
PAO

1
00:00:04,870 --> 00:00:03,110
hi everybody josh byerly here inside

2
00:00:06,630 --> 00:00:04,880
mission control houston i'm joined by my

3
00:00:08,790 --> 00:00:06,640
friend katie coleman again former well

4
00:00:11,430 --> 00:00:08,800
not for your current astronaut former

5
00:00:13,749 --> 00:00:11,440
space station crew member uh katie was

6
00:00:15,589 --> 00:00:13,759
really instrumental in the htv that

7
00:00:17,670 --> 00:00:15,599
happened last year with htv2 right it

8
00:00:19,429 --> 00:00:17,680
was the second one that flew up there so

9
00:00:20,870 --> 00:00:19,439
uh you know she's really an expert on

10
00:00:21,910 --> 00:00:20,880
how these things go up there on board

11
00:00:23,189 --> 00:00:21,920
the station we've been talking a lot

12
00:00:24,790 --> 00:00:23,199
about how the crew is getting ready to

13
00:00:26,390 --> 00:00:24,800

greet this thing tomorrow so we figured

14
00:00:27,589 --> 00:00:26,400
katie would come in here and actually

15
00:00:28,790 --> 00:00:27,599
tell us here on earth you know what it's

16
00:00:30,310 --> 00:00:28,800
like for the crew to work on these

17
00:00:31,349 --> 00:00:30,320
things so katie talk a little bit about

18
00:00:33,190 --> 00:00:31,359
you know it's the day before this thing

19
00:00:34,870 --> 00:00:33,200
gets up there the crew is going through

20
00:00:35,750 --> 00:00:34,880
quite a bit of onboard training kind of

21
00:00:37,750 --> 00:00:35,760
making sure that they've got all their

22
00:00:39,830 --> 00:00:37,760
procedures ready to go what was it like

23
00:00:42,069 --> 00:00:39,840
whenever you were up there doing this

24
00:00:43,270 --> 00:00:42,079
well you know this this thing is big

25
00:00:44,630 --> 00:00:43,280
yeah

26
00:00:46,950 --> 00:00:44,640
and basically and it launches in a

27
00:00:48,630 --> 00:00:46,960
rocket and you know comes up to meet the

28
00:00:51,510 --> 00:00:48,640
space station and then you know this and

29
00:00:53,830 --> 00:00:51,520
the space station are flying in parallel

30
00:00:55,910 --> 00:00:53,840
and uh and they're both going 17 500

31
00:00:58,389 --> 00:00:55,920
miles an hour together and so then the

32
00:01:01,029 --> 00:00:58,399
crew which was myself and paolo nespoli

33
00:01:03,270 --> 00:01:01,039
last year um are at the controls of the

34
00:01:04,869 --> 00:01:03,280
robotic arm and controlling that robotic

35
00:01:06,469 --> 00:01:04,879
arm now i'm going to be the arm they're

36
00:01:08,469 --> 00:01:06,479
going to go for this i don't know if you

37
00:01:10,950 --> 00:01:08,479
can see this grapple pin right here it's

38
00:01:13,190 --> 00:01:10,960

a little pin that thing is actually as

39
00:01:15,270 --> 00:01:13,200
big as my as my arm here huge so it's

40
00:01:17,350 --> 00:01:15,280
really really this whole thing is really

41
00:01:18,550 --> 00:01:17,360
big like the size of a school bus and so

42
00:01:21,749 --> 00:01:18,560
they're going to reach out with the

43
00:01:24,469 --> 00:01:21,759
robotic arm and grab this thing

44
00:01:26,230 --> 00:01:24,479
and the trick is um it would be easy if

45
00:01:27,830 --> 00:01:26,240
something happened if the space station

46
00:01:29,270 --> 00:01:27,840
could just move away

47
00:01:31,510 --> 00:01:29,280
but the space station is very big and

48
00:01:33,190 --> 00:01:31,520
hard to maneuver and so we have to have

49
00:01:34,870 --> 00:01:33,200
it really just perfect because if

50
00:01:36,230 --> 00:01:34,880
something goes wrong and we you know

51
00:01:38,069 --> 00:01:36,240
bang this thing and then it's going

52
00:01:39,910 --> 00:01:38,079
towards the space station we could all

53
00:01:41,990 --> 00:01:39,920
be in big trouble and so we do a lot of

54
00:01:43,429 --> 00:01:42,000
training you know to to model what you

55
00:01:44,950 --> 00:01:43,439
know as this thing is flying along it's

56
00:01:46,870 --> 00:01:44,960
actually keeping itself in a nice little

57
00:01:48,550 --> 00:01:46,880
box and you know just making sure that

58
00:01:50,389 --> 00:01:48,560
it stays in one place

59
00:01:51,830 --> 00:01:50,399
but before we grab it we want to make

60
00:01:52,789 --> 00:01:51,840
sure that it is not trying to go

61
00:01:54,950 --> 00:01:52,799
anywhere

62
00:01:57,109 --> 00:01:54,960
so we send a command called free drift

63
00:01:59,749 --> 00:01:57,119

meaning these little jets that help it

64
00:02:02,310 --> 00:01:59,759
control where it goes um we tell them

65
00:02:04,230 --> 00:02:02,320
they can't fire but if it's on its way

66
00:02:05,830 --> 00:02:04,240
to like you know going maybe this

67
00:02:08,150 --> 00:02:05,840
direction as it was kind of just doing

68
00:02:09,830 --> 00:02:08,160
its little circle here then it's going

69
00:02:11,990 --> 00:02:09,840
to be continuing so with the robotic arm

70
00:02:13,910 --> 00:02:12,000
we have to track that we have to be you

71
00:02:16,070 --> 00:02:13,920
know following the pin and so we

72
00:02:17,990 --> 00:02:16,080
actually practice you know what's much

73
00:02:19,510 --> 00:02:18,000
more exciting than the actual day we

74
00:02:21,190 --> 00:02:19,520
practice as if this thing is you know

75
00:02:22,790 --> 00:02:21,200
running away and we are trying to catch

76
00:02:24,390 --> 00:02:22,800
it and trying to make good decisions

77
00:02:26,470 --> 00:02:24,400
about what what if things happen when

78
00:02:27,990 --> 00:02:26,480
you know that are unexpected on the real

79
00:02:29,830 --> 00:02:28,000
