



1  
00:00:52,290 --> 00:00:50,370  
the countdown has been going smoothly

2  
00:00:55,229 --> 00:00:52,300  
overnight we have not been working any

3  
00:01:01,440 --> 00:00:55,239  
technical issues since the tanking began

4  
00:01:04,229 --> 00:01:01,450  
at 11:09 last night loading the Space

5  
00:01:06,000 --> 00:01:04,239  
Shuttle external tank with the 525

6  
00:01:09,030 --> 00:01:06,010  
thousand gallons of liquid hydrogen and

7  
00:01:12,420 --> 00:01:09,040  
liquid oxygen was concluded that 205

8  
00:01:17,370 --> 00:01:15,420  
once again all our countdown events are

9  
00:01:20,580 --> 00:01:17,380  
proceeding normally leading to an

10  
00:01:22,230 --> 00:01:20,590  
opening of a launch window in 806 we're

11  
00:01:25,140 --> 00:01:22,240  
cautiously optimistic about the weather

12  
00:01:27,750 --> 00:01:25,150  
we're now at the astronaut quarters and

13  
00:01:30,300 --> 00:01:27,760

the operations and check-out building at

14

00:01:34,850 --> 00:01:30,310

the Kennedy Space Center where the STS

15

00:01:37,470 --> 00:01:34,860

59 cake is in the center of the table

16

00:01:41,400 --> 00:01:37,480

mission specialists - Linda Godwin down

17

00:01:47,460 --> 00:01:41,410

at the end of the table and sitting next

18

00:01:49,389 --> 00:01:47,470

to her mission specialist J apt Linda

19

00:01:52,010 --> 00:01:49,399

Godwin and

20

00:01:55,880 --> 00:01:52,020

J apt working on the space radar

21

00:02:00,139 --> 00:01:55,890

laboratory during the flight and the

22

00:02:02,480 --> 00:02:00,149

next two J apt is mission specialist Tom

23

00:02:06,319 --> 00:02:02,490

Jones who will also be flying on the

24

00:02:07,940 --> 00:02:06,329

space shuttle once again in August on

25

00:02:08,419 --> 00:02:07,950

the next space Mars radar laboratory

26

00:02:14,720 --> 00:02:08,429

mission

27

00:02:17,869 --> 00:02:14,730

srl - again on endeavour our pilot Kevin

28

00:02:21,500 --> 00:02:17,879

Chilton and sitting next to him is our

29

00:02:23,150 --> 00:02:21,510

commander Sid guitarist and then on the

30

00:02:27,589 --> 00:02:23,160

far end is mission specialist rich

31

00:02:31,479 --> 00:02:27,599

Clifford this is shuttle launch control

32

00:02:36,020 --> 00:02:31,489

at t-minus 3 hours and Counting

33

00:02:39,199 --> 00:02:36,030

countdown has picked up once again for

34

00:02:42,140 --> 00:02:39,209

the launch of STS 59 and endeavour and

35

00:02:45,800 --> 00:02:42,150

all of our activities are on schedule

36

00:02:49,640 --> 00:02:45,810

this morning cautiously optimistic about

37

00:02:52,069 --> 00:02:49,650

the weather the broken layer at the

38

00:02:54,830 --> 00:02:52,079

Shuttle Landing Facility is expected to

39

00:02:58,699 --> 00:02:54,840

go scattered sometime after sunrise so

40

00:03:01,009 --> 00:02:58,709

we're still love hopeful that if the

41

00:03:02,449 --> 00:03:01,019

wind does not become any stronger than

42

00:03:07,650 --> 00:03:02,459

it is currently that we will have a

43

00:03:12,720 --> 00:03:10,500

among the tools that the ice team is

44

00:03:15,990 --> 00:03:12,730

using is the portable infrared scanner

45

00:03:18,000 --> 00:03:16,000

that's the most important device which

46

00:03:20,400 --> 00:03:18,010

obtains temperature measurements on the

47

00:03:23,730 --> 00:03:20,410

surface of the vehicle and it can also

48

00:03:26,810 --> 00:03:23,740

spot any leaks and they're looking for

49

00:03:29,160 --> 00:03:26,820

any ice which could be on the tank or

50

00:03:30,870 --> 00:03:29,170

other areas of the fixed service

51  
00:03:42,789 --> 00:03:30,880  
structure which could at launch could

52  
00:03:48,130 --> 00:03:45,020  
this is shuttle launch control at

53  
00:03:53,000 --> 00:03:48,140  
t-minus three hours and holding our

54  
00:04:02,160 --> 00:03:53,010  
commander sigit IRA's outfitted there

55  
00:04:02,170 --> 00:04:12,730  
and final the check of the helmet

56  
00:04:12,740 --> 00:04:18,600  
and our pilot kevin chilton

57  
00:04:18,610 --> 00:04:25,689  
flew previously on the sts-49 mission

58  
00:04:25,699 --> 00:04:56,770  
he's ready to go this morning

59  
00:05:15,600 --> 00:04:59,590  
and there's our payload commander Linda

60  
00:05:35,110 --> 00:05:31,210  
and mission specialist rich Clifford Tom

61  
00:05:47,519 --> 00:05:35,120  
Jones mission specialists will be flying

62  
00:05:55,820 --> 00:05:51,449  
astronaut Dave Lisa they're talking with

63  
00:06:00,480 --> 00:05:58,140

this is shuttle launch control at

64

00:06:04,170 --> 00:06:00,490

t-minus two hours 51 minutes and

65

00:06:06,950 --> 00:06:04,180

Counting our commander Sid gair is

66

00:06:15,100 --> 00:06:06,960

followed by mission specialist Tom Jones

67

00:06:20,230 --> 00:06:18,790

Dave Lisa moth and hoot Gibson also

68

00:06:21,640 --> 00:06:20,240

riding down the elevator he'll be flying

69

00:06:24,070 --> 00:06:21,650

the shuttle training aircraft this

70

00:06:30,999 --> 00:06:24,080

morning and the t-38 for weather

71

00:06:59,740 --> 00:06:31,009

reconnaissance Mike Stevens from NASA

72

00:07:05,960 --> 00:07:02,260

and away they go

73

00:07:12,340 --> 00:07:05,970

quite pleasant out of dad this morning

74

00:07:14,440 --> 00:07:12,350

temperatures 72 degrees winds out of the

75

00:07:45,150 --> 00:07:14,450

east-southeast

76  
00:07:51,730 --> 00:07:48,520  
