00:13:22,750 --> 00:13:20,630
opportunity on the 18th there you can

298
00:13:25,780 --> 00:13:22,760
see the hack we're on final now and to

299
00:13:28,420 --> 00:13:25,790
runway two two at Edwards and the winds

300
00:13:29,920 --> 00:13:28,430
were a little bit gusty at Edwards you

301
00:13:32,290 --> 00:13:29,930
can see a little bit of the dust coming

302
00:13:33,699 --> 00:13:32,300
off the lake beds but but there wasn't

303
00:13:35,769 --> 00:13:33,709
an appreciable amount of turbulence we

304
00:13:38,800 --> 00:13:35,779
could feel a little bit of turbulence on

305
00:13:40,810 --> 00:13:38,810
final and the right to left crosswind

306
00:13:42,610 --> 00:13:40,820
was definitely noticeable but nothing

307
00:13:45,310 --> 00:13:42,620
that wasn't well within the performance

308
00:13:46,990 --> 00:13:45,320
capabilities of the orbiter and for

309
00:13:49,660 --> 00:13:47,000
those of us that have flown before

310
00:13:52,180 --> 00:13:49,670
there wasn't a whole heck of a lot of

311
00:13:55,690 --> 00:13:52,190
difference between an eight day to ten

312
00:13:57,819 --> 00:13:55,700
day flight in a 17 day flight so if

313
00:13:59,319 --> 00:13:57,829

there is a limit on the amount of time

314
00:14:00,880 --> 00:13:59,329
that people can go to space and come

315
00:14:03,850 --> 00:14:00,890
back and land in orbiter we don't think

316
00:14:07,180 --> 00:14:03,860
it's at the 17 day point it was a

317
00:14:09,150 --> 00:14:07,190
wonderful flight we had an orbiter that

318
00:14:11,490 --> 00:14:09,160
gave us virtually no problems whatsoever

319
00:14:14,500 --> 00:14:11,500
the folks down at Kennedy Space Center

320
00:14:16,420 --> 00:14:14,510
should be very very proud of the orbiter

321
00:14:18,430 --> 00:14:16,430
that they gave us we hope that we gave

322
00:14:19,420 --> 00:14:18,440
it back in pretty good shape to them so

323
00:14:22,090 --> 00:14:19,430
that they can turn it around for the

324
00:14:24,130 --> 00:14:22,100
next bunch of folks that go fly it it

325
00:14:27,850 --> 00:14:24,140
was a tremendous adventure for us we

326
00:14:30,010 --> 00:14:27,860
were very pleased with the results I had

327
00:14:32,530 --> 00:14:30,020
a tremendous group of people to go fly

328
00:14:35,199 --> 00:14:32,540
with exceptionally talented a group of

329
00:14:37,840 --> 00:14:35,209
folks and so if we could if we just go

330
00:14:39,550 --> 00:14:37,850
ahead and start the slides now okay as

331
00:14:41,260 --> 00:14:39,560
is traditional the rookies are pretty

332
00:14:42,910 --> 00:14:41,270
much responsible for the crew patch and

333
00:14:44,710 --> 00:14:42,920
we think that they did just a great job

334
00:14:47,350 --> 00:14:44,720
pretty well tells the story of the

335
00:14:48,910 --> 00:14:47,360
mission has the telescope's which

336
00:14:50,800 --> 00:14:48,920
operated of course in the ultraviolet

337
00:14:52,150 --> 00:14:50,810
part of the spectrum three different

338
00:14:53,690 --> 00:14:52,160

instruments from the payload Bay that

339
00:14:58,250 --> 00:14:53,700
the science guys will tell you about

340
00:15:00,290 --> 00:14:58,260
in more detail later but we we launched

341
00:15:01,880 --> 00:15:00,300
on the 2nd of March we really didn't

342
00:15:04,550 --> 00:15:01,890
think we were going to do that with the

343
00:15:07,460 --> 00:15:04,560
weather as it was when we got down there

344
00:15:11,330 --> 00:15:07,470
I was a night launch primarily because

345
00:15:12,770 --> 00:15:11,340
we were attempting to maximize the

346
00:15:14,210 --> 00:15:12,780
amount of observing time and as it

347
00:15:16,730 --> 00:15:14,220
turned out launching in the middle of

348
00:15:18,200 --> 00:15:16,740
the night minimized the amount of time

349
00:15:20,870 --> 00:15:18,210
that we were going to be in the South

350
00:15:24,560 --> 00:15:20,880
Atlantic anomaly during the night time

351
00:15:27,320 --> 00:15:24,570
passes so we went to the program the

352
00:15:29,330 --> 00:15:27,330
science guys did along with payload

353
00:15:30,680 --> 00:15:29,340
commander Tammy Jernigan and made the

354
00:15:32,750 --> 00:15:30,690
case for launching in the middle of the

355
00:15:34,490 --> 00:15:32,760
night and we did that we launched a 137

356
00:15:37,190 --> 00:15:34,500
eastern time I guess we're a minute late

357
00:15:39,680 --> 00:15:37,200
138 Eastern Time on the 17th and I can

358
00:15:43,640 --> 00:15:39,690
tell you what or the second it's my

359
00:15:45,200 --> 00:15:43,650
second night launch and day launches are

360
00:15:46,580 --> 00:15:45,210
impressive night launches are really

361
00:15:49,250 --> 00:15:46,590
something it gets to be no kid in broad

362
00:15:53,770 --> 00:15:49,260
daylight down there at Kennedy Space

363
00:15:56,960 --> 00:15:53,780

Center for just a little while although

364
00:15:58,780 --> 00:15:56,970
Astro is sometimes talked about as an

365
00:16:01,520 --> 00:15:58,790
individual payload there are actually

366
00:16:04,220 --> 00:16:01,530
more than one instrument that come

367
00:16:06,790 --> 00:16:04,230
together to to make the observatory

368
00:16:11,380 --> 00:16:06,800
itself and in this picture we see

369
00:16:13,670 --> 00:16:11,390
starting from the left the long conical

370
00:16:15,790 --> 00:16:13,680
sunshade you see there is actually part

371
00:16:19,640 --> 00:16:15,800
of a star tracker that we use for

372
00:16:23,330 --> 00:16:19,650
correcting image motion that are created

373
00:16:24,980 --> 00:16:23,340
by disturbances in the orbiter just to

374
00:16:26,660 --> 00:16:24,990
the right of that that you can see sort

375
00:16:30,470 --> 00:16:26,670
of in the back is the ultraviolet

376
00:16:33,110 --> 00:16:30,480
imaging telescope which actually takes

377
00:16:35,090 --> 00:16:33,120
images of ultraviolet objects and it's

378
00:16:38,240 --> 00:16:35,100
it was built at Goddard Space Flight

379
00:16:41,600 --> 00:16:38,250
Center and to the right of that the

380
00:16:44,000 --> 00:16:41,610
larger tube is the Hopkins ultraviolet

381
00:16:48,950 --> 00:16:44,010
telescope from Johns Hopkins University

382
00:16:51,650 --> 00:16:48,960
and here's another view of the same

383
00:16:56,270 --> 00:16:51,660
telescopes the same telescope package

384
00:16:58,190 --> 00:16:56,280
the Astra Observatory the instrument you

385
00:16:59,930 --> 00:16:58,200
see in the foreground with the square

386
00:17:02,770 --> 00:16:59,940
aluminum baffle is a Wisconsin

387
00:17:05,850 --> 00:17:02,780
ultraviolet photo polarimeter experiment