day uh

80
00:02:32,070 --> 00:02:29,840
the first one and the second one of this

81
00:02:33,990 --> 00:02:32,080
vehicle have behaved perfectly

82
00:02:35,430 --> 00:02:34,000
and and there it was with just a tiny

83
00:02:37,830 --> 00:02:35,440
little drift and we could reach out with

84
00:02:39,990 --> 00:02:37,840
a robotic arm grab this thing and then

85
00:02:43,430 --> 00:02:40,000
we're actually going to you know anchor

86
00:02:45,509 --> 00:02:43,440
this end onto the space station

87
00:02:46,309 --> 00:02:45,519
and then we'll open hatches

88
00:02:50,390 --> 00:02:46,319

and

89
00:02:52,949 --> 00:02:50,400
that have been planned for experiments

90
00:02:53,990 --> 00:02:52,959
uh care packages probably for us you

91
00:02:55,750 --> 00:02:54,000
know a lot of different kinds of

92
00:02:57,430 --> 00:02:55,760
supplies but it's uh it's one of the

93
00:02:59,430 --> 00:02:57,440
most critical things that this this crew

94
00:03:01,750 --> 00:02:59,440
will do so it'll be a high point of

95
00:03:02,790 --> 00:03:01,760
their of their expedition so let's talk

96
00:03:03,830 --> 00:03:02,800
about you know we were talking about

97
00:03:05,350 --> 00:03:03,840
before we came on the air you guys

98
00:03:06,710 --> 00:03:05,360
trained for two and a half years i mean

99
00:03:09,110 --> 00:03:06,720
it's a long training program to get

100
00:03:11,030 --> 00:03:09,120
ready to fly up the station um

101
00:03:12,949 --> 00:03:11,040
you know how much do you train just for

102
00:03:13,910 --> 00:03:12,959
general robotics just kind of anything

103
00:03:16,229 --> 00:03:13,920
that could come up there versus

104
00:03:17,750 --> 00:03:16,239
something specific like htv or like we

105
00:03:18,949 --> 00:03:17,760
talked about before with is dragging i

106
00:03:20,149 --> 00:03:18,959
mean how much what's the difference

107
00:03:22,630 --> 00:03:20,159
between kind of overall training and

108
00:03:24,309 --> 00:03:22,640
really training for this real task that

109
00:03:26,390 --> 00:03:24,319
you're going to have to do well all of

110
00:03:27,830 --> 00:03:26,400
us train in robotics just the general

111
00:03:30,229 --> 00:03:27,840
principles of you know if i'm going to

112
00:03:31,990 --> 00:03:30,239
go and grab this with the arm you know

113
00:03:33,830 --> 00:03:32,000

right now you and i have this view right

114
00:03:36,070 --> 00:03:33,840
here and we can tell how close i am

115
00:03:37,670 --> 00:03:36,080
closer closer closer but if we only have

116
00:03:38,869 --> 00:03:37,680
this view we don't know how close we are

117
00:03:40,630 --> 00:03:38,879
so we're training all the time the

118
00:03:41,830 --> 00:03:40,640
principles of do you really know what

119
00:03:43,350 --> 00:03:41,840
you're doing do you really know where

120
00:03:45,270 --> 00:03:43,360
the arm is going and what are you going

121
00:03:46,710 --> 00:03:45,280
to do when it goes someplace different

122
00:03:49,110 --> 00:03:46,720
so we're always training those general

123
00:03:51,750 --> 00:03:49,120
things but with a situation that can be

124
00:03:53,509 --> 00:03:51,760
as dynamic as this one

125
00:03:55,750 --> 00:03:53,519
you need to be just physically and

126
00:03:57,589 --> 00:03:55,760
mentally proficient so that means

127
00:03:59,350 --> 00:03:57,599
practicing a lot you know the few weeks

128
00:04:01,670 --> 00:03:59,360
ahead of time and that means in the few

129
00:04:03,270 --> 00:04:01,680
years before that making sure that you

130
00:04:04,949 --> 00:04:03,280
really understand what you're doing and

131
00:04:07,429 --> 00:04:04,959
you have good hand controller skills you

132
00:04:09,509 --> 00:04:07,439
know where we're not only going this way

133
00:04:11,110 --> 00:04:09,519
but we can move the hand controller and

134
00:04:12,710 --> 00:04:11,120
move the arm this way but it also can

135
00:04:14,550 --> 00:04:12,720
move in pitch and yaw and all those

136
00:04:16,229 --> 00:04:14,560
things are kind of interconnected and we

137
00:04:17,990 --> 00:04:16,239
have to practice really

138
00:04:19,990 --> 00:04:18,000

looking at a picture you know a

139
00:04:21,909 --> 00:04:20,000
two-dimensional picture and

140
00:04:23,189 --> 00:04:21,919
understanding in three dimensions what

141
00:04:25,110 --> 00:04:23,199
this vehicle

142
00:04:26,390 --> 00:04:25,120
might be doing so there's a lot of

143
00:04:28,150 --> 00:04:26,400
different practice but some of that two

144
00:04:29,909 --> 00:04:28,160
and a half years is generic space

145
00:04:31,510 --> 00:04:29,919
station systems i mean i would say one

146
00:04:34,070 --> 00:04:31,520
of the frustrating parts of an astronaut

147
00:04:35,749 --> 00:04:34,080
job is just that

148
00:04:37,830 --> 00:04:35,759
we train a lot for things that are

149
00:04:39,670 --> 00:04:37,840
hopefully never going to happen you know

150
00:04:41,590 --> 00:04:39,680
what if this thing breaks on the space

151
00:04:43,030 --> 00:04:41,600
station and we can't get hold of mission

152
00:04:44,950 --> 00:04:43,040
control and they can't help us solve the

153
00:04:46,550 --> 00:04:44,960
problem so worst case scenario exactly

154
00:04:49,430 --> 00:04:46,560
so we train for a lot of those it's

155
00:04:51,670 --> 00:04:49,440
necessary it's part of the job and uh

156
00:04:53,590 --> 00:04:51,680
and when things almost happen

157
00:04:55,110 --> 00:04:53,600
it reminds you that you need that

158
00:04:56,550 --> 00:04:55,120