aboard endeavour helping the crew again

77  
00:07:57,000 --> 00:07:51,740  
today as astronaut Andy Thomas has been

78  
00:08:00,520 --> 00:07:57,010  
in the crew compartment configuring the

79  
00:08:02,080 --> 00:08:00,530  
switches making any changes necessary to

80  
00:08:31,630 --> 00:08:02,090  
the compartment and will be assisting

81  
00:08:37,130 --> 00:08:35,360  
ETL your step eight points for step

82  
00:08:40,839 --> 00:08:37,140  
eight twenty eight and seven friends is

83  
00:08:46,790 --> 00:08:40,849  
reading one for 0.85

84  
00:08:49,130 --> 00:08:46,800  
copy that step 8 26 through 832 and CDR

85  
00:08:58,070 --> 00:08:49,140  
you can go ahead and reconsider VSS

86  
00:09:08,660 --> 00:08:58,080  
memory and video please go to clues

87  
00:09:10,250 --> 00:09:08,670  
tabatha sent down this is MPD taken

88  
00:09:11,780 --> 00:09:10,260

along to that of six a go/no-go for

89

00:09:16,040 --> 00:09:11,790

launch so do you think go

90

00:09:18,829 --> 00:09:16,050

ABC PPC CTC go stop here

91

00:09:20,870 --> 00:09:18,839

I'll help you to go do some Pike go

92

00:09:28,810 --> 00:09:20,880

mouse go

93

00:09:43,310 --> 00:09:33,980

SP entity go ahead a pity that's gonna

94

00:09:45,380 --> 00:09:43,320

go pelagic scope CDR LOD LOD ago no Carl

95

00:09:46,190 --> 00:09:45,390

that's alright let's go the other wing

96

00:09:50,480 --> 00:09:46,200

clear to launch

97

00:10:03,199 --> 00:09:50,490

copy at Devereaux PC close and lock your

98

00:10:04,370 --> 00:10:03,209

visors that o2 flow - 45 seconds

99

00:10:06,710 --> 00:10:04,380

standing by for the handoff to

100

00:10:19,290 --> 00:10:06,720

endeavours onboard computers in about 10

101  
00:10:19,300 --> 00:10:31,970  
Debra's computer is now controlling

102  
00:10:42,030 --> 00:10:34,169  
sound suppression water system being

103  
00:10:48,269 --> 00:10:42,040  
activated seven six main engine start

104  
00:10:51,059 --> 00:10:48,279  
five four three two one zero and liftoff

105  
00:11:08,040 --> 00:10:51,069  
of the space shuttle Endeavour observing

106  
00:11:13,930 --> 00:11:10,780  
Debra already traveling about 300 laws

107  
00:11:15,760 --> 00:11:13,940  
now on a course that will have it the

108  
00:11:17,560 --> 00:11:15,770  
northeast side of the Atlantic Ocean

109  
00:11:24,860 --> 00:11:17,570  
parallel to the eastern seaboard the

110  
00:11:30,600 --> 00:11:27,660  
Dever speed now one thousand miles an

111  
00:11:39,360 --> 00:11:30,610  
hour I'm miles downrange never go at

112  
00:11:43,950 --> 00:11:39,370  
throttle up altitude nine miles three

113  
00:11:45,180 --> 00:11:43,960

engines now back at full throttle one

114

00:11:47,040 --> 00:11:45,190  
and a half minutes since launch

115

00:11:48,690 --> 00:11:47,050  
endeavours already burned more than two

116

00:11:50,130 --> 00:11:48,700  
and a quarter million pounds propellant

117

00:12:00,770 --> 00:11:50,140  
and weighs less than half of what it did

118

00:12:04,020 --> 00:12:00,780  
it lifts off altitude now 15 miles speed

119

00:12:06,180 --> 00:12:04,030  
2,100 miles an hour 15 miles east of the

120

00:12:07,770 --> 00:12:06,190  
launch pad Fat Controller standing by

121

00:12:28,650 --> 00:12:07,780  
for burnout and jettison of the twin

122

00:12:36,930 --> 00:12:30,090  
good solid rocket booster separation

123

00:12:40,640 --> 00:12:36,940  
confirmed Deborah now 33 miles northeast

124

00:12:43,710 --> 00:12:40,650  
to the launch pad altitude 30 miles

125

00:13:13,630 --> 00:12:43,720  
speed 2700 miles now and ever

126

00:13:13,640 --> 00:13:24,970

p0 f OB ignition liftoff confirmed copy

127

00:14:02,000 --> 00:13:31,850

Roger roll endeavour like I didn't see

128

00:14:17,780 --> 00:14:05,280

thought aloud Street at 1:04 and never

129

00:14:22,979 --> 00:14:20,249

endeavour Houston we see at nominal Miko

130

00:14:39,720 --> 00:14:22,989

homes one not required you have a go for

131

00:14:42,960 --> 00:14:39,730

the et photo DTO by Capcom I'd like to

132

00:14:44,879 --> 00:14:42,970

get the LS and LS times for Diego worked

133

00:14:48,419 --> 00:14:44,889

up to add to the spiel I'll give them

134

00:15:10,740 --> 00:14:48,429

four I OS and AOS from the east and the

135

00:15:23,629 --> 00:15:13,559

and taco stand by one on the north of

136

00:15:23,639 --> 00:18:28,600

all right you were checking licensing

137

00:18:28,610 --> 00:20:08,349

plastic best

138

00:20:08,359 --> 00:20:36,620

officials are great

139

00:20:45,500 --> 00:20:43,259

and we've got a good picture rich ok so

140

00:20:48,000 --> 00:20:45,510

what you're seeing is some live cells

141

00:20:51,090 --> 00:20:48,010

growing in the space station los be

142

00:20:54,480 --> 00:20:51,100

experiment s ft-lb along with its

143

00:20:56,130 --> 00:20:54,490

companion st la or growing live cells in

144

00:20:57,600 --> 00:20:56,140

the microgravity environment to evaluate

145

00:21:00,299 --> 00:20:57,610

the effects of microgravity on the

146

00:21:02,519 --> 00:21:00,309

growth process you know the novelty of

147

00:21:04,409 --> 00:21:02,529

ft-lb is it's making its baton flight to

148

00:21:06,000 --> 00:21:04,419

check out a new video microscope system

149

00:21:07,769 --> 00:21:06,010

which is going to allow real-time

150

00:21:10,080 --> 00:21:07,779

monitoring of cell growth process in

151  
00:21:12,840 --> 00:21:10,090  
