
9:21:55 AM
APR. 5 '97
9:39 AM
APR. 5 '97

1
00:00:00,030 --> 00:00:27,570
Oh

2
00:00:31,330 --> 00:00:29,830
Thank You mr. Abby and thank you ladies

3
00:00:34,420 --> 00:00:31,340
and gentlemen for this opportunity to

4
00:00:35,830 --> 00:00:34,430
talk a little bit about SCS 83 as mr.

5
00:00:37,630 --> 00:00:35,840
Abby has just alluded to it turned out

6
00:00:39,520 --> 00:00:37,640
to be a much different spaceflight from

7
00:00:41,830 --> 00:00:39,530
from what we'd anticipated but no less

8
00:00:43,450 --> 00:00:41,840
important in the sense that it gave a

9
00:00:45,160 --> 00:00:43,460
chance for all of us in this room and in

10
00:00:46,450 --> 00:00:45,170
fact all the NASA centers the people who

11
00:00:48,759 --> 00:00:46,460
are listening to me around the country

12
00:00:51,729 --> 00:00:48,769
to do what NASA does best and that is

13
00:00:53,710 --> 00:00:51,739

when a problem crops up people spent

14
00:00:55,569 --> 00:00:53,720
that whole weekend of April 5th inside

15
00:00:57,850 --> 00:00:55,579
Mission Control working that fuel cell

16
00:01:00,359 --> 00:00:57,860
problem coming up with options coming up

17
00:01:02,289 --> 00:01:00,369
with ideas trying to solve the problem

18
00:01:04,210 --> 00:01:02,299
presenting options to the mission

19
00:01:05,530 --> 00:01:04,220
management team who then decided hey the

20
00:01:07,060 --> 00:01:05,540
right thing to do is to come home and

21
00:01:08,980 --> 00:01:07,070
let's let's think about it more when we

22
00:01:10,750 --> 00:01:08,990
get the crew and the vehicle safely down

23
00:01:13,210 --> 00:01:10,760
on earth and then we'll fly them again

24
00:01:14,710 --> 00:01:13,220
so kudos to everybody on this side

25
00:01:17,230 --> 00:01:14,720
answered throughout the country who made

26
00:01:19,810 --> 00:01:17,240
that safe return of the vehicle and the

27
00:01:21,100 --> 00:01:19,820
crew a possibility what I'd like to do

28
00:01:22,840 --> 00:01:21,110
now is introduce a crew perhaps in a

29
00:01:24,670 --> 00:01:22,850
little bit more depth for you to my

30
00:01:26,770 --> 00:01:24,680
right as our pilot Lieutenant Commander

31
00:01:29,110 --> 00:01:26,780
Susan still from the United States Navy

32
00:01:31,990 --> 00:01:29,120
she she filled those very important

33
00:01:33,430 --> 00:01:32,000
front right seat duties magnificently it

34
00:01:35,650 --> 00:01:33,440
was her first flight and we were lucky

35
00:01:39,160 --> 00:01:35,660
to have her on board this mission to her

36
00:01:40,780 --> 00:01:39,170
right dr. Janice Voss Janice has her

37
00:01:42,820 --> 00:01:40,790
background her academic degrees for

38
00:01:44,890 --> 00:01:42,830

advanced degrees from MIT in both Aero

39
00:01:46,810 --> 00:01:44,900
and Astro she was able to bring that

40
00:01:48,700 --> 00:01:46,820
academic background together with two

41
00:01:50,800 --> 00:01:48,710
prior space flights and experience made

42
00:01:53,160 --> 00:01:50,810
her the right person to be a payload

43
00:01:56,500 --> 00:01:53,170
commander in this crew to her right is

44
00:01:58,719 --> 00:01:56,510
mission specialist number two dr. Mike

45
00:02:00,030 --> 00:01:58,729
Bernhardt Mike's a unique individual in

46
00:02:02,830 --> 00:02:00,040
the sense that he has a background

47
00:02:04,899 --> 00:02:02,840
academically in bio bio engineering from

48
00:02:06,370 --> 00:02:04,909
the University of Pennsylvania but it

49
00:02:07,960 --> 00:02:06,380
combines that with a lot of hands-on

50
00:02:09,759 --> 00:02:07,970
operational experience as a professional

51
00:02:12,070 --> 00:02:09,769
deep-sea diver in the petroleum industry

52
00:02:14,710 --> 00:02:12,080
for a number of years so I made him the

53
00:02:16,660 --> 00:02:14,720
right person to apply those skills as on

54
00:02:18,280 --> 00:02:16,670
the blue shift the shift where Susan and

55
00:02:19,809 --> 00:02:18,290
I were sleeping he was in charge of the

56
00:02:22,869 --> 00:02:19,819
orbiter and keeping the orbiter safe and

57
00:02:24,369 --> 00:02:22,879
running as a space lab while we were

58
00:02:26,710 --> 00:02:24,379
asleep and he ran the blue ship for us

59
00:02:28,809 --> 00:02:26,720
and did a great job there the other

60
00:02:30,940 --> 00:02:28,819
experienced very experienced space flyer

61
00:02:33,970 --> 00:02:30,950
that we have on board is dr. Don Thomas

62
00:02:36,580 --> 00:02:33,980
Don has a background in materials

63
00:02:37,309 --> 00:02:36,590

science specializing the semiconductor

64
00:02:39,979 --> 00:02:37,319
industry to

65
00:02:43,309 --> 00:02:39,989
from Case Western and Cornell and then a

66
00:02:45,589 --> 00:02:43,319
standin Billy Bell AT&T Labs prior to

67
00:02:46,880 --> 00:02:45,599
coming to us at NASA Donna and I had the

68
00:02:49,280 --> 00:02:46,890
very unique experience of flying

69
00:02:52,009 --> 00:02:49,290
together on our first flight on STS 65

70
00:02:53,720 --> 00:02:52,019
back in 1994 on a mission which was very

71
00:02:57,559 --> 00:02:53,730
similar almost identical to this one

72
00:02:59,059 --> 00:02:57,569
dual shift long-duration laboratory

73
