



1
00:00:17,910 --> 00:00:13,799
the first thing I'd like to do here now

2
00:00:21,240 --> 00:00:17,920
is to reintroduce my crew on my right is

3
00:00:23,040 --> 00:00:21,250
Scott Horowitz the mission pilot to his

4
00:00:26,460 --> 00:00:23,050
right is Joe Tanner one of our space

5
00:00:28,859 --> 00:00:26,470
walkers next to him is Steve Hawley this

6
00:00:31,470 --> 00:00:28,869
was Steve's fourth flight next to him is

7
00:00:34,500 --> 00:00:31,480
Greg Harbaugh another one of our space

8
00:00:37,110 --> 00:00:34,510
walkers his right is Mark Lee our

9
00:00:38,610 --> 00:00:37,120
payload commander and on the end is

10
00:00:40,830 --> 00:00:38,620
Steve Smith the youngest member of the

11
00:00:43,380 --> 00:00:40,840
crew this was Steve's second flight the

12
00:00:46,110 --> 00:00:43,390
goal of our mission was to fly up to the

13
00:00:47,759 --> 00:00:46,120

Hubble Space Telescope retrieve it

14

00:00:51,000 --> 00:00:47,769

mounted in the Bay on the servicing

15

00:00:53,759 --> 00:00:51,010

structure perform for Evie A's

16

00:00:57,450 --> 00:00:53,769

that were planned to replace some of the

17

00:00:58,680 --> 00:00:57,460

major science instruments with modern

18

00:01:00,569 --> 00:00:58,690

technology that would allow the

19

00:01:03,720 --> 00:01:00,579

telescope to return more data at a

20

00:01:05,160 --> 00:01:03,730

faster rate and also to replace some of

21

00:01:05,880 --> 00:01:05,170

the electronic components of the

22

00:01:08,610 --> 00:01:05,890

telescope

23

00:01:11,160 --> 00:01:08,620

we were able to do more than was planned

24

00:01:14,310 --> 00:01:11,170

if you include the mo I repairs that

25

00:01:17,820 --> 00:01:14,320

were a late addition during the flight

26
00:01:20,670 --> 00:01:17,830
the success of the mission is directly

27
00:01:22,380 --> 00:01:20,680
attributable to thousands of people here

28
00:01:25,530 --> 00:01:22,390
on the ground people who plan the flight

29
00:01:27,690 --> 00:01:25,540
people who prepared the hardware and the

30
00:01:30,750 --> 00:01:27,700
people who trained the the folks on the

31
00:01:33,540 --> 00:01:30,760
ground in Mission Control and who helped

32
00:01:35,910 --> 00:01:33,550
us train as a crew and we were really

33
00:01:38,550 --> 00:01:35,920
happy to be the ones that got to go up

34
00:01:39,810 --> 00:01:38,560
and see the telescope up close we had a

35
00:01:42,540 --> 00:01:39,820
lot of fun and we saw some beautiful

36
00:01:44,430 --> 00:01:42,550
sights we brought a movie with us today

37
00:01:46,110 --> 00:01:44,440
and some slides too to try and share

38
00:01:49,460 --> 00:01:46,120

some of that with you so if we could get

39

00:01:52,740 --> 00:01:49,470

the lights down and and start the movie

40

00:01:54,390 --> 00:01:52,750

something that was great for me as the

41

00:01:57,630 --> 00:01:54,400

commander of this flight was not only

42

00:01:59,520 --> 00:01:57,640

did we launch on time we launched two

43

00:02:01,440 --> 00:01:59,530

days earlier than the initial scheduled

44

00:02:04,620 --> 00:02:01,450

date when I was assigned as the mission

45

00:02:06,270 --> 00:02:04,630

commander it started here at about

46

00:02:10,309 --> 00:02:06,280

midnight as we walked out of the crew

47

00:02:13,199 --> 00:02:10,319

quarters and manned up the Astro van and

48

00:02:16,589 --> 00:02:13,209

a few hours later the main engines lit

49

00:02:17,850 --> 00:02:16,599

to take us on up into orbit you feel

50

00:02:19,410 --> 00:02:17,860

that rumble of the engines when they

51
00:02:21,180 --> 00:02:19,420
light outside but you're not really sure

52
00:02:22,590 --> 00:02:21,190
till the SRBs light then there's a

53
00:02:24,210 --> 00:02:22,600
tremendous bright

54
00:02:25,770 --> 00:02:24,220
light reflecting off of the launch

55
00:02:27,840 --> 00:02:25,780
platform it looks like somebody's

56
00:02:30,300 --> 00:02:27,850
welding right outside your window and

57
00:02:33,180 --> 00:02:30,310
then you feel the kick in your back and

58
00:02:34,470 --> 00:02:33,190
you know you're off and as you can see

59
00:02:37,110 --> 00:02:34,480
we go through the clouds here at about

60
00:02:39,270 --> 00:02:37,120
3000 feet I guess both a little concern

61
00:02:41,610 --> 00:02:39,280
with weather but pretty soon we're VFR

62
00:02:45,390 --> 00:02:41,620
on top and we're off on our way to space

63
00:02:46,740 --> 00:02:45,400

SRBs are kind of a bumpy ride you're

64

00:02:48,390 --> 00:02:46,750

getting shook around it's interesting

65

00:02:51,540 --> 00:02:48,400

around Mach 3 it smoothed out and then

66

00:02:53,100 --> 00:02:51,550

shortly thereafter the SRB Sep and folks

67

00:02:55,590 --> 00:02:53,110

on the ground at night got this

68

00:02:57,180 --> 00:02:55,600

beautiful view of the two SRBs as they

69

00:02:58,890 --> 00:02:57,190

tailed off and stepped from the orbiter

70

00:03:02,810 --> 00:02:58,900

and looked kind of like a point of light

71

00:03:05,760 --> 00:03:02,820

like a star going off into into orbit

72

00:03:08,670 --> 00:03:05,770

once we got to orbit the real work on

73

00:03:10,290 --> 00:03:08,680

the mission started opening the payload

74

00:03:13,020 --> 00:03:10,300

bay doors and getting about the business

75

00:03:16,410 --> 00:03:13,030

of turning our rocket ship into an

76

00:03:19,020 --> 00:03:16,420

on-orbit space ship we had to convert

77

00:03:22,260 --> 00:03:19,030

the mid-deck to a working area set up

78

00:03:24,620 --> 00:03:22,270

the tools and the spacesuits in

79

00:03:27,690 --> 00:03:24,630

preparation for the spacewalks upcoming

80

00:03:30,000 --> 00:03:27,700

fracture the rendezvous as is normally

81

00:03:31,560 --> 00:03:30,010

done on flights like this we check out

82

00:03:34,440 --> 00:03:31,570

the robot arm the robot arm was

83

00:03:37,290 --> 00:03:34,450

tremendously enjoyable piece of gear to

84

00:03:37,680 --> 00:03:37,300

operate and in our case if it checked

85

00:03:39,960 --> 00:03:37,690

out

86

00:03:42,080 --> 00:03:39,970

fully completely as it always does it's

87

00:03:44,730 --> 00:03:42,090

a very reliable piece of gear

88

00:03:46,020 --> 00:03:44,740

none of our simulators can fully prepare

89

00:03:47,490 --> 00:03:46,030

you for everything you're going to see

90

00:03:48,870 --> 00:03:47,500

during a rendezvous number one the

91

00:03:51,630 --> 00:03:48,880

beauty of the real satellite that's

92

00:03:54,540 --> 00:03:51,640

compared to our visuals but also the Sun

93

00:03:55,860 --> 00:03:54,550

in the real world and the confusion you

94

00:03:56,970 --> 00:03:55,870

can get on the flight deck just from the

95

00:03:59,270 --> 00:03:56,980

number of people who are up there

96

00:04:01,250 --> 00:03:59,280

helping out with the task

97

00:04:04,370 --> 00:04:01,260

it really is a team effort with

98

00:04:06,680 --> 00:04:04,380

everybody providing an input but we

99

00:04:08,360 --> 00:04:06,690

managed to stabilize the telescope like

100

00:04:11,930 --> 00:04:08,370

this and the co-ass and bring it down so

101
00:04:13,880 --> 00:04:11,940
Steve could grab it Scottie and Sox were

102
00:04:17,330 --> 00:04:13,890
responsible for the first 330 miles or

103
00:04:19,039 --> 00:04:17,340