388
00:17:10,199 --> 00:17:05,860

which we commonly just call whoopee

389
00:17:14,579 --> 00:17:10,209
and on the two it's right you see three

390
00:17:16,289 --> 00:17:14,589
small tubes those are the baffles for

391
00:17:18,569 --> 00:17:16,299
the optical sensor package which was

392
00:17:20,069 --> 00:17:18,579
three star trackers that were used in

393
00:17:24,240 --> 00:17:20,079
conjunction with the instrument pointing

394
00:17:30,029 --> 00:17:24,250
system to help acquire stars and to

395
00:17:32,759 --> 00:17:30,039
guide on those guide stars during the

396
00:17:34,769 --> 00:17:32,769
observation this particular image if you

397
00:17:38,070 --> 00:17:34,779
look at the landmass below has special

398
00:17:41,340 --> 00:17:38,080
significance to astronomers this is in

399
00:17:42,870 --> 00:17:41,350
the southern hemisphere and I can't

400
00:17:45,840 --> 00:17:42,880
forgot to make this laser pointer work

401
00:17:48,960 --> 00:17:45,850
yeah okay right in here in this region

402
00:17:50,580 --> 00:17:48,970
are all of our almost all of the large

403
00:17:52,560 --> 00:17:50,590
ground-based observatories in the

404
00:17:55,830 --> 00:17:52,570
southern hemisphere this is northern

405
00:17:58,500 --> 00:17:55,840
chile and right in this region and here

406
00:18:01,049 --> 00:17:58,510
is the Las Campanas Observatory the

407
00:18:02,070 --> 00:18:01,059
European Southern Observatory and just

408
00:18:05,940 --> 00:18:02,080
to the right over here is the

409
00:18:07,769 --> 00:18:05,950
inter-american Observatory and much of

410
00:18:10,759 --> 00:18:07,779
the astronomy and the southern

411
00:18:14,389 --> 00:18:10,769
hemisphere is conducted in this region

412
00:18:17,909 --> 00:18:14,399
or in Australia and so this picture has

413
00:18:20,730 --> 00:18:17,919

special significance to us and in fact

414
00:18:22,980 --> 00:18:20,740
the last time I flew an aster one as we

415
00:18:24,299 --> 00:18:22,990
were flying over like this some people I

416
00:18:30,509 --> 00:18:24,309
was working with were down here making

417
00:18:34,710 --> 00:18:30,519
observations in Chile okay this is where

418
00:18:35,490 --> 00:18:34,720
I this has got both of the orbital

419
00:18:37,259 --> 00:18:35,500
pilots here

420
00:18:40,889 --> 00:18:37,269
Wendy Lawrence on the left of course

421
00:18:42,330 --> 00:18:40,899
then bill Gregory on the right and those

422
00:18:44,340 --> 00:18:42,340
two folks were on different ships we're

423
00:18:46,259 --> 00:18:44,350
divided up and do into two shifts and

424
00:18:48,779 --> 00:18:46,269
ran 24-hour operations onboard the

425
00:18:53,100 --> 00:18:48,789
orbiter for all 17 days that we were

426
00:18:56,519 --> 00:18:53,110
flying and Wendy was the blue shift

427
00:18:59,070 --> 00:18:56,529
pilot she was ran basically all of the

428
00:19:02,879 --> 00:18:59,080
orbital maneuvers that we did we had

429
00:19:05,549 --> 00:19:02,889
over 377 maneuvers that supported the

430
00:19:07,220 --> 00:19:05,559
payload just a little over 400 maneuvers

431
00:19:09,899 --> 00:19:07,230
all told for the flight

432
00:19:12,090 --> 00:19:09,909
Wendy basically loaded every single one

433
00:19:13,470 --> 00:19:12,100
of those on the blue shift bill did all

434
00:19:15,970 --> 00:19:13,480
of them except for a few that I managed

435
00:19:19,660 --> 00:19:15,980
to screw up on the red shift and

436
00:19:21,940 --> 00:19:19,670
and and they did an awesome job not only

437
00:19:23,650 --> 00:19:21,950
of keeping track of the attitude

438
00:19:26,110 --> 00:19:23,660

timeline to make sure that the orbiter

439
00:19:27,670 --> 00:19:26,120
was maneuvered properly to support the

440
00:19:29,920 --> 00:19:27,680
observation is that the science folks

441
00:19:31,620 --> 00:19:29,930
wanted to make with the telescopes but

442
00:19:34,540 --> 00:19:31,630
also just in keeping the orbiter clean

443
00:19:37,390 --> 00:19:34,550
doing all the things for the system's

444
00:19:39,220 --> 00:19:37,400
the flash evaporator systems the

445
00:19:41,350 --> 00:19:39,230
wastewater dumps all those kinds of

446
00:19:43,810 --> 00:19:41,360
things that you need to do in order to

447
00:19:45,490 --> 00:19:43,820
keep the orbiter up and running to

448
00:19:51,670 --> 00:19:45,500
support science operations these guys

449
00:19:54,490 --> 00:19:51,680
were doing one on each shift Tammy

450
00:19:55,570 --> 00:19:54,500
Jernigan was the payload commander for

451
00:19:56,950 --> 00:19:55,580
that matter still is the payload

452
00:20:01,990 --> 00:19:56,960
commander until we managed to get the

453
00:20:04,060 --> 00:20:02,000
flight report written and and she was

454
00:20:06,000 --> 00:20:04,070
assigned to the flight both she and John

455
00:20:09,610 --> 00:20:06,010
were assigned before the orbiter crew

456
00:20:12,070 --> 00:20:09,620
was even mentioned in context with STS

457
00:20:14,740 --> 00:20:12,080
67 by about six months so Tammy was

458
00:20:16,750 --> 00:20:14,750
working all those issues with the

459
00:20:19,450 --> 00:20:16,760
payload community at Marshall Space

460
00:20:20,980 --> 00:20:19,460
Flight Center and a Goddard with all the

461
00:20:23,800 --> 00:20:20,990
science teams the principal

462
00:20:25,480 --> 00:20:23,810
investigators to try to get the

463
00:20:28,060 --> 00:20:25,490

operations in sync with her science

464
00:20:31,330 --> 00:20:28,070
early on and she did just an awesome job

465
00:20:34,180 --> 00:20:31,340
here you see her working with one of the

466
00:20:36,150 --> 00:20:34,190
many PG SES that we had these were

467
00:20:38,800 --> 00:20:36,160
dedicated to the payload we had three

468
00:20:41,290 --> 00:20:38,810
computers that were dedicated to Astro

469
00:20:44,410 --> 00:20:41,300
and that was our primary interface with

470
00:20:47,050 --> 00:20:44,420
the Space Lab system the s-class the

471
00:20:50,140 --> 00:20:47,060
subsystem operating software and the

472
00:20:52,120 --> 00:20:50,150
e-class the experiment software to work

473
00:20:56,170 --> 00:20:52,130
with the payloads we had the the s-class

474
00:20:58,030 --> 00:20:56,180
running primarily on the starboard side

475
00:21:00,580 --> 00:20:58,040
left side as you're looking at which was

476
00:21:03,040 --> 00:21:00,590
the MS station and then the experiment

477
00:21:08,800 --> 00:21:03,050
side was primarily run by the folks on

478
00:21:12,070 --> 00:21:08,810
the right side that being the PS okay

479
00:21:14,410 --> 00:21:12,080
speaking of one of the PS Ron fries dr.