00:03:00,410 --> 00:02:59,069
mission so we were able to bring and

74
00:03:04,309 --> 00:03:00,420
Donna in particular was able to bring

75
00:03:06,050 --> 00:03:04,319
that expertise to bear on STS 83 and it

76
00:03:08,330 --> 00:03:06,060
was it was magnificent having him and

77
00:03:09,830 --> 00:03:08,340
his experience on this mission the last

78
00:03:11,509 --> 00:03:09,840
two individuals that I want to introduce

79
00:03:13,069 --> 00:03:11,519
to you are important in the sense that

80
00:03:14,690 --> 00:03:13,079
they were brought from outside the

81
00:03:18,349 --> 00:03:14,700
astronaut crew office because of their

82
00:03:22,190 --> 00:03:18,359
particular expertise we have dr. Roger

83
00:03:24,949 --> 00:03:22,200
Crouch degrees from Tennessee Tech and

84
00:03:27,050 --> 00:03:24,959
Virginia Tech and he's his background is

85
00:03:30,020 --> 00:03:27,060
he was in charge of the NASA material

86
00:03:34,009 --> 00:03:30,030
science program for about a hundred

87
00:03:35,750 --> 00:03:34,019
years is that right yeah he was up at

88
00:03:37,429 --> 00:03:35,760

NASA headquarters really managing the

89
00:03:39,289 --> 00:03:37,439
material science of the microgravity

90
00:03:40,429 --> 00:03:39,299
science program for all of NASA for a

91
00:03:43,670 --> 00:03:40,439
number of years so this was his

92
00:03:45,619 --> 00:03:43,680
opportunity to come back and apply not

93
00:03:47,869 --> 00:03:45,629
only his top level skills but also his

94
00:03:49,369 --> 00:03:47,879
hands-on researcher skills in the

95
00:03:51,469 --> 00:03:49,379
laboratory environment we were lucky to

96
00:03:53,439 --> 00:03:51,479
have him on board finally but certainly

97
00:03:56,629 --> 00:03:53,449
not least we have dr. Greg Lynn Terrace

98
00:03:58,879 --> 00:03:56,639
Greg has degrees from Stanford and from

99
00:04:01,159 --> 00:03:58,889
Princeton his specialty is fire

100
00:04:03,229 --> 00:04:01,169
combustion which was important for the

101
00:04:04,879 --> 00:04:03,239
this flight because that was one of two

102
00:04:07,460 --> 00:04:04,889
particular areas that we were trying to

103
00:04:09,170 --> 00:04:07,470
target all of our experiments onboard

104
00:04:11,210 --> 00:04:09,180
Columbia and onboard the microgravity

105
00:04:12,920 --> 00:04:11,220
science laboratory so Greg was the right

106
00:04:14,839 --> 00:04:12,930
person to have onboard that mission and

107
00:04:17,149 --> 00:04:14,849
he too on his first flight did a great

108
00:04:18,680 --> 00:04:17,159
job for us so that's the crew and what

109
00:04:19,969 --> 00:04:18,690
we'd like to do at this time is roll the

110
00:04:21,860 --> 00:04:19,979
film for you we have an 11 minute

111
00:04:23,149 --> 00:04:21,870
videotape to kind of show you what what

112
00:04:27,500 --> 00:04:23,159
we plan and what actually happened when

113
00:04:30,050 --> 00:04:27,510

STS 83 here's the patch is designed to

114
00:04:32,029 --> 00:04:30,060
show in an artistic fashion combustion

115
00:04:34,279 --> 00:04:32,039
science and the material science that we

116
00:04:36,320 --> 00:04:34,289
were on board to do around the crew one

117
00:04:39,529 --> 00:04:36,330
more time Susan still the pilot from

118
00:04:41,920 --> 00:04:39,539
Augusta Georgia there's Mike ms2 the

119
00:04:44,210 --> 00:04:41,930
flight engineer from Mansfield Ohio

120
00:04:47,720 --> 00:04:44,220
Janice Voss pelo commander from

121
00:04:49,730 --> 00:04:47,730
Rockville Rockford Illinois that's right

122
00:04:54,070 --> 00:04:49,740
Cleveland Ohio's representative Don

123
00:04:57,010 --> 00:04:54,080
Thomas Roger Crouch from Tennessee

124
00:05:00,740 --> 00:04:57,020
Gregg Glenn Terrace from numerous

125
00:05:02,570 --> 00:05:00,750
numerous New Jersey so finally the big

126
00:05:05,330 --> 00:05:02,580
day we've been training so hard for has

127
00:05:08,420 --> 00:05:05,340
come and what a beautiful day to go into

128
00:05:10,730 --> 00:05:08,430
space aboard Columbia as we're all

129
00:05:13,790 --> 00:05:10,740
getting strapped in I find that I'm not

130
00:05:16,310 --> 00:05:13,800
nervous at all I'm mentally reviewing

131
00:05:18,380 --> 00:05:16,320
procedures and waiting with excitement

132
00:05:22,520 --> 00:05:18,390
for when I get to start moving switches

133
00:05:24,800 --> 00:05:22,530
in preparation for launch six seconds

134
00:05:28,070 --> 00:05:24,810
prior to t0 the three main engines

135
00:05:30,620 --> 00:05:28,080
ignite and throttle up when the

136
00:05:33,650 --> 00:05:30,630
computers see good engines the solid

137
00:05:37,520 --> 00:05:33,660
rocket boosters ignite and there's no

138
00:05:39,680 --> 00:05:37,530

stopping us now the vibrations I felt

139
00:05:42,410 --> 00:05:39,690
during launch were less than I had

140
00:05:45,050 --> 00:05:42,420
anticipated which was nice the

141
00:05:47,450 --> 00:05:45,060
acceleration off the launch pad was less

142
00:05:50,720 --> 00:05:47,460
than I've experienced catapulting off of

143
00:05:53,420 --> 00:05:50,730
aircraft carriers but soon things got

144
00:05:56,210 --> 00:05:53,430
pretty exciting when I started feeling