so and my job was the last 10 feet they

104
00:04:20,840 --> 00:04:19,049
did such a good job with their part that

105
00:04:24,320 --> 00:04:20,850
my job was easy we were able to grab it

106
00:04:25,879 --> 00:04:24,330
and for Sox and me it was it was

107
00:04:29,420 --> 00:04:25,889
enjoyable to get to see it again

108
00:04:32,690 --> 00:04:29,430
and got it birth on the FSS so that the

109
00:04:36,110 --> 00:04:32,700
real mission operations could begin with

110
00:04:37,640 --> 00:04:36,120
the epa's all right here we are this is

111
00:04:39,950 --> 00:04:37,650
a couple days into the fight we need to

112
00:04:43,040 --> 00:04:39,960
check out the e/m use first as you know

113
00:04:44,750 --> 00:04:43,050

these emus were updated that's a new

114

00:04:47,150 --> 00:04:44,760

configuration we hope to have on station

115

00:04:49,790 --> 00:04:47,160

once they're all checked out it's time

116

00:04:52,580 --> 00:04:49,800

to Don the suits for the first of the

117

00:04:54,770 --> 00:04:52,590

epa's I've got my Green Bay Packers hat

118

00:04:56,719 --> 00:04:54,780

on here which I wore every day and I'm

119

00:05:03,530 --> 00:04:56,729

sure that was one of the forces that

120

00:05:05,360 --> 00:05:03,540

kept us you know this is coming out of

121

00:05:06,710 --> 00:05:05,370

the hatch the very first day it seems

122

00:05:08,180 --> 00:05:06,720

like I'm having a little trouble I can't

123

00:05:10,610 --> 00:05:08,190

figure out why but we had a lot you have

124

00:05:12,350 --> 00:05:10,620

a lot of chords and the umbilicals and

125

00:05:14,510 --> 00:05:12,360

you also have tools in the airlock and a

126

00:05:16,400 --> 00:05:14,520

lot of times it's it's hard to kind of

127

00:05:17,840 --> 00:05:16,410

get out the door but once we get out you

128

00:05:19,909 --> 00:05:17,850

can go ahead and start setting up for

129

00:05:23,330 --> 00:05:19,919

the day the manipulator foot restraint

130

00:05:24,920 --> 00:05:23,340

handle was detached and it was developed

131

00:05:27,260 --> 00:05:24,930

here at the Johnson Space Center a real

132

00:05:29,900 --> 00:05:27,270

good job on that we went up and hooked

133

00:05:31,940 --> 00:05:29,910

it on to the MFR I went to work yeah

134

00:05:33,590 --> 00:05:31,950

first day the first of the five days was

135

00:05:35,779 --> 00:05:33,600

spent removing two large

136

00:05:38,120 --> 00:05:35,789

refrigerator-sized objects from the

137

00:05:39,920 --> 00:05:38,130

telescope Here I am pulling out the FOS

138

00:05:42,260 --> 00:05:39,930

instrument these instruments weighed

139

00:05:44,690 --> 00:05:42,270

between six hundred eighty-five and 850

140

00:05:46,070 --> 00:05:44,700

pounds after we pull out one of the old

141

00:05:47,540 --> 00:05:46,080

instruments we then go get one of the

142

00:05:51,200 --> 00:05:47,550

new ones out of the payload Bay and this

143

00:05:53,120 --> 00:05:51,210

is this coming out of course these boxes

144

00:05:55,940 --> 00:05:53,130

are designed to increase the scientific

145

00:05:58,670 --> 00:05:55,950

returns that Hubble will have we are

146

00:06:00,620 --> 00:05:58,680

putting stiffs into the telescope here

147

00:06:02,719 --> 00:06:00,630

unfortunately it happened at night the

148

00:06:04,250 --> 00:06:02,729

major three boxes that we installed all

149

00:06:06,080 --> 00:06:04,260

occurred at night so it made it a little

150

00:06:09,320 --> 00:06:06,090

bit more difficult tasks that just as a

151
00:06:10,640 --> 00:06:09,330
matter of timing after you put a new box

152
00:06:13,070 --> 00:06:10,650
into the telescope

153
00:06:16,010 --> 00:06:13,080
you stole the old box mrs. stowing the

154
00:06:18,529 --> 00:06:16,020
ghr sbox I might add that these scenes

155
00:06:19,909 --> 00:06:18,539
are all sped up to some extent about

156
00:06:21,469 --> 00:06:19,919
five times the normal speed

157
00:06:24,860 --> 00:06:21,479
everything goes a lot slower in space

158
00:06:26,330 --> 00:06:24,870
this is just another view of stowing gh

159
00:06:28,010 --> 00:06:26,340
RS into the payload bay you might notice

160
00:06:29,719 --> 00:06:28,020
over my left shoulder there's a gold

161
00:06:31,700 --> 00:06:29,729
colored box that's a new camera we had

162
00:06:33,860 --> 00:06:31,710
on board that actually brought the

163
00:06:35,059 --> 00:06:33,870

ground into the work envelope basically

164

00:06:38,619 --> 00:06:35,069

looked over our shoulder and you'll see

165

00:06:41,929 --> 00:06:38,629

pictures of that in the upcoming scenes

166

00:06:43,610 --> 00:06:41,939

the EBA took about seven hours that

167

00:06:44,959 --> 00:06:43,620

first day often we had a chance to look

168

00:06:46,760 --> 00:06:44,969

out at beautiful sights notice the

169

00:06:48,469 --> 00:06:46,770

external airlock here also that was the

170

00:06:49,510 --> 00:06:48,479

first flighted external airlock and

171

00:06:53,240 --> 00:06:49,520

gorgeous view

172

00:06:56,270 --> 00:06:53,250

well after market Steve had shown us how

173

00:06:59,809 --> 00:06:56,280

to correctly perform EBA it was Greg in

174

00:07:01,520 --> 00:06:59,819

my turn on on day two put your pants on

175

00:07:03,140 --> 00:07:01,530

a little different in space you can put

176

00:07:05,869 --> 00:07:03,150

both legs in at the same time and the

177

00:07:08,089 --> 00:07:05,879

suit up was assisted by dock every time

178

00:07:11,209 --> 00:07:08,099

and here's Greg reporting that he was

179

00:07:13,010 --> 00:07:11,219

ready to go our job was to change one of

180

00:07:16,339 --> 00:07:13,020

the fine guidance sensors and here we

181

00:07:18,260 --> 00:07:16,349

are working on the doors to that Bay and

182

00:07:21,170 --> 00:07:18,270

here is the insertion also done at night

183

00:07:23,450 --> 00:07:21,180

it's Steve noted of the the new fine

184

00:07:25,730 --> 00:07:23,460

guidance sensor this box weighs about

185

00:07:28,309 --> 00:07:25,740

500 pounds but in space doesn't feel

186

00:07:32,360 --> 00:07:28,319

like anything here we are

187

00:07:33,829 --> 00:07:32,370

stowing the old STS to return it to home

188

00:07:37,399 --> 00:07:33,839

where it will be refurbished and

189

00:07:40,309 --> 00:07:37,409

launched on a future mission we also

190

00:07:42,230 --> 00:07:40,319

changed out one of the science tape

191

00:07:43,339 --> 00:07:42,240

recorders and that's the black box that

192

00:07:45,290 --> 00:07:43,349

I'm holding right there and this is a

193

00:07:47,719 --> 00:07:45,300

beautiful shot of the earth reflecting

194

00:07:57,409 --> 00:07:47,729

off the telescope and you can see Greg

195

00:08:01,890 --> 00:07:59,459

once we got down with all the large

196

00:08:04,080 --> 00:08:01,900

boxes the lower 12 feet or so has all of

197

00:08:05,490 --> 00:08:04,090

them you know scientific instruments we

198

00:08:07,619 --> 00:08:05,500

started going in the bays and there's

199

00:08:09,659 --> 00:08:07,629

about 15 20 different Bay's that have

200

00:08:11,550 --> 00:08:09,669

the electronics that run the Hubble

201
00:08:13,950 --> 00:08:11,560
Space Telescope in this case I'm

202
00:08:17,070 --> 00:08:13,960
changing out a data interface unit and

203
00:08:18,839 --> 00:08:17,080
