1
00:00:12,549 --> 00:00:10,790
good morning welcome to johnson space

2
00:00:16,070 --> 00:00:12,559
center and to the sts

3
00:00:16,790 --> 00:00:16,080
48 post flight crew press conference i

4
00:00:19,830 --> 00:00:16,800
would like to

5
00:00:23,029 --> 00:00:19,840
introduce the commander on the mission

6
00:00:26,150 --> 00:00:23,039
captain j.o creighton j.o

7
00:00:28,230 --> 00:00:26,160
thank you we're extremely

8
00:00:29,669 --> 00:00:28,240
pleased to be here this morning to have

9
00:00:33,190 --> 00:00:29,679
the opportunity to talk to you

10
00:00:35,350 --> 00:00:33,200
about the very successful sts-48 mission

11
00:00:37,030 --> 00:00:35,360
uh often called the uar's mission which

12
00:00:38,229 --> 00:00:37,040
stood for the upper atmospheric research

13
00:00:40,549 --> 00:00:38,239

satellite

14
00:00:41,990 --> 00:00:40,559
uh everything went extremely well on the

15
00:00:44,069 --> 00:00:42,000
flight

16
00:00:45,590 --> 00:00:44,079
including the deployment as of a couple

17
00:00:47,670 --> 00:00:45,600
of days ago that was

18
00:00:49,670 --> 00:00:47,680
the latest information i have why the ur

19
00:00:52,150 --> 00:00:49,680
satellite was up and operating very well

20
00:00:53,110 --> 00:00:52,160
test and checkout was going extremely

21
00:00:54,869 --> 00:00:53,120
smooth

22
00:00:56,549 --> 00:00:54,879
one of the instruments had been brought

23
00:00:57,990 --> 00:00:56,559
online is taking data and the rest of

24
00:00:59,510 --> 00:00:58,000
the instruments will be brought online

25
00:01:02,470 --> 00:00:59,520
and begin taking data here within the

26
00:01:04,310 --> 00:01:02,480
next one to two weeks

27
00:01:06,469 --> 00:01:04,320
i'd like it this time to introduce the

28
00:01:09,590 --> 00:01:06,479
rest of my crew to my immediate left

29
00:01:10,230 --> 00:01:09,600
is a ken rightler the pilot on the

30
00:01:17,749 --> 00:01:10,240
flight

31
00:01:19,109 --> 00:01:17,759
he have to learn to back me up on all

32
00:01:19,749 --> 00:01:19,119
the orbiter systems and learn how to

33
00:01:22,950 --> 00:01:19,759
land the

34
00:01:25,990 --> 00:01:22,960
orbiter he also had to become a

35
00:01:28,230 --> 00:01:26,000
an arm operator an rms operator

36
00:01:29,190 --> 00:01:28,240
to help mark with the deployment of the

37
00:01:31,429 --> 00:01:29,200
satellite

38
00:01:33,030 --> 00:01:31,439

he was the iv crewman which is the

39
00:01:34,789 --> 00:01:33,040
person inside the cabin that helps in

40
00:01:36,550 --> 00:01:34,799
case we have to send people outside to

41
00:01:39,270 --> 00:01:36,560
do a spacewalk

42
00:01:39,990 --> 00:01:39,280
and he was he had a full plate and it

43
00:01:41,350 --> 00:01:40,000
was uh

44
00:01:43,270 --> 00:01:41,360
very fortunate for us that we had

45
00:01:44,069 --> 00:01:43,280
somebody with ken's talents to be able

46
00:01:47,910 --> 00:01:44,079
to

47
00:01:51,030 --> 00:01:47,920
flight itself

48
00:01:53,990 --> 00:01:51,040
next to ken is sam gamar

49
00:01:55,030 --> 00:01:54,000
a mission specialist a designated ms-1

50
00:01:58,389 --> 00:01:55,040
on the flight

51
00:02:01,590 --> 00:01:58,399
sam was our prime ur's uh person

52
00:02:02,870 --> 00:02:01,600
the payload expert this was sam's second

53
00:02:04,389 --> 00:02:02,880
flight

54
00:02:06,149 --> 00:02:04,399
he was also one of the two crewmen that

55
00:02:09,430 --> 00:02:06,159
would have gone outside had a

56
00:02:11,750 --> 00:02:09,440
contingency eva or a mission success eva

57
00:02:14,869 --> 00:02:11,760
been required

58
00:02:17,350 --> 00:02:14,879
next to sam is jim buckley

59
00:02:19,270 --> 00:02:17,360
jim was ms2 on the flight he was the

60
00:02:22,949 --> 00:02:19,280
real veteran on the flight this was his

61
00:02:25,510 --> 00:02:22,959
fourth flight jim as ms2 was uh

62
00:02:27,430 --> 00:02:25,520
the flight engineer on the flight deck

63
00:02:29,589 --> 00:02:27,440

sitting between ken and i and

64
00:02:31,110 --> 00:02:29,599
keeping us in line and making sure that

65
00:02:33,270 --> 00:02:31,120
everything went smoothly for the asset

66
00:02:36,550 --> 00:02:33,280
and entry portions of the flight

67
00:02:38,550 --> 00:02:36,560
jim was also one of the crew members to

68
00:02:39,910 --> 00:02:38,560
go outside on an eva if it had been

69
00:02:42,949 --> 00:02:39,920
necessary

70
00:02:43,990 --> 00:02:42,959
and he was also one of the two people to

71
00:02:46,150 --> 00:02:44,000
operate the

72
00:02:47,589 --> 00:02:46,160
mid deck experiment called mode that

73
00:02:49,589 --> 00:02:47,599
we'll talk about a little more

74
00:02:51,110 --> 00:02:49,599
in detail as we get on into the

75
00:02:55,270 --> 00:02:51,120
presentation

76
00:02:57,990 --> 00:02:55,280
and last but not least uh mark

77
00:02:59,830 --> 00:02:58,000
brown was ms-3 on the flight this was

78
00:03:02,390 --> 00:02:59,840
mark's second flight

79
00:03:03,270 --> 00:03:02,400
mark was a prime arm operator to lift

80
00:03:05,430 --> 00:03:03,280
the ur

81
00:03:06,309 --> 00:03:05,440
satellite out of the payload bay mark

82
00:03:08,790 --> 00:03:06,319
was also

83
00:03:10,550 --> 00:03:08,800
the prime individual responsible for the

84
00:03:12,229 --> 00:03:10,560
electronic still camera on the flight

85
00:03:13,750 --> 00:03:12,239
which generated

86
00:03:15,110 --> 00:03:13,760
a lot of interest particularly within

87
00:03:16,149 --> 00:03:15,120
the media during the course of the

88
00:03:18,390 --> 00:03:16,159

flight

89
00:03:19,190 --> 00:03:18,400
and we had the opportunity to ship a

90
00:03:20,869 --> 00:03:19,200
number of uh

91