microgravity to check out the system

152  
00:21:14,340 --> 00:21:12,850  
fish eggs are being used to watch the

153  
00:21:16,409 --> 00:21:14,350  
development of the embryo during early

154  
00:21:17,909 --> 00:21:16,419  
division stages this is going to

155  
00:21:20,399 --> 00:21:17,919  
evaluate a changes in gravitational

156  
00:21:22,919 --> 00:21:20,409  
force have an effect on cell movement in

157  
00:21:24,750 --> 00:21:22,929  
three dimensions experiments like this

158  
00:21:26,669 --> 00:21:24,760  
should provide unique insights on the

159  
00:21:28,680 --> 00:21:26,679  
effects of physical forces on cell

160  
00:21:30,149 --> 00:21:28,690  
movement and may provide clues to the

161  
00:21:35,930 --> 00:21:30,159  
understanding of how wounds and organs

162  
00:21:41,310 --> 00:21:39,149  
with jealous commander of this SRL

163  
00:21:43,590 --> 00:21:41,320

mission and this morning I'm going to

164

00:21:45,870 --> 00:21:43,600

try to do my most difficult task of the

165

00:21:48,690 --> 00:21:45,880

entire mission and that is to attempt to

166

00:21:51,830 --> 00:21:48,700

explain \$0.00 steering so in the course

167

00:21:55,409 --> 00:21:51,840

of this mission we've been initiating

168

00:21:59,730 --> 00:21:55,419

proximately 460 maneuvers in fact this

169

00:22:01,710 --> 00:21:59,740

morning we just initiated the behind two

170

00:22:04,080 --> 00:22:01,720

hundred and sixty second of over four

171

00:22:06,090 --> 00:22:04,090

hundred and sixty maneuvers by the time

172

00:22:08,039 --> 00:22:06,100

we finished this flight we will have an

173

00:22:10,409 --> 00:22:08,049

issue it in war maneuvers than any other

174

00:22:12,690 --> 00:22:10,419

shuttle mission these servers are very

175

00:22:16,620 --> 00:22:12,700

important because they help us point our

176  
00:22:18,720 --> 00:22:16,630  
radar in a very special way in our

177  
00:22:23,159 --> 00:22:18,730  
normal attitude we fly around the earth

178  
00:22:26,129 --> 00:22:23,169  
with either our nose forward or our tail

179  
00:22:29,820 --> 00:22:26,139  
forward with the payload Bay radar

180  
00:22:32,730 --> 00:22:29,830  
pointed at selected sites they surveyed

181  
00:22:35,039 --> 00:22:32,740  
our image by sending a radar signal

182  
00:22:37,860 --> 00:22:35,049  
which is bounced off the earth and

183  
00:22:41,700 --> 00:22:37,870  
returned to an antenna in the payload

184  
00:22:44,310 --> 00:22:41,710  
Bay scientists used very powerful

185  
00:22:47,190 --> 00:22:44,320  
computers and very complex software to

186  
00:22:49,410 --> 00:22:47,200  
process this radar data in a very

187  
00:22:52,290 --> 00:22:49,420  
special way to produce but we

188  
00:22:54,990 --> 00:22:52,300

a synthetic aperture radar image in fact

189

00:22:57,630 --> 00:22:55,000

just this morning they transmitted up to

190

00:23:00,930 --> 00:22:57,640

us on our tips machine a picture of a

191

00:23:05,130 --> 00:23:00,940

radar image that was taken of the

192

00:23:10,700 --> 00:23:05,140

Galapagos Islands was taken to the

193

00:23:17,010 --> 00:23:14,220

probably hard to see this on the on the

194

00:23:25,440 --> 00:23:17,020

television image but this was created

195

00:23:31,230 --> 00:23:25,450

with the radar image this very complex

196

00:23:33,570 --> 00:23:31,240

processing assumes that the orbiter is

197

00:23:36,600 --> 00:23:33,580

parallel to its ground track as it

198

00:23:38,640 --> 00:23:36,610

travels around the earth sue sees it

199

00:23:40,980 --> 00:23:38,650

burn earth that does not rotate an earth

200

00:23:43,440 --> 00:23:40,990

that's perfectly still this is probably

201  
00:23:46,350 --> 00:23:43,450  
true but we all know that our earth

202  
00:23:49,110 --> 00:23:46,360  
rotates so as the orbiter goes around

203  
00:23:50,820 --> 00:23:49,120  
the earth and the earth rotates that

204  
00:23:53,820 --> 00:23:50,830  
means that our ground track in the

205  
00:23:55,590 --> 00:23:53,830  
orbiter are not perfectly aligned and

206  
00:23:59,220 --> 00:23:55,600  
I've exaggerated this a little bit for

207  
00:24:01,980 --> 00:23:59,230  
demonstration purposes we can make them

208  
00:24:04,140 --> 00:24:01,990  
aligned by constantly maneuvering at

209  
00:24:06,870 --> 00:24:04,150  
just a fraction of a degree per minute

210  
00:24:09,720 --> 00:24:06,880  
so that as we fly around the earth and

211  
00:24:12,360 --> 00:24:09,730  
as the Earth rotates underneath us our

212  
00:24:15,270 --> 00:24:12,370  
orbiter is always aligned with the

213  
00:24:17,340 --> 00:24:15,280

ground track that we trace across the

214

00:24:20,490 --> 00:24:17,350

ground which is what is really important

215

00:24:23,040 --> 00:24:20,500

for the radar we call this zero Doppler

216

00:24:24,990 --> 00:24:23,050

steering and this is one of their types

217

00:24:26,960 --> 00:24:25,000

of consumables that sometimes can limit

218

00:24:30,090 --> 00:24:26,970

flight duration we of course have plenty

219

00:24:32,660 --> 00:24:30,100

stowed for our mission and that are very

220

00:24:36,150 --> 00:24:32,670

large stutters it shouldn't that our

221

00:24:38,100 --> 00:24:36,160

side so protecting firmly that we have

222

00:24:42,990 --> 00:24:38,110

to remove before we put it down into the

223

00:24:45,990 --> 00:24:43,000

air purification system this is the