training yeah i mean we had some of

159
00:04:58,710 --> 00:04:56,560
those things on on board you know in the

160
00:05:00,150 --> 00:04:58,720
middle of the night an alarm rings and

161
00:05:01,110 --> 00:05:00,160
you know you race down to the computer

162
00:05:03,749 --> 00:05:01,120
all of you

163
00:05:04,950 --> 00:05:03,759

and figure out what it is and uh one

164
00:05:06,070 --> 00:05:04,960
time we were actually pretty excited

165
00:05:07,670 --> 00:05:06,080
because we thought we might actually get

166
00:05:10,150 --> 00:05:07,680
to go do a spacewalk but it turns out

167
00:05:12,710 --> 00:05:10,160
that you know nasa being nasa we already

168
00:05:15,510 --> 00:05:12,720
had a spare of that box already outside

169
00:05:17,590 --> 00:05:15,520
all we had to do was was uh you know

170
00:05:19,029 --> 00:05:17,600
change the power and the data path and

171
00:05:20,950 --> 00:05:19,039
everything was all set and we did not

172
00:05:22,629 --> 00:05:20,960
get that spacewalk so you know this is a

173
00:05:24,390 --> 00:05:22,639
pretty cool looking cargo craft i mean

174
00:05:25,830 --> 00:05:24,400
it takes up supplies but it's really i

175
00:05:27,749 --> 00:05:25,840
mean it's it's a it's a cool looking

176
00:05:29,029 --> 00:05:27,759
thing i mean just looking at the model

177
00:05:30,310 --> 00:05:29,039
is pretty neat so talk about whenever

178
00:05:32,390 --> 00:05:30,320
you saw it in person and also whenever

179
00:05:33,749 --> 00:05:32,400
you saw it in space well it's amazingly

180
00:05:35,670 --> 00:05:33,759
complicated i mean let me just tell you

181
00:05:37,110 --> 00:05:35,680
something that's not obvious is that

182
00:05:38,230 --> 00:05:37,120
there's there's a whole bunch of cargo

183
00:05:39,590 --> 00:05:38,240
we're going to go in this end we're

184
00:05:40,870 --> 00:05:39,600
going to touch this end of the space

185
00:05:42,469 --> 00:05:40,880
station and this end is filled with

186
00:05:44,390 --> 00:05:42,479
cargo okay

187
00:05:46,150 --> 00:05:44,400
but then there's this and i can't take

188
00:05:48,469 --> 00:05:46,160

it out of this model but it's like a

189
00:05:49,909 --> 00:05:48,479
little cart like a little wagon so

190
00:05:51,270 --> 00:05:49,919
there's another grapple fixture one of

191
00:05:53,830 --> 00:05:51,280
those things that the robotic arm can

192
00:05:55,270 --> 00:05:53,840
grab onto so along with the ground who's

193
00:05:57,110 --> 00:05:55,280
going to do a lot of these operations

194
00:05:59,189 --> 00:05:57,120
this time the ground is going to

195
00:06:02,070 --> 00:05:59,199
actually use the robotic arm to grab

196
00:06:03,990 --> 00:06:02,080
that grapple fixture bring that cart out

197
00:06:05,670 --> 00:06:04,000
we're going to hand this card which is

198
00:06:07,670 --> 00:06:05,680
carrying a bunch of really important

199
00:06:09,590 --> 00:06:07,680
spare parts for the space station we're

200
00:06:11,909 --> 00:06:09,600
going to hand that to the japanese

201
00:06:13,670 --> 00:06:11,919
robotic arm and so the japanese and so

202
00:06:15,430 --> 00:06:13,680
here if you hold that for a second

203
00:06:17,110 --> 00:06:15,440
you know it's almost as if if you've got

204
00:06:19,350 --> 00:06:17,120
that you're the space station robotic

205
00:06:21,430 --> 00:06:19,360
arm and now i'm going to then grab it

206
00:06:24,070 --> 00:06:21,440
with this robotic arm then you let go

207
00:06:25,909 --> 00:06:24,080
and then i have it so we do a handoff

208
00:06:26,950 --> 00:06:25,919
between two robotic arms on the space

209
00:06:29,029 --> 00:06:26,960
station

210
00:06:31,189 --> 00:06:29,039
and aki hoshide will be flying the gem

211
00:06:33,270 --> 00:06:31,199
robotic arm joe acaba and suni williams

212
00:06:35,990 --> 00:06:33,280
we will be flying the space station

213
00:06:37,350 --> 00:06:36,000

robotic arm and so this this cart this

214
00:06:39,189 --> 00:06:37,360
uh you know platform that's got the

215
00:06:41,350 --> 00:06:39,199
spares on it will be sitting on the back

216
00:06:44,150 --> 00:06:41,360
of the japanese module and then that

217
00:06:45,909 --> 00:06:44,160
japanese arm will they'll park it there

218
00:06:48,230 --> 00:06:45,919
we'll reach down pick up some of these

219
00:06:49,670 --> 00:06:48,240
spare parts and put them in their places

220
00:06:52,309 --> 00:06:49,680
on the space station

221
00:06:53,670 --> 00:06:52,319
so there's there's a lot to this vehicle

222
00:06:54,790 --> 00:06:53,680
that it you know it looks like just one

223
00:06:56,870 --> 00:06:54,800
big craft but it's got a lot of

224
00:06:58,629 --> 00:06:56,880
different functions talk about the

225
00:06:59,990 --> 00:06:58,639
cupola you know whenever you're up here

226
00:07:01,270 --> 00:07:00,000
we you know we see these views all the

227
00:07:02,710 --> 00:07:01,280
time and it's really kind of

228
00:07:04,230 --> 00:07:02,720
revolutionary that the crew gets to see

229
00:07:06,070 --> 00:07:04,240
that much you know that much around i

230
00:07:07,670 --> 00:07:06,080
mean whenever we see these vehicles fly

231
00:07:09,029 --> 00:07:07,680
up there you know we talked about you

232
00:07:10,150 --> 00:07:09,039
don't really get a sense of the size of

233
00:07:11,909 --> 00:07:10,160
it and then also you're looking at these

234
00:07:13,510 --> 00:07:11,919
windows and i mean it's a really big

235
00:07:15,350 --> 00:07:13,520
space ground what is it like to actually

236
00:07:17,909 --> 00:07:15,360