480
00:21:15,910 --> 00:21:14,420
Ron Perez and when we got back to

481
00:21:18,610 --> 00:21:15,920
Ellington I said that he had been

482
00:21:20,680 --> 00:21:18,620
assigned to astro since the earth cooled

483
00:21:21,760 --> 00:21:20,690
and that's not really completely

484
00:21:24,430 --> 00:21:21,770
accurate

485
00:21:25,900 --> 00:21:24,440
however he has been working astro since

486
00:21:29,800 --> 00:21:25,910
he graduated from college which was

487
00:21:34,520 --> 00:21:32,270
and basically the guy is an expert on

488
00:21:38,300 --> 00:21:34,530

Astro as you would suspect he flew on on

489
00:21:41,030 --> 00:21:38,310
Astro one Jacqueline Vance brass and

490
00:21:43,400 --> 00:21:41,040
Vance bran and Guy Gardner and Sam

491
00:21:46,330 --> 00:21:43,410
Durant's all well executed the first

492
00:21:49,850 --> 00:21:46,340
mission here and so he was just a

493
00:21:51,920 --> 00:21:49,860
tremendous source of knowledge not only

494
00:21:54,080 --> 00:21:51,930
on UI key which is his particular area

495
00:21:57,170 --> 00:21:54,090
of expertise but on the other two

496
00:21:58,640 --> 00:21:57,180
payloads as well and besides that he was

497
00:22:00,950 --> 00:21:58,650
just a great guy to go fly with always

498
00:22:03,020 --> 00:22:00,960
willing to do anything that was required

499
00:22:05,060 --> 00:22:03,030
he and Sam both were the were the suit

500
00:22:07,250 --> 00:22:05,070
guys for a post insertion and the orbit

501
00:22:09,050 --> 00:22:07,260
prep Sam and Ron were the folks that

502
00:22:13,130 --> 00:22:09,060
that got all the rest of this dressed in

503
00:22:15,410 --> 00:22:13,140
the morning you see Sam on the right

504
00:22:17,180 --> 00:22:15,420
Sam dorrance and that John Grunsfeld on

505
00:22:20,150 --> 00:22:17,190
the left John was the first time flier

506
00:22:22,390 --> 00:22:20,160
as was both wendy and borneo bill

507
00:22:26,290 --> 00:22:22,400
Gregory affectionately known as Borneo

508
00:22:29,540 --> 00:22:26,300
John was the other MS he was the

509
00:22:30,400 --> 00:22:29,550
blueshift guy that ran the instrument

510
00:22:33,320 --> 00:22:30,410
pointing system

511
00:22:35,540 --> 00:22:33,330
starboard side a flight deck he's also

512
00:22:37,160 --> 00:22:35,550
forgotten more about laptop computers

513
00:22:40,190 --> 00:22:37,170

than the whole rest of the crew combined

514
00:22:41,750 --> 00:22:40,200
ever knew and he was just a huge help in

515
00:22:43,520 --> 00:22:41,760
that area since we were operating about

516
00:22:46,730 --> 00:22:43,530
six of those things simultaneously to

517
00:22:49,880 --> 00:22:46,740
support the payload and the orbiter Sam

518
00:22:53,450 --> 00:22:49,890
of course also flew on Astro one with

519
00:22:56,360 --> 00:22:53,460
ron van sky and company and and as such

520
00:22:58,970 --> 00:22:56,370
was was another super expert his primary

521
00:23:01,370 --> 00:22:58,980
area of expertise being cut the hopkins

522
00:23:05,080 --> 00:23:01,380
ultraviolet telescope which he works

523
00:23:09,830 --> 00:23:07,790
buck you see sam and i holding contains

524
00:23:11,270 --> 00:23:09,840
the target procedures we observed

525
00:23:13,070 --> 00:23:11,280
hundreds of targets and we had an

526
00:23:15,590 --> 00:23:13,080
individual procedure for each target

527
00:23:17,060 --> 00:23:15,600
that was observed and as you can see we

528
00:23:20,060 --> 00:23:17,070
affectionately named his book the

529
00:23:21,530 --> 00:23:20,070
rolodex since it became so full with all

530
00:23:23,090 --> 00:23:21,540
the new procedures that the ground

531
00:23:27,070 --> 00:23:23,100
uplink and we had a little fun with it

532
00:23:32,060 --> 00:23:29,870
wherever we go Steve gets the

533
00:23:33,830 --> 00:23:32,070
opportunity to introduce all of us and

534
00:23:35,870 --> 00:23:33,840
because he does that we don't get a

535
00:23:37,640 --> 00:23:35,880
chance to brag about him so I'm gonna

536
00:23:40,580 --> 00:23:37,650
take a second here to point out that

537
00:23:43,070 --> 00:23:40,590
Steven flown twice previously this

538
00:23:45,140 --> 00:23:43,080

his first flight as a commander and he

539
00:23:46,850 --> 00:23:45,150
took on the ambitious chore of going

540
00:23:49,070 --> 00:23:46,860
uphill with an all rookie flight deck

541
00:23:51,710 --> 00:23:49,080
his first time in the left seat and

542
00:23:53,930 --> 00:23:51,720
three brand-new spanking astronaut

543
00:23:56,000 --> 00:23:53,940
wannabes fulfilling the rest of the

544
00:23:59,510 --> 00:23:56,010
flight deck did an admirable job of

545
00:24:02,630 --> 00:23:59,520
getting us up hill what Steve did was

546
00:24:06,890 --> 00:24:02,640
basically turned the mission over to the

547
00:24:09,460 --> 00:24:06,900
red team the blue team leaders and what

548
00:24:12,260 --> 00:24:09,470
he did was he supervised us and kept

549
00:24:13,789 --> 00:24:12,270
basically the ground in tune with what

550
00:24:16,669 --> 00:24:13,799
we were doing and handling any of the

551
00:24:19,610 --> 00:24:16,679
problems and this is a picture of him at

552
00:24:21,549 --> 00:24:19,620
work doing what he did best and that was

553
00:24:24,110 --> 00:24:21,559
keeping the ground informed via

554
00:24:26,360 --> 00:24:24,120
basically the same email that we use

555
00:24:28,460 --> 00:24:26,370
here on earth and you can see he's

556
00:24:32,029 --> 00:24:28,470
typing on a keyboard and when issues

557
00:24:34,549 --> 00:24:32,039
came up Steve would use magical keyboard

558
00:24:36,200 --> 00:24:34,559
to talk to the ground and we got some

559
00:24:38,810 --> 00:24:36,210
awesome results at the Johnson Space

560
00:24:41,299 --> 00:24:38,820
Center and the folks in Huntsville

561
00:24:43,490 --> 00:24:41,309
Marshall did a wonderful job of helping

562
00:24:46,250 --> 00:24:43,500
us out when we were in a bind we also

563
00:24:48,230 --> 00:24:46,260

used this keyboard for communicating