224

00:24:47,580 --> 00:24:46,000

earth at the end of each of our shifts

225

00:24:49,440 --> 00:24:47,590

the red shift and a blue shift so we

226

00:24:59,460 --> 00:24:49,450

swap out that sometimes one and

227

00:25:05,650 --> 00:25:02,470

this is removed very carefully a save

228

00:25:07,840 --> 00:25:05,660

via the tape repealing ours and the

229

00:25:10,810 --> 00:25:07,850

coumarine and we put they used hands

230

00:25:12,790 --> 00:25:10,820

back in that and still them back in the

231

00:25:14,080 --> 00:25:12,800

same area and sometimes we know that we

232

00:25:15,910 --> 00:25:14,090

can come back and get some of those at

233

00:28:29,960 --> 00:25:15,920

again after some reason we need some

234

00:28:34,550 --> 00:28:32,420

hi from sick Gutierrez commander the

235

00:28:36,830 --> 00:28:34,560

Space Shuttle Endeavor this message was

236

00:28:39,050 --> 00:28:36,840

recorded in April as we were orbiting

237

00:28:41,870 --> 00:28:39,060

the planet studying the surface of the

238

00:28:43,670 --> 00:28:41,880

earth and the atmosphere above it as we

239

00:28:46,250 --> 00:28:43,680

image the surface of the earth with our

240

00:28:48,380 --> 00:28:46,260

radar and visual photography we've

241

00:28:50,900 --> 00:28:48,390

noticed certain rectangular patterns all

242

00:28:52,970 --> 00:28:50,910

over the world more and more of these

243

00:28:56,420 --> 00:28:52,980

patterns are appearing in the United

244

00:28:59,270 --> 00:28:56,430

States on closer examination we realized

245

00:29:01,250 --> 00:28:59,280

that these are soccer fields more people

246

00:29:04,190 --> 00:29:01,260

are playing soccer than any other sport

247

00:29:06,230 --> 00:29:04,200

and for the first time in history the

248

00:29:09,800 --> 00:29:06,240

World Cup is being held in the United

249

00:29:11,740 --> 00:29:09,810

States so from way up here to all the

250

00:29:16,130 --> 00:29:11,750

participating countries back on earth

251  
00:29:53,690 --> 00:29:16,140  
welcome to world cup good luck but watch

252  
00:30:03,720 --> 00:30:02,280  
this is in five are you know it's

253  
00:30:07,560 --> 00:30:03,730  
exciting and all to be up here in the

254  
00:30:07,570 --> 00:30:25,850  
the thing that really makes you feel

255  
00:30:31,200 --> 00:30:29,460  
happiest ever for those watching Sid

256  
00:30:34,050 --> 00:30:31,210  
he's talking to the Boy Scouts of

257  
00:30:36,170 --> 00:30:34,060  
America down in Richardson Texas at this

258  
00:30:38,760 --> 00:30:36,180  
time on our shuttle amateur radio

259  
00:30:41,820 --> 00:30:38,770  
experiment basically a ham radio and

260  
00:31:24,550 --> 00:30:41,830  
answering questions that the scouts have

261  
00:32:33,470 --> 00:31:26,320  
and just all the stores it's being

262  
00:32:39,330 --> 00:32:35,820  
good morning to everyone and back there

263  
00:32:40,860 --> 00:32:39,340

on the central time zone I'm Tom Jones a

264

00:32:43,290 --> 00:32:40,870

mission specialist aboard the space

265

00:32:46,230 --> 00:32:43,300

shuttle Endeavour we're now over the

266

00:32:48,210 --> 00:32:46,240

South Pacific Ocean just southeast of

267

00:32:49,980 --> 00:32:48,220

New Zealand I want to take a few minutes

268

00:32:53,730 --> 00:32:49,990

out of our busy schedule up here of

269

00:32:55,890 --> 00:32:53,740

maneuvers and science operations to tell

270

00:32:57,420 --> 00:32:55,900

you about our studies of global change

271

00:33:00,300 --> 00:32:57,430

on this mission this mission of the

272

00:33:02,850 --> 00:33:00,310

space radar lab aboard STS 59 on

273

00:33:04,800 --> 00:33:02,860

endeavour is part of NASA's mission to

274

00:33:07,380 --> 00:33:04,810

Planet Earth which is a comprehensive

275

00:33:09,330 --> 00:33:07,390

program using the Space Shuttle and

276

00:33:12,300 --> 00:33:09,340

unmanned satellites to study the earth

277

00:33:13,740 --> 00:33:12,310

as the next century began to understand

278

00:33:16,230 --> 00:33:13,750

the changes that are going on both

279

00:33:18,900 --> 00:33:16,240

natural and man-made now I'd like to

280

00:33:20,280 --> 00:33:18,910

tell you about our experiences here for

281

00:33:22,890 --> 00:33:20,290

the first four days of the flight we've

282

00:33:25,050 --> 00:33:22,900

been seeing traces of both man-made and

283

00:33:26,400 --> 00:33:25,060

natural change spring is coming to the

284

00:33:29,940 --> 00:33:26,410

northern hemisphere we can see the snow

285

00:33:33,480 --> 00:33:29,950

line retreating across Asia and we're

286

00:33:36,090 --> 00:33:33,490

seeing vegetation patterns land-use

287

00:33:39,060 --> 00:33:36,100

changes natural changes caused by

288

00:33:40,770 --> 00:33:39,070

weather and geology like volcanoes and

289

00:33:42,180 --> 00:33:40,780

earthquakes but looking for all those

290

00:33:44,130 --> 00:33:42,190

kinds of phenomena I'd like to tell you

291

00:33:45,810 --> 00:33:44,140

about why we're able to study global

292

00:33:46,260 --> 00:33:45,820

change from the space shuttle on this

293

00:33:48,060 --> 00:33:46,270

flight

294

00:33:50,490 --> 00:33:48,070

first of all I want to mention our

295

00:33:52,860 --> 00:33:50,500

vantage point up here in orbit above the

296

00:33:54,750 --> 00:33:52,870

earth what the space radar lab out in

297

00:33:56,250 --> 00:33:54,760