see that in space is it does it get your

237
00:07:19,830 --> 00:07:17,919
attention well you know i told aki today

238
00:07:21,749 --> 00:07:19,840

we were telling him when and where he

239
00:07:23,670 --> 00:07:21,759
could see the htv because it you know

240
00:07:26,309 --> 00:07:23,680
today it's getting closer and closer and

241
00:07:27,909 --> 00:07:26,319
closer and i said remember aki objects

242
00:07:29,430 --> 00:07:27,919
in the mirror maybe larger that they

243
00:07:30,469 --> 00:07:29,440
appear

244
00:07:32,950 --> 00:07:30,479
but actually

245
00:07:34,230 --> 00:07:32,960
they it looks really big i mean at first

246
00:07:35,749 --> 00:07:34,240
when you look down the first time you

247
00:07:37,589 --> 00:07:35,759
see it it's pretty exciting because you

248
00:07:38,710 --> 00:07:37,599
see this tiny little thing

249
00:07:41,029 --> 00:07:38,720
big earth

250
00:07:43,350 --> 00:07:41,039
tiny little htv and you think okay

251
00:07:46,070 --> 00:07:43,360
that's okay and then it gets closer and

252
00:07:48,869 --> 00:07:46,080
closer and closer and it is the size of

253
00:07:51,189 --> 00:07:48,879
a school bus it is giant and it is only

254
00:07:52,469 --> 00:07:51,199
about i don't know 15 feet away from the

255
00:07:53,510 --> 00:07:52,479
space station yeah when you actually

256
00:07:54,550 --> 00:07:53,520
grapple it

257
00:07:56,550 --> 00:07:54,560
so

258
00:07:58,230 --> 00:07:56,560
it's big and it's and it's amazing and

259
00:08:00,070 --> 00:07:58,240
because there's no atmosphere out there

260
00:08:01,510 --> 00:08:00,080
everything is very sharp and very clear

261
00:08:04,150 --> 00:08:01,520
i think it makes it seem that much

262
00:08:06,070 --> 00:08:04,160
bigger very high that much closer so i

263
00:08:07,430 --> 00:08:06,080

tried not to think about that when paulo

264
00:08:09,189 --> 00:08:07,440
and i i was on the controls of the

265
00:08:11,430 --> 00:08:09,199
robotic arm and paulo was telling me you

266
00:08:13,909 --> 00:08:11,440
know how close i was getting as i was

267
00:08:15,990 --> 00:08:13,919
as i was grappling so try not to think

268
00:08:17,510 --> 00:08:16,000
about that part and just you know do it

269
00:08:18,550 --> 00:08:17,520
like we practiced but it was really

270
00:08:22,390 --> 00:08:18,560
beautiful

271
00:08:24,390 --> 00:08:22,400
to see the the htv overland over japan

272
00:08:26,790 --> 00:08:24,400
uh we we actually did the capture over

273
00:08:28,869 --> 00:08:26,800
new england where i'm from so it's just

274
00:08:30,869 --> 00:08:28,879
pretty neat to you know just see this

275
00:08:33,110 --> 00:08:30,879
pla this uh this supply ship actually

276
00:08:34,550 --> 00:08:33,120
have a life all over the world yeah

277
00:08:35,909 --> 00:08:34,560
what is it like to actually go inside of

278
00:08:37,029 --> 00:08:35,919
it i mean i know you're looking forward

279
00:08:38,949 --> 00:08:37,039
to the care packages and things like

280
00:08:40,230 --> 00:08:38,959
that but whenever you open up the

281
00:08:41,750 --> 00:08:40,240
the hatch is is it different from the

282
00:08:44,630 --> 00:08:41,760
other vehicles does it look different on

283
00:08:46,710 --> 00:08:44,640
the inside um it's uh it's like a big

284
00:08:50,389 --> 00:08:46,720
closet okay where it's got you know it's

285
00:08:52,630 --> 00:08:50,399
a big square closet and um it's almost

286
00:08:53,910 --> 00:08:52,640
like you have four four doors yeah and

287
00:08:55,910 --> 00:08:53,920
in back of each of those doors there's a

288
00:08:58,389 --> 00:08:55,920

lot of stuff but then strapped to the

289
00:09:00,230 --> 00:08:58,399
front of each of those doors is also a

290
00:09:01,990 --> 00:09:00,240
lot of stuff so in order to get to

291
00:09:03,750 --> 00:09:02,000
things you actually have to start it in

292
00:09:05,590 --> 00:09:03,760
the middle which when it gets there it's

293
00:09:07,190 --> 00:09:05,600
pretty packed so there's not much space

294
00:09:08,389 --> 00:09:07,200
there so you have to unstrap the stuff

295
00:09:09,670 --> 00:09:08,399
from the outside

296
00:09:11,269 --> 00:09:09,680
find a place to put it on the space

297
00:09:12,870 --> 00:09:11,279
station which fortunately the people

298
00:09:15,030 --> 00:09:12,880
here on the ground have thought about

299
00:09:16,790 --> 00:09:15,040
all that yeah and they've got a plan for

300
00:09:18,230 --> 00:09:16,800
almost this shell game of you know this

301
00:09:20,550 --> 00:09:18,240
gets here and this goes here and this

302
00:09:22,870 --> 00:09:20,560
gets put away there but uh

303
00:09:24,550 --> 00:09:22,880
one thing that was surprising i think to

304
00:09:26,470 --> 00:09:24,560
us was that

305
00:09:28,389 --> 00:09:26,480
it was confusing

306
00:09:30,070 --> 00:09:28,399
to go in there really because you know

307
00:09:31,350 --> 00:09:30,080
we're used to coming to you know an

308
00:09:32,949 --> 00:09:31,360
intersection we're in the space station

309
00:09:34,870 --> 00:09:32,959
we're going down the hallway we can go

310
00:09:37,269 --> 00:09:34,880
left and go into the gym we can go right

311
00:09:38,790 --> 00:09:37,279
and go into columbus and and then the

312
00:09:40,790 --> 00:09:38,800
hallway ends right there that's where

313
00:09:42,550 --> 00:09:40,800

the state the space shuttle would dock

314
00:09:45,110 --> 00:09:42,560
usually but now suddenly there's

315
00:09:46,949 --> 00:09:45,120
something down there yeah and and so we