564
00:24:53,690 --> 00:24:48,240
with other members of the astronaut

565
00:24:55,220 --> 00:24:53,700
office and our families and friends have

566
00:24:56,899 --> 00:24:55,230
an opportunity to introduce some of the

567
00:24:59,210 --> 00:24:56,909
mid-deck experiments that we carried

568
00:25:01,010 --> 00:24:59,220
these gave an opportunity for Bill and

569
00:25:04,460 --> 00:25:01,020
myself to participate in some of the

570
00:25:07,370 --> 00:25:04,470
science operations I'm presently in

571
00:25:09,950 --> 00:25:07,380
front of what's called PCG test protein

572
00:25:12,110 --> 00:25:09,960
crystal growth thermal enclosure system

573
00:25:13,399 --> 00:25:12,120
that was one of the protein crystal

574
00:25:14,840 --> 00:25:13,409
growth experiments that we had

575
00:25:17,269 --> 00:25:14,850
unfortunately you can't see the other

576
00:25:19,850 --> 00:25:17,279
one which was PCGS test for single

577
00:25:22,610 --> 00:25:19,860
thermal enclosure system and this is

578
00:25:24,769 --> 00:25:22,620
another one another flight in the long

579
00:25:26,779 --> 00:25:24,779
we hope long series of flights that will

580
00:25:29,960 --> 00:25:26,789
continue protein crystal growth on orbit

581
00:25:31,370 --> 00:25:29,970
it's had tremendous success as far as we

582
00:25:33,049 --> 00:25:31,380
know we had the same success in our

583
00:25:35,990 --> 00:25:33,059
flight they were certainly interested in

584
00:25:38,539 --> 00:25:36,000
having 16 days worth of protein crystal

585
00:25:40,909 --> 00:25:38,549
growth on orbit primarily we were

586
00:25:43,580 --> 00:25:40,919
growing crystals for drug research in

587
00:25:46,310 --> 00:25:43,590
this experiment and the locker that you

588
00:25:48,560 --> 00:25:46,320

see on top the other silver metal box is

589
00:25:51,169 --> 00:25:48,570
cemex which stands for a commercial

590
00:25:53,270 --> 00:25:51,179
materials dispersion apparatus ita

591
00:25:54,019 --> 00:25:53,280
experiment the unique thing about this

592
00:25:56,299 --> 00:25:54,029
experiment as

593
00:25:57,859 --> 00:25:56,309
it's a commercially sponsored experiment

594
00:26:00,649 --> 00:25:57,869
in conjunction with the University of

595
00:26:02,749 --> 00:26:00,659
Huntsville Alabama at Huntsville and

596
00:26:07,789 --> 00:26:02,759
I'll let Bill continue to explain what

597
00:26:09,919 --> 00:26:07,799
we did with the CEMEX experiment we had

598
00:26:12,830 --> 00:26:09,929
a couple of portions of the C mix we had

599
00:26:15,139 --> 00:26:12,840
the box which you saw just above Wendy

600
00:26:18,680 --> 00:26:15,149
which was the thermal enclosure and then

601
00:26:22,310 --> 00:26:18,690
we also had a pouch assembly that had a

602
00:26:25,159 --> 00:26:22,320
variety of syringes which contained

603
00:26:27,229 --> 00:26:25,169
different compounds into her life-forms

604
00:26:29,989 --> 00:26:27,239
and what we did was once we got up on

605
00:26:32,989 --> 00:26:29,999
orbit we would push these syringes to

606
00:26:34,339 --> 00:26:32,999
activate and we would have corresponding

607
00:26:36,379 --> 00:26:34,349
syringes on the ground that would be

608
00:26:37,940 --> 00:26:36,389
activated at the same time and then

609
00:26:41,269 --> 00:26:37,950
later on in the mission we would

610
00:26:43,489 --> 00:26:41,279
deactivate by sending a fixer in by

611
00:26:45,769 --> 00:26:43,499
pushing the syringe a second time and so

612
00:26:48,349 --> 00:26:45,779
we were able to model both the ground

613
00:26:50,749 --> 00:26:48,359

and up in orbit exactly what was going

614
00:26:52,639 --> 00:26:50,759
on and we filmed these so that they

615
00:26:55,940 --> 00:26:52,649
could provide further analysis once we

616
00:26:59,119 --> 00:26:55,950
landed another mid-deck experiment we

617
00:27:00,919 --> 00:26:59,129
had that was great and kept our

618
00:27:03,499 --> 00:27:00,929
commander busy almost the entire flight

619
00:27:07,219 --> 00:27:03,509
on the mid-deck was the mid-deck active

620
00:27:08,719 --> 00:27:07,229
control experiment and this is a very

621
00:27:10,999 --> 00:27:08,729
good payload that involved a lot of

622
00:27:12,829 --> 00:27:11,009
human interactivity built at the

623
00:27:15,499 --> 00:27:12,839
Massachusetts Institute of Technology in

624
00:27:18,019 --> 00:27:15,509
collaboration with Langley and it's a

625
00:27:20,180 --> 00:27:18,029
control structure technology experiment

626
00:27:23,269 --> 00:27:20,190
and basically it was a long beam that at

627
00:27:24,619 --> 00:27:23,279
one end had a little gimbal assembly

628
00:27:26,479 --> 00:27:24,629
that would try and disturb the whole

629
00:27:29,359 --> 00:27:26,489
structure and at the other end the one

630
00:27:31,700 --> 00:27:29,369
that's closest to the left on the screen

631
00:27:33,829 --> 00:27:31,710
had a little pointing instrument in it

632
00:27:35,959 --> 00:27:33,839
and gimbals and the purpose was the

633
00:27:38,359 --> 00:27:35,969
disturbing end would try and shake the

634
00:27:40,339 --> 00:27:38,369
pointy end and some computer algorithms

635
00:27:42,709 --> 00:27:40,349
and gyros and the gimbals would try and

636
00:27:44,749 --> 00:27:42,719
hold the pointy end very very stable and

637
00:27:47,180 --> 00:27:44,759
this is a model for all sorts of space

638
00:27:48,889 --> 00:27:47,190

structures this was relatively low cost

639
00:27:50,719 --> 00:27:48,899
experiment but from what they learned on

640
00:27:52,700 --> 00:27:50,729
our flight with all the runs that

641
00:27:54,079 --> 00:27:52,710
osborne EO and some of the other crew

642
00:27:56,989 --> 00:27:54,089
members did we'll be able to hopefully

643
00:27:58,909 --> 00:27:56,999
to leverage some great cost savings for

644
00:28:00,680 --> 00:27:58,919
building very large satellites such as

645
00:28:03,829 --> 00:28:00,690
some of the earth observation systems or

646
00:28:05,210 --> 00:28:03,839