145
00:05:59,210 --> 00:05:56,220
the g-forces build-up pressing down on

146
00:06:02,409 --> 00:05:59,220
my chest I knew I was accelerating

147
00:06:08,090 --> 00:06:02,419
faster than ever before

148
00:06:10,750 --> 00:06:08,100
zero to 17,000 miles 17,500 miles per

149
00:06:14,480 --> 00:06:10,760
hour in only eight and a half minutes

150
00:06:16,370 --> 00:06:14,490
now that's pretty exciting now we're

151
00:06:20,270 --> 00:06:16,380
over a hundred and sixty nautical miles

152
00:06:21,650 --> 00:06:20,280
from the Earth's surface one of the

153
00:06:22,820 --> 00:06:21,660
first things we need to do when you get

154
00:06:24,320 --> 00:06:22,830
up into orbit to get into orbit

155
00:06:24,710 --> 00:06:24,330
configuration is open the payload bay

156
00:06:26,659 --> 00:06:24,720
doors

157
00:06:28,490 --> 00:06:26,669
the shiny surface on the inside is a

158
00:06:30,440 --> 00:06:28,500
radiator and we use that to get rid of

159
00:06:33,110 --> 00:06:30,450
the waste heat I'm sure most of you know

160
00:06:35,060 --> 00:06:33,120
how all that works but we have to get

161
00:06:36,260 --> 00:06:35,070
them up in just a few hours or we have

162
00:06:38,570 --> 00:06:36,270
to come back because of all the waste

163
00:06:40,640 --> 00:06:38,580

heat that we generate on board the next

164
00:06:42,110 --> 00:06:40,650
major activity for me and the payload

165
00:06:44,210 --> 00:06:42,120
team was getting the space live

166
00:06:45,240 --> 00:06:44,220
activated you see Roger coming in on the

167
00:06:47,160 --> 00:06:45,250
left there I'm right

168
00:06:48,990 --> 00:06:47,170
this is our first trip into the Space

169
00:06:50,670 --> 00:06:49,000
Lab module after getting up into orbit

170
00:06:51,960 --> 00:06:50,680
you can tell it's early in the flight

171
00:06:53,280 --> 00:06:51,970
because the module is still nice and

172
00:06:55,440 --> 00:06:53,290
clean everything is still packed away

173
00:06:57,660 --> 00:06:55,450
that'll change pretty quick as we get

174
00:06:59,490 --> 00:06:57,670
things set up for flight we have to get

175
00:07:01,530 --> 00:06:59,500
all the systems activated the subsystem

176
00:07:02,700 --> 00:07:01,540
computer and the experiment computer get

177
00:07:04,920 --> 00:07:02,710
that up and running so we can get

178
00:07:06,570 --> 00:07:04,930
heavily into science see Don Tom is here

179
00:07:08,130 --> 00:07:06,580
working on the worldmap computer and the

180
00:07:11,940 --> 00:07:08,140
you can also see the space to have

181
00:07:13,890 --> 00:07:11,950
computer next to him what was happening

182
00:07:15,780 --> 00:07:13,900
on the ground it first unknown to us but

183
00:07:17,640 --> 00:07:15,790
briefly made shortly made known to us

184
00:07:19,980 --> 00:07:17,650
was that we had a fuel cell to problem

185
00:07:22,080 --> 00:07:19,990
fuel co2 had high substantive volts

186
00:07:23,910 --> 00:07:22,090
which is a technical term for saying

187
00:07:26,610 --> 00:07:23,920
that there's the possibility that fuel

188
00:07:28,800 --> 00:07:26,620

cell 2 could have a fire so at the upper

189
00:07:31,290 --> 00:07:28,810
right-hand part of this screen you see

190
00:07:32,840 --> 00:07:31,300
the the flight control team meeting

191
00:07:34,770 --> 00:07:32,850
together trying to go over our options

192
00:07:36,360 --> 00:07:34,780
figure out what the right thing to do

193
00:07:37,860 --> 00:07:36,370
the mission management team met and the

194
00:07:40,170 --> 00:07:37,870
right thing to do was to come on home

195
00:07:43,050 --> 00:07:40,180
here you see Chris Hadfield our Capcom

196
00:07:44,460 --> 00:07:43,060
telling us come on home on day 4 one of

197
00:07:46,350 --> 00:07:44,470
the big results of the power-down that

198
00:07:48,120 --> 00:07:46,360
we did was to shut off all non-critical

199
00:07:49,830 --> 00:07:48,130
equipment on board and when the first

200
00:07:51,570 --> 00:07:49,840
things to go back into space that module

201
00:07:53,250 --> 00:07:51,580
was the lights you can see here I'm

202
00:07:54,750 --> 00:07:53,260
working with a flashlight in my mouth

203
00:07:56,280 --> 00:07:54,760
that was standard operating procedure

204
00:07:57,810 --> 00:07:56,290
for us back there to look at procedures

205
00:07:59,790 --> 00:07:57,820
and see what we were doing and it made

206
00:08:05,130 --> 00:07:59,800
for a most interesting work experience

207
00:08:07,980 --> 00:08:05,140
back then before things got quite this

208
00:08:10,530 --> 00:08:07,990
interesting the 32 science teams working

209
00:08:11,940 --> 00:08:10,540
in the payload Operations Control Center

210
00:08:13,620 --> 00:08:11,950
at Marshall Space Flight Center had

211
00:08:16,080 --> 00:08:13,630
started replanting the scientific

212
00:08:18,420 --> 00:08:16,090
experiments and the red team went to

213
00:08:19,830 --> 00:08:18,430

work doing the new pcap or the new plan

214
00:08:21,930 --> 00:08:19,840
for how the science was going to be

215
00:08:23,700 --> 00:08:21,940
carried out the orbiter crew chipped in

216
00:08:26,820 --> 00:08:23,710