the Diu had lost half of it essentially

204
00:08:20,879 --> 00:08:18,849
half of its capability so we put a new

205
00:08:23,550 --> 00:08:20,889
one in it's a little bit tougher task

206
00:08:26,189 --> 00:08:23,560
than some of the normally VA because it

207
00:08:28,619 --> 00:08:26,199
wasn't designed to be a compatible

208
00:08:30,059 --> 00:08:28,629
electoral connectors didn't have wing

209
00:08:32,639 --> 00:08:30,069
tabs a lot of the other things that we

210
00:08:35,190 --> 00:08:32,649
tend to do like the reaction wheel that

211
00:08:37,230 --> 00:08:35,200
you see here the reaction wheel was one

212
00:08:39,600 --> 00:08:37,240
of those 12 15 years ago and they first

213
00:08:41,880 --> 00:08:39,610

built Hubble that was meant to be

214

00:08:43,350 --> 00:08:41,890

changed out EBA and we weren't doing the

215

00:08:45,000 --> 00:08:43,360

work the people inside we're looking

216

00:08:47,069 --> 00:08:45,010

down this is thunderstorms over the top

217

00:08:50,100 --> 00:08:47,079

of Houston and it's certainly it's like

218

00:08:52,170 --> 00:08:50,110

a string of firecrackers it's probably

219

00:08:54,600 --> 00:08:52,180

the most incredible lightning display

220

00:08:56,490 --> 00:08:54,610

that most then any of us had ever seen

221

00:09:01,490 --> 00:08:56,500

from orbit so it was pretty spectacular

222

00:09:08,160 --> 00:09:04,980

guess here we are getting to work on the

223

00:09:10,110 --> 00:09:08,170

TVA for this is the solar array drive

224

00:09:12,540 --> 00:09:10,120

electronics box changer

225

00:09:14,970 --> 00:09:12,550

that's Joe handing it off to me and then

226

00:09:16,769 --> 00:09:14,980

closing the lid and I'm on the on the

227

00:09:19,230 --> 00:09:16,779

end of the arm there and I've got it in

228

00:09:21,960 --> 00:09:19,240

my hands and we go up to where the

229

00:09:24,259 --> 00:09:21,970

worksite I believe this is at sunrise so

230

00:09:29,160 --> 00:09:24,269

you'll see the lighting changed fairly

231

00:09:31,680 --> 00:09:29,170

rapidly here and this is real time Sun

232

00:09:35,579 --> 00:09:31,690

goes up and goes down very quickly on

233

00:09:38,340 --> 00:09:35,589

orbit real commendation to the folks who

234

00:09:42,120 --> 00:09:38,350

trained us this task was just like it

235

00:09:44,310 --> 00:09:42,130

was in the training process except the

236

00:09:45,780 --> 00:09:44,320

screws were they although they were

237

00:09:47,430 --> 00:09:45,790

equally small they weren't nearly as

238

00:09:51,420 --> 00:09:47,440

corroded as they were in the water but

239

00:09:53,040 --> 00:09:51,430

it was it was a challenging task to

240

00:09:54,720 --> 00:09:53,050

change that that solar ray Drive

241

00:09:57,509 --> 00:09:54,730

electronics box but it was very doable

242

00:10:00,150 --> 00:09:57,519

the way it was designed by the engineers

243

00:10:02,340 --> 00:10:00,160

and there are Joe and I up at the top of

244

00:10:04,930 --> 00:10:02,350

the telescope we're not paying any

245

00:10:07,300 --> 00:10:04,940

attention to the earth up there

246

00:10:10,090 --> 00:10:07,310

changing that or putting some covers on

247

00:10:12,879 --> 00:10:10,100

magnetometers one of the efforts that

248

00:10:16,030 --> 00:10:12,889

was underway while we were out there was

249

00:10:19,139 --> 00:10:16,040

Scott was working on some other repairs

250

00:10:22,720 --> 00:10:19,149

some patches that were designed and

251

00:10:26,679 --> 00:10:22,730

built up by Scott in the course of that

252

00:10:28,629 --> 00:10:26,689

Evie a day I had Joe and I actually put

253

00:10:31,360 --> 00:10:28,639

a couple patches on towards the end of

254

00:10:33,160 --> 00:10:31,370

every a day for but then Mark and Steve

255

00:10:36,610 --> 00:10:33,170

put on the remainder of the patches on

256

00:10:39,819 --> 00:10:36,620

an unscheduled Evie a day five that all

257

00:10:41,470 --> 00:10:39,829

went absolutely superbly the design

258

00:10:44,290 --> 00:10:41,480

developed by the folks on the ground

259

00:10:46,329 --> 00:10:44,300

with the stuff available to us was was

260

00:10:49,650 --> 00:10:46,339

just great real kudos to everybody that

261

00:10:55,119 --> 00:10:53,230

towards the end of that activity then we

262

00:10:57,910 --> 00:10:55,129

were we finished up and it was the end

263

00:11:00,160 --> 00:10:57,920

of the EVs with EPA successfully

264

00:11:02,800 --> 00:11:00,170

completed it was time to but let Hubble

265

00:11:04,329 --> 00:11:02,810

fly free again and it's a little bit I

266

00:11:05,530 --> 00:11:04,339

guess like having your kids come home

267

00:11:06,939 --> 00:11:05,540

from college you know we were really

268

00:11:08,439 --> 00:11:06,949

happy to see help all when it showed up

269

00:11:14,679 --> 00:11:08,449

and where was time to send it off we

270

00:11:17,590 --> 00:11:14,689

were really happy to see it go once

271

00:11:19,629 --> 00:11:17,600

again I got to grapple it and raise it

272

00:11:22,929 --> 00:11:19,639

up off of the FSS bring it forward in

273

00:11:26,319 --> 00:11:22,939

the bay release it from the arm and then

274

00:11:29,199 --> 00:11:26,329

I told Scott to go ahead and execute the

275

00:11:31,509 --> 00:11:29,209

maneuver which he did the maneuver was

276

00:11:34,870 --> 00:11:31,519

kicked off by a firing forward Jets and

277

00:11:36,699 --> 00:11:34,880

as soon as we did that we fired the Jets

278

00:11:38,290 --> 00:11:36,709

the orbiter went back and the telescope

279

00:11:40,569 --> 00:11:38,300

flew right over the top window this is a

280

00:11:43,300 --> 00:11:40,579

view right over our heads looking out

281

00:11:45,160 --> 00:11:43,310

the starboard window and it was pretty

282

00:11:48,579 --> 00:11:45,170

amazing to see this large telescope fly

283

00:11:49,749 --> 00:11:48,589

right over our heads the maneuver after

284

00:11:52,329 --> 00:11:49,759

the telescope went out of the window

285

00:11:54,490 --> 00:11:52,339

took us so we like flew like a loop over

286

00:11:56,319 --> 00:11:54,500

and atop the telescope so the next thing

287

00:11:59,499 --> 00:11:56,329

we saw about 15 minutes later was the

288

00:12:02,340 --> 00:11:59,509

telescope flying over sharks Bay

289

00:12:05,049 --> 00:12:02,350

Australia we saw a lot of sharks Bay

290

00:12:06,699 --> 00:12:05,059

every turn never retired was beautiful

291

00:12:09,220 --> 00:12:06,709

sight and then we got to see the

292

00:12:11,199 --> 00:12:09,230

telescope almost like a telescope riser

293

00:12:12,759 --> 00:12:11,209

said as it goes across the horizon with

294

00:12:15,920 --> 00:12:12,769

a beautiful blue planet in the

295

00:12:18,380 --> 00:12:15,930

background it was quite an amazing sight

296

00:12:19,820 --> 00:12:18,390

of course our are calling theme the

297

00:12:21,380 --> 00:12:19,830

whole time was more power to the

298

00:12:24,400 --> 00:12:21,390

telescope and here we are celebrating

299

00:12:26,480 --> 00:12:24,410

the fact that telescope has more power

300

00:12:28,070 --> 00:12:26,490

Sox was in real trouble because

301
00:12:29,110 --> 00:12:28,080
Valentine's Day had come and gone and he

302
00:12:32,360 --> 00:12:29,120
hadn't written home yet

303