316
00:09:49,430 --> 00:09:46,959
usually go in kind of head first and

317
00:09:51,110 --> 00:09:49,440
then somehow when you come out

318
00:09:52,870 --> 00:09:51,120
you're always facing a different way

319
00:09:54,470 --> 00:09:52,880
than you really expected to get your

320
00:09:55,590 --> 00:09:54,480
bearings and we find that at these

321
00:09:57,990 --> 00:09:55,600
intersections where there's something

322
00:09:59,829 --> 00:09:58,000
coming in this way this way this way and

323
00:10:02,230 --> 00:09:59,839
then one more way where it's not just

324
00:10:04,389 --> 00:10:02,240
sort of the horizontal axis of you know

325
00:10:05,990 --> 00:10:04,399
a left and a right and a straight ahead

326
00:10:07,990 --> 00:10:06,000
as soon as you put an upper down in

327
00:10:09,750 --> 00:10:08,000
there when you come out of there

328
00:10:10,949 --> 00:10:09,760
you have to almost look around in fact

329
00:10:14,710 --> 00:10:10,959
we label

330
00:10:17,430 --> 00:10:14,720
round here but the hatch itself is

331
00:10:20,550 --> 00:10:17,440
square and so we will label them port

332
00:10:21,990 --> 00:10:20,560
starboard you know aft so that we know

333
00:10:23,590 --> 00:10:22,000
where we're going and we don't suddenly

334
00:10:24,630 --> 00:10:23,600
start flying you know in the wrong

335
00:10:26,069 --> 00:10:24,640
direction

336
00:10:27,269 --> 00:10:26,079
we even saw that during shuttle missions

337
00:10:29,190 --> 00:10:27,279
whenever you had the multi-purpose

338
00:10:30,949 --> 00:10:29,200

logistics modules being attached i mean

339
00:10:32,069 --> 00:10:30,959
you're really adding a new room yeah i

340
00:10:33,430 --> 00:10:32,079
mean it's like if you added something

341
00:10:34,389 --> 00:10:33,440
under your house all of a sudden just in

342
00:10:35,670 --> 00:10:34,399
a day

343
00:10:37,590 --> 00:10:35,680
it kind of changes the layout a little

344
00:10:39,190 --> 00:10:37,600
bit so it's big yeah and it's it was

345
00:10:41,030 --> 00:10:39,200
kind of fun um

346
00:10:42,230 --> 00:10:41,040
uh we have conferences with our families

347
00:10:44,310 --> 00:10:42,240
once a week

348
00:10:47,030 --> 00:10:44,320
and we have computers that have video

349
00:10:48,949 --> 00:10:47,040
cameras on them so it's almost like um

350
00:10:51,590 --> 00:10:48,959
we could have a video conference but

351
00:10:53,269 --> 00:10:51,600
these computers are wireless so i got to

352
00:10:55,670 --> 00:10:53,279
actually take my family you know fly

353
00:10:58,389 --> 00:10:55,680
through into the htv i said okay so here

354
00:11:01,030 --> 00:10:58,399
we go okay take you know hold on and we

355
00:11:03,350 --> 00:11:01,040
went down into the htv and we looked

356
00:11:04,630 --> 00:11:03,360
around you know it's just really pretty

357
00:11:06,069 --> 00:11:04,640
neat to be able to take them in there

358
00:11:08,550 --> 00:11:06,079
and have that become

359
00:11:10,150 --> 00:11:08,560
three-dimensional to them as well well

360
00:11:11,430 --> 00:11:10,160
it looks so clean what i mean you know

361
00:11:13,190 --> 00:11:11,440
it's just one of you when we see these

362
00:11:14,389 --> 00:11:13,200
videos of these these new modules and

363
00:11:17,269 --> 00:11:14,399

these cargo craft everything's so

364
00:11:19,670 --> 00:11:17,279
pristine and organized and right it's

365
00:11:21,110 --> 00:11:19,680
awesome so even though we know that um

366
00:11:23,590 --> 00:11:21,120
something that we do

367
00:11:24,389 --> 00:11:23,600
uh as a matter of safety is um

368
00:11:25,750 --> 00:11:24,399
is

369
00:11:27,430 --> 00:11:25,760
we think that everything will be clean

370
00:11:29,829 --> 00:11:27,440
but you know it was packed on the ground

371
00:11:31,750 --> 00:11:29,839
everything had gravity to sort of sit it

372
00:11:33,670 --> 00:11:31,760
and and plus it had a pretty big shaking

373
00:11:35,190 --> 00:11:33,680
probably on the way up in that rocket

374
00:11:37,509 --> 00:11:35,200
things might have come loose and now

375
00:11:39,430 --> 00:11:37,519
they'd all be floating so usually when

376
00:11:41,590 --> 00:11:39,440
we first go into a module we'll actually

377
00:11:42,790 --> 00:11:41,600
wear goggles yeah and maybe a mask you

378
00:11:44,470 --> 00:11:42,800
know just in case there's little you

379
00:11:46,069 --> 00:11:44,480
know little small pieces of dust or

380
00:11:48,230 --> 00:11:46,079
metal you know could really harm your

381
00:11:49,829 --> 00:11:48,240
eyes and so we're usually well more

382
00:11:51,750 --> 00:11:49,839
careful the first time we go in until we

383
00:11:54,150 --> 00:11:51,760
establish that actually it really is

384
00:11:57,350 --> 00:11:54,160
clean inside so talk about the reverse

385
00:11:59,269 --> 00:11:57,360
process how you basically unbirth it and

386
00:12:01,590 --> 00:11:59,279
is it exactly the same just backwards is

387
00:12:02,470 --> 00:12:01,600
it easier is it harder what

388
00:12:04,710 --> 00:12:02,480

um

389
00:12:08,550 --> 00:12:04,720
i would say

390
00:12:10,389 --> 00:12:08,560
release

391
00:12:12,150 --> 00:12:10,399
in that you know so here it is attached

392
00:12:14,230 --> 00:12:12,160
to the space station we're going to

393
00:12:15,590 --> 00:12:14,240
grapple it by that grapple fixture with

394
00:12:17,750 --> 00:12:15,600
the robotic arm and you know that

395
00:12:18,949 --> 00:12:17,760
robotic arm doesn't look very big but

396
00:12:20,870 --> 00:12:18,959