here you see Susan helping on a Japanese

217
00:08:28,409 --> 00:08:26,830
furnished large isothermal furnace for

218
00:08:30,120 --> 00:08:28,419
some of the material science experiments

219
00:08:35,579 --> 00:08:30,130
Gregg's are doing some combustion here

220
00:08:37,740 --> 00:08:35,589
oh that Don doing material science still

221
00:08:40,170 --> 00:08:37,750
on the Lord isothermal furnace apologize

222
00:08:41,760 --> 00:08:40,180
for that he's changing the samples here

223
00:08:43,230 --> 00:08:41,770
going with some of the samples that had

224
00:08:46,650 --> 00:08:43,240
shorter run times than what we'd

225
00:08:50,460 --> 00:08:46,660
previously anticipated doing and you can

226
00:08:51,840 --> 00:08:50,470
see that he's working from a new pcap

227
00:08:54,720 --> 00:08:51,850
that had just been

228
00:08:56,400 --> 00:08:54,730
that day this is great sorry combustion

229
00:08:58,230 --> 00:08:56,410
was one of the important areas of

230
00:09:00,749 --> 00:08:58,240
research on our our mission and what I'm

231
00:09:02,129 --> 00:09:00,759
doing here is a suit formation

232
00:09:04,050 --> 00:09:02,139
experiment said of course is an

233
00:09:05,639 --> 00:09:04,060
important airborne pollutant this is the

234
00:09:07,860 --> 00:09:05,649
igniter in the combustion chamber you'll

235
00:09:09,629 --> 00:09:07,870
see the flame and ethylene air diffusion

236
00:09:11,939 --> 00:09:09,639
flame lighting it's actually upside down

237
00:09:13,889 --> 00:09:11,949
here it's forming soot our job at this

238
00:09:16,139 --> 00:09:13,899

point was to adjust the flow rate of the

239
00:09:17,759 --> 00:09:16,149
fuel in order to eliminate the soot

240
00:09:19,740 --> 00:09:17,769
formation and bring it just below the

241
00:09:22,829 --> 00:09:19,750
set point so the flow rate is being

242
00:09:26,069 --> 00:09:22,839
adjusted down the next image is a laser

243
00:09:27,509 --> 00:09:26,079
extinction image of the same flame and

244
00:09:29,460 --> 00:09:27,519
this is what the scientists on the

245
00:09:31,259 --> 00:09:29,470
ground used to quantify the soot

246
00:09:33,900 --> 00:09:31,269
formation rate in this particular flame

247
00:09:35,370 --> 00:09:33,910
another area of research was droplet

248
00:09:37,110 --> 00:09:35,380
combustion droplets of course in

249
00:09:39,269 --> 00:09:37,120
ubiquitous in many combustion using

250
00:09:41,100 --> 00:09:39,279
devices I'm setting up the experiment

251
00:09:44,309 --> 00:09:41,110
here in the next image you'll see an

252
00:09:46,290 --> 00:09:44,319
actual droplet burn the droplet is

253
00:09:48,930 --> 00:09:46,300
formed in between the center needles and

254
00:09:51,540 --> 00:09:48,940
it's stretched released and then ignited

255
00:09:52,889 --> 00:09:51,550
and then it burns from the burning rate

256
00:09:54,389 --> 00:09:52,899
of the droplet the scientists can

257
00:09:56,939 --> 00:09:54,399
understand the chemical kinetics and the

258
00:09:59,069 --> 00:09:56,949
physics of the burning process the next

259
00:10:00,870 --> 00:09:59,079
image is an ultraviolet image

260
00:10:02,460 --> 00:10:00,880
intensified and you can see that the

261
00:10:04,650 --> 00:10:02,470
droplet burns all the way to extinction

262
00:10:06,960 --> 00:10:04,660
which is exactly what the investigators

263
00:10:08,579 --> 00:10:06,970

wanted to try and see I spent a lot of

264
00:10:10,710 --> 00:10:08,589
time during our four days working on the

265
00:10:12,329 --> 00:10:10,720
glovebox experiments here and this is

266
00:10:14,639 --> 00:10:12,339
one of the material science one from

267
00:10:16,019 --> 00:10:14,649
Northwestern University we wouldn't have

268
00:10:17,639 --> 00:10:16,029
been able to do the great job we did up

269
00:10:18,990 --> 00:10:17,649
there without outstanding support here

270
00:10:21,480 --> 00:10:19,000
in the ground both at the Johnson Space

271
00:10:24,030 --> 00:10:21,490
Center in Huntsville Alabama at the

272
00:10:25,470 --> 00:10:24,040
payload operations Control Center and a

273
00:10:27,059 --> 00:10:25,480
number one man they're working with us

274
00:10:28,579 --> 00:10:27,069
was Paul Ronnie or alternate payload

275
00:10:30,780 --> 00:10:28,589
specialist who did an outstanding job

276
00:10:33,210 --> 00:10:30,790
helping us get all the experiments done

277
00:10:35,400 --> 00:10:33,220
in time we had a couple of experiments

278
00:10:36,710 --> 00:10:35,410
onboard that we're looking at hardware

279
00:10:39,059 --> 00:10:36,720
we might be using for the space station

280
00:10:41,280 --> 00:10:39,069
this is an example of how we could

281
00:10:42,540 --> 00:10:41,290
upgrade an experiment as the station of

282
00:10:44,910 --> 00:10:42,550
vowels as you learn more about the

283
00:10:46,410 --> 00:10:44,920
science or improve the hardware to allow

284
00:10:48,329 --> 00:10:46,420
you to change experiments over the

285
00:10:49,679 --> 00:10:48,339
course of Space Station's life this is

286
00:10:51,389 --> 00:10:49,689
the combustion module where at the

287
00:10:53,309 --> 00:10:51,399
beginning of flight inserting the

288