00:12:36,050 --> 00:12:32,370
so he's catching up and this is a

304
00:12:38,530 --> 00:12:36,060
demonstration of one of the real

305
00:12:42,710 --> 00:12:38,540
problems with using power tools on orbit

306
00:12:45,350 --> 00:12:42,720
and this is a study in hydro fluid

307
00:12:47,270 --> 00:12:45,360
mechanics but it's interesting to note

308
00:12:48,320 --> 00:12:47,280
that the little M&Ms will float right in

309
00:12:49,520 --> 00:12:48,330
the middle of the water ball it makes

310
00:12:54,470 --> 00:12:49,530
kind of a pretty picture to show your

311
00:12:56,060 --> 00:12:54,480
kids exercise is an important part of

312
00:12:57,950 --> 00:12:56,070
daily life on orbit just as it is on

313
00:12:59,870 --> 00:12:57,960

earth but we have a little bit better

314

00:13:01,250 --> 00:12:59,880

view and if you find a scene that you

315

00:13:03,470 --> 00:13:01,260

want to take a picture of you ask for a

316

00:13:05,650 --> 00:13:03,480

camera that on earth weighs quite a bit

317

00:13:09,230 --> 00:13:05,660

and someone just passes it over to you

318

00:13:12,950 --> 00:13:09,240

Sox's motto was a clean ship as a happy

319

00:13:14,990 --> 00:13:12,960

ship and you got us all busy cleaning up

320

00:13:17,470 --> 00:13:15,000

and we were real fortunate to get some

321

00:13:20,180 --> 00:13:17,480

excellent views of the hale-bopp comet

322

00:13:24,860 --> 00:13:20,190

that is still visible in the morning sky

323

00:13:27,230 --> 00:13:24,870

right now or the first landing

324

00:13:28,850 --> 00:13:27,240

opportunity was waved off due to bad

325

00:13:30,830 --> 00:13:28,860

weather at the Cape and so but we didn't

326

00:13:33,110 --> 00:13:30,840

mind we got this extra view of Florida

327

00:13:35,540 --> 00:13:33,120

flying over you can see Orlando and the

328

00:13:37,460 --> 00:13:35,550

Cape and Miami this is what it looks

329

00:13:39,530 --> 00:13:37,470

like inside during a night entry you get

330

00:13:41,570 --> 00:13:39,540

flashes from the plasma and the overhead

331

00:13:42,980 --> 00:13:41,580

windows that that light up the inside of

332

00:13:45,230 --> 00:13:42,990

the ship and you can see the orange glow

333

00:13:47,780 --> 00:13:45,240

from the fireball that's what the orange

334

00:13:49,340 --> 00:13:47,790

glow looks like from the outside and

335

00:13:50,630 --> 00:13:49,350

that's pretty much the view the folks

336

00:13:52,400 --> 00:13:50,640

here in Houston saw as we streaked

337

00:13:54,380 --> 00:13:52,410

overhead and a couple hundred thousand

338

00:13:55,820 --> 00:13:54,390

feet it was great for me I looked out my

339

00:13:58,100 --> 00:13:55,830

left window and there was Houston I

340

00:13:59,540 --> 00:13:58,110

could see the street outlines and right

341

00:14:01,640 --> 00:13:59,550

at the lower window frame was where the

342

00:14:03,290 --> 00:14:01,650

Johnson Space Center should be this is

343

00:14:05,510 --> 00:14:03,300

the first flight that the Kennedy Space

344

00:14:08,090 --> 00:14:05,520

Center where we had centreline lights on

345

00:14:11,060 --> 00:14:08,100

the runway it was a really nice addition

346

00:14:12,620 --> 00:14:11,070

to the runway gave me a good feel during

347

00:14:16,160 --> 00:14:12,630

the landing in the rollout for where I

348

00:14:18,980 --> 00:14:16,170

was on the runway it Scott did a super

349

00:14:20,810 --> 00:14:18,990

job getting a drag chute out and we

350

00:14:22,220 --> 00:14:20,820

tapped the brakes just to check them and

351
00:14:23,300 --> 00:14:22,230
make sure they worked we really didn't

352
00:14:25,850 --> 00:14:23,310
need the brakes with the wind that we

353
00:14:27,860 --> 00:14:25,860
had that day but as a pilot I wanted to

354
00:14:29,730 --> 00:14:27,870
see what they felt like they were

355
00:14:32,700 --> 00:14:29,740
beautiful

356
00:14:36,870 --> 00:14:32,710
jettison the the chute and and roll to a

357
00:14:38,400 --> 00:14:36,880
stop there on the runway one of the

358
00:14:41,100 --> 00:14:38,410
three had been a great place to live in

359
00:14:43,770 --> 00:14:41,110
a and a great place to work the whole 10

360
00:14:47,820 --> 00:14:43,780
days we were up in space and I was kind

361
00:14:49,200 --> 00:14:47,830
of sad to see it come to an end it's

362
00:14:50,820 --> 00:14:49,210
always tough when you when you're in the

363
00:14:52,230 --> 00:14:50,830

mission you know you're not gonna be

364

00:14:55,380 --> 00:14:52,240

spending as much time with with your

365

00:15:00,090 --> 00:14:55,390

crew as you got to during the previous

366

00:15:02,340 --> 00:15:00,100

ten days movies great for for seeing how

367

00:15:04,920 --> 00:15:02,350

things move in space but nothing can

368

00:15:07,710 --> 00:15:04,930

quite beat the still imagery the the

369

00:15:11,910 --> 00:15:07,720

slides that would get so we've got a lot

370

00:15:14,610 --> 00:15:11,920

of them to show you today this is our

371

00:15:17,880 --> 00:15:14,620

crew patch it was actually pretty easy

372

00:15:21,110 --> 00:15:17,890

to do this patch and we took the image

373

00:15:23,700 --> 00:15:21,120

of that telescopes directly from a

374

00:15:26,280 --> 00:15:23,710

picture from the first servicing mission

375

00:15:29,550 --> 00:15:26,290

and that's why the arrays look a little

376

00:15:31,710 --> 00:15:29,560

bit twisted but it looked just like that

377

00:15:36,120 --> 00:15:31,720

when we got back up and ron abboud with

378

00:15:38,550 --> 00:15:36,130

it the night launches is just

379

00:15:41,040 --> 00:15:38,560

spectacular my first flight was on a day

380

00:15:42,690 --> 00:15:41,050

launch and you know the forces are all

381

00:15:44,310 --> 00:15:42,700

the same but but the light show out your

382

00:15:45,660 --> 00:15:44,320

window is pretty incredible in fact it's

383

00:15:48,090 --> 00:15:45,670

pretty hard to see the stars and the

384

00:15:49,410 --> 00:15:48,100

beach as you take off because the light

385

00:15:54,120 --> 00:15:49,420

is so bright from the flames that

386

00:15:54,660 --> 00:15:54,130

surround you I talked about the Sun in

387

00:15:56,220 --> 00:15:54,670

the rendezvous

388

00:15:58,740 --> 00:15:56,230

I use my thumb a lot an old fighter

389

00:16:00,390 --> 00:15:58,750

pilot trick attack pilot trick to you

390

00:16:02,370 --> 00:16:00,400

just take your thumb and put it up in

391

00:16:04,530 --> 00:16:02,380

the window to block out the disc of the

392

00:16:08,780 --> 00:16:04,540

Sun and that worked great to keep the

393

00:16:14,580 --> 00:16:10,800

this is what the telescope looked like

394

00:16:16,520 --> 00:16:14,590

added about 1,500 feet the aperture end

395

00:16:18,600 --> 00:16:16,530

was pointed towards us and as we

396

00:16:21,870 --> 00:16:18,610

continued the rendezvous the telescope

397

00:16:23,880 --> 00:16:21,880

actually rotated 180 degrees until we

398

00:16:25,230 --> 00:16:23,890

were in close the bottom end of the

399

00:16:28,200 --> 00:16:25,240

telescope was pointed down at the

400

00:16:30,420 --> 00:16:28,210

payload Bay and then we went an ER shil

401
00:16:32,730 --> 00:16:30,430
so that we matched the exact rate of the

402
00:16:35,190 --> 00:16:32,740
telescope and then drifted in another

403