really the end of it the end of it

397
00:12:22,949 --> 00:12:20,880
that's going to go on here that that

398
00:12:23,829 --> 00:12:22,959
thing is this big it's huge right so

399
00:12:25,350 --> 00:12:23,839
we're going to go in there we're going

400
00:12:27,350 --> 00:12:25,360
to grab this make sure we have a good

401
00:12:28,710 --> 00:12:27,360
hold everything's locked down and then

402
00:12:30,550 --> 00:12:28,720
we're going to release all the bolts

403
00:12:33,110 --> 00:12:30,560
that are holding into the space station

404
00:12:35,350 --> 00:12:33,120
and then just do this sort of big giant

405
00:12:37,269 --> 00:12:35,360
swing around and into the correct

406
00:12:39,350 --> 00:12:37,279
position to then

407
00:12:40,310 --> 00:12:39,360
let it go hopefully without giving it a

408
00:12:41,829 --> 00:12:40,320
push

409
00:12:43,030 --> 00:12:41,839
because you know we don't really want to

410
00:12:44,949 --> 00:12:43,040
give it a push we want to have it

411
00:12:46,710 --> 00:12:44,959
floating in exactly the right attitude

412
00:12:48,470 --> 00:12:46,720
and then it's got its own way to push

413
00:12:50,790 --> 00:12:48,480

which is these little jets you know

414
00:12:53,750 --> 00:12:50,800
where there's gases that combine to go

415
00:12:56,150 --> 00:12:53,760
you know and they can then move the htv

416
00:12:58,470 --> 00:12:56,160
in a safe trajectory away from the space

417
00:13:00,550 --> 00:12:58,480
station and of course there's folks that

418
00:13:02,230 --> 00:13:00,560
you know spend a lot of time doing math

419
00:13:04,949 --> 00:13:02,240
which is why we're trying to always you

420
00:13:06,710 --> 00:13:04,959
know convince uh our our kids and and

421
00:13:08,790 --> 00:13:06,720
their friends to study math and science

422
00:13:11,030 --> 00:13:08,800
and engineering is that everything we

423
00:13:13,269 --> 00:13:11,040
just talked about today has to do with

424
00:13:14,629 --> 00:13:13,279
math and engineering you know somebody

425
00:13:16,150 --> 00:13:14,639
had to figure these things out and the

426
00:13:19,110 --> 00:13:16,160
reason that somebody like me is safe up

427
00:13:21,190 --> 00:13:19,120
there is because of math

428
00:13:22,389 --> 00:13:21,200
it's well yeah there's a lot that goes

429
00:13:23,509 --> 00:13:22,399
into planning i mean we you know you

430
00:13:24,310 --> 00:13:23,519
talked about a while ago that it looks

431
00:13:26,230 --> 00:13:24,320
so

432
00:13:27,430 --> 00:13:26,240
kind of slow and easy while it's up

433
00:13:30,550 --> 00:13:27,440
there but both those spacecraft are

434
00:13:32,829 --> 00:13:30,560
going incredibly fast they both weigh

435
00:13:34,710 --> 00:13:32,839
a lot i don't even remember how many

436
00:13:35,990 --> 00:13:34,720
tons that

437
00:13:37,350 --> 00:13:36,000
was in a public affairs person let's say

438
00:13:39,350 --> 00:13:37,360

the station's a millionaire yeah six

439
00:13:41,269 --> 00:13:39,360
tons of cargo it's yeah something like

440
00:13:43,030 --> 00:13:41,279
that yeah it's it's a big really heavy

441
00:13:44,550 --> 00:13:43,040
spacecraft and you know and that's the

442
00:13:46,550 --> 00:13:44,560
thing with things that are weightless is

443
00:13:47,430 --> 00:13:46,560
even something this this big and this

444
00:13:48,870 --> 00:13:47,440
heavy

445
00:13:51,350 --> 00:13:48,880
given a push

446
00:13:53,430 --> 00:13:51,360
has now got its own momentum and it will

447
00:13:55,829 --> 00:13:53,440
continue going in that direction until

448
00:13:58,069 --> 00:13:55,839
it's got a force that opposes it so you

449
00:14:00,710 --> 00:13:58,079
really want to learn how to be gentle

450
00:14:02,150 --> 00:14:00,720
and uh and also you know we practice we

451
00:14:03,189 --> 00:14:02,160
practice a lot in a simulator and i'll

452
00:14:05,829 --> 00:14:03,199
tell you that was something that was

453
00:14:07,430 --> 00:14:05,839
kind of surprising to us up there is

454
00:14:09,269 --> 00:14:07,440
that i practice a lot in front of

455
00:14:11,110 --> 00:14:09,279
something that looks like a video game

456
00:14:12,870 --> 00:14:11,120
and i've practiced you know this part of

457
00:14:14,949 --> 00:14:12,880
it and you know looking at a cartoon

458
00:14:18,470 --> 00:14:14,959
picture of this and all those things and

459
00:14:21,269 --> 00:14:18,480
the reality of being in the cupola where

460
00:14:22,550 --> 00:14:21,279
windows surround you both here and up

461
00:14:25,110 --> 00:14:22,560
above

462
00:14:28,710 --> 00:14:25,120
was is very disconcerting

463
00:14:29,670 --> 00:14:28,720

is it to just have that um all that that

464
00:14:31,430 --> 00:14:29,680
you know

465
00:14:32,550 --> 00:14:31,440
that stuff in the way and in fact it was

466
00:14:35,350 --> 00:14:32,560
actually hard for us to remember i've

467
00:14:36,949 --> 00:14:35,360
talked about the judging of the distance

468
00:14:38,629 --> 00:14:36,959
so this was um

469
00:14:41,269 --> 00:14:38,639
this was paulo's job was to understand

470
00:14:43,269 --> 00:14:41,279
how to judge the distance now meanwhile

471
00:14:45,350 --> 00:14:43,279
we're going over the earth at you know a

472
00:14:46,870 --> 00:14:45,360
couple miles a second right and so the

473
00:14:49,030 --> 00:14:46,880
earth is moving

474
00:14:51,670 --> 00:14:49,040
and it was hard to judge this diff

475
00:14:53,590 --> 00:14:51,680
distance harder than in the simulator so

476
00:14:55,269 --> 00:14:53,600