00:10:54,840 --> 00:10:53,319

experiment mounting structure for the

289
00:10:56,670 --> 00:10:54,850
suit flame that Greg was talking about

290
00:10:58,429 --> 00:10:56,680
earlier halfway through the flight will

291
00:11:00,900 --> 00:10:58,439
change these out and put in a flame ball

292
00:11:03,640 --> 00:11:00,910
experiment that would be the second half

293
00:11:06,490 --> 00:11:03,650
of that combustion experiment

294
00:11:08,590 --> 00:11:06,500
very first full day on orbit one of our

295
00:11:10,720 --> 00:11:08,600
first jobs was to activate some protein

296
00:11:12,550 --> 00:11:10,730
crystal growth experiments and that's

297
00:11:14,920 --> 00:11:12,560
what Don and I are doing here protein

298
00:11:16,269 --> 00:11:14,930
crystals of course helped the scientists

299
00:11:18,070 --> 00:11:16,279
on the ground understand the structure

300
00:11:21,540 --> 00:11:18,080
of the proteins for which they can then

301
00:11:23,470 --> 00:11:21,550
then design drugs our job was to

302
00:11:28,900 --> 00:11:23,480
photograph with 35 millimeter

303
00:11:30,880 --> 00:11:28,910
photography the activation process one

304
00:11:32,950 --> 00:11:30,890
of the major challenges facing a

305
00:11:35,650 --> 00:11:32,960
separate person clearly we'd like we had

306
00:11:38,380 --> 00:11:35,660
is to convert the ascent rocket into an

307
00:11:40,750 --> 00:11:38,390
orbiting laboratory and basically you're

308
00:11:42,460 --> 00:11:40,760
trying to stow away about 10 pounds of

309
00:11:45,430 --> 00:11:42,470
potatoes and 5 pound sack and then

310
00:11:47,500 --> 00:11:45,440
deploy all the various experiments this

311
00:11:50,220 --> 00:11:47,510
is Janice taking an air sample in the

312
00:11:52,750 --> 00:11:50,230
lab one of the tasks we do when we first

313
00:11:54,340 --> 00:11:52,760

activate the lab and then here you see

314
00:11:55,900 --> 00:11:54,350
me working on the computer and I'm

315
00:11:57,490 --> 00:11:55,910
completely upside down on the ceiling

316
00:11:59,650 --> 00:11:57,500
and that's one of the things that we did

317
00:12:01,600 --> 00:11:59,660
a lot of is to try to spread the people

318
00:12:03,820 --> 00:12:01,610
out seven people in the mid that don't

319
00:12:05,410 --> 00:12:03,830
fit very well on the floor of course we

320
00:12:08,320 --> 00:12:05,420
have to get exercise and there's Jim

321
00:12:10,090 --> 00:12:08,330
doing the ergometer our exercise prayers

322
00:12:12,130 --> 00:12:10,100
were compressed because of the short

323
00:12:17,019 --> 00:12:12,140
flight but normally this is a very

324
00:12:19,120 --> 00:12:17,029
important part of our day the window was

325
00:12:21,100 --> 00:12:19,130
pretty impressive this is the Baja

326
00:12:23,019 --> 00:12:21,110
Peninsula which is oriented kind of

327
00:12:25,210 --> 00:12:23,029
upside down the United States is towards

328
00:12:28,690 --> 00:12:25,220
the bottom of the screen we have Mexico

329
00:12:30,190 --> 00:12:28,700
up in the upper left hand corner this is

330
00:12:32,650 --> 00:12:30,200
part of the Middle East with the Nile

331
00:12:35,050 --> 00:12:32,660
River in the top portion of the screen

332
00:12:38,290 --> 00:12:35,060
the Red Sea in the middle and Saudi

333
00:12:40,120 --> 00:12:38,300
Arabia towards the bottom it's one of

334
00:12:44,800 --> 00:12:40,130
the prettiest parts of the world

335
00:12:47,910 --> 00:12:44,810
I think the Sinai Peninsula in the same

336
00:12:52,199 --> 00:12:47,920
area with the Gulf's of Suez and acaba

337
00:12:55,030 --> 00:12:52,209
consider Suez Canal up in the upper left

338
00:12:56,829 --> 00:12:55,040

these pivot point irrigation circles are

339
00:12:58,690 --> 00:12:56,839
all over the deserts especially in the

340
00:13:03,420 --> 00:12:58,700
Middle East they go down thousands of

341
00:13:07,660 --> 00:13:05,650
well the most spectacular sights we've

342
00:13:09,820 --> 00:13:07,670
got to see from a short mission was

343
00:13:11,290 --> 00:13:09,830
comet hale-bopp and what you're looking

344
00:13:13,150 --> 00:13:11,300
at is a sequence of pictures here

345
00:13:14,890 --> 00:13:13,160
watching the combat actually set through

346
00:13:16,370 --> 00:13:14,900
the atmosphere and we were actually able

347
00:13:18,500 --> 00:13:16,380
to see it set beyond the limit

348
00:13:19,880 --> 00:13:18,510
here you could see also the orange

349
00:13:22,010 --> 00:13:19,890
lights there that are down on the earth

350
00:13:24,620 --> 00:13:22,020
those are fires burning over Central

351
00:13:26,390 --> 00:13:24,630
Africa as we passed over there the

352
00:13:28,130 --> 00:13:26,400
sunsets are spectacular although they're

353
00:13:29,990 --> 00:13:28,140
very short and they occur over like ten

354
00:13:31,580 --> 00:13:30,000
seconds or so we get to see about 60

355
00:13:34,700 --> 00:13:31,590
November every day which makes up for

356
00:13:36,830 --> 00:13:34,710
the shortness well after a lot of

357
00:13:38,150 --> 00:13:36,840
unexpected quick work we had the vehicle

358
00:13:39,800 --> 00:13:38,160
and ship ready to come home here we are

359
00:13:40,670 --> 00:13:39,810