00:03:22,229 --> 00:03:20,879
pictures down from space and i think

92
00:03:23,990 --> 00:03:22,239
some of those were released to the media

93
00:03:26,470 --> 00:03:24,000
during the course of the flight

94
00:03:28,070 --> 00:03:26,480
and mark also was the other person

95
00:03:29,750 --> 00:03:28,080
intimately involved with the

96
00:03:31,990 --> 00:03:29,760
the mode experiment secondary experiment

97
00:03:33,430 --> 00:03:32,000
on the mid-deck

98
00:03:34,789 --> 00:03:33,440
what we would like to do this morning is

99
00:03:36,550 --> 00:03:34,799
share with you some of the things that

100
00:03:39,509 --> 00:03:36,560
we had an opportunity to see and

101
00:03:44,470 --> 00:03:41,670
as you're no doubt aware we flew on the

102
00:03:47,670 --> 00:03:44,480
space shuttle discovery

103
00:03:49,830 --> 00:03:47,680
this was the 13th flight of discovery

104
00:03:51,110 --> 00:03:49,840
unlike a lot of previous flights uh we

105
00:03:53,670 --> 00:03:51,120
had gentleman's hours

106
00:03:55,270 --> 00:03:53,680
we got up about two in the afternoon had

107
00:03:56,710 --> 00:03:55,280
a quick breakfast and then we went into

108
00:03:58,229 --> 00:03:56,720
the suiting room where we put on our

109
00:04:00,789 --> 00:03:58,239
pressure suits

110
00:04:01,429 --> 00:04:00,799
this is a final opportunity to check the

111
00:04:02,869 --> 00:04:01,439
suits out

112
00:04:04,710 --> 00:04:02,879
make sure that everything was working

113
00:04:07,990 --> 00:04:04,720

the communications the

114
00:04:10,710 --> 00:04:08,000
cooling systems and also the pressure

115
00:04:14,550 --> 00:04:12,390
you'll see here i'm being pumped up

116
00:04:15,670 --> 00:04:14,560
inside the suit just to make sure that

117
00:04:16,949 --> 00:04:15,680
it holds pressure and then

118
00:04:22,469 --> 00:04:16,959
we're satisfied that everything's

119
00:04:25,590 --> 00:04:24,390
board the crew van which will take us

120
00:04:30,629 --> 00:04:25,600
the

121
00:04:35,350 --> 00:04:34,070
we launched right at sunset

122
00:04:36,469 --> 00:04:35,360
it's pretty quiet laying on your back

123
00:04:39,270 --> 00:04:36,479
there for about three hours but

124
00:04:40,790 --> 00:04:39,280
eventually somebody says 109876 and it

125
00:04:42,550 --> 00:04:40,800
in about six and a half seconds they

126
00:04:44,629 --> 00:04:42,560
light the main engines the whole vehicle

127
00:04:46,390 --> 00:04:44,639
starts to rumble and shake

128
00:04:47,749 --> 00:04:46,400
count continues on down to zero and at

129
00:04:49,350 --> 00:04:47,759
that point they

130
00:04:51,590 --> 00:04:49,360
blow the hold down bolts ignite the

131
00:04:53,189 --> 00:04:51,600
solid rocket boosters

132
00:04:54,950 --> 00:04:53,199
and you're on your way if you look

133
00:04:55,670 --> 00:04:54,960
closely you can see the shock waves in

134
00:05:04,710 --> 00:04:55,680
the

135
00:05:05,990 --> 00:05:04,720
we do a roll right after we lift off

136
00:05:07,749 --> 00:05:06,000
from the tower

137
00:05:09,189 --> 00:05:07,759
to establish our launch inclination

138
00:05:10,550 --> 00:05:09,199

which is just a fancy word for what

139
00:05:11,430 --> 00:05:10,560
direction we're going to head and in our

140
00:05:13,510 --> 00:05:11,440
case it was

141
00:05:14,870 --> 00:05:13,520
a 57 degree inclination which put us

142
00:05:16,070 --> 00:05:14,880
right up the east coast of the united

143
00:05:18,070 --> 00:05:16,080
states you can see the

144
00:05:19,430 --> 00:05:18,080
shock waves as we go through mach 1

145
00:05:23,590 --> 00:05:19,440
forming on the leading edges of the

146
00:05:28,150 --> 00:05:26,070
that flash uh that you saw right there

147
00:05:33,029 --> 00:05:28,160
was just a reflection off of a cloud

148
00:05:39,350 --> 00:05:34,710
the solid rocket boosters burned for

149
00:05:41,029 --> 00:05:39,360
about two minutes and 11 seconds

150
00:05:43,749 --> 00:05:41,039
during that period of time it's a fairly

151
00:05:45,270 --> 00:05:43,759
uh violent ride is probably too strong a

152
00:05:46,790 --> 00:05:45,280
word but there's a lot of shake rattle

153
00:05:48,710 --> 00:05:46,800
and roll going on

154
00:05:49,830 --> 00:05:48,720
the end of two minutes and 11 seconds

155
00:05:51,990 --> 00:05:49,840
their work is done

156
00:05:54,230 --> 00:05:52,000
they burned about 2.6 million pounds

157
00:05:55,990 --> 00:05:54,240
worth of propellant

158
00:06:00,309 --> 00:05:56,000
and so at that point the boosters are

159
00:06:03,430 --> 00:06:01,670
and are recovered via parachute

160
00:06:04,950 --> 00:06:03,440
approximately 100 miles downrange

161
00:06:06,710 --> 00:06:04,960
and here you can see the solid booster

162
00:06:07,029 --> 00:06:06,720
separating from the main stack meanwhile

163
00:06:12,230 --> 00:06:07,039

the

164
00:06:13,909 --> 00:06:12,240
minutes or so

165
00:06:18,390 --> 00:06:13,919
and then at about eight minutes and 35

166
00:06:18,400 --> 00:06:26,870
and we were in space

167
00:06:30,070 --> 00:06:28,390
you don't really have much time to enjoy

168
00:06:31,670 --> 00:06:30,080
the ride you're sort of hanging on for

169
00:06:32,950 --> 00:06:31,680
assets so when you get on orbit it's the

170
00:06:34,309 --> 00:06:32,960
first opportunity you really have to

171
00:06:35,909 --> 00:06:34,319
look out the window and the first words

172
00:06:38,469 --> 00:06:35,919
out of my mouth were amazement of just

173
00:06:40,629 --> 00:06:38,479
how high we were

174
00:06:45,189 --> 00:06:40,639
shortly after getting on to orbit we

175
00:06:48,950 --> 00:06:46,950
had our first opportunity to glimpse our

176