the payload Bay is looking for and then

298

00:33:57,780 --> 00:33:56,260

give you some examples of the kinds of

299

00:34:00,330 --> 00:33:57,790

change that we're hoping to study on the

300

00:34:02,460 --> 00:34:00,340

flight our vantage point here aboard

301  
00:34:05,280 --> 00:34:02,470  
endeavour is very important we're about

302  
00:34:07,530 --> 00:34:05,290  
138 nautical miles above the Earth's

303  
00:34:10,500 --> 00:34:07,540  
surface circling the globe once about

304  
00:34:13,200 --> 00:34:10,510  
every 89 minutes and that elevation that

305  
00:34:15,120 --> 00:34:13,210  
altitude gives us a horizon that's out

306  
00:34:16,290 --> 00:34:15,130  
several hundred miles from wherever we

307  
00:34:18,270 --> 00:34:16,300  
happen to be over the earth and that

308  
00:34:19,860 --> 00:34:18,280  
gives us the broad perspective and the

309  
00:34:21,690 --> 00:34:19,870  
ability for our sensors in the cargo bay

310  
00:34:24,540 --> 00:34:21,700  
to see a long distance and measure

311  
00:34:27,419 --> 00:34:24,550  
change in a reasonably efficient amount

312  
00:34:29,610 --> 00:34:27,429  
of time also because we're in orbit our

313  
00:34:32,250 --> 00:34:29,620

speed is very important circling the

314

00:34:35,040 --> 00:34:32,260

Earth of 17,000 miles an hour we're able

315

00:34:38,040 --> 00:34:35,050

to use our speed to let our radar out in

316

00:34:39,450 --> 00:34:38,050

the cargo bay circe XR create a much

317

00:34:40,950 --> 00:34:39,460

larger electron

318

00:34:42,930 --> 00:34:40,960

antenna than would otherwise be possible

319

00:34:44,700 --> 00:34:42,940

we can see finer detail on the ground

320

00:34:46,440 --> 00:34:44,710

because of our speed across the Earth's

321

00:34:49,710 --> 00:34:46,450

surface that whole technique is called

322

00:34:51,510 --> 00:34:49,720

synthetic aperture radar and also with

323

00:34:52,200 --> 00:34:51,520

our pollution sensor called maps in the

324

00:34:54,270 --> 00:34:52,210

cargo bay

325

00:34:56,790 --> 00:34:54,280

our speed permits us to cover the world

326  
00:34:58,319 --> 00:34:56,800  
as it rotates beneath us and thus we can

327  
00:35:00,960 --> 00:34:58,329  
create in just two or three days a

328  
00:35:03,030 --> 00:35:00,970  
global map of carbon monoxide a tracer

329  
00:35:04,559 --> 00:35:03,040  
gas of pollution or burning on the

330  
00:35:06,960 --> 00:35:04,569  
planet's surface so the vantage point

331  
00:35:08,730 --> 00:35:06,970  
here is very important now what kinds of

332  
00:35:11,880 --> 00:35:08,740  
changes can we see from this vantage

333  
00:35:14,160 --> 00:35:11,890  
point in low-earth orbit our synthetic

334  
00:35:16,770 --> 00:35:14,170  
aperture radar creates images pictures

335  
00:35:18,390 --> 00:35:16,780  
of the ground using microwaves which can

336  
00:35:21,480 --> 00:35:18,400  
be taken during darkness or through

337  
00:35:24,750 --> 00:35:21,490  
clouds the maps carbon monoxide sensor

338  
00:35:26,609 --> 00:35:24,760

creates a map of global pollution it

339

00:35:30,359 --> 00:35:26,619

traces sources of combustion and how

340

00:35:32,640 --> 00:35:30,369

that trace gas Co spreads across the

341

00:35:35,339 --> 00:35:32,650

globe by using those images and that

342

00:35:38,130 --> 00:35:35,349

pollution map we can look at its past

343

00:35:40,680 --> 00:35:38,140

present and its future we can look back

344

00:35:42,210 --> 00:35:40,690

into Earth's past by noting changes in

345

00:35:44,490 --> 00:35:42,220

the geology of the earth that tell us

346

00:35:46,319 --> 00:35:44,500

about the world's past climate we can

347

00:35:48,690 --> 00:35:46,329

look at the present and take a snapshot

348

00:35:52,280 --> 00:35:48,700

a baseline measurement if you will of

349

00:35:55,079 --> 00:35:52,290

the pulse of Earth's forests cities

350

00:35:57,780 --> 00:35:55,089

production of pollution and both

351  
00:35:59,609 --> 00:35:57,790  
hemispheres and we can also measure the

352  
00:36:02,309 --> 00:35:59,619  
ecology the environment and take its

353  
00:36:04,140 --> 00:36:02,319  
present temperature if you will and now

354  
00:36:06,630 --> 00:36:04,150  
we can look into Earth's future by

355  
00:36:09,539 --> 00:36:06,640  
flying the space radar lab twice this

356  
00:36:11,970 --> 00:36:09,549  
year on STS 68 later in the year and

357  
00:36:13,559 --> 00:36:11,980  
later radar of this type that a similar

358  
00:36:15,690 --> 00:36:13,569  
suite of instruments could be orbited on

359  
00:36:17,309 --> 00:36:15,700  
an unmanned platform and by measuring

360  
00:36:19,410 --> 00:36:17,319  
Earth's environment over months and

361  
00:36:22,380 --> 00:36:19,420  
years we can see the trends on our

362  
00:36:27,510 --> 00:36:22,390  
ecosphere that would help us manage the

363  
00:36:30,720 --> 00:36:27,520

planet okay let's see what we did was

364

00:36:34,230 --> 00:36:30,730

earlier today we recorded us doing what

365

00:36:35,670 --> 00:36:34,240

we're here for which is to do a large

366

00:36:38,069 --> 00:36:35,680

number of manoeuvres support the road

367

00:36:40,170 --> 00:36:38,079

are exactly at the targets that the

368

00:36:42,270 --> 00:36:40,180

radar folks are interested in and we

369

00:36:45,030 --> 00:36:42,280

understand from the radar people that

370

00:36:47,730 --> 00:36:45,040