on Dior birthday everybody suited up

360
00:13:42,140 --> 00:13:40,680
Susan left

361
00:13:44,120 --> 00:13:42,150
flight engineer Mike they're in the in

362
00:13:46,640 --> 00:13:44,130
the middle and me on the right we did

363
00:13:49,100 --> 00:13:46,650

the deorbit burn made a safe and

364
00:13:50,960 --> 00:13:49,110
successful to fuel sale entry back into

365
00:13:53,240 --> 00:13:50,970
the Earth's atmosphere and at about this

366
00:13:54,650 --> 00:13:53,250
point about about Mach point nine is

367
00:13:56,870 --> 00:13:54,660
where I had the opportunity to fly the

368
00:13:59,120 --> 00:13:56,880
Space Shuttle for the first time I had

369
00:14:02,180 --> 00:13:59,130
about 1,000 practice shuttle training

370
00:14:03,560 --> 00:14:02,190
aircraft approaches but I had never as

371
00:14:06,050 --> 00:14:03,570
pilot had the opportunity to actually

372
00:14:07,730 --> 00:14:06,060
fly the shuttle and when I first took

373
00:14:09,680 --> 00:14:07,740
control of the vehicle manually I did a

374
00:14:11,720 --> 00:14:09,690
little pitch pulse to see how it flew no

375
00:14:13,280 --> 00:14:11,730
roll pulse and I told Susan hey it's

376
00:14:16,040 --> 00:14:13,290
just like the STA and I think that's a

377
00:14:18,470 --> 00:14:16,050
tribute to our training people and

378
00:14:20,480 --> 00:14:18,480
system that a first-time flyer can feel

379
00:14:22,160 --> 00:14:20,490
that comfortable here we are rolling out

380
00:14:23,990 --> 00:14:22,170
on final approach down got a good view

381
00:14:26,480 --> 00:14:24,000
of the runway out there over over

382
00:14:29,930 --> 00:14:26,490
Susan's shoulder at 2,000 feet I did the

383
00:14:31,550 --> 00:14:29,940
pre-flare and at 300 feet Susan dropped

384
00:14:33,650 --> 00:14:31,560
the gear down right here we had a little

385
00:14:35,120 --> 00:14:33,660
bit of crosswind from my right to left

386
00:14:37,520 --> 00:14:35,130
as I was looking out the commander's

387
00:14:38,660 --> 00:14:37,530
window that was causing some concern by

388
00:14:39,650 --> 00:14:38,670

the people on the ground and you see

389
00:14:41,120 --> 00:14:39,660
that I did have to make a little

390
00:14:43,580 --> 00:14:41,130
correction back to the centreline to the

391
00:14:45,800 --> 00:14:43,590
left here and then stop the rate by

392
00:14:48,410 --> 00:14:45,810
dipping the right wing down to have a

393
00:14:51,470 --> 00:14:48,420
zero across the runway rate as we touch

394
00:14:54,290 --> 00:14:51,480
down the vehicle touched down the whole

395
00:14:55,910 --> 00:14:54,300
landing task was was well well practice

396
00:14:57,800 --> 00:14:55,920
in the shuttle training aircraft I felt

397
00:15:02,090 --> 00:14:57,810
comfortable with it as I lowered the

398
00:15:04,430 --> 00:15:02,100
nose Susan put the but the chute out and

399
00:15:05,870 --> 00:15:04,440
the chute causes a lot of drag or at

400
00:15:07,730 --> 00:15:05,880
least it seems that way after several

401
00:15:09,140 --> 00:15:07,740
days of zero gravity the jerk that you

402
00:15:10,700 --> 00:15:09,150
get seems like a lot and you just have

403
00:15:12,230 --> 00:15:10,710
no desire to really put on the brakes

404
00:15:15,320 --> 00:15:12,240
you let the vehicle roll out with almost

405
00:15:17,150 --> 00:15:15,330
no braking Susan drops issued at sixty

406
00:15:18,470 --> 00:15:17,160
knots and I do use the brakes here for

407
00:15:19,490 --> 00:15:18,480
about the first time to bring it to a

408
00:15:21,590 --> 00:15:19,500
full and complete stop

409
00:15:23,080 --> 00:15:21,600
I found the brakes they weren't draggy I

410
00:15:25,460 --> 00:15:23,090
did find the nosewheel steering to be a

411
00:15:27,510 --> 00:15:25,470
fairly stiff in the sense that if iraq

412
00:15:31,290 --> 00:15:27,520
reacted very quickly to any inputs that

413
00:15:32,790 --> 00:15:31,300

me after that after about an hour of

414
00:15:34,470 --> 00:15:32,800
medical testing we were able to get out

415
00:15:38,270 --> 00:15:34,480
and wave to the photographers who were

416
00:15:41,940 --> 00:15:40,590
thanks to the hard work that's going on

417
00:15:44,370 --> 00:15:41,950
right now at the Kennedy Space Center

418
00:15:45,990 --> 00:15:44,380
that to be continued that slogan is

419
00:15:47,790 --> 00:15:46,000
going to be truth on July 1st they're

420
00:15:50,250 --> 00:15:47,800
gonna have the vehicle and the payload

421
00:15:52,020 --> 00:15:50,260
and us back out there and ready to go

422
00:15:53,370 --> 00:15:52,030
again and it's it's happening only

423
00:15:54,810 --> 00:15:53,380
because of the hard work that the

424
00:15:56,010 --> 00:15:54,820
engineers and the technicians down to

425
00:15:59,310 --> 00:15:56,020
the Cape are putting in on this

426
00:16:01,260 --> 00:15:59,320
unprecedented and record-setting a turn

427
00:16:03,030 --> 00:16:01,270
of the vehicle in the payload what we

428
00:16:04,260 --> 00:16:03,040
have next are a series of slides of some

429
00:16:06,270 --> 00:16:04,270
of the more interesting earth

430
00:16:08,040 --> 00:16:06,280
observation sites that we that we were

431