00:16:35,850 --> 00:16:35,200
hundred feet or so till Steve was able

404
00:16:39,860 --> 00:16:35,860
to grab it

405
00:16:42,050 --> 00:16:39,870
I know socks and I talked one

406
00:16:44,840 --> 00:16:42,060
preparations for the flight that we each

407
00:16:47,269 --> 00:16:44,850
felt very fortunate to have a chance to

408
00:16:52,280 --> 00:16:47,279
be able to see the Hubble telescope

409
00:16:54,530 --> 00:16:52,290
twice and we had exchanged memories

410
00:16:56,990 --> 00:16:54,540
about what it looked like and and of

411
00:16:59,120 --> 00:16:57,000
course we had told the other crew

412
00:17:01,700 --> 00:16:59,130
members kind of what to expect and how

413
00:17:05,410 --> 00:17:01,710

pretty the satellite was I know Sox used

414

00:17:08,990 --> 00:17:05,420

to say that he remembered being able to

415

00:17:10,429 --> 00:17:09,000

see the reflections of the earth in the

416

00:17:13,309 --> 00:17:10,439

telescope such that the telescope

417

00:17:15,699 --> 00:17:13,319

actually looked blueish rather than

418

00:17:19,670 --> 00:17:15,709

silver and one of my recollections was

419

00:17:22,250 --> 00:17:19,680

at the Terminator it was the Sun setting

420

00:17:24,140 --> 00:17:22,260

or a rising would shine on the

421

00:17:25,819 --> 00:17:24,150

solar rays such that it almost appeared

422

00:17:28,309 --> 00:17:25,829

that the solar rays had their own source

423

00:17:31,430 --> 00:17:28,319

of illumination and this is a picture of

424

00:17:34,400 --> 00:17:31,440

kind of what that looked like the it was

425

00:17:36,860 --> 00:17:34,410

it was it was a treat special privilege

426
00:17:38,810 --> 00:17:36,870
to see the telescope again the side that

427
00:17:42,410 --> 00:17:38,820
you see here which is the side that that

428
00:17:44,510 --> 00:17:42,420
was facing us as we did the grapple and

429
00:17:47,870 --> 00:17:44,520
the birth actually looked quite a lot

430
00:17:49,250 --> 00:17:47,880
like like I remembered it from before it

431
00:17:51,020 --> 00:17:49,260
wasn't until we had shed see the other

432
00:17:52,700 --> 00:17:51,030
side that we realized there's a

433
00:17:54,500 --> 00:17:52,710
difference between the side that

434
00:17:57,140 --> 00:17:54,510
preferentially faces the sign and and

435
00:17:59,390 --> 00:17:57,150
the side that doesn't and of course that

436
00:18:02,900 --> 00:17:59,400
led to the moai repair activities later

437
00:18:08,540 --> 00:18:02,910
on but it's a big spacecraft and it's

438
00:18:11,720 --> 00:18:08,550

it's truly a beautiful spacecraft we all

439

00:18:14,900 --> 00:18:11,730

had different duties on the VA days and

440

00:18:18,260 --> 00:18:14,910

leading up to the VA so my job was

441

00:18:20,330 --> 00:18:18,270

getting the guys are up and ready to go

442

00:18:23,120 --> 00:18:20,340

when Joe and I were not going out the

443

00:18:24,919 --> 00:18:23,130

door ourselves one of the things we all

444

00:18:27,080 --> 00:18:24,929

took care of ourselves was wiping down

445

00:18:31,760 --> 00:18:27,090

our own helmets and putting the anti-fog

446

00:18:34,430 --> 00:18:31,770

in there next slide so here is Mark and

447

00:18:37,280 --> 00:18:34,440

the next slide of Steve getting ready

448

00:18:38,720 --> 00:18:37,290

for their first CVA and they're all

449

00:18:43,840 --> 00:18:38,730

pumped up and ready to go

450

00:18:46,070 --> 00:18:43,850

so we got these guys all suited up and

451

00:18:48,200 --> 00:18:46,080

pre breathed and all that and then it

452

00:18:51,210 --> 00:18:48,210

was time to hand off to Joe who directed

453

00:18:54,930 --> 00:18:51,220

the operation from there Steve and

454

00:18:57,330 --> 00:18:54,940

on our off EDA days activists the ivy or

455

00:19:00,810 --> 00:18:57,340

the person the choreographer I guess of

456

00:19:04,140 --> 00:19:00,820

the of the Eevee a task and we pretty

457

00:19:05,850 --> 00:19:04,150

much stayed glued to w-9 the window

458

00:19:08,640 --> 00:19:05,860

looking at everything that was going on

459

00:19:12,120 --> 00:19:08,650

and keeping track of the activities and

460

00:19:15,050 --> 00:19:12,130

making sure that the EPA was going as as

461

00:19:18,150 --> 00:19:15,060

we had trained in it as we had planned

462

00:19:20,940 --> 00:19:18,160

of course we were always assisted Abele

463

00:19:22,860 --> 00:19:20,950

by dr. Steve E and we referred to Steve

464

00:19:24,000 --> 00:19:22,870

and dr. Stevie in that way so it's not

465

00:19:27,810 --> 00:19:24,010

to get them confused

466

00:19:30,990 --> 00:19:27,820

but Steve dr. Stevie and Steve and I all

467

00:19:34,590 --> 00:19:31,000

work together closely to make sure the

468

00:19:36,480 --> 00:19:34,600

arm movements or or what we had trained

469

00:19:39,330 --> 00:19:36,490

and planned on and it was it was really

470

00:19:40,440 --> 00:19:39,340

a team effort with socks you can't see

471

00:19:48,750 --> 00:19:40,450

him in the picture but he's right behind

472

00:19:51,750 --> 00:19:48,760

us acting worried and here Steve is is

473

00:19:56,580 --> 00:19:51,760

handling one of the large boxes and that

474

00:20:01,470 --> 00:19:56,590

is probably G hrs being stowed on the on

475

00:20:03,960 --> 00:20:01,480

the a fixture and while we stole them

476
00:20:06,150 --> 00:20:03,970
temporarily there while we got the new

477
00:20:08,190 --> 00:20:06,160
instrument out of one of the protective

478
00:20:09,570 --> 00:20:08,200
enclosures and install the new

479
00:20:11,130 --> 00:20:09,580
instrument in the telescope and then

480
00:20:15,750 --> 00:20:11,140
retrieve the old instrument for stowage

481
00:20:17,280 --> 00:20:15,760
and what is now an empty closure this is

482
00:20:19,740 --> 00:20:17,290
it during the first EP a market myself

483
00:20:21,240 --> 00:20:19,750
you can see this large enclosure in the

484
00:20:22,920 --> 00:20:21,250
front is where the new instruments

485
00:20:25,740 --> 00:20:22,930
launched and the old instruments were

486
00:20:27,150 --> 00:20:25,750
stowed for entry that's myself on the

487
00:20:28,920 --> 00:20:27,160
arm there you can see the camera is

488
00:20:31,200 --> 00:20:28,930

right in front of my face or that silver

489

00:20:37,860 --> 00:20:31,210

box mark is in the back inspecting the

490

00:20:42,340 --> 00:20:41,140

this is the other large box that we move

491

00:20:44,200 --> 00:20:42,350

during the flight to find guidance

492

00:20:45,490 --> 00:20:44,210

sensor that's Joe and the arm holding it

493

00:20:47,440 --> 00:20:45,500

as he mentioned before it weighs about

494

00:20:49,480 --> 00:20:47,450

500 pounds we often refer to it as the

495

00:20:52,210 --> 00:20:49,490

piano because it was about the size and

496

00:20:54,100 --> 00:20:52,220

shape of a grand piano you see Greg in

497

00:20:57,100 --> 00:20:54,110

the back inspecting the bay after Joe

498

00:20:58,750 --> 00:20:57,110

has removed the old instrument also you

499

00:21:00,760 --> 00:20:58,760

notice greg has a tether

500

00:21:02,980 --> 00:21:00,770

going down by his right leg there he was

501
00:21:04,630 --> 00:21:02,990
always tethered to the shuttle in that

502
00:21:06,010 --> 00:21:04,640
respect he also knows near his left foot

503
00:21:07,810 --> 00:21:06,020