00:06:52,950 --> 00:06:48,960
primary payload the ur's upper

177
00:06:56,550 --> 00:06:55,029
and here we're putting out the ku band

178
00:06:57,749 --> 00:06:56,560
antenna which is one of the primary

179
00:07:00,469 --> 00:06:57,759
means that we use to

180
00:07:01,990 --> 00:07:00,479
communicate with the orbiter through the

181
00:07:04,230 --> 00:07:02,000
tdrs are tracking and data relay

182
00:07:06,550 --> 00:07:04,240
satellites that nasa uses to both track

183
00:07:10,230 --> 00:07:06,560
and communicate with the

184
00:07:11,029 --> 00:07:10,240
the space shuttles on day two we did a

185
00:07:12,710 --> 00:07:11,039
raising burn

186
00:07:14,309 --> 00:07:12,720
we initially inserted into a circular

187
00:07:16,309 --> 00:07:14,319
292 degree

188
00:07:17,350 --> 00:07:16,319

uh mile burn and then we raised it up to

189
00:07:19,270 --> 00:07:17,360
308

190
00:07:21,510 --> 00:07:19,280
these pulses that you see flashing up

191
00:07:23,189 --> 00:07:21,520
here are the forward rcs jets that are

192
00:07:25,510 --> 00:07:23,199
pulsing to maintain attitude

193
00:07:26,309 --> 00:07:25,520
the glow right here are the sustained

194
00:07:28,710 --> 00:07:26,319
firing

195
00:07:30,390 --> 00:07:28,720
of the jets that are actually doing the

196
00:07:36,629 --> 00:07:30,400
raising burn itself

197
00:07:40,469 --> 00:07:38,710
we spent months training and it was a

198
00:07:41,830 --> 00:07:40,479
sort of a giant pain always climbing up

199
00:07:43,270 --> 00:07:41,840
and down the ladder getting from the mid

200
00:07:44,950 --> 00:07:43,280
deck to the flight deck but it gets a

201
00:07:46,950 --> 00:07:44,960
whole lot easier we get it into space

202
00:07:48,950 --> 00:07:46,960
you just sort of float out of your seat

203
00:07:51,510 --> 00:07:48,960
and then just sort of float down the

204
00:07:54,070 --> 00:07:51,520
axis way down into the mid deck

205
00:07:56,710 --> 00:07:54,080
getting around is in zero gravity is a

206
00:08:00,309 --> 00:07:58,469
this is a short clip of the electronic

207
00:08:01,510 --> 00:08:00,319
still camera which we used extensively

208
00:08:04,309 --> 00:08:01,520
on orbit

209
00:08:06,230 --> 00:08:04,319
it's quite simply a nikon f4 modified

210
00:08:07,670 --> 00:08:06,240
not to use regular commercial film but

211
00:08:10,469 --> 00:08:07,680
instead record the images

212
00:08:12,150 --> 00:08:10,479
as digital ones and zeros as a normal

213
00:08:14,309 --> 00:08:12,160

flash attachment on the top

214
00:08:15,189 --> 00:08:14,319
and can use any regular nikon off the

215
00:08:18,710 --> 00:08:15,199
shelf lens

216
00:08:20,230 --> 00:08:18,720
and we took about 240 pictures on orbit

217
00:08:22,309 --> 00:08:20,240
down linked about 200

218
00:08:24,070 --> 00:08:22,319
and i understand about 25 were released

219
00:08:26,950 --> 00:08:24,080
to the press

220
00:08:28,710 --> 00:08:26,960
and we're quite well we took a wide

221
00:08:30,390 --> 00:08:28,720
variety of other types of photographic

222
00:08:32,550 --> 00:08:30,400
equipment with us as well

223
00:08:33,829 --> 00:08:32,560
you've seen some of the examples of uh

224
00:08:36,070 --> 00:08:33,839
the products of those

225
00:08:36,949 --> 00:08:36,080
what we're working with now is the dual

226
00:08:40,149 --> 00:08:36,959
mount

227
00:08:43,829 --> 00:08:40,159
twin 70 millimeter hasselblad cameras

228
00:08:46,870 --> 00:08:43,839
one with color ir film and one with eye

229
00:08:47,590 --> 00:08:46,880
visual film we also use the same mount

230
00:08:50,630 --> 00:08:47,600
for

231
00:08:52,310 --> 00:08:50,640
putting polarization filters on to

232
00:08:54,070 --> 00:08:52,320
to take advantage of the difference

233
00:09:08,470 --> 00:08:54,080
between polarized light that's reflected

234
00:09:09,990 --> 00:09:08,480
off the surface of the ocean

235
00:09:11,350 --> 00:09:10,000
we spent a lot of time taking pictures

236
00:09:12,710 --> 00:09:11,360
from space but occasionally all the

237
00:09:14,150 --> 00:09:12,720
cameras were taken and

238
00:09:16,230 --> 00:09:14,160

we had the opportunity just to look out

239
00:09:19,670 --> 00:09:16,240
the window here i'm using the

240
00:09:21,269 --> 00:09:19,680
stabilized binoculars gyro stabilized

241
00:09:23,350 --> 00:09:21,279
binoculars to

242
00:09:25,350 --> 00:09:23,360
watch australia go by here we're just

243
00:09:29,430 --> 00:09:25,360
taking a a quick trip across the

244
00:09:33,110 --> 00:09:31,430
this gives you appreciation for how fast

245
00:09:36,070 --> 00:09:33,120
the world is going by

246
00:09:37,430 --> 00:09:36,080
even from that that altitude uh this is

247
00:09:39,030 --> 00:09:37,440
uh pretty much just the

248
00:09:41,190 --> 00:09:39,040
camera being fixed pointed out the

249
00:09:44,310 --> 00:09:41,200
window taking whatever is

250
00:09:47,110 --> 00:09:44,320
floating by in the in the world below

251
00:09:49,110 --> 00:09:47,120
and you can see not only the the rate at

252
00:09:50,949 --> 00:09:49,120
which the earth goes by but also the

253
00:09:52,550 --> 00:09:50,959
detail that you can see

254
00:09:54,230 --> 00:09:52,560
another thing which always struck me

255
00:09:56,630 --> 00:09:54,240
going across australia was the

256
00:09:57,910 --> 00:09:56,640
diversity of the color of the ground you

257
00:10:00,389 --> 00:09:57,920
can see the uh

258
00:10:01,030 --> 00:10:00,399
the very very deep blue of the ocean the

259
00:10:07,350 --> 00:10:01,040
the

260
00:10:09,030 --> 00:10:07,360
and in some cases an occasional lake

261
00:10:10,870 --> 00:10:09,040
goes by with a

262