we've now prepared other crews to know

477
00:14:56,870 --> 00:14:55,279
that you know looking at this thing is

478
00:14:58,629 --> 00:14:56,880
going to be a little bit difficult you

479
00:14:59,829 --> 00:14:58,639
know judging the distance because it's

480
00:15:01,750 --> 00:14:59,839
like when when you're sitting in your

481
00:15:03,670 --> 00:15:01,760
car and the car next to you moves yeah

482
00:15:04,949 --> 00:15:03,680
and you wonder which one is moving

483
00:15:06,870 --> 00:15:04,959
right so that made it a little bit

484
00:15:09,430 --> 00:15:06,880
difficult but just that view out the

485
00:15:10,949 --> 00:15:09,440
window is just astounding and it's going

486
00:15:12,230 --> 00:15:10,959
to be amazing i don't think anything can

487
00:15:14,069 --> 00:15:12,240
prepare you for that you know i mean you

488
00:15:15,990 --> 00:15:14,079

can you can see any kind of high

489
00:15:17,269 --> 00:15:16,000
definition imagery that we can ever

490
00:15:18,710 --> 00:15:17,279
invent here at nasa and it's probably

491
00:15:19,990 --> 00:15:18,720
not what you actually

492
00:15:21,590 --> 00:15:20,000
see with your own eyes while you're up

493
00:15:24,069 --> 00:15:21,600
there i would imagine it's it's

494
00:15:26,150 --> 00:15:24,079
beautiful and the cupola is a big change

495
00:15:29,030 --> 00:15:26,160
for us in that all the windows on the

496
00:15:30,870 --> 00:15:29,040
space station up until then were portals

497
00:15:32,949 --> 00:15:30,880
so they're just you know single circles

498
00:15:35,110 --> 00:15:32,959
like on a boat and you see the world go

499
00:15:37,030 --> 00:15:35,120
by very quickly and so if you're looking

500
00:15:38,550 --> 00:15:37,040
like for example for hawaii

501
00:15:40,389 --> 00:15:38,560
you you can see on our computer program

502
00:15:41,910 --> 00:15:40,399
that hawaii is coming and you know

503
00:15:43,590 --> 00:15:41,920
actually almost exactly when you'll see

504
00:15:44,870 --> 00:15:43,600
it but you're looking looking looking

505
00:15:45,910 --> 00:15:44,880
and boy you better take that picture

506
00:15:48,069 --> 00:15:45,920
right away

507
00:15:50,550 --> 00:15:48,079
but with a cupola where there's windows

508
00:15:52,550 --> 00:15:50,560
now all around and then also above our

509
00:15:54,470 --> 00:15:52,560
head you know i can look out and i can

510
00:15:56,150 --> 00:15:54,480
see hawaii coming and it's getting

511
00:15:58,230 --> 00:15:56,160
bigger and bigger and bigger and now

512
00:16:00,550 --> 00:15:58,240
it's over my head and i'm here i can

513
00:16:03,910 --> 00:16:00,560

turn around i can see it go and i have a

514
00:16:07,110 --> 00:16:03,920
couple minutes really to see hawaii and

515
00:16:08,550 --> 00:16:07,120
even just to see it in the context of

516
00:16:10,470 --> 00:16:08,560
you know taking magnified pictures where

517
00:16:12,069 --> 00:16:10,480
you really see what's going on in hawaii

518
00:16:14,470 --> 00:16:12,079
or you know just the

519
00:16:16,230 --> 00:16:14,480
its place on the whole earth and i and i

520
00:16:17,749 --> 00:16:16,240
love to take those sort of contextual

521
00:16:19,509 --> 00:16:17,759
pictures where you see the curve of the

522
00:16:21,670 --> 00:16:19,519
earth and you realize that you know this

523
00:16:24,150 --> 00:16:21,680
is what your country looks like yeah

524
00:16:25,189 --> 00:16:24,160
well it's got to be

525
00:16:27,030 --> 00:16:25,199
you know i can't imagine what it's like

526
00:16:28,629 --> 00:16:27,040
to be up there but but you also you've

527
00:16:29,910 --> 00:16:28,639
got to get a sense of how fast you're

528
00:16:31,030 --> 00:16:29,920
actually going to whenever you see

529
00:16:32,230 --> 00:16:31,040
hawaii coming at you and obviously

530
00:16:33,990 --> 00:16:32,240
you're on top of it and you're gone in a

531
00:16:35,269 --> 00:16:34,000
matter of just a few seconds you know

532
00:16:36,470 --> 00:16:35,279
the same thing with these vehicles you

533
00:16:37,670 --> 00:16:36,480
know they look so tiny and all of a

534
00:16:39,269 --> 00:16:37,680
sudden they're up

535
00:16:39,990 --> 00:16:39,279
very close you're staying in your face

536
00:16:41,350 --> 00:16:40,000
right

537
00:16:43,910 --> 00:16:41,360
you know and so getting back to what the

538
00:16:45,990 --> 00:16:43,920

crew is going to do tomorrow so it is

539
00:16:48,069 --> 00:16:46,000
sunny and aki and joe this is their big

540
00:16:48,870 --> 00:16:48,079
task tomorrow and

541
00:16:51,030 --> 00:16:48,880
uh

542
00:16:52,629 --> 00:16:51,040
aki and joe are going to be the the pair

543
00:16:54,550 --> 00:16:52,639
on the robotic arm we always do these

544
00:16:56,310 --> 00:16:54,560
and these things in twos they back each

545
00:16:58,550 --> 00:16:56,320
other up joe will actually be at the

546
00:17:00,550 --> 00:16:58,560
controls aki would be calling distances

547
00:17:01,829 --> 00:17:00,560
for the grapple and then they'll switch

548
00:17:04,150 --> 00:17:01,839
when they're actually going to install

549
00:17:06,630 --> 00:17:04,160
this on the space station and then aki

550
00:17:08,630 --> 00:17:06,640
will be at the controls and joe will be

551
00:17:10,470 --> 00:17:08,640
calling distances and checking and

552
00:17:11,669 --> 00:17:10,480
making sure everything looks right and

553
00:17:14,069 --> 00:17:11,679
meanwhile

554
00:17:15,829 --> 00:17:14,079
sunny is their third set of eyes because

555
00:17:18,710 --> 00:17:15,839