is a foot restraint that we actually

504
00:21:09,909 --> 00:21:07,820
installed on the telescope to give Greg

505
00:21:12,520 --> 00:21:09,919
a platform somewhat like what Joe was

506
00:21:14,620 --> 00:21:12,530
using on the end of the arm I might add

507
00:21:16,870 --> 00:21:14,630
that Joe and I compared notes after the

508
00:21:18,730 --> 00:21:16,880
flight just to describe how things went

509
00:21:20,590 --> 00:21:18,740
in spaces they didn't on earth and it

510
00:21:22,720 --> 00:21:20,600
really was very very similar we each had

511
00:21:25,450 --> 00:21:22,730
installed these large boxes I'd say

512
00:21:28,180 --> 00:21:25,460
about 30 to 35 times on earth before we

513
00:21:30,970 --> 00:21:28,190

did it in space each of us got about 135

514

00:21:34,810 --> 00:21:30,980

to 150 hours of water time before the

515

00:21:37,419 --> 00:21:34,820

flight also well at the end of a lot of

516

00:21:38,950 --> 00:21:37,429

the replacement work on the telescope

517

00:21:40,650 --> 00:21:38,960

but one of our goals was to actually

518

00:21:43,390 --> 00:21:40,660

raise the telescope to a higher orbit

519

00:21:45,039 --> 00:21:43,400

the telescope doesn't have any engines

520

00:21:47,560 --> 00:21:45,049

it just has the reaction wheels to

521

00:21:49,210 --> 00:21:47,570

maintain attitude and so over time even

522

00:21:50,440 --> 00:21:49,220

though there's very little atmosphere up

523

00:21:51,970 --> 00:21:50,450

there what little atmosphere there is

524

00:21:53,409 --> 00:21:51,980

will drag the telescope down so we did

525

00:21:55,150 --> 00:21:53,419

what's called a vernier reboost and

526
00:21:57,039 --> 00:21:55,160
you've heard some people were rewarded

527
00:21:58,810 --> 00:21:57,049
for their efforts because this is a

528
00:22:00,760 --> 00:21:58,820
pretty unusual way to use the Space

529
00:22:01,840 --> 00:22:00,770
Shuttle to boost a payload because the

530
00:22:03,700 --> 00:22:01,850
little vernier jets really weren't

531
00:22:05,590 --> 00:22:03,710
designed for that so they came up with a

532
00:22:07,570 --> 00:22:05,600
very clever procedure that basically

533
00:22:11,730 --> 00:22:07,580
faked the Jets out into boosting us into

534
00:22:14,440 --> 00:22:11,740
a higher orbit and we spent 82 minutes

535
00:22:16,930 --> 00:22:14,450
using the little vernier Jets over the

536
00:22:18,549 --> 00:22:16,940
entire mission and boosted the telescope

537
00:22:21,220 --> 00:22:18,559
about eight miles higher which will

538
00:22:26,640 --> 00:22:21,230

ensure that it has a very safe orbit for

539

00:22:30,390 --> 00:22:26,650

years to come now these next four slides

540

00:22:32,650 --> 00:22:30,400

typifies some of the the work that we do

541

00:22:34,299 --> 00:22:32,660

pre-flight an in-flight and it's the

542

00:22:35,950 --> 00:22:34,309

interaction between the astronauts and

543

00:22:37,900 --> 00:22:35,960

the engineers and the ground team and

544

00:22:40,180 --> 00:22:37,910

all of all designers that allow you to

545

00:22:41,919 --> 00:22:40,190

pull off some of this work for the data

546

00:22:43,810 --> 00:22:41,929

interface unit it's something even

547

00:22:45,790 --> 00:22:43,820

before the crew was named that we had

548

00:22:47,470 --> 00:22:45,800

three or four runs over at the NBS at

549

00:22:48,860 --> 00:22:47,480

Marshall and we knew that would be

550

00:22:50,950 --> 00:22:48,870

difficult to do because

551
00:22:53,810 --> 00:22:50,960
reaching access in the base they design

552
00:22:55,940 --> 00:22:53,820
umbilicals gender changers for some of

553
00:22:57,620 --> 00:22:55,950
the connectors that were powered saw and

554
00:23:00,230 --> 00:22:57,630
so forth and the end result is you've

555
00:23:02,770 --> 00:23:00,240
come up with something through iteration

556
00:23:05,210 --> 00:23:02,780
that really works works well next and

557
00:23:07,430 --> 00:23:05,220
that's particularly true about the solar

558
00:23:09,770 --> 00:23:07,440
array Drive electronics task which we

559
00:23:12,049 --> 00:23:09,780
did have difficulty on sts-61 because

560
00:23:14,720 --> 00:23:12,059
some of the screws came out but through

561
00:23:16,280 --> 00:23:14,730
the good work the engineers up at

562
00:23:18,049 --> 00:23:16,290
Goddard and inputs from the crew were

563
00:23:20,410 --> 00:23:18,059

able to come up with a design that made

564

00:23:23,780 --> 00:23:20,420

change out of the box much much easier

565

00:23:27,169 --> 00:23:23,790

to do and basically eliminated the

566

00:23:28,880 --> 00:23:27,179

possibility of losing connectors all

567

00:23:31,190 --> 00:23:28,890

that interaction takes place before the

568

00:23:33,410 --> 00:23:31,200

flight and then even in flight the same

569

00:23:36,200 --> 00:23:33,420

people are able to work on the

570

00:23:38,299 --> 00:23:36,210

multi-layer insulation repair kits where

571

00:23:39,830 --> 00:23:38,309

they look at all the things on board and

572

00:23:42,110 --> 00:23:39,840

I've heard a lot some of the reporters

573

00:23:44,299 --> 00:23:42,120

that have talked to me and after the

574

00:23:46,730 --> 00:23:44,309

flight talked about Apollo 13 it's the

575

00:23:48,200 --> 00:23:46,740

same sort of effort where the people on

576
00:23:49,820 --> 00:23:48,210
the ground throw everything they've got

577
00:23:52,310 --> 00:23:49,830
in a room and they all come up with the

578
00:23:56,060 --> 00:23:52,320
best solution to the problems that we

579
00:23:58,730 --> 00:23:56,070
have and once doc used all the kit that

580
00:24:01,580 --> 00:23:58,740
we had on board to fabricate them we

581
00:24:04,220 --> 00:24:01,590
were able to go outside and put them on

582
00:24:06,260 --> 00:24:04,230
and it worked just the way the people

583
00:24:08,000 --> 00:24:06,270
designed them if you take the pictures

584
00:24:10,280 --> 00:24:08,010
of what they had at the NBL and compare

585
00:24:12,350 --> 00:24:10,290
them to what we had up in space they're

586
00:24:14,060 --> 00:24:12,360
virtually identical which shows you know

587
00:24:18,950 --> 00:24:14,070
a great work they do on the ground to

588
00:24:21,980 --> 00:24:18,960

get these things ready this is a wide

589

00:24:22,700 --> 00:24:21,990

shot perfect the yeah flight deck one of

590

00:24:24,710 --> 00:24:22,710

the things you should notice the

591

00:24:25,940 --> 00:24:24,720

external airlock in the foreground again

592

00:24:27,260 --> 00:24:25,950

it was the first flight where we didn't

593

00:24:29,660 --> 00:24:27,270

have the airlock inside the cockpit

594

00:24:31,820 --> 00:24:29,670

instead it was outside and again a

595

00:24:34,190 --> 00:24:31,830

beautiful view of the earth with Hubble

596

00:24:37,430 --> 00:24:34,200

in front there it's marking myself doing

597

00:24:39,320 --> 00:24:37,440

some of the MRI repair I might add that

598

00:24:40,880 --> 00:24:39,330

on my first flight I was at 120 nautical

599

00:24:42,260 --> 00:24:40,890

miles which is the lowest the shuttle

600

00:24:43,669 --> 00:24:42,270

goes and a heaven there an interesting

601
00:24:45,020 --> 00:24:43,679
view at that altitude and this was the

602
00:24:46,730 --> 00:24:45,030
highest the shuttle go so it was a real

603