00:10:12,230 --> 00:10:10,880
lighter color blue we're finally

263
00:10:14,230 --> 00:10:12,240

crossing the continent and

264
00:10:19,030 --> 00:10:14,240
coming out the other side into the

265
00:10:21,269 --> 00:10:19,040
pacific ocean

266
00:10:22,790 --> 00:10:21,279
and it was mentioned earlier australia

267
00:10:35,110 --> 00:10:22,800
was one of the clearest places

268
00:10:38,949 --> 00:10:37,110
these next few scenes were taken on

269
00:10:41,110 --> 00:10:38,959
deployment day

270
00:10:42,150 --> 00:10:41,120
i was respond primarily responsible for

271
00:10:45,430 --> 00:10:42,160
operating the arm

272
00:10:47,990 --> 00:10:45,440
and ken was my backup sam was in charge

273
00:10:50,230 --> 00:10:48,000
of our interface with the spacecraft

274
00:10:51,990 --> 00:10:50,240
jim kept an eye on the space shuttle in

275
00:10:53,670 --> 00:10:52,000
jail with his rubber hose kept an eye on

276
00:10:56,790 --> 00:10:53,680
all of us

277
00:10:58,150 --> 00:10:56,800
the unbirthing and extraction of the urs

278
00:11:01,030 --> 00:10:58,160
payload was actually quite

279
00:11:03,110 --> 00:11:01,040
straightforward a series of commands

280
00:11:06,150 --> 00:11:03,120
were given the urs to transfer it to its

281
00:11:08,230 --> 00:11:06,160
own battery power source

282
00:11:10,150 --> 00:11:08,240
and then we flew the arm down and

283
00:11:11,430 --> 00:11:10,160
grappled with the fixture on the ur

284
00:11:13,829 --> 00:11:11,440
spacecraft itself

285
00:11:16,389 --> 00:11:13,839
that was a structural strong point right

286
00:11:19,590 --> 00:11:18,630
the arm flew quite smoothly there's no

287
00:11:21,670 --> 00:11:19,600
problem at all

288
00:11:23,670 --> 00:11:21,680

this is the rou which is the big

289
00:11:25,430 --> 00:11:23,680
electrical plug between the orbiter and

290
00:11:27,829 --> 00:11:25,440
the ur spacecraft

291
00:11:29,829 --> 00:11:27,839
over this electrical plug go all the

292
00:11:30,550 --> 00:11:29,839
data and information on the spacecraft

293
00:11:32,630 --> 00:11:30,560
as well as

294
00:11:34,550 --> 00:11:32,640
back up electrical power until yours is

295
00:11:36,790 --> 00:11:34,560
on its own

296
00:11:39,030 --> 00:11:36,800
this scene shows you ours being gently

297
00:11:40,630 --> 00:11:39,040
lifted out of the payload bay

298
00:11:43,350 --> 00:11:40,640
from our perspective it went quite

299
00:11:45,350 --> 00:11:43,360
smoothly and was no problem

300
00:11:46,870 --> 00:11:45,360
we moved the spacecraft from its birth

301
00:11:48,550 --> 00:11:46,880
position to its

302
00:11:54,710 --> 00:11:48,560
release position directly above the

303
00:11:57,829 --> 00:11:56,310
as you can see you are's is very

304
00:12:01,110 --> 00:11:57,839
colorful with all the gold

305
00:12:04,230 --> 00:12:01,120
foil and white capped on protective

306
00:12:08,069 --> 00:12:04,240
coverings it is not a sleek spacecraft

307
00:12:10,150 --> 00:12:08,079
by any means but is extremely functional

308
00:12:12,230 --> 00:12:10,160
that spacecraft took up approximately

309
00:12:18,470 --> 00:12:12,240
half the payload bay in length and

310
00:12:22,150 --> 00:12:20,150
it's interesting that the arm is capable

311
00:12:23,590 --> 00:12:22,160
of lifting that 15 000 pounds in space

312
00:12:31,750 --> 00:12:23,600
and yet it's unable to lift its own

313
00:12:35,509 --> 00:12:33,910

this is a scene in the flight deck with

314
00:12:37,509 --> 00:12:35,519
mark on the right side

315
00:12:39,269 --> 00:12:37,519
actually controlling the arm me in the

316
00:12:40,949 --> 00:12:39,279
middle watching over him and

317
00:12:43,350 --> 00:12:40,959
and checking all the other indications

318
00:12:44,710 --> 00:12:43,360
and john on the left side ready to

319
00:12:46,550 --> 00:12:44,720
conduct the maneuvers away from the

320
00:12:47,430 --> 00:12:46,560
spacecraft once we're ready to maneuver

321
00:12:49,190 --> 00:12:47,440
away

322
00:12:50,949 --> 00:12:49,200
once the arm was in position right over

323
00:12:53,509 --> 00:12:50,959
our heads first thing we

324
00:12:56,230 --> 00:12:53,519
did was to deploy the solar array and

325
00:12:57,990 --> 00:12:56,240
you can see it's starting to extend now

326
00:12:59,269 --> 00:12:58,000
after the solar array is fully deployed

327
00:13:01,670 --> 00:12:59,279
as you see in this scene

328
00:13:03,509 --> 00:13:01,680
we then commanded the uh the ground

329
00:13:05,110 --> 00:13:03,519
commanded the high gain antenna which is

330
00:13:06,150 --> 00:13:05,120
seen right at the very bottom looks like

331
00:13:08,870 --> 00:13:06,160
a dish

332
00:13:10,310 --> 00:13:08,880
into a series of commands which checked

333
00:13:12,150 --> 00:13:10,320
it out made sure that it was going to be

334
00:13:14,470 --> 00:13:12,160
functional

335
00:13:15,269 --> 00:13:14,480
this scene shows the actual release of

336
00:13:17,350 --> 00:13:15,279
uars

337
00:13:20,069 --> 00:13:17,360
with the mechanical arm the arm is being

338
00:13:20,389 --> 00:13:20,079

backed away from the spacecraft once

339
00:13:23,190 --> 00:13:20,399
we're

340
00:13:23,509 --> 00:13:23,200
well clear we simply put the brakes on

341
00:13:25,430 --> 00:13:23,519
and

342
00:13:27,990 --> 00:13:25,440
turn turn it over to john whose job it

343
00:13:29,750 --> 00:13:28,000
was to back us away

344
00:13:31,509 --> 00:13:29,760
once we got well clear of the spacecraft

345
00:13:33,590 --> 00:13:31,519
with the arm we put in about a two foot

346
00:13:37,190 --> 00:13:33,600
per second separation burn

347
00:13:38,310 --> 00:13:37,200
it was a forward jet burn so that caused