space stations or spacecraft to head out

647
00:28:08,089 --> 00:28:05,220
and explore the planets

648
00:28:09,979 --> 00:28:08,099
we also had an experiment on board

649
00:28:13,849 --> 00:28:09,989
called Tsar X it's an amateur radio

650
00:28:16,580 --> 00:28:13,859
experiment and here you see wa4 s ir AKA

651
00:28:18,889 --> 00:28:16,590
ron freeze talking to one of the school

652
00:28:21,080 --> 00:28:18,899
groups on the ground and we had a record

653
00:28:23,330 --> 00:28:21,090
number of contacts and everyone i

654
00:28:25,339 --> 00:28:23,340
thought was truly excellent the kids

655
00:28:27,560 --> 00:28:25,349
asked and students has just wonderful

656
00:28:28,609 --> 00:28:27,570
questions and it was really need to be

657
00:28:31,989 --> 00:28:28,619
able to talk to them and give them

658
00:28:34,070 --> 00:28:31,999
real-time feedback we also had our

659
00:28:36,200 --> 00:28:34,080
experiment looked up to computers so

660
00:28:37,969 --> 00:28:36,210
people could log on to the orbiter and

661
00:28:40,369 --> 00:28:37,979
receive a little bit of information I

662
00:28:42,219 --> 00:28:40,379
mean over 1,200 contacts for people were

663
00:28:44,779 --> 00:28:42,229

able to connect with the orbiter and

664
00:28:47,210 --> 00:28:44,789
lots more where we were just able to

665
00:28:52,009 --> 00:28:47,220
talk to folks from all over the world as

666
00:28:53,889 --> 00:28:52,019
we passed over on an amateur radio one

667
00:28:56,960 --> 00:28:53,899
of the other experiments that we flew

668
00:29:00,229 --> 00:28:56,970
was the pilot and what you're looking at

669
00:29:02,649 --> 00:29:00,239
here is a computer workstation and just

670
00:29:05,359 --> 00:29:02,659
out of view are my hands holding a

671
00:29:06,950 --> 00:29:05,369
second stick and what this allowed us to

672
00:29:10,460 --> 00:29:06,960
do is through the course of a mission

673
00:29:13,009 --> 00:29:10,470
fly numerous approaches and landings to

674
00:29:15,200 --> 00:29:13,019
a simulated shuttle landing site and

675
00:29:18,219 --> 00:29:15,210
we're looking for a possible degradation

676
00:29:21,469 --> 00:29:18,229
over the period of the 16-day mission

677
00:29:24,769 --> 00:29:21,479
additionally this allowed us to practice

678
00:29:27,259 --> 00:29:24,779
prior to the actual landing and Steve

679
00:29:29,330 --> 00:29:27,269
myself and Wendy were able to practice

680
00:29:31,489 --> 00:29:29,340
our crew coordination and our calls and

681
00:29:35,169 --> 00:29:31,499
kind of get back into the saddle as far

682
00:29:37,190 --> 00:29:35,179
as being prepared for our actual landing

683
00:29:39,529 --> 00:29:37,200
unfortunately we were not scheduled to

684
00:29:42,080 --> 00:29:39,539
work all the time all of us had an

685
00:29:44,299 --> 00:29:42,090
opportunity to relax on the bicycle

686
00:29:45,710 --> 00:29:44,309
ergometer John is actually the one doing

687
00:29:48,589 --> 00:29:45,720
work and I'm having a lot of fun playing

688
00:29:50,149 --> 00:29:48,599

alongside it was a great way to relieve

689
00:29:52,279 --> 00:29:50,159
stress like just like you would do down

690
00:29:54,409 --> 00:29:52,289
here on the ground we exercise

691
00:29:55,969 --> 00:29:54,419
throughout the day you were better folks

692
00:29:57,799 --> 00:29:55,979
tended to exercise during the middle of

693
00:30:00,169 --> 00:29:57,809
our shift and we left the pre and post a

694
00:30:02,450 --> 00:30:00,179
period available for the payload crew to

695
00:30:05,180 --> 00:30:02,460
hop on the bike and I think every one of

696
00:30:07,549 --> 00:30:05,190
us would feel that we we really felt

697
00:30:09,109 --> 00:30:07,559
great post landing because we had had an

698
00:30:12,109 --> 00:30:09,119
extensive opportunity to get on the

699
00:30:13,700 --> 00:30:12,119
bicycle and pedal three of us had an

700
00:30:16,080 --> 00:30:13,710
opportunity to pedal around the world

701
00:30:17,700 --> 00:30:16,090
that took about 95 minutes to do

702
00:30:19,619 --> 00:30:17,710
and we thoroughly enjoyed that the only

703
00:30:21,570 --> 00:30:19,629
problem with the current configuration

704
00:30:24,570 --> 00:30:21,580
of the bicycle is unfortunately have to

705
00:30:26,099 --> 00:30:24,580
look at the sleep stations if we had

706
00:30:27,359 --> 00:30:26,109
been able to set it up the other way we

707
00:30:29,190 --> 00:30:27,369
could have peddled around the world and

708
00:30:31,139 --> 00:30:29,200
actually looked at at the same time but

709
00:30:35,659 --> 00:30:31,149
it really was a great way to get some

710
00:30:40,229 --> 00:30:38,430
and those of us on the blue ship had

711
00:30:43,259 --> 00:30:40,239
this wonderful opportunity every morning

712
00:30:45,089 --> 00:30:43,269
we got to see that old Borneo Bill wake

713
00:30:48,810 --> 00:30:45,099

up and climb up and climb out of his

714
00:30:50,579 --> 00:30:48,820
sleep station we had four sleep stations

715
00:30:53,579 --> 00:30:50,589
installed which was really a wonderful

716
00:30:55,649 --> 00:30:53,589
thing for a dual shift flight and keep

717
00:30:57,359 --> 00:30:55,659
in mind that why half of the crew is up

718
00:30:59,700 --> 00:30:57,369
and working the other half of the crew

719
00:31:02,879 --> 00:30:59,710
needs to be asleep so we can conduct our

720
00:31:04,200 --> 00:31:02,889
24-hour operations and the sleep

721
00:31:06,359 --> 00:31:04,210
stations really provided you with a

722
00:31:06,899 --> 00:31:06,369
great way to get a good quiet night's

723
00:31:08,879 --> 00:31:06,909
sleep

724
00:31:11,969 --> 00:31:08,889
personally I never used earplugs and I

725
00:31:13,680 --> 00:31:11,979
slept great on orbit it was really kind

726
00:31:15,869 --> 00:31:13,690
of neat to be even though you're inside

727
00:31:17,279 --> 00:31:15,879
of a sleeping bag kind of a cocoon like

728
00:31:18,659 --> 00:31:17,289
sleeping bag that's attached to the

729
00:31:20,009 --> 00:31:18,669