joe and aki are thinking about the

556
00:17:21,350 --> 00:17:18,720
robotic arm and how it's doing and in

557
00:17:24,230 --> 00:17:21,360
with relationship to you know capturing

558
00:17:27,270 --> 00:17:24,240
this htv uh which has a name actually

559
00:17:30,310 --> 00:17:27,280
kunatori white stork exactly yeah it's

560
00:17:32,710 --> 00:17:30,320
kunatori iii yeah uh so kunis they're

561
00:17:34,390 --> 00:17:32,720
they're looking at kunatori well sunny

562
00:17:36,789 --> 00:17:34,400
is actually in charge of understanding

563
00:17:39,590 --> 00:17:36,799

what if kunatori has a problem what if

564
00:17:40,870 --> 00:17:39,600
suddenly um you know the computer says i

565
00:17:42,549 --> 00:17:40,880
don't know all the things i'm supposed

566
00:17:45,350 --> 00:17:42,559
to know this isn't safe

567
00:17:47,750 --> 00:17:45,360
and in that case that means that aki and

568
00:17:51,270 --> 00:17:47,760
joe have to back the arm away and then

569
00:17:53,190 --> 00:17:51,280
send a command to kunatori to retreat to

570
00:17:55,750 --> 00:17:53,200
bring itself a safe distance away which

571
00:17:58,150 --> 00:17:55,760
is either about 30 meters about 100 feet

572
00:17:59,990 --> 00:17:58,160
or even further depending on what the

573
00:18:01,510 --> 00:18:00,000
problem is it's very similar to spacex

574
00:18:02,710 --> 00:18:01,520
wasn't it they had the same ability to

575
00:18:05,190 --> 00:18:02,720
basically send a command saying okay

576
00:18:07,590 --> 00:18:05,200
back off exactly you know in fact we're

577
00:18:09,830 --> 00:18:07,600
trying to make all of these supply

578
00:18:11,590 --> 00:18:09,840
vehicles that come have similar

579
00:18:14,310 --> 00:18:11,600
procedures so that there's not something

580
00:18:16,070 --> 00:18:14,320
special you have to do for one because

581
00:18:18,710 --> 00:18:16,080
all of us can get confused the crew can

582
00:18:20,390 --> 00:18:18,720
get confused uh mission control can get

583
00:18:21,909 --> 00:18:20,400
confused you want to make sure that you

584
00:18:24,070 --> 00:18:21,919
know the procedures are pretty much the

585
00:18:25,669 --> 00:18:24,080
same for for all of them and and it

586
00:18:27,669 --> 00:18:25,679
makes sense actually because it's it's

587
00:18:29,669 --> 00:18:27,679
all about physics of you know when it

588
00:18:32,710 --> 00:18:29,679

approaches and how to grab it what might

589
00:18:33,909 --> 00:18:32,720
be different is um for example htv is

590
00:18:36,630 --> 00:18:33,919
much bigger

591
00:18:39,669 --> 00:18:36,640
than spacex than the dragon and so it's

592
00:18:41,590 --> 00:18:39,679
very much heavier and it has a slower

593
00:18:44,070 --> 00:18:41,600
kind of dance that it does when it's

594
00:18:46,630 --> 00:18:44,080
keeping itself in one place whereas uh

595
00:18:48,070 --> 00:18:46,640
dragon had kind of larger jets but

596
00:18:49,909 --> 00:18:48,080
smaller spurts and so it was pretty

597
00:18:51,350 --> 00:18:49,919
quick it could move quickly it's not

598
00:18:53,190 --> 00:18:51,360
it's still not going to go very far it

599
00:18:55,430 --> 00:18:53,200
still has a box you know a little place

600
00:18:57,669 --> 00:18:55,440
that it has to stay and the crew knows

601
00:19:00,710 --> 00:18:57,679
it will but it's a question of when they

602
00:19:01,830 --> 00:19:00,720
say free drift dragon might be darting

603
00:19:03,510 --> 00:19:01,840
you know it might have been going a

604
00:19:05,750 --> 00:19:03,520
little faster and be a little faster to

605
00:19:06,950 --> 00:19:05,760
track but we practiced that yeah

606
00:19:07,909 --> 00:19:06,960
well katie thanks for coming up here

607
00:19:09,190 --> 00:19:07,919
it's always good to talk about this

608
00:19:12,230 --> 00:19:09,200
stuff you know this stuff better than

609
00:19:13,990 --> 00:19:12,240
than than any of us could possibly hear

610
00:19:15,590 --> 00:19:14,000
on this one brings me it brings me back

611
00:19:17,110 --> 00:19:15,600
just to be here in mission control look

612
00:19:19,190 --> 00:19:17,120
at the i'll be cap coming for them

613
00:19:20,390 --> 00:19:19,200

tomorrow so i'll be you know their coach

614
00:19:21,590 --> 00:19:20,400
on the ground so to speak and

615
00:19:23,590 --> 00:19:21,600
representing all the folks here in

616
00:19:25,750 --> 00:19:23,600
mission control but it certainly brings

617
00:19:27,190 --> 00:19:25,760
me back it was pretty special days that

618
00:19:29,430 --> 00:19:27,200
we had and it was certainly a highlight

619
00:19:31,830 --> 00:19:29,440
of the mission to you know capture

620
00:19:33,190 --> 00:19:31,840
kunatori too yeah and bring her onboard

621
00:19:35,190 --> 00:19:33,200
the space station you'll have to hang on

622
00:19:36,630 --> 00:19:35,200
to that model a little bit

623
00:19:38,470 --> 00:19:36,640
i think i'll have to give it back it's a

624
00:19:40,390 --> 00:19:38,480
pretty precious model we'll be on the

625
00:19:41,669 --> 00:19:40,400
air tomorrow morning at 6 00 a.m central

626
00:19:43,909 --> 00:19:41,679
time uh of course we'll have live

627
00:19:46,310 --> 00:19:43,919
coverage of htv3 and the arrival is joe

628
00:19:47,510 --> 00:19:46,320
acaba and aki hoshide with sunny

629
00:19:48,870 --> 00:19:47,520
williams helping

630
00:19:50,150 --> 00:19:48,880
reach out and grab onto this cargo

631
00:19:52,549 --> 00:19:50,160
vehicle and get it installed to the

632
00:19:54,390 --> 00:19:52,559
space station so again 6 am central time