00:16:10,560 --> 00:16:08,050
privileged to have the opportunity to

432
00:16:15,210 --> 00:16:10,570
look down on from about 160 nautical

433
00:16:17,190 --> 00:16:15,220
miles this is Long Island the northern

434
00:16:18,990 --> 00:16:17,200
half of Long Island in the Bahamas and

435
00:16:20,880 --> 00:16:19,000
we didn't have a whole lot of time to

436
00:16:22,590 --> 00:16:20,890
look out the window but when I met when

437
00:16:24,360 --> 00:16:22,600
I could I would look down particularly

438
00:16:26,430 --> 00:16:24,370

the Bahamas which to me is the prettiest

439
00:16:27,900 --> 00:16:26,440
place in the world here you see the

440
00:16:30,720 --> 00:16:27,910
tongue of the ocean on the right hand

441
00:16:33,360 --> 00:16:30,730
side with a where the the Shelf drops

442
00:16:35,550 --> 00:16:33,370
off from about 60 feet down to 6,000

443
00:16:37,290 --> 00:16:35,560
feet and the picture doesn't really do

444
00:16:39,000 --> 00:16:37,300
it justice I remember when I was in

445
00:16:41,550 --> 00:16:39,010
space looking at the window and just

446
00:16:45,420 --> 00:16:41,560
really awestruck at the beauty there in

447
00:16:46,800 --> 00:16:45,430
thinking that the only the second place

448
00:16:48,630 --> 00:16:46,810
in the world I'd want to be is there the

449
00:16:50,790 --> 00:16:48,640
Bahamas the first place was was on the

450
00:16:53,220 --> 00:16:50,800
spaceship at the time and fortunately

451
00:16:55,560 --> 00:16:53,230
for us we we landed we debriefed for a

452
00:16:57,540 --> 00:16:55,570
few days and got two weeks off so I went

453
00:16:59,760 --> 00:16:57,550
straight down there and actually did

454
00:17:01,950 --> 00:16:59,770
some dive in it at this location and it

455
00:17:04,170 --> 00:17:01,960
was really special to to go underwater

456
00:17:06,180 --> 00:17:04,180
and see that environment and have in

457
00:17:12,750 --> 00:17:06,190
your mind the same image of that place

458
00:17:15,420 --> 00:17:12,760
from space is very very awesome this is

459
00:17:17,670 --> 00:17:15,430
the Nile River in Egypt and as you pass

460
00:17:19,340 --> 00:17:17,680
over Egypt and you see the brown deserts

461
00:17:21,720 --> 00:17:19,350
below you the two things that stand out

462
00:17:23,730 --> 00:17:21,730
one of them is the bend in the Nile

463
00:17:25,350 --> 00:17:23,740

River here at Luxor and what you're

464
00:17:27,780 --> 00:17:25,360
looking at is the Nile River and either

465
00:17:29,370 --> 00:17:27,790
side of the river itself you can see the

466
00:17:31,110 --> 00:17:29,380
green agricultural areas where the

467
00:17:33,180 --> 00:17:31,120
growing crops all along the Nile and

468
00:17:35,430 --> 00:17:33,190
this is where the Valley of the Kings is

469
00:17:36,990 --> 00:17:35,440
where they found the King Tutankhamun

470
00:17:40,389 --> 00:17:37,000
and there's still you know discovering

471
00:17:43,009 --> 00:17:40,399
new tombs there today next

472
00:17:44,570 --> 00:17:43,019
another spectacular area on the Nile

473
00:17:47,659 --> 00:17:44,580
River is little further down is the

474
00:17:49,700 --> 00:17:47,669
Aswan Dam and Lake Nasser here the dam

475
00:17:51,560 --> 00:17:49,710
is just near the top center of the

476
00:17:54,200 --> 00:17:51,570
picture you can see it barely there a

477
00:17:56,210 --> 00:17:54,210
little great structure crossing the Nile

478
00:17:59,180 --> 00:17:56,220
the water levels were at near record

479
00:18:01,159 --> 00:17:59,190
level here when we flew over the denial

480
00:18:03,440 --> 00:18:01,169
in Lake Nasser that was due to heavy

481
00:18:04,960 --> 00:18:03,450
rains that they've been having in Kenya

482
00:18:11,389 --> 00:18:04,970
over near the headwaters of the Nile

483
00:18:16,129 --> 00:18:11,399
since December of last year this is the

484
00:18:17,960 --> 00:18:16,139
Indus River and Pakistan and well what

485
00:18:22,220 --> 00:18:17,970
the scientists on the ground like to see

486
00:18:25,879 --> 00:18:22,230
from photos like this is the level of

487
00:18:28,159 --> 00:18:25,889
water in the rivers and the agricultural

488
00:18:30,109 --> 00:18:28,169

the amount of area the agriculture

489
00:18:32,840 --> 00:18:30,119
extends from the river boundaries and

490
00:18:40,789 --> 00:18:32,850
the build-up of the cities surrounding

491
00:18:42,590 --> 00:18:40,799
the river this is the Mayan volcano in

492
00:18:44,690 --> 00:18:42,600
the Philippines it's the most active

493
00:18:48,310 --> 00:18:44,700
volcano in the Philippines you can see

494
00:18:51,799 --> 00:18:48,320
the smoke still coming out the top it's

495
00:18:54,980 --> 00:18:51,809
erupted 47 times since the early 1600s

496
00:18:57,109 --> 00:18:54,990
the most impressive part about this

497
00:18:59,720 --> 00:18:57,119
picture is that we were able to take it

498
00:19:07,440 --> 00:18:59,730
because typically there's cloud coverage

499
00:19:13,480 --> 00:19:11,049
they're reminding me that this is this

500
00:19:15,909 --> 00:19:13,490
is the great gray whale breeding ground

501
00:19:16,779 --> 00:19:15,919
located on the west coast of Baja now

502