they're getting accuracies that are far

371

00:36:49,440 --> 00:36:47,740

beyond their initial expectations and

372

00:36:50,880 --> 00:36:49,450

the targets are showing up right in the

373

00:36:53,100 --> 00:36:50,890

middle of their radar swath and we will

374

00:36:56,550 --> 00:36:53,110

happy to be able to help

375

00:36:58,290 --> 00:36:56,560

that we are putting in one of the 465

376  
00:36:59,510 --> 00:36:58,300  
maneuvers that the ground has planned

377  
00:37:03,750 --> 00:36:59,520  
for us

378  
00:37:06,720 --> 00:37:03,760  
and it's it's real pleasure to be able

379  
00:37:08,820 --> 00:37:06,730  
to go do that and see the results like

380  
00:37:10,830 --> 00:37:08,830  
the Reta folks have been showing people

381  
00:37:14,520 --> 00:37:10,840  
down there know that we're able to point

382  
00:37:17,520 --> 00:37:14,530  
the orbiter extremely precisely to get

383  
00:37:20,970 --> 00:37:17,530  
very specific targets within range of

384  
00:37:23,610 --> 00:37:20,980  
the radar beams from Nick's from our own

385  
00:37:25,440 --> 00:37:23,620  
equipment out in the payload Bay this is

386  
00:37:28,770 --> 00:37:25,450  
what we've spent most of our time doing

387  
00:37:44,210 --> 00:37:28,780  
and what I think you guys have been

388  
00:37:51,910 --> 00:37:46,960

so we're just now coming up on Chile

389

00:37:55,220 --> 00:37:51,920

after passing across the coastline and

390

00:37:59,329 --> 00:37:55,230

the target area for this observation is

391

00:38:11,250 --> 00:37:59,339

the Andes Mountains central cordiality

392

00:38:18,000 --> 00:38:15,900

dr. Isaacs is mapping the topography and

393

00:38:20,850 --> 00:38:18,010

studying the climate in the central

394

00:38:23,640 --> 00:38:20,860

Andes Mountains he's napping

395

00:38:25,350 --> 00:38:23,650

things such as plate tectonics or the

396

00:38:30,230 --> 00:38:25,360

movement of the Earth's crust in this

397

00:38:40,040 --> 00:38:30,240

area as well as mudslides and other

398

00:38:46,050 --> 00:38:43,290

this is a real-time image seen exactly

399

00:38:55,440 --> 00:38:46,060

as the radar system aboard endeavour

400

00:39:00,960 --> 00:38:55,450

records it and now endeavours radars

401  
00:39:13,529 --> 00:39:00,970  
crossing the coast of Italy this is the

402  
00:39:27,609 --> 00:39:16,319  
the matira italy calibration site is

403  
00:39:34,569 --> 00:39:30,269  
and the wavy lines and the image are the

404  
00:39:54,029 --> 00:39:34,579  
former Yugoslavian territory Eastern

405  
00:39:56,920 --> 00:39:54,039  
Europe you can see the Cuban antennae

406  
00:40:00,069 --> 00:39:56,930  
lit up there and that's how a lot of the

407  
00:40:05,200 --> 00:40:00,079  
data that you're super real-time down on

408  
00:40:09,420 --> 00:40:05,210  
earth gets down there so near over okay

409  
00:40:24,849 --> 00:40:12,969  
okay where today great we're all

410  
00:40:28,319 --> 00:40:24,859  
listening just ahead of us and the CIO

411  
00:40:31,089 --> 00:40:28,329  
Chili's that tried to shoot right now

412  
00:40:33,549 --> 00:40:31,099  
okay we're seeing the XR come down and

413  
00:40:44,920 --> 00:40:33,559

see the ice looking as large flows that

414

00:40:48,630 --> 00:40:44,930

are breaking up we see those right now

415

00:40:52,420 --> 00:40:48,640

the leads are showing up quite clearly

416

00:40:56,759 --> 00:40:52,430

we have a video that will show you next

417

00:41:00,009 --> 00:40:56,769

which is a view of the earth along the

418

00:41:01,690 --> 00:41:00,019

across Canada and you'll see both the

419

00:41:04,900 --> 00:41:01,700

earth as viewed by the astronauts

420

00:41:08,499 --> 00:41:04,910

through a video downlink and the earth

421

00:41:10,539 --> 00:41:08,509

as viewed by the radar and this is

422

00:41:14,349 --> 00:41:10,549

coming across the screen now you see the

423

00:41:16,509 --> 00:41:14,359

white areas on the right are frozen

424

00:41:20,019 --> 00:41:16,519

lakes in the radar image they appear

425

00:41:24,759 --> 00:41:20,029

black and the bright areas in the radar

426

00:41:26,979 --> 00:41:24,769

image on the left are forests this is a

427

00:41:29,289 --> 00:41:26,989

time of year when thawing is occurring

428

00:41:31,120 --> 00:41:29,299

and in the early part of the mission the

429

00:41:33,700 --> 00:41:31,130

astronauts were calling down that all of

430

00:41:35,829 --> 00:41:33,710

these lakes appeared nearly completely

431

00:41:38,589 --> 00:41:35,839

frozen and now today they're calling

432

00:41:40,390 --> 00:41:38,599

down that some of the ice is starting to

433

00:41:40,970 --> 00:41:40,400

break up and so we're pretty excited

434

00:41:42,530 --> 00:41:40,980

about this

435

00:41:46,780 --> 00:41:42,540

this means that we might capture the

436

00:41:50,300 --> 00:41:46,790

thaw in these high boreal forest regions

437

00:41:55,640 --> 00:41:50,310

this is a real-time image coming down

438

00:42:10,599 --> 00:41:55,650

from the synthetic aperture radar the

439

00:42:14,210 --> 00:42:10,609

site that is currently being tracked is

440

00:42:17,750 --> 00:42:14,220

of the Netherlands region of flavell and

441

00:42:21,590 --> 00:42:17,760

the orbiters again moving to the

442

00:42:25,060 --> 00:42:21,600

southeast this is a calibration site of

443

00:42:28,070 --> 00:42:25,070

high interest primarily because of its

444