348
00:13:41,350 --> 00:13:38,320
the payload to actually

349
00:13:42,949 --> 00:13:41,360
come right over the cockpit in fairly

350
00:13:44,790 --> 00:13:42,959
quick manner and because we had released

351
00:13:46,310 --> 00:13:44,800
it at night we were really afraid that

352
00:13:47,990 --> 00:13:46,320
we were going to immediately lose sight

353
00:13:50,550 --> 00:13:48,000
of the spacecraft and in fact i

354
00:13:52,150 --> 00:13:50,560
did however we had a one camcorder that

355
00:13:53,910 --> 00:13:52,160
was mounted in the overhead window that

356
00:13:54,629 --> 00:13:53,920
managed to keep side of the payload for

357
00:13:56,550 --> 00:13:54,639
a little while

358
00:13:57,750 --> 00:13:56,560
as it gradually receded away and just

359
00:14:11,350 --> 00:13:57,760
disappeared into the

360
00:14:14,949 --> 00:14:12,949
the life of the urs uh one of the

361
00:14:17,430 --> 00:14:14,959
instruments on board is a cryogenically

362
00:14:19,269 --> 00:14:17,440
cooled and it's limited to approximately

363
00:14:20,710 --> 00:14:19,279

18 months to two years of lifetime the

364
00:14:23,110 --> 00:14:20,720
rest of the instruments

365
00:14:24,470 --> 00:14:23,120
uh can continue on to collect data for a

366
00:14:25,829 --> 00:14:24,480
number of years in the future in fact

367
00:14:26,550 --> 00:14:25,839
they estimate that the fuel on board

368
00:14:28,790 --> 00:14:26,560
will allow the

369
00:14:30,629 --> 00:14:28,800
most of the instruments on on urs to

370
00:14:31,670 --> 00:14:30,639
continue to collect data about the upper

371
00:14:35,189 --> 00:14:31,680
atmosphere

372
00:14:36,790 --> 00:14:35,199
for eight to ten years again as

373
00:14:38,870 --> 00:14:36,800
many of you probably know the primary

374
00:14:40,389 --> 00:14:38,880
mission of the ur spacecraft is to study

375
00:14:42,790 --> 00:14:40,399
the upper atmosphere

376
00:14:44,150 --> 00:14:42,800
and primarily to study the ozone layer

377
00:14:45,670 --> 00:14:44,160
and to see if we can't understand

378
00:14:47,750 --> 00:14:45,680
exactly what's happening to the ozone

379
00:14:49,030 --> 00:14:47,760
layer and it's done by 10 different

380
00:14:50,550 --> 00:14:49,040
instruments that are mounted on that

381
00:14:52,710 --> 00:14:50,560
spacecraft

382
00:14:54,949 --> 00:14:52,720
that take a look at three areas the

383
00:14:56,550 --> 00:14:54,959
chemistry of the atmosphere

384
00:14:58,389 --> 00:14:56,560
the dynamics of the atmosphere the

385
00:14:59,590 --> 00:14:58,399
intermixing of the winds between the

386
00:15:00,949 --> 00:14:59,600
lower and the upper atmosphere and

387
00:15:03,509 --> 00:15:00,959
finally the total energy input to the

388
00:15:06,949 --> 00:15:05,990

after we were safely away from the urs

389
00:15:08,790 --> 00:15:06,959
we started to

390
00:15:10,389 --> 00:15:08,800
to work some other experiments we had on

391
00:15:12,870 --> 00:15:10,399
board this one happens to be

392
00:15:14,629 --> 00:15:12,880
the modular dynamic experiment called

393
00:15:17,189 --> 00:15:14,639
mode

394
00:15:18,710 --> 00:15:17,199
it was built and constructed by mit with

395
00:15:21,750 --> 00:15:18,720
its own computer on board

396
00:15:25,189 --> 00:15:21,760
the idea of mode is to

397
00:15:28,069 --> 00:15:25,199
do testing on fluids on orbit to see how

398
00:15:30,550 --> 00:15:28,079
fluids respond inside a container

399
00:15:31,350 --> 00:15:30,560
to different frequency and amplitude

400
00:15:34,790 --> 00:15:31,360
responses

401
00:15:38,230 --> 00:15:34,800
this particular little vessel had

402
00:15:41,030 --> 00:15:38,240
silicon oil in it mark is trying to line

403
00:15:43,990 --> 00:15:41,040
the oil bubble at the bottom

404
00:15:44,470 --> 00:15:44,000
of the container so that when we excited

405
00:15:45,829 --> 00:15:44,480
it

406
00:15:47,990 --> 00:15:45,839
we could look at the dynamics and

407
00:15:49,430 --> 00:15:48,000
interaction between the container walls

408
00:15:51,430 --> 00:15:49,440
and the surface tension

409
00:15:54,230 --> 00:15:51,440
you had to be a little careful in

410
00:15:57,189 --> 00:15:54,240
maneuvering it around to keep that

411
00:15:58,710 --> 00:15:57,199
meniscus aligned but on orbit it was

412
00:16:01,189 --> 00:15:58,720
much easier to do than it was

413
00:16:02,550 --> 00:16:01,199

here on the ground we also had a very

414
00:16:04,069 --> 00:16:02,560
large structure

415
00:16:05,590 --> 00:16:04,079
that we were interested in this is a

416
00:16:09,749 --> 00:16:05,600
particular this structure

417
00:16:12,470 --> 00:16:09,759
is instrumented hooked into the computer

418
00:16:12,790 --> 00:16:12,480
it replicates the scale model of what we

419
00:16:14,870 --> 00:16:12,800
think

420
00:16:16,230 --> 00:16:14,880
the space station will look like and

421
00:16:18,790 --> 00:16:16,240
we're interested in looking at the

422
00:16:20,829 --> 00:16:18,800
dynamics and the harmonics

423
00:16:23,509 --> 00:16:20,839
associated with a large structure and

424
00:16:25,590 --> 00:16:23,519
weightlessness

425
00:16:26,870 --> 00:16:25,600
when it was completed the structure was

426
00:16:28,949 --> 00:16:26,880
about seven feet

427
00:16:30,310 --> 00:16:28,959
in length we lightly tethered it on the

428
00:16:33,829 --> 00:16:30,320
mid deck so that it wouldn't

429
00:16:36,310 --> 00:16:33,839
float away and and contaminate the data

430
00:16:38,310 --> 00:16:36,320
then we ran a series of frequency sweeps

431
00:16:41,910 --> 00:16:38,320
across the structure to see what

432
00:16:43,829 --> 00:16:41,920
different harmonics would be excited

433