00:19:18,250 --> 00:19:16,789
I'm not going to tell you that we can

503
00:19:20,649 --> 00:19:18,260
count whales from space at least these

504
00:19:23,830 --> 00:19:20,659
40 year old guys can't but what we can

505
00:19:25,539 --> 00:19:23,840
do is is get the big picture that is

506
00:19:29,620 --> 00:19:25,549
what are the plankton blooms like what

507
00:19:31,029 --> 00:19:29,630
are the the other large-scale current

508
00:19:32,500 --> 00:19:31,039
changes that might be affecting the gray

509
00:19:34,240 --> 00:19:32,510
whales as they migrate down from the

510
00:19:36,549 --> 00:19:34,250
Bering Sea down the coast of North

511
00:19:40,680 --> 00:19:36,559
America to this area where they feed and

512
00:19:42,850 --> 00:19:40,690
breed to begin the cycle for a new year

513
00:19:45,279 --> 00:19:42,860

one thing that I always find fascinating

514
00:19:47,440 --> 00:19:45,289
is how you look at something from space

515
00:19:48,460 --> 00:19:47,450
and remind you of some small thing but

516
00:19:50,710 --> 00:19:48,470
you're seeing it on a much more

517
00:19:52,779 --> 00:19:50,720
tremendous scale I see a picture like

518
00:19:53,980 --> 00:19:52,789
this and I think of a pebble in a stream

519
00:19:55,810 --> 00:19:53,990
this is what it looks like to me but

520
00:19:58,330 --> 00:19:55,820
what you're seeing is the peak of

521
00:20:00,370 --> 00:19:58,340
Guadalupe Island interacting with the

522
00:20:02,860 --> 00:20:00,380
atmosphere to create this wake on the

523
00:20:04,810 --> 00:20:02,870
leeward side of the island I think it's

524
00:20:06,100 --> 00:20:04,820
fascinating just to watch the how these

525
00:20:07,659 --> 00:20:06,110
things develop and how summer they

526
00:20:09,760 --> 00:20:07,669
looked as something as small as a pebble

527
00:20:11,620 --> 00:20:09,770
in water but the scientists can actually

528
00:20:13,690 --> 00:20:11,630
tell a lot about the environment around

529
00:20:15,669 --> 00:20:13,700
this island from an analysing picture

530
00:20:17,799 --> 00:20:15,679
like this for example because the wake

531
00:20:19,720 --> 00:20:17,809
downstream of the island is a solid

532
00:20:22,510 --> 00:20:19,730
cloud bank they can tell that the winds

533
00:20:23,889 --> 00:20:22,520
at this time were less than 5 m/s had

534
00:20:25,690 --> 00:20:23,899
the winds been higher you would see

535
00:20:28,930 --> 00:20:25,700
turbulent wakes like you see behind an

536
00:20:30,370 --> 00:20:28,940
airplane when the air is kind of humid

537
00:20:32,380 --> 00:20:30,380
and you'll see you can actually see the

538
00:20:34,630 --> 00:20:32,390

wakes forming off the wings and you'll

539
00:20:36,220 --> 00:20:34,640
see that air the cloud patterns disturb

540
00:20:38,289 --> 00:20:36,230
behind there with von Karman vortices

541
00:20:39,610 --> 00:20:38,299
forming since there are no vortices here

542
00:20:41,169 --> 00:20:39,620
they can tell it this time of year and

543
00:20:45,789 --> 00:20:41,179
these are other conditions the wind

544
00:20:47,590 --> 00:20:45,799
speeds are fairly low we were fortunate

545
00:20:49,690 --> 00:20:47,600
enough especially myself who was the

546
00:20:51,730 --> 00:20:49,700
first time flier to have Jim Hall sail

547
00:20:53,080 --> 00:20:51,740
constantly telling us when things were

548
00:20:56,289 --> 00:20:53,090
happening that we had to be sure not to

549
00:20:57,399 --> 00:20:56,299
mesh yes and Roger and I and the other

550
00:20:59,080 --> 00:20:57,409
crew members were spending a lot of time

551
00:21:00,850 --> 00:20:59,090
back in the laboratory but Jim finally

552
00:21:03,460 --> 00:21:00,860
said to me Greg come on up to the flight

553
00:21:04,990 --> 00:21:03,470
lab to the flight deck because you have

554
00:21:08,169 --> 00:21:05,000
to see at least one of these before we

555
00:21:10,060 --> 00:21:08,179
can go home and so I came up and and

556
00:21:13,060 --> 00:21:10,070
this is what I saw it was a sunset and

557
00:21:15,700 --> 00:21:13,070
the difference to me was that you see

558
00:21:19,090 --> 00:21:15,710
this very very deep and gorgeous red at

559
00:21:23,080 --> 00:21:19,100
the same time as a very very bright

560
00:21:24,310 --> 00:21:23,090
a neon blue during the sunset and for me

561
00:21:26,230 --> 00:21:24,320
it was very very spectacular and

562
00:21:30,390 --> 00:21:26,240
beautiful the slide is good but it was

563
00:21:36,549 --> 00:21:35,380

sometimes you go in and add a sunset

564
00:21:38,260 --> 00:21:36,559
you're able to see a little bit of

565
00:21:40,630 --> 00:21:38,270
three-dimensional structure and here you

566
00:21:42,190 --> 00:21:40,640
see the class Janice says the cloud

567
00:21:44,830 --> 00:21:42,200
formations and the changing cloud

568
00:21:46,570 --> 00:21:44,840
formations are always very dynamic and

569
00:21:49,210 --> 00:21:46,580
interesting here you see a cloud cover

570
00:21:52,570 --> 00:21:49,220
coming out of that cloud cover is a huge

571
00:21:54,399 --> 00:21:52,580
thunder sail that's just bulging up and

572
00:21:56,169 --> 00:21:54,409
in the sunset the glinting off of that