00:42:33,050 --> 00:42:28,080

it was artificially created by the Dutch

445

00:42:34,880 --> 00:42:33,060

and it allows for easy interpretation of

446

00:42:40,010 --> 00:42:34,890

the radar data once it's obtained here

447

00:42:54,360 --> 00:42:40,020

on the ground these are the German Alps

448

00:42:59,580 --> 00:42:56,730

now we're approaching the super site at

449

00:43:02,730 --> 00:42:59,590

over five and hoof in Germany where the

450

00:43:05,670 --> 00:43:02,740

24 locations with their active radar

451  
00:43:12,510 --> 00:43:05,680  
calibrators are set up and the Munich

452  
00:43:20,250 --> 00:43:12,520  
Airport passing right below / - - is

453  
00:43:26,970 --> 00:43:20,260  
just outside Munich and the Danube River

454  
00:43:29,790 --> 00:43:26,980  
now in the picture before sunrise on the

455  
00:43:31,560 --> 00:43:29,800  
California coast but the radar can see

456  
00:43:36,560 --> 00:43:31,570  
through that as the California coastline

457  
00:43:39,990 --> 00:43:36,570  
comes into view on a northeasterly track

458  
00:43:42,360 --> 00:43:40,000  
endeavour will cost across the coastal

459  
00:43:46,290 --> 00:43:42,370  
ranges which are mountains that are made

460  
00:43:48,750 --> 00:43:46,300  
from various fault lines should also

461  
00:43:51,120 --> 00:43:48,760  
cross over the San Andreas Fault just

462  
00:43:53,460 --> 00:43:51,130  
before the San Joaquin Valley which is

463  
00:43:58,290 --> 00:43:53,470

coming into view a large agricultural

464

00:44:00,810 --> 00:43:58,300

area the orbiter is now crossing the

465

00:44:03,690 --> 00:44:00,820

Sierra Nevada to the Mammoth Mountain

466

00:44:07,880 --> 00:44:03,700

area which is a backup super site which

467

00:44:12,840 --> 00:44:10,410

as mentioned this is a hydrology site

468

00:44:15,720 --> 00:44:12,850

the interest here is for the snow cover

469

00:44:19,080 --> 00:44:15,730

and the amount of snow cover in that

470

00:44:20,910 --> 00:44:19,090

area because of the production of water

471

00:44:31,749 --> 00:44:20,920

that the Sierras produced for the

472

00:44:36,329 --> 00:44:33,609

what you're going to see in a minute is

473

00:44:38,799 --> 00:44:36,339

a sur CL band image of Death Valley

474

00:44:41,229 --> 00:44:38,809

Death Valley is one of what we call our

475

00:44:43,029 --> 00:44:41,239

super sites in front of you you can see

476

00:44:45,189 --> 00:44:43,039

the Long Valley which is the dark area

477

00:44:47,339 --> 00:44:45,199

at the at the center of the image and on

478

00:44:50,319 --> 00:44:47,349

either side you can see the high ranges

479

00:44:52,809 --> 00:44:50,329

now a lot of you may be familiar we

480

00:44:55,149 --> 00:44:52,819

produce some similar videos for the

481

00:44:56,949 --> 00:44:55,159

Magellan mission we start out here in

482

00:44:58,929 --> 00:44:56,959

the cotton ball Basin the bright rough

483

00:45:01,419 --> 00:44:58,939

surfaces that you see are salt deposits

484

00:45:02,919 --> 00:45:01,429

along the bottom of the valley and also

485

00:45:05,229 --> 00:45:02,929

some of the rougher rocky or surface

486

00:45:06,639 --> 00:45:05,239

surfaces now this is El ban which means

487

00:45:09,309 --> 00:45:06,649

that the bright surfaces you that you

488

00:45:11,859 --> 00:45:09,319

see are produced by sort of rubble sized

489

00:45:13,359 --> 00:45:11,869

or medium sized blocks now we're flying

490

00:45:15,219 --> 00:45:13,369

down through Death Valley the smooth

491

00:45:17,559 --> 00:45:15,229

deposits you're seeing are some of the

492

00:45:20,229 --> 00:45:17,569

relatively smooth salt deposits on the

493

00:45:21,849 --> 00:45:20,239

floor and some of the smoother fans now

494

00:45:24,339 --> 00:45:21,859

these fans that are coming down from the

495

00:45:26,799 --> 00:45:24,349

sides of the valley are produced by much

496

00:45:28,089 --> 00:45:26,809

wetter periods in history what we're

497

00:45:30,579 --> 00:45:28,099

trying to understand here at Death

498

00:45:32,319 --> 00:45:30,589

Valley with this radar data is what can

499

00:45:37,839 --> 00:45:32,329

these alluvial fans tell us about the

500

00:45:41,559 --> 00:45:37,849

past climate history of the earth and

501  
00:45:44,789 --> 00:45:41,569  
the coastline coming into view vision

502  
00:45:47,229 --> 00:45:44,799  
from the synthetic aperture radar as

503  
00:45:50,139 --> 00:45:47,239  
endeavour crosses the coastline of North

504  
00:45:57,189 --> 00:45:50,149  
America up just above the state of

505  
00:45:59,109 --> 00:45:57,199  
Washington the data take is of the Juan

506  
00:46:02,469 --> 00:45:59,119  
de Fuca Strait which is off the coast

507  
00:46:06,999 --> 00:46:02,479  
line and this is an oceanographic data

508  
00:46:10,139 --> 00:46:07,009  
take for the radar system again designed

509  
00:46:13,029 --> 00:46:10,149  
to observe surface and internal waves as

510  
00:46:43,180 --> 00:46:13,039  
as well as wind motion at the sea

511  
00:46:51,950 --> 00:46:47,270  
we're using 14 cameras on this flight 35

512  
00:46:54,010 --> 00:46:51,960  
millimeter cameras Hasselblad cameras -

513  
00:46:57,140 --> 00:46:54,020

these cameras out the payload Bay a

514

00:48:37,820 --> 00:46:57,150

movie camera and this big four by five

515

00:48:44,090 --> 00:48:40,700

alright now this just short clip here is

516

00:48:46,190 --> 00:48:44,100