walls of the sleep station you can

730
00:31:22,109 --> 00:31:20,019
definitely tell that you are floating

731
00:31:26,639 --> 00:31:22,119
and I thought that was better than any

732
00:31:28,440 --> 00:31:26,649
waterbed that I had been on well as I'm

733
00:31:30,209 --> 00:31:28,450
sure you hear from every crew one of the

734
00:31:33,209 --> 00:31:30,219
most exciting parts of any flight is

735
00:31:35,489 --> 00:31:33,219
looking out the window and the Earth

736
00:31:37,560 --> 00:31:35,499
Observation program actually gives us a

737
00:31:40,889 --> 00:31:37,570
real requirement to do that so it's it's

738
00:31:45,239 --> 00:31:40,899

a great program and here you see John

739
00:31:48,149 --> 00:31:45,249
John and Wendy were our onboard film and

740
00:31:50,399 --> 00:31:48,159
camera folks they made sure we had

741
00:31:51,930 --> 00:31:50,409
plenty of film loaded that the cameras

742
00:31:55,709 --> 00:31:51,940
were working great lenses were clean

743
00:31:59,219 --> 00:31:55,719
windows were clean and as I was

744
00:32:00,869 --> 00:31:59,229
mentioned before we took over 7,000 70

745
00:32:07,649 --> 00:32:00,879
millimeter frames most of which was

746
00:32:10,499 --> 00:32:07,659
Earth Observation photography and one of

747
00:32:12,690 --> 00:32:10,509
the very pretty places that we flew over

748
00:32:14,539 --> 00:32:12,700
many many times in the daylight on this

749
00:32:17,249 --> 00:32:14,549
flight was Australia this is a view

750
00:32:20,489 --> 00:32:17,259
along the western coast of Australia of

751
00:32:22,680 --> 00:32:20,499
an area called Shark Bay Shark Bay is

752
00:32:25,289 --> 00:32:22,690
just a beautiful area to look at from

753
00:32:27,779 --> 00:32:25,299
space there are a number of rivers this

754
00:32:30,479 --> 00:32:27,789
is a very arid desert region

755
00:32:32,869 --> 00:32:30,489
and there are some rivers that flow into

756
00:32:37,649 --> 00:32:32,879
the bay and you see a lot of sediment

757
00:32:39,479 --> 00:32:37,659
produced here this work there we go

758
00:32:41,099 --> 00:32:39,489
there's for example river coming out

759
00:32:43,859 --> 00:32:41,109
here you see the sediment plume coming

760
00:32:47,340 --> 00:32:43,869
out into the bay and all of this stuff

761
00:32:48,810 --> 00:32:47,350
here is lime and algae deposits that

762
00:32:51,359 --> 00:32:48,820
have built up in the bay but they have

763
00:32:58,349 --> 00:32:51,369

these tidal flows going through them

764
00:33:02,609 --> 00:32:58,359
that make very pretty patterns and this

765
00:33:04,409 --> 00:33:02,619
is further across Australia as our orbit

766
00:33:08,639 --> 00:33:04,419
carries us across Australia this is in

767
00:33:11,399 --> 00:33:08,649
the central region of Australia which is

768
00:33:15,509 --> 00:33:11,409
very area and dry and you see here the

769
00:33:18,629 --> 00:33:15,519
Copper Canyon region Copper Creek region

770
00:33:22,979 --> 00:33:18,639
and normally these lakes are these

771
00:33:25,139 --> 00:33:22,989
rivers and lakes are dry a few times

772
00:33:26,909 --> 00:33:25,149
every century they flood and create

773
00:33:31,190 --> 00:33:26,919
these very wide floodplains and you can

774
00:33:35,249 --> 00:33:31,200
see the creeks here the floodplain

775
00:33:36,960 --> 00:33:35,259
covers this wide area here there have

776
00:33:38,430 --> 00:33:36,970
been a number of rains recently in

777
00:33:40,499 --> 00:33:38,440
Australia and you can see in the Sun

778
00:33:42,210 --> 00:33:40,509
glint that a lot of the rills in this

779
00:33:44,279 --> 00:33:42,220
floodplain are filled with water you can

780
00:33:46,289 --> 00:33:44,289
see the Sun glint off of the water and

781
00:33:48,509 --> 00:33:46,299
this lake down here is the late

782
00:33:52,099 --> 00:33:48,519
colleague Yama Yama and it is in fact

783
00:33:54,060 --> 00:33:52,109
you can see water filling the lake

784
00:33:55,769 --> 00:33:54,070
Australia actually did have quite a bit

785
00:34:00,469 --> 00:33:55,779
of water in it this time normally this

786
00:34:07,379 --> 00:34:03,029
another thing we see from orbit are

787
00:34:09,149 --> 00:34:07,389
weather patterns this is a a circulation

788
00:34:12,539 --> 00:34:09,159

around a low-pressure area in the

789
00:34:15,089 --> 00:34:12,549
southern hemisphere you can see the as

790
00:34:17,250 --> 00:34:15,099
the air mass moves in toward the low

791
00:34:21,119 --> 00:34:17,260
pressure area it takes on this cyclonic

792
00:34:22,829 --> 00:34:21,129
circulation and you see here are various

793
00:34:28,379 --> 00:34:22,839
lines of thunderstorms forming around

794
00:34:31,180 --> 00:34:28,389
the low-pressure area itself this is one

795
00:34:32,800 --> 00:34:31,190
of my favorite places in the whole world

796
00:34:35,550 --> 00:34:32,810
spend a lot of time there back when I

797
00:34:40,960 --> 00:34:35,560
was in the Navy in a previous life and

798
00:34:43,000 --> 00:34:40,970
here we see Mount Pinatubo and basically

799
00:34:45,400 --> 00:34:43,010
this this particular photo will be the

800
00:34:47,200 --> 00:34:45,410
baseline for the coming raining season a

801
00:34:49,170 --> 00:34:47,210
season in the Philippines this is the

802
00:34:52,000 --> 00:34:49,180
big island of Luzon here's Manila Bay

803
00:34:54,940 --> 00:34:52,010
manila's over here the Bataan Peninsula

804
00:34:57,130 --> 00:34:54,950
of world war to fame and of course Mount

805
00:34:59,470 --> 00:34:57,140
Pinatubo with crater lake at the top

806
00:35:01,960 --> 00:34:59,480
bright blue and you can see the mud

807
00:35:04,270 --> 00:35:01,970
flows that have come down Clark Air

808
00:35:06,550 --> 00:35:04,280
Force Base is located right here you can

809
00:35:08,650 --> 00:35:06,560
actually see the runways there and all

810
00:35:11,040 --> 00:35:08,660
the mud flows that have that have

811
00:35:13,060 --> 00:35:11,050
followed the eruption of Mount Pinatubo