00:24:47,780 --> 00:24:46,740
contrast for me and you notice the

604
00:24:50,750 --> 00:24:47,790
curvature of the earth was very

605
00:24:52,190 --> 00:24:50,760
pronounced in that last picture here we

606
00:24:54,799 --> 00:24:52,200
see you see the enhanced spacesuit that

607
00:24:56,120 --> 00:24:54,809
we wore we had four people that did

608
00:24:57,800 --> 00:24:56,130
spacewalks on this flight but we only

609
00:25:00,080 --> 00:24:57,810
took three spacesuits in order to save

610
00:25:02,450 --> 00:25:00,090
weight in order to do that the spacesuit

611
00:25:03,889 --> 00:25:02,460
had to be resizable very easily in orbit

612
00:25:05,749 --> 00:25:03,899
and folks here at the Johnson Space

613
00:25:07,460 --> 00:25:05,759

Center as well as a couple of the

614

00:25:09,320 --> 00:25:07,470

contractors up in the Northeast came up

615

00:25:11,060 --> 00:25:09,330

with this new way to resize suits during

616

00:25:12,499 --> 00:25:11,070

the flight Joe and I shared one

617

00:25:14,320 --> 00:25:12,509

spacesuit the one you see here

618

00:25:20,029 --> 00:25:14,330

over the five EPA's it works very well

619

00:25:22,580 --> 00:25:20,039

thanks line on the second DVA

620

00:25:24,440 --> 00:25:22,590

the customer asked us to go take a look

621

00:25:26,029 --> 00:25:24,450

at some of the solar arrays you'll see

622

00:25:28,100 --> 00:25:26,039

Joe here at the top of the picture and

623

00:25:30,769 --> 00:25:28,110

Greg on the back of the arm here with

624

00:25:31,999 --> 00:25:30,779

the removable evie a camera that's

625

00:25:33,739 --> 00:25:32,009

what's in Joe's right hand there and

626
00:25:35,659 --> 00:25:33,749
they actually did a real-time survey of

627
00:25:37,310 --> 00:25:35,669
the solar arrays to help the customer

628
00:25:39,350 --> 00:25:37,320
determine why one of the panels on the

629
00:25:40,820 --> 00:25:39,360
SOL race wasn't operating as efficiently

630
00:25:43,190 --> 00:25:40,830
as some of these other solar arrays

631
00:25:44,810 --> 00:25:43,200
you'll see this camera in use likely

632
00:25:46,489 --> 00:25:44,820
during the space station here because it

633
00:25:52,249 --> 00:25:46,499
turned out to be very very useful on our

634
00:25:55,460 --> 00:25:52,259
flight we also had a 35-millimeter

635
00:25:57,350 --> 00:25:55,470
camera out there a Nikon f3 this is what

636
00:25:59,389 --> 00:25:57,360
we often saw when we were up on the arm

637
00:26:00,980 --> 00:25:59,399
about 35 or 40 feet above the payload

638
00:26:02,629 --> 00:26:00,990

Bay and we would look back at the

639

00:26:04,249 --> 00:26:02,639

cockpit so we're looking forward you see

640

00:26:06,560 --> 00:26:04,259

the four windows of the cockpit to

641

00:26:08,539 --> 00:26:06,570

facing a half-two facing up the external

642

00:26:10,489 --> 00:26:08,549

airlock at the lower part of the screen

643

00:26:15,639 --> 00:26:10,499

and to the right as the kayuu band

644

00:26:21,649 --> 00:26:18,409

going back to that slide that you saw a

645

00:26:24,289 --> 00:26:21,659

moment ago with joe and i looking up at

646

00:26:26,389 --> 00:26:24,299

that solar ray what you don't see in

647

00:26:29,180 --> 00:26:26,399

that slide is the incredible view of the

648

00:26:31,639 --> 00:26:29,190

earth that we had in the background it

649

00:26:36,560 --> 00:26:31,649

was very difficult for me and the back

650

00:26:38,810 --> 00:26:36,570

of the arm there to not be staring at

651
00:26:40,789 --> 00:26:38,820
the earth and keep my mind on the solar

652
00:26:43,070 --> 00:26:40,799
array that we were trying to inspect but

653
00:26:46,039 --> 00:26:43,080
it was just an absolutely spectacular

654
00:26:49,639 --> 00:26:46,049
view this is marek holding that camera

655
00:26:52,129 --> 00:26:49,649
again and i must say i think we've sort

656
00:26:54,080 --> 00:26:52,139
of set a precedent here that is most

657
00:26:55,820 --> 00:26:54,090
likely to be followed in satellite

658
00:27:01,700 --> 00:26:55,830
servicing from here on out in terms of

659
00:27:03,850 --> 00:27:01,710
use of a camera out with the EBA crew

660
00:27:07,909 --> 00:27:03,860
members it was absolutely invaluable

661
00:27:10,009 --> 00:27:07,919
both for us onboard but more importantly

662
00:27:11,989 --> 00:27:10,019
for the folks on the ground to assess

663
00:27:15,360 --> 00:27:11,999

the condition of the satellite and the

664

00:27:17,370 --> 00:27:15,370

state of the task once we completed it

665

00:27:19,049 --> 00:27:17,380

it really proved it's worth over and

666

00:27:22,470 --> 00:27:19,059

over again you can see on the top of it

667

00:27:23,940 --> 00:27:22,480

is a little light it's actually a

668

00:27:25,650 --> 00:27:23,950

modified helmet light through it's

669

00:27:30,450 --> 00:27:25,660

attached to the top and we use that to

670

00:27:32,490 --> 00:27:30,460

illuminate the worksite every now and

671

00:27:35,640 --> 00:27:32,500

then if you take enough pictures you're

672

00:27:37,230 --> 00:27:35,650

going to get lucky and I have to admit I

673

00:27:39,000 --> 00:27:37,240

would love to say that I plan this

674

00:27:42,900 --> 00:27:39,010

picture but I think it was just pure

675

00:27:47,700 --> 00:27:42,910

luck that's Joe and it just turned out

676
00:27:50,580 --> 00:27:47,710
absolutely spectacularly I think you can

677
00:27:54,840 --> 00:27:50,590
if you look at it maybe not here but in

678
00:27:57,750 --> 00:27:54,850
if you study the photograph you can see

679
00:27:59,310 --> 00:27:57,760
Joe's face and it really just turned out

680
00:28:05,130 --> 00:27:59,320
nice so I'm really proud of that

681
00:28:08,430 --> 00:28:05,140
photograph the work that EBN guys who

682
00:28:09,930 --> 00:28:08,440
described being able to to perform

683
00:28:11,880 --> 00:28:09,940
servicing activities like this is

684
00:28:14,370 --> 00:28:11,890
obviously going to be very important as

685
00:28:16,650 --> 00:28:14,380
we move into Space Station it's probably

686
00:28:19,200 --> 00:28:16,660
worth noting as well that the ability of

687
00:28:22,830 --> 00:28:19,210
the robotic arm to move around heavy

688
00:28:24,840 --> 00:28:22,840

payloads into position the VA crew

689

00:28:28,110 --> 00:28:24,850

members with precision is also going to

690

00:28:29,580 --> 00:28:28,120

be an important component of our suite

691

00:28:33,419 --> 00:28:29,590

of skills that we're going to need as we

692

00:28:35,580 --> 00:28:33,429

enter space station construction again

693

00:28:39,210 --> 00:28:35,590

after the successful completion of the

694

00:28:41,370 --> 00:28:39,220

five EPA's we were ready to let Hubble

695

00:28:44,549 --> 00:28:41,380

go back and perform its mission our

696

00:28:46,440 --> 00:28:44,559

contribution to Hubble was pretty much

697

00:28:49,380 --> 00:28:46,450

at an end at this point in the flight of

698

00:28:51,030 --> 00:28:49,390

course there's a lot of activity still

699

00:28:54,060 --> 00:28:51,040

ongoing by the rest of the Hubble team

700

00:28:56,580 --> 00:28:54,070

to check out the instruments the new

701
00:28:58,290 --> 00:28:56,590
electronics that that were installed and

702
00:29:00,660 --> 00:28:58,300
and all that checkouts going very well

703
00:29:02,610 --> 00:29:00,670