00:16:49,189 --> 00:16:43,839
by the actuator which is on the bottom

434
00:16:53,910 --> 00:16:52,310
yeah as on orbit as uh down here the day

435
00:16:55,590 --> 00:16:53,920
gradually comes to an end and it's time

436
00:16:58,150 --> 00:16:55,600
to go to bed

437
00:17:01,670 --> 00:16:58,160
here you can see uh sam uh comfortably

438
00:17:01,680 --> 00:17:14,549

jim hasn't uh quite gotten to bed yet

439
00:17:17,990 --> 00:17:15,990
sometimes we were tethered out in the

440
00:17:21,829 --> 00:17:18,000
middle and sometimes people slept

441
00:17:24,069 --> 00:17:21,839
against the walls uh here you see me

442
00:17:24,949 --> 00:17:24,079
putting on a series of electrodes this

443
00:17:28,870 --> 00:17:24,959
was a

444
00:17:30,630 --> 00:17:28,880
24-hour heart halter i took ekg data 24

445
00:17:32,950 --> 00:17:30,640
hours continuous and

446
00:17:34,630 --> 00:17:32,960
monitored blood pressure took blood

447
00:17:36,070 --> 00:17:34,640
pressure measurements every 20 minutes

448
00:17:40,789 --> 00:17:36,080
and most of this research is being done

449
00:17:44,549 --> 00:17:42,870
morning started with the normal ritual

450
00:17:45,750 --> 00:17:44,559
of getting getting up and getting

451
00:17:49,029 --> 00:17:45,760
cleaned up

452
00:17:51,350 --> 00:17:49,039
we used primarily electric razors to

453
00:17:54,789 --> 00:17:51,360
take care of the stubble problem that

454
00:17:59,110 --> 00:17:57,029
after that we generally would get ready

455
00:18:01,350 --> 00:17:59,120
to have our morning meal

456
00:18:02,950 --> 00:18:01,360
we fixed a lot of the same kinds of food

457
00:18:06,710 --> 00:18:02,960
we have here on earth with

458
00:18:08,310 --> 00:18:06,720
scrambled eggs and sausage available and

459
00:18:10,070 --> 00:18:08,320
the only other problem was trying to

460
00:18:11,029 --> 00:18:10,080
control some of this food as you can see

461
00:18:12,710 --> 00:18:11,039
sam has

462
00:18:14,150 --> 00:18:12,720
got a runaway shrimp right there trying

463
00:18:16,310 --> 00:18:14,160

to control that

464
00:18:24,230 --> 00:18:16,320
uh that beauty and eventually gets it

465
00:18:27,110 --> 00:18:25,510
we were busy throughout the flight

466
00:18:28,470 --> 00:18:27,120
didn't often have an opportunity to eat

467
00:18:30,070 --> 00:18:28,480
all together but some of the evening

468
00:18:31,430 --> 00:18:30,080
meals uh particularly towards the end of

469
00:18:33,110 --> 00:18:31,440
the mission we did have an opportunity

470
00:18:33,990 --> 00:18:33,120
as a crew to all sit down and eat at one

471
00:18:36,549 --> 00:18:34,000
time

472
00:18:37,350 --> 00:18:36,559
generally breakfast and or lunch were

473
00:18:39,110 --> 00:18:37,360
sort of

474
00:18:40,630 --> 00:18:39,120
grabbed as the time was available and we

475
00:18:42,310 --> 00:18:40,640
tended to eat individually or perhaps

476
00:18:45,750 --> 00:18:42,320
just snack rather than sit down to a

477
00:18:48,710 --> 00:18:47,350
periodically i think the ground was

478
00:18:50,230 --> 00:18:48,720
curious as to what was going on and

479
00:18:51,590 --> 00:18:50,240
would try and spy on us but taking

480
00:18:53,430 --> 00:18:51,600
control of some of the

481
00:18:54,789 --> 00:18:53,440
aft cameras and shining them towards the

482
00:18:56,470 --> 00:18:54,799
cockpit

483
00:18:58,150 --> 00:18:56,480
we mentioned early on that most of the

484
00:18:59,750 --> 00:18:58,160
northern hemisphere was uh

485
00:19:01,750 --> 00:18:59,760
in darkness when we were up there here

486
00:19:03,029 --> 00:19:01,760
was one of the uh because of that we had

487
00:19:05,270 --> 00:19:03,039
the opportunity to see the

488
00:19:07,110 --> 00:19:05,280

northern lights or the auroras up there

489
00:19:09,110 --> 00:19:07,120
very spectacular

490
00:19:11,110 --> 00:19:09,120
generally tended to be centered around

491
00:19:12,470 --> 00:19:11,120
the northeastern canada around the

492
00:19:13,750 --> 00:19:12,480
hudson bay area

493
00:19:15,110 --> 00:19:13,760
although this is a black and white

494
00:19:16,630 --> 00:19:15,120
camera to take advantage of its

495
00:19:19,909 --> 00:19:16,640
low-light capabilities

496
00:19:22,870 --> 00:19:19,919
the aurora itself as you saw or may know

497
00:19:24,630 --> 00:19:22,880
as a bluish-green color occasionally you

498
00:19:28,310 --> 00:19:24,640
get some other colors blues and reds in

499
00:19:31,590 --> 00:19:30,549
here's another view of the uh the ice

500
00:19:33,990 --> 00:19:31,600
pack with

501
00:19:35,110 --> 00:19:34,000
some of the islands are peeking out at

502
00:19:37,190 --> 00:19:35,120
the top

503
00:19:38,870 --> 00:19:37,200
the the opportunity to see a lot of that

504
00:19:41,909 --> 00:19:38,880
ice was really spectacular

505
00:19:46,470 --> 00:19:41,919
first because it was in such a clear

506
00:19:51,110 --> 00:19:47,990
did not look like a good place to

507
00:20:06,950 --> 00:19:51,120
vacation by the way

508
00:20:09,830 --> 00:20:06,960
however the air was clear

509
00:20:10,149 --> 00:20:09,840
i i thought that uh the opportunity to

510
00:20:12,470 --> 00:20:10,159
take

511
00:20:13,590 --> 00:20:12,480
pictures and use all those uh cameras

512
00:20:16,230 --> 00:20:13,600
was one of the greatest

513
00:20:17,750 --> 00:20:16,240

thrills of of being in space flight and

514
00:20:19,590 --> 00:20:17,760
uh as john mentioned

515
00:20:20,870 --> 00:20:19,600
a lot of times we were actually able to

516
00:20:23,990 --> 00:20:20,880
see lights at night

517
00:20:25,430 --> 00:20:24,000
and the detail that is the nile delta

518
00:20:27,190 --> 00:20:25,440