812
00:35:15,490 --> 00:35:13,070
the particular area that I was

813
00:35:17,320 --> 00:35:15,500

interested in this is Subic Bay Cuba

814
00:35:19,030 --> 00:35:17,330
point Naval Air Station that both Clark

815
00:35:21,010 --> 00:35:19,040
and Subic Bay have been given back to

816
00:35:22,780 --> 00:35:21,020
the Philippine government now but we

817
00:35:24,700 --> 00:35:22,790
used to drop a lot of bombs onto targets

818
00:35:26,920 --> 00:35:24,710
right out here and there's another

819
00:35:28,390 --> 00:35:26,930
target right up this away it wasn't

820
00:35:30,310 --> 00:35:28,400
supposed to be a target but one

821
00:35:32,160 --> 00:35:30,320
particular air wearing commander decided

822
00:35:34,090 --> 00:35:32,170
to make it a target one afternoon which

823
00:35:36,400 --> 00:35:34,100
unfortunately it was a recreation area

824
00:35:37,810 --> 00:35:36,410
for the communication station and there

825
00:35:40,450 --> 00:35:37,820
were a number of families fortunately on

826
00:35:42,460 --> 00:35:40,460
the other end of the island but but

827
00:35:44,230 --> 00:35:42,470
obviously this is a place where a lot of

828
00:35:45,790 --> 00:35:44,240
folks currently in the astronaut office

829
00:35:49,950 --> 00:35:45,800
has been an awful lot of time and it's a

830
00:35:54,520 --> 00:35:52,330
have the oceanography background on the

831
00:35:57,070 --> 00:35:54,530
flight so they voted for me to discuss

832
00:35:59,110 --> 00:35:57,080
this line we're actually looking at the

833
00:36:01,330 --> 00:35:59,120
Ritchie archipelago which is in the

834
00:36:03,220 --> 00:36:01,340
Andaman Sea that's actually between

835
00:36:07,270 --> 00:36:03,230
India and Burma and the Bay of Bengal

836
00:36:09,460 --> 00:36:07,280
and because of the reflection of the Sun

837
00:36:12,100 --> 00:36:09,470
off the surface of the water were able

838
00:36:14,260 --> 00:36:12,110

to detect many features of the ocean in

839
00:36:15,430 --> 00:36:14,270
this case circulation patterns you're

840
00:36:18,430 --> 00:36:15,440
going to take some of the current that's

841
00:36:21,280 --> 00:36:18,440
running along the shore and as Sam

842
00:36:23,620 --> 00:36:21,290
talked about weather patterns in in the

843
00:36:25,150 --> 00:36:23,630
airmass the cyclonic circulation you can

844
00:36:27,370 --> 00:36:25,160
also have the same features that will

845
00:36:29,980 --> 00:36:27,380
develop in the ocean you'll have some

846
00:36:31,960 --> 00:36:29,990
circular patterns on the ocean surface

847
00:36:33,940 --> 00:36:31,970
detected by the Sun glint which we call

848
00:36:36,190 --> 00:36:33,950
Eddie's other features that you can

849
00:36:38,920 --> 00:36:36,200
detect in this photo this is a large

850
00:36:41,650 --> 00:36:38,930
area in which are which is experiencing

851
00:36:43,600 --> 00:36:41,660
a wind gust and the wind blowing over

852
00:36:44,660 --> 00:36:43,610
the surface is actually forming some

853
00:36:45,980 --> 00:36:44,670
linear waves that you

854
00:36:47,690 --> 00:36:45,990
can actually make out and I was quite

855
00:36:50,930 --> 00:36:47,700
surprised that we would be able to

856
00:36:53,359 --> 00:36:50,940
detect that amount of detail from 190

857
00:36:54,770 --> 00:36:53,369
miles above the surface and down here in

858
00:36:56,240 --> 00:36:54,780
the bottom unfortunately I can't quite

859
00:36:58,730 --> 00:36:56,250
make it out in the slide but there is a

860
00:37:01,309 --> 00:36:58,740
ship that is traveling out to sea and

861
00:37:02,599 --> 00:37:01,319
that was another fun thing for me to

862
00:37:05,960 --> 00:37:02,609
look out the window and try and look for

863
00:37:07,460 --> 00:37:05,970

ship wakes as I'm not in my former life

864
00:37:08,839 --> 00:37:07,470
I'm still in the Navy and I have a lot

865
00:37:10,010 --> 00:37:08,849
of friends who were out at sea right now

866
00:37:16,490 --> 00:37:10,020
so I was trying to track down their

867
00:37:18,890 --> 00:37:16,500
boats also as an orbiter pilot once

868
00:37:21,319 --> 00:37:18,900
you've got the maneuver kicked off you

869
00:37:23,599 --> 00:37:21,329
have a an opportunity to look out the

870
00:37:25,490 --> 00:37:23,609
window I did that as much as I could and

871
00:37:28,069 --> 00:37:25,500
this is my one claim to fame I was

872
00:37:29,690 --> 00:37:28,079
looking out the window and flight day 6

873
00:37:32,000 --> 00:37:29,700
I think it was and we were passing over

874
00:37:34,220 --> 00:37:32,010
the Andaman Islands and lo and behold

875
00:37:37,150 --> 00:37:34,230
saw this plume of smoke and realized we

876
00:37:39,559 --> 00:37:37,160
were looking at volcanic activity and

877
00:37:42,530 --> 00:37:39,569
this is barren island just to the east

878
00:37:46,549 --> 00:37:42,540
of the the Andaman Island chain it had

879
00:37:50,630 --> 00:37:46,559
an eruption back in 1991 and it had a

880
00:37:52,069 --> 00:37:50,640
subsequent eruption in late 1994 and

881
00:37:53,990 --> 00:37:52,079
they had been tracking that and they

882
00:37:56,599 --> 00:37:54,000
were surprised to see that as is gaining

883
00:37:59,030 --> 00:37:56,609
in momentum at the rate that it is in

884
00:38:01,130 --> 00:37:59,040
the Smithsonian Institution was

885
00:38:03,410 --> 00:38:01,140
interested in our subsequent

886
00:38:05,420 --> 00:38:03,420
observations and so any opportunity we

887
00:38:08,059 --> 00:38:05,430
had we grabbed the camcorder their arrow

888
00:38:11,510 --> 00:38:08,069

flicks and the house of Bloods and took

889
00:38:14,150 --> 00:38:11,520
lots of photos this is a picture of the

890
00:38:17,450 --> 00:38:14,160
mighty Himalayas rooftop to the world

891
00:38:19,099 --> 00:38:17,460
and when I was a small boy I had two

892
00:38:22,010 --> 00:38:19,109
great dreams one of which was to fly in

893
00:38:25,430 --> 00:38:22,020
space and the others to go climbing the

894
00:38:27,079 --> 00:38:25,440