a far northeastern Asia or the mainland

517

00:48:49,700 --> 00:48:46,200

passing out to sea and you can see on

518

00:48:51,950 --> 00:48:49,710

the video here the coastline of Sakhalin

519

00:48:54,470 --> 00:48:51,960

Island and it's very snowy still in this

520

00:48:57,770 --> 00:48:54,480

part of the world as winter ends and

521

00:49:00,680 --> 00:48:57,780

there is sea ice all along the island of

522

00:49:03,500 --> 00:49:00,690

Sakhalin up to the cmf not the radar is

523

00:49:04,850 --> 00:49:03,510

imaging for experiments on the

524

00:49:08,030 --> 00:49:04,860

penetration of the radar into the ice

525

00:49:11,060 --> 00:49:08,040

field and you can see frozen lakes and

526  
00:49:13,340 --> 00:49:11,070  
ponds of the tundra region up here and

527  
00:49:16,850 --> 00:49:13,350  
in particular one of the calibration

528  
00:49:19,220 --> 00:49:16,860  
sites for the radar mission to evaluate

529  
00:49:22,190 --> 00:49:19,230  
the performance of the radar beam that

530  
00:49:24,590 --> 00:49:22,200  
strength and signal intensity and it's a

531  
00:49:26,660 --> 00:49:24,600  
the ability to aim the radar actually is

532  
00:49:28,880 --> 00:49:26,670  
Sarabeth to Japan then that calibration

533  
00:49:30,890 --> 00:49:28,890  
site is coming into view right here you

534  
00:49:33,500 --> 00:49:30,900  
can see some of the snow-capped peaks

535  
00:49:35,630 --> 00:49:33,510  
around this area of the coast and then

536  
00:49:37,250 --> 00:49:35,640  
the street pattern there just to the

537  
00:49:40,760 --> 00:49:37,260  
north needs to serve ETSU on the coast

538  
00:49:43,880 --> 00:49:40,770

of Hokkaido and there you see us passing

539

00:50:02,780 --> 00:49:43,890

out over the east coast of Hokkaido into

540

00:50:05,000 --> 00:50:02,790

the Pacific Ocean take of the water for

541

00:50:07,850 --> 00:50:05,010

agricultural irrigation of the constancy

542

00:50:10,820 --> 00:50:07,860

of the Democratic staff and it's not the

543

00:50:17,600 --> 00:50:10,830

area just to the top your screen there

544

00:50:19,700 --> 00:50:17,610

up at the bottom of your screen left

545

00:50:21,980 --> 00:50:19,710

high and dry 30 or 40 miles of the water

546

00:50:25,130 --> 00:50:21,990

used to be an enormous commercial

547

00:50:28,340 --> 00:50:25,140

fishing area but now it's drawn up at

548

00:50:32,000 --> 00:50:28,350

the predictions that if things continue

549

00:50:35,090 --> 00:50:32,010

at the current rate of diverting water

550

00:50:39,170 --> 00:50:35,100

the whole air or sea will be dry by year

551  
00:50:45,020 --> 00:50:41,630  
this is Mission Control these views are

552  
00:50:47,750 --> 00:50:45,030  
from endeavours payload Bay cameras as

553  
00:50:50,480 --> 00:50:47,760  
it flies down across the Southern

554  
00:50:54,710 --> 00:50:50,490  
Pacific Ocean on this orbit it will pass

555  
00:51:01,309 --> 00:50:54,720  
just slightly north of the tip of New

556  
00:51:04,160 --> 00:51:01,319  
Zealand endeavour is on a southeasterly

557  
00:51:07,130 --> 00:51:04,170  
track now out over the Atlantic Ocean

558  
00:51:08,750 --> 00:51:07,140  
just after crossing over the coastline

559  
00:51:11,690 --> 00:51:08,760  
of the east coast of the United States

560  
00:51:12,950 --> 00:51:11,700  
the orbiters in a nose forward position

561  
00:52:15,630 --> 00:51:12,960  
with the payload bay of the orbiter

562  
00:52:28,160 --> 00:52:18,100  
endeavour Houston were alive on the

563  
00:52:39,250 --> 00:52:30,530

and Deborah Houston New York City sure

564

00:52:58,060 --> 00:52:41,450

yeah bill we just got a beautiful pass

565

00:53:02,680 --> 00:53:01,450

you're rich I'm trying to tell Brent he

566

00:53:04,390 --> 00:53:02,690

should have gotten here just a couple

567

00:54:17,750 --> 00:53:04,400

minutes ago and maybe has seen that

568

00:54:17,760 --> 00:54:26,970

yeah I do yeah I have a surplus

569

00:54:26,980 --> 00:55:01,490

Danny could see this last time

570

00:55:16,680 --> 00:55:11,340

we'll stop damn straight that would have

571

00:55:23,620 --> 00:55:16,690

a deal but billiard fantasticks it felt

572

00:55:28,370 --> 00:55:26,690

Dever is about to get on to the heading

573

00:55:31,580 --> 00:55:28,380

alignment circle and will begin

574

00:55:34,460 --> 00:55:31,590

executing a 285 degree left overhead

575

00:55:39,980 --> 00:55:34,470

turn to align the vehicle for a landing

576  
00:55:43,000 --> 00:55:39,990  
on Edwards runway 22 at about 57,000

577  
00:55:47,210 --> 00:55:44,930  
traveling eight hundred seventy five

578  
00:56:08,370 --> 00:55:47,220  
miles an hour descending at about three

579  
00:56:39,040 --> 00:56:14,390  
now below 30,000 feet 530 miles an hour

580  
00:56:42,980 --> 00:56:41,150  
endeavor you're on glide slope on

581  
00:58:14,020 --> 00:56:42,990  
centerline surface wind three six zero

582  
00:58:21,200 --> 00:58:19,520  
we'll stop roger wheelstop endeavour did

583  
00:58:23,960 --> 00:58:21,210  
your radar laboratories provided an

584  
00:58:25,310 --> 00:58:23,970  
unprecedented view of our planet and you

585  
00:59:04,900 --> 00:58:25,320  
and your crew been a joy to work with

586  
00:59:08,580 --> 00:59:07,450  
I don't still own glideslope instead yes

587  
00:59:10,690 --> 00:59:08,590  
sir

588  
00:59:12,520 --> 00:59:10,700

endeavour you're on glide slope on