that's the city of cairo right there at

519
00:20:28,549 --> 00:20:27,200
the top and then you just follow the

520
00:20:30,870 --> 00:20:28,559
nile river on down here and there

521
00:20:32,390 --> 00:20:30,880
literally is a river of light at night

522
00:20:34,870 --> 00:20:32,400
the sahara on either side there's

523
00:20:37,270 --> 00:20:34,880
nothing and then but where there's water

524
00:20:39,430 --> 00:20:37,280
there's population the lights right up

525
00:20:41,270 --> 00:20:39,440
here are just the edge of the red sea

526
00:20:43,430 --> 00:20:41,280
and this uh river in the nile river just

527
00:20:46,149 --> 00:20:43,440
continues right on down with the

528
00:20:47,990 --> 00:20:46,159
population showing there at night

529
00:20:54,950 --> 00:20:48,000
until you get to the aswan dam and then

530
00:20:58,390 --> 00:20:56,630
these are the galapagos islands you

531
00:21:08,070 --> 00:20:58,400
notice the tips of the cones of

532
00:21:11,510 --> 00:21:09,590
this was the granddaddy of all the

533
00:21:14,950 --> 00:21:11,520
cameras we carried on board this was the

534
00:21:16,549 --> 00:21:14,960
linhof each negative there is about five

535
00:21:18,390 --> 00:21:16,559
inches square

536
00:21:20,470 --> 00:21:18,400
one of the more spectacular things that

537
00:21:21,830 --> 00:21:20,480
we saw uh while we were up there was a

538
00:21:23,830 --> 00:21:21,840

night pass

539
00:21:26,230 --> 00:21:23,840
well we saw it on almost every rev over

540
00:21:30,310 --> 00:21:26,240
the united states that we passed over

541
00:21:31,909 --> 00:21:30,320
here you see uh chicago coming into view

542
00:21:33,590 --> 00:21:31,919
we're looking we're traveling from over

543
00:21:35,270 --> 00:21:33,600
chicago down towards miami and we're

544
00:21:36,870 --> 00:21:35,280
looking out towards the southwest here

545
00:21:40,149 --> 00:21:36,880
we have st louis

546
00:21:44,789 --> 00:21:40,159
kansas city over here dallas

547
00:21:48,870 --> 00:21:44,799
and houston all in view at the same time

548
00:21:51,830 --> 00:21:50,470
and mark correct me if i'm wrong you're

549
00:21:52,870 --> 00:21:51,840
from the midwest but i believe this is

550
00:21:57,190 --> 00:21:52,880
indianapolis here

551
00:22:03,110 --> 00:21:57,200
that's right followed by louisville and

552
00:22:07,270 --> 00:22:04,870
it's very surprising to me to be able to

553
00:22:07,590 --> 00:22:07,280
see the detail of cities at night like

554
00:22:09,990 --> 00:22:07,600
that

555
00:22:11,510 --> 00:22:10,000
and to actually if you look closely you

556
00:22:13,029 --> 00:22:11,520
can see the highway system connecting

557
00:22:14,310 --> 00:22:13,039
them occasionally right in the middle of

558
00:22:16,390 --> 00:22:14,320
the screen you'll see a

559
00:22:24,070 --> 00:22:16,400
giant thunderstorm and lightning show

560
00:22:27,350 --> 00:22:25,909
being up at 300 miles is truly

561
00:22:29,190 --> 00:22:27,360
incredible with just the

562
00:22:31,270 --> 00:22:29,200
amount of the earth that you can see

563
00:22:33,830 --> 00:22:31,280

it's very very impressive

564
00:22:34,310 --> 00:22:33,840
again you can see the uh the limb there

565
00:22:36,710 --> 00:22:34,320
and the

566
00:22:38,310 --> 00:22:36,720
atmosphere extending above the surface

567
00:22:39,750 --> 00:22:38,320
here itself and there's a glow here that

568
00:22:39,990 --> 00:22:39,760
will gradually get more pronounced and

569
00:22:45,510 --> 00:22:40,000
that's

570
00:22:48,549 --> 00:22:47,110
we're coming up on the east coast of the

571
00:22:51,830 --> 00:22:48,559
united states but up in the

572
00:22:54,549 --> 00:22:51,840
upper part of the of the screen you can

573
00:22:56,789 --> 00:22:54,559
see the coast of the gulf of mexico from

574
00:23:00,390 --> 00:22:56,799
houston

575
00:23:05,590 --> 00:23:02,789
new orleans and then further down toward

576
00:23:07,270 --> 00:23:05,600
the florida peninsula

577
00:23:11,830 --> 00:23:07,280
i believe this is atlanta coming into

578
00:23:15,029 --> 00:23:13,270
in the lower left-hand corner you can

579
00:23:15,909 --> 00:23:15,039
see some of those major highway systems

580
00:23:20,830 --> 00:23:15,919
strung out

581
00:23:20,840 --> 00:23:34,870
north

582
00:23:39,750 --> 00:23:37,430
should begin to see uh the recognizable

583
00:23:41,590 --> 00:23:39,760
peninsula of florida showing up here

584
00:23:44,789 --> 00:23:41,600
begin to appear right up in this area

585
00:23:48,470 --> 00:23:46,390
really what's spectacular to be able to

586
00:23:50,870 --> 00:23:48,480
see at night looking across the whole

587
00:23:51,830 --> 00:23:50,880
front of the uh orbiter from from one

588
00:23:55,669 --> 00:23:51,840

window to the other

589
00:23:59,430 --> 00:23:55,679
sometimes almost coast to coast

590
00:24:00,630 --> 00:23:59,440
here we have the city of charleston

591
00:24:02,830 --> 00:24:00,640
you're starting to see the florida

592
00:24:09,110 --> 00:24:02,840
peninsula now the city of jacksonville

593
00:24:12,950 --> 00:24:11,430
tampa st pete area is starting to come

594
00:24:13,830 --> 00:24:12,960
into view here now and then it will be

595
00:24:17,750 --> 00:24:13,840
connected

596
00:24:19,750 --> 00:24:17,760
to orlando and it's almost

597
00:24:21,830 --> 00:24:19,760
surprising to us but it's almost totally

598
00:24:23,830 --> 00:24:21,840
uh

599
00:24:25,430 --> 00:24:23,840
cut florida in half here with the

600
00:24:26,870 --> 00:24:25,440
population in the light string almost

601
00:24:29,350 --> 00:24:26,880
all the way across the peninsula right

602
00:24:33,830 --> 00:24:31,750