Himalayas on an expedition and I think

895
00:38:28,579 --> 00:38:27,089
this is certainly the more exciting of

896
00:38:30,680 --> 00:38:28,589
the expeditions but maybe someday I'll

897
00:38:32,990 --> 00:38:30,690
get down there but it was amazing from a

898
00:38:34,430 --> 00:38:33,000
couple hundred miles up to look down on

899
00:38:37,579 --> 00:38:34,440
this particular part of the earth and

900
00:38:39,410 --> 00:38:37,589
have a feeling for the great relief in

901
00:38:40,789 --> 00:38:39,420
the surface of the earth there's you

902
00:38:42,410 --> 00:38:40,799
know tens of thousands of feet of

903
00:38:44,630 --> 00:38:42,420
difference between some of the low-lying

904
00:38:46,819 --> 00:38:44,640
areas in the picture and at the top of

905
00:38:49,190 --> 00:38:46,829
the mountain it's just a really neat

906
00:38:51,380 --> 00:38:49,200
place to see and we saw an amazing

907
00:38:54,260 --> 00:38:51,390
variety of terrain you know as Wendy was

908
00:38:56,450 --> 00:38:54,270
talking about the the ocean surface with

909
00:38:58,820 --> 00:38:56,460
waves being measured in

910
00:39:00,829 --> 00:38:58,830
tens of feet at the most hundreds of

911
00:39:02,120 --> 00:39:00,839
feet and here we have tens of thousands

912
00:39:07,849 --> 00:39:02,130
of feet it's really just a beautiful

913
00:39:11,000 --> 00:39:07,859

planet we also saw waves on the surface

914
00:39:12,829 --> 00:39:11,010
of sand and this is in Saudi Arabia and

915
00:39:15,440 --> 00:39:12,839
you can see really two prominent types

916
00:39:17,380 --> 00:39:15,450
of terrain here there the the dunes both

917
00:39:19,760 --> 00:39:17,390
linear dunes and somewhat circular dunes

918
00:39:22,490 --> 00:39:19,770
separated by areas where you see many

919
00:39:24,260 --> 00:39:22,500
many small green spots and those green

920
00:39:27,470 --> 00:39:24,270
spots are not natural the way the dunes

921
00:39:29,180 --> 00:39:27,480
are that are actually farmers pumping

922
00:39:31,390 --> 00:39:29,190
water from under the ground up to the

923
00:39:34,099 --> 00:39:31,400
surface in center-pivot irrigation and

924
00:39:37,310 --> 00:39:34,109
creating very very tiny islands in the

925
00:39:42,050 --> 00:39:37,320
sand of Agriculture so it's really very

926
00:39:43,700 --> 00:39:42,060
striking more detailed photographs of

927
00:39:48,170 --> 00:39:43,710
Oahu at least that I've ever seen from

928
00:39:52,070 --> 00:39:48,180
space you can see the of course Pearl

929
00:39:54,230 --> 00:39:52,080
Harbor and the International Airport and

930
00:39:57,020 --> 00:39:54,240
you can also see waves breaking on the

931
00:39:58,490 --> 00:39:57,030
north shore on Oahu just a wonderful

932
00:40:00,980 --> 00:39:58,500
view and I'm hoping to get a little bit

933
00:40:06,829 --> 00:40:00,990
closer look up after we land excuse me a

934
00:40:10,190 --> 00:40:06,839
little bit later this year still up

935
00:40:12,890 --> 00:40:10,200
there in spirit this is one of the views

936
00:40:15,620 --> 00:40:12,900
we were treated to close to the end of

937
00:40:17,329 --> 00:40:15,630
our mission we have of course the

938
00:40:19,010 --> 00:40:17,339

instrument pointing system doing the

939
00:40:21,260 --> 00:40:19,020
fine job it did during the whole flight

940
00:40:23,540 --> 00:40:21,270
and of course the orbiter performed

941
00:40:25,820 --> 00:40:23,550
beautifully our instruments operated

942
00:40:28,790 --> 00:40:25,830
very well and you can see in this

943
00:40:31,460 --> 00:40:28,800
photograph if I can activate the pointer

944
00:40:32,990 --> 00:40:31,470
here here's the earth glow it's about 95

945
00:40:36,290 --> 00:40:33,000
kilometers above the surface of the

946
00:40:38,960 --> 00:40:36,300
earth oh this is a moonlit view with a

947
00:40:40,310 --> 00:40:38,970
wonderful stellar background we were

948
00:40:43,250 --> 00:40:40,320
just delighted to be part of this

949
00:40:45,980 --> 00:40:43,260
mission very pleased that the orbiter

950
00:40:51,020 --> 00:40:45,990
the instruments and the IPS performs so

951
00:40:54,500 --> 00:40:51,030
beautifully ok and every every flight

952
00:40:56,570 --> 00:40:54,510
needs to have their sunset photo and to

953
00:40:57,920 --> 00:40:56,580
be perfectly honest with you we don't

954
00:40:59,510 --> 00:40:57,930
really know if this is a sunrise or a

955
00:41:01,830 --> 00:40:59,520
sunset

956
00:41:05,700 --> 00:41:01,840
if they really kind of look alike and

957
00:41:07,200 --> 00:41:05,710
you get 16 of them each every day and so

958
00:41:08,820 --> 00:41:07,210
there were a lot of them but they're

959
00:41:11,730 --> 00:41:08,830
pretty quick you gotta you gotta catch

960
00:41:14,070 --> 00:41:11,740
him in a hurry but it is just dazzling

961
00:41:16,620 --> 00:41:14,080
the amount of detail that she can get

962
00:41:19,740 --> 00:41:16,630
looking at the Earth's atmosphere with

963
00:41:21,030 --> 00:41:19,750

the Sun in the background and we were

964
00:41:22,350 --> 00:41:21,040
trying to count the layers of the

965
00:41:23,790 --> 00:41:22,360
atmosphere we finally figured out there

966
00:41:26,280 --> 00:41:23,800
were at least 10 that you could detect

967
00:41:27,690 --> 00:41:26,290
with the naked eye and and I think you

968
00:41:29,430 --> 00:41:27,700
can probably see at least 10 of them

969
00:41:31,890 --> 00:41:29,440
here and it's always amazed me that

970
00:41:34,440 --> 00:41:31,900
these thunderstorms that usually are

971
00:41:36,060 --> 00:41:34,450
only 40 or 50 thousand feet high that

972
00:41:39,540 --> 00:41:36,070
you can actually see those so very

973
00:41:40,980 --> 00:41:39,550
clearly with the naked eye in the

974
00:41:41,370 --> 00:41:40,990
atmosphere with the Sun coming up or

975
00:41:43,800 --> 00:41:41,380
going down

976
00:41:45,210 --> 00:41:43,810
it's just a beautiful beautiful way and

977
00:41:46,350 --> 00:41:45,220
it can actually distract you from what