so we're very hopeful that we really

704
00:29:05,060 --> 00:29:02,620
will leave Hubble with more power and

705
00:29:07,970 --> 00:29:05,070
and better than it was when we found it

706
00:29:11,210 --> 00:29:07,980
all it's been able to do over the last

707
00:29:14,310 --> 00:29:11,220
seven years with the 1970s technology

708
00:29:16,230 --> 00:29:14,320
has fundamentally changed the way we we

709
00:29:19,650 --> 00:29:16,240
think of our universe and our place in

710
00:29:22,550 --> 00:29:19,660
it and our understanding of it and it's

711
00:29:25,110 --> 00:29:22,560
amazing to me to even speculate on what

712
00:29:27,720 --> 00:29:25,120
1990s technology will allow Hubble to do

713
00:29:28,480 --> 00:29:27,730

so there's great promise and everybody

714

00:29:32,200 --> 00:29:28,490

that had

715

00:29:34,900 --> 00:29:32,210

chance to work on the telescope either

716

00:29:36,850 --> 00:29:34,910

previously or part of 82 or or on a

717

00:29:38,650 --> 00:29:36,860

future mission is contributing to

718

00:29:40,990 --> 00:29:38,660

something that that I think will be a

719

00:29:45,480 --> 00:29:41,000

tremendous legacy for the human race for

720

00:29:50,650 --> 00:29:48,760

well we saw this view in the in the

721

00:29:53,169 --> 00:29:50,660

movie it happened preflighting Lee

722

00:29:55,000 --> 00:29:53,179

because it went by so fast so it's real

723

00:29:57,160 --> 00:29:55,010

nice to have us still and we'll look at

724

00:29:59,020 --> 00:29:57,170

the sequence here of the Hubble during

725

00:30:01,900 --> 00:29:59,030

the deploy and you look at the sequence

726

00:30:03,970 --> 00:30:01,910

- just want to note as we go through it

727

00:30:06,100 --> 00:30:03,980

it was really amazing to work on the

728

00:30:07,480 --> 00:30:06,110

Hubble we're very focused the crew was

729

00:30:10,060 --> 00:30:07,490

you know working very hard the grounds

730

00:30:12,640 --> 00:30:10,070

worked very hard and even all the way up

731

00:30:15,340 --> 00:30:12,650

to deploy and at this point I guess it

732

00:30:17,169 --> 00:30:15,350

hit me what we had just done I mean we

733

00:30:18,430 --> 00:30:17,179

had planned and everyone worked really

734

00:30:20,410 --> 00:30:18,440

hard for all these years to get ready

735

00:30:22,419 --> 00:30:20,420

for this mission and now we were

736

00:30:24,549 --> 00:30:22,429

releasing Hubble to go out and do its

737

00:30:27,970 --> 00:30:24,559

job and and it was really a beautiful

738

00:30:30,220 --> 00:30:27,980

sight and as we released the Hubble and

739

00:30:32,230 --> 00:30:30,230

it goes off to explore the universe you

740

00:30:34,240 --> 00:30:32,240

know I looked at it with the hope

741

00:30:37,450 --> 00:30:34,250

someday of maybe coming back to visit it

742

00:30:40,390 --> 00:30:37,460

again because it's it's amazing thing

743

00:30:43,270 --> 00:30:40,400

that we do and hopefully the returns

744

00:30:45,610 --> 00:30:43,280

will produce scientific results that

745

00:30:49,780 --> 00:30:45,620

will improve our life for all of the

746

00:30:52,299 --> 00:30:49,790

people of the world and you have to have

747

00:30:53,620 --> 00:30:52,309

the obligatory crew in orbit photo and

748

00:30:55,120 --> 00:30:53,630

of course you can tell it's in orbit

749

00:30:56,770 --> 00:30:55,130

with the Hubble you see the solar arrays

750

00:30:58,540 --> 00:30:56,780

and a piece of the telescope there in

751
00:31:00,690 --> 00:30:58,550
the background and just want you to note

752
00:31:06,010 --> 00:31:00,700
the the wonderful use of color their

753
00:31:09,430 --> 00:31:06,020
navy blue is a wonderful color navy blue

754
00:31:11,590 --> 00:31:09,440
good of course here's our more power

755
00:31:13,750 --> 00:31:11,600
sign that really summed up as we said

756
00:31:16,570 --> 00:31:13,760
earlier what we had intended to do to

757
00:31:18,940 --> 00:31:16,580
the telescope and we felt after we had

758
00:31:22,060 --> 00:31:18,950
completed the 5 e bas that we truly left

759
00:31:24,640 --> 00:31:22,070
the telescope in a in a more power

760
00:31:26,940 --> 00:31:24,650
situation we were pretty happy you can

761
00:31:29,560 --> 00:31:26,950
see relief on the faces of everybody at

762
00:31:31,680 --> 00:31:29,570
about the mission being a successfully

763
00:31:33,669 --> 00:31:31,690

accomplished you you read that correctly

764

00:31:39,269 --> 00:31:33,679

they wanted to put that up on the

765

00:31:44,409 --> 00:31:42,940

of course socks spent a fair amount of

766

00:31:46,539 --> 00:31:44,419

time in the windows

767

00:31:48,669 --> 00:31:46,549

he made a challenge to doc that he

768

00:31:51,399 --> 00:31:48,679

couldn't shoot up all of the film that

769

00:31:53,380 --> 00:31:51,409

we had left on board after the telescope

770

00:31:55,090 --> 00:31:53,390

was gone and telescopes still here right

771

00:31:58,990 --> 00:31:55,100

now but we were shooting some earth

772

00:32:00,700 --> 00:31:59,000

earth obscene so far of the telescope

773

00:32:02,590 --> 00:32:00,710

but we did take a few beautiful shots of

774

00:32:06,370 --> 00:32:02,600

Australia no this next one

775

00:32:09,549 --> 00:32:06,380

there's certainly one of the best this

776
00:32:12,070 --> 00:32:09,559
is a Spencer Bay in August northeast

777
00:32:15,070 --> 00:32:12,080
Australia and we covered every inch of

778
00:32:19,570 --> 00:32:15,080
Australia and enjoyed it every time it

779
00:32:22,389 --> 00:32:19,580
came by we like to take pictures of all

780
00:32:24,100 --> 00:32:22,399
the dirt we see for the geologists we

781
00:32:27,509 --> 00:32:24,110
like to take pictures of the clouds in

782
00:32:29,440 --> 00:32:27,519
water too so here's one of our prettier

783
00:32:37,600 --> 00:32:29,450
pictures in that category

784
00:32:42,010 --> 00:32:40,180
it had been about over a year since

785
00:32:46,090 --> 00:32:42,020
discovery had flown before this flight

786
00:32:47,650 --> 00:32:46,100
and we couldn't find the key so we had

787
00:32:51,669 --> 00:32:47,660
to make our own on-orbit to make sure we

788
00:32:52,900 --> 00:32:51,679

could come home we're gonna give that to

789

00:32:56,010 --> 00:32:52,910

the next crew and hopefully they'll be

790

00:32:59,130 --> 00:32:56,020

able to pass it on to crews beyond them

791

00:33:02,380 --> 00:32:59,140

103 was a fantastic vehicle to fly in

792

00:33:03,730 --> 00:33:02,390

discovery gave us no problems during the

793

00:33:06,100 --> 00:33:03,740

flight that's because of all the work

794

00:33:08,320 --> 00:33:06,110

that had been done so well by the people

795

00:33:10,360 --> 00:33:08,330

on the ground and it really enabled us

796

00:33:17,500 --> 00:33:10,370

to focus on the mission of fixing the

797

00:33:19,620 --> 00:33:17,510

telescope well every mission has to come

798

00:33:23,740 --> 00:33:19,630

to an end here's our empty payload Bay

799

00:33:25,810 --> 00:33:23,750

the Sun setting not long after this we

800

00:33:31,360 --> 00:33:25,820

closed the payload bay doors and and

801

00:33:36,760 --> 00:33:31,370

came home touched down at the Kennedy

802

00:33:39,669 --> 00:33:36,770

Space Center we felt good after the

803

00:33:43,930 --> 00:33:39,679

mission because we were pretty sure we