this is uh daytona beach the area of

603
00:24:35,590 --> 00:24:33,840
cocoa beach right here and the launchpad

604
00:24:38,630 --> 00:24:35,600
where we left a couple of days before is

605
00:24:41,830 --> 00:24:40,149
if you watch closely you'll see what we

606
00:24:46,310 --> 00:24:41,840
think is a meteorite coming in right

607
00:24:47,430 --> 00:24:46,320
over orlando

608
00:24:49,510 --> 00:24:47,440
to me that was one of the most

609
00:24:51,990 --> 00:24:49,520
spectacular scenes and and uh

610
00:24:53,269 --> 00:24:52,000
unexpected was to be able to look down

611
00:24:55,750 --> 00:24:53,279
and see

612
00:24:56,950 --> 00:24:55,760
shooting stars or meteorites coming in

613
00:24:58,549 --> 00:24:56,960

underneath of you

614
00:25:00,070 --> 00:24:58,559
into the atmosphere and you could follow

615
00:25:05,029 --> 00:25:00,080
them from the time they started to glow

616
00:25:09,269 --> 00:25:06,789
and finally the tip of florida in the

617
00:25:10,549 --> 00:25:09,279
miami fort lauderdale area right here

618
00:25:13,190 --> 00:25:10,559
and there was a lot of thunderstorm

619
00:25:15,029 --> 00:25:13,200
activity down off the

620
00:25:17,110 --> 00:25:15,039
coast here probably centered pretty well

621
00:25:18,390 --> 00:25:17,120
over cuba

622
00:25:19,909 --> 00:25:18,400
the bright light you see in the upper

623
00:25:20,789 --> 00:25:19,919
right hand corner is in fact the moon

624
00:25:23,430 --> 00:25:20,799
coming down this

625
00:25:24,710 --> 00:25:23,440
these are low light level television

626
00:25:28,310 --> 00:25:24,720
capable to

627
00:25:31,269 --> 00:25:28,320
to see that sort of thing

628
00:25:34,070 --> 00:25:31,279
well unfortunately all good things uh

629
00:25:39,430 --> 00:25:36,070
and uh the setting sun sort of

630
00:25:42,230 --> 00:25:39,440
symbolized that it was time to go home

631
00:25:43,510 --> 00:25:42,240
as the opposite of when we get on orbit

632
00:25:45,110 --> 00:25:43,520
one of the first things we do is

633
00:25:47,029 --> 00:25:45,120
open up the payload bay doors one of the

634
00:25:48,470 --> 00:25:47,039
last things we do is

635
00:25:56,310 --> 00:25:48,480
close the payload bay doors in

636
00:25:59,590 --> 00:25:56,320
preparation for coming home

637
00:26:00,950 --> 00:25:59,600
a very empty payload bay

638
00:26:05,590 --> 00:26:00,960

but that's good because that means a

639
00:26:10,230 --> 00:26:08,549
here i am doing the final portion of

640
00:26:11,190 --> 00:26:10,240
getting suited up here putting my helmet

641
00:26:12,549 --> 00:26:11,200
on my

642
00:26:14,630 --> 00:26:12,559
pressure suit that we wear for launch

643
00:26:17,190 --> 00:26:14,640
and entry

644
00:26:18,549 --> 00:26:17,200
and now you can begin to see the glow of

645
00:26:22,390 --> 00:26:18,559
the ionized air

646
00:26:25,590 --> 00:26:22,400
over the windows we we started out

647
00:26:27,750 --> 00:26:25,600
did the deorbit burn over

648
00:26:29,350 --> 00:26:27,760
africa came all the way across the

649
00:26:34,230 --> 00:26:29,360
indian ocean across the pacific

650
00:26:37,350 --> 00:26:36,149
four of us were up on the flight deck

651
00:26:38,789 --> 00:26:37,360
and for entry

652
00:26:41,350 --> 00:26:38,799
sam was down in the mid deck here you

653
00:26:41,669 --> 00:26:41,360
can start to see the recombining of the

654
00:26:43,350 --> 00:26:41,679
uh

655
00:26:44,710 --> 00:26:43,360
the plasma this that surrounds the

656
00:26:46,549 --> 00:26:44,720
orbiter on re-entry

657
00:26:48,630 --> 00:26:46,559
and it recombines up on top of the

658
00:26:50,390 --> 00:26:48,640
orbiter and although it looks like

659
00:26:52,310 --> 00:26:50,400
it might be the tip of the tail this is

660
00:26:55,909 --> 00:26:52,320
actually just a very hot uh

661
00:26:57,909 --> 00:26:55,919
gas that recombines on top as we plunge

662
00:26:58,950 --> 00:26:57,919
down into the atmosphere

663
00:27:00,070 --> 00:26:58,960

you're starting to see if you look at

664
00:27:01,750 --> 00:27:00,080
this car you can see a little bit of

665
00:27:06,950 --> 00:27:01,760
shaking going on as we went through

666
00:27:08,470 --> 00:27:06,960
mach 14 or 14 times the speed of sound

667
00:27:10,310 --> 00:27:08,480
then you can see a little bit of the the

668
00:27:12,549 --> 00:27:10,320
boundary layer being tripped here by the

669
00:27:14,789 --> 00:27:12,559
windows and this white spidery uh

670
00:27:16,390 --> 00:27:14,799
uh almost looked like a st elmo's fire

671
00:27:18,070 --> 00:27:16,400
dancing on the windows

672
00:27:20,549 --> 00:27:18,080
here were the long range cameras from

673
00:27:21,350 --> 00:27:20,559
vandenberg ir cameras taking pictures of

674
00:27:24,070 --> 00:27:21,360
us as

675
00:27:25,830 --> 00:27:24,080
we came in over southern california and

676
00:27:27,029 --> 00:27:25,840
you can start to see the the delta shape

677
00:27:29,430 --> 00:27:27,039
of the orbiter

678
00:27:31,110 --> 00:27:29,440
again another ir shot taken from the

679
00:27:32,549 --> 00:27:31,120
ground at edwards air force base as we

680
00:27:35,190 --> 00:27:32,559
make our final descent

681
00:27:36,710 --> 00:27:35,200
into the runway and then coming through

682
00:27:38,149 --> 00:27:36,720
the bright lights that uh the xenon

683
00:27:42,870 --> 00:27:38,159
lights that are we used to

684
00:27:46,310 --> 00:27:42,880
illuminate the runway we uh touch down

685
00:27:50,310 --> 00:27:46,320
and roll out about 9000 feet to a

686
00:28:01,190 --> 00:27:50,320
to a safe and conclusion to a very

687
00:28:04,389 --> 00:28:03,909
and after five days eight hours and 28