
Fluids & Combustion Facility (FCF)

1
00:00:06,869 --> 00:00:03,110
station this is houston are you ready

2
00:00:09,669 --> 00:00:08,070
houston station we're ready for the

3
00:00:11,509 --> 00:00:09,679
event

4
00:00:13,509 --> 00:00:11,519
national public radio this is mission

5
00:00:15,430 --> 00:00:13,519
control houston please call station for

6
00:00:17,269 --> 00:00:15,440
a voice check

7
00:00:21,189 --> 00:00:17,279
station this is national public radio

8
00:00:24,470 --> 00:00:23,109
got you loud and clear good to talk to

9
00:00:26,470 --> 00:00:24,480
you today ira

10
00:00:28,630 --> 00:00:26,480
that's great thank you we're very happy

11
00:00:32,069 --> 00:00:28,640
uh to talk to you uh can you both hear

12
00:00:36,870 --> 00:00:34,389
we've got you loud and clear

13
00:00:38,790 --> 00:00:36,880

we used to say in the old uh

14
00:00:40,310 --> 00:00:38,800
business five by five or something like

15
00:00:44,790 --> 00:00:40,320
that when i was

16
00:00:50,790 --> 00:00:44,800
a ham radio operator or something

17
00:00:54,790 --> 00:00:53,670
all right let's let's begin um

18
00:00:57,029 --> 00:00:54,800
uh

19
00:00:58,950 --> 00:00:57,039
let me ask you don first is does the

20
00:01:01,189 --> 00:00:58,960
does the view in space

21
00:01:03,590 --> 00:01:01,199
ever get tiring as you look out the

22
00:01:04,469 --> 00:01:03,600
windows tiring as you look out the

23
00:01:07,270 --> 00:01:04,479
window

24
00:01:09,990 --> 00:01:07,280
it never gets tiring to

25
00:01:13,590 --> 00:01:10,000
view earth from space or

26
00:01:16,230 --> 00:01:13,600
space from space just like

27
00:01:19,030 --> 00:01:16,240
any number of views

28
00:01:21,830 --> 00:01:19,040
from earth of earth never get tiring to

29
00:01:24,149 --> 00:01:21,840
see a sweeping mountain scene never gets

30
00:01:27,270 --> 00:01:24,159
tiring

31
00:01:28,950 --> 00:01:27,280
there's something about natural beauty

32
00:01:31,510 --> 00:01:28,960
that is

33
00:01:34,230 --> 00:01:31,520
inspiring to

34
00:01:36,630 --> 00:01:34,240
myself and i will generalize to human

35
00:01:39,510 --> 00:01:36,640
beings

36
00:01:41,749 --> 00:01:39,520
what question do you get asked most by

37
00:01:43,670 --> 00:01:41,759
people besides the bathroom question

38
00:01:45,670 --> 00:01:43,680

we'll do away with that one what

39
00:01:47,670 --> 00:01:45,680
question do people want to know most

40
00:01:51,350 --> 00:01:47,680
about your experience in in the space

41
00:01:58,469 --> 00:01:54,710
one real common question is what i miss

42
00:01:59,910 --> 00:01:58,479
most from earth being up here for a six

43
00:02:02,149 --> 00:01:59,920
month mission

44
00:02:03,429 --> 00:02:02,159
and

45
00:02:04,870 --> 00:02:03,439
one

46
00:02:07,030 --> 00:02:04,880
real astute

47
00:02:09,589 --> 00:02:07,040
student asked me

48
00:02:13,670 --> 00:02:09,599
the inverse question what will i miss

49
00:02:16,390 --> 00:02:13,680
most from space once i return to earth

50
00:02:18,949 --> 00:02:16,400
so i i thought that was a very clever

51
00:02:21,510 --> 00:02:18,959
play on one of the standard questions

52
00:02:23,589 --> 00:02:21,520
that people ask you

53
00:02:26,630 --> 00:02:23,599
dan burbank uh you were recently

54
00:02:28,550 --> 00:02:26,640
evacuated from the space station because

55
00:02:30,470 --> 00:02:28,560
of what turned out to be a close call

56
00:02:32,470 --> 00:02:30,480
with space debris

57
00:02:36,630 --> 00:02:32,480
give us an idea of what that experience

58
00:02:40,229 --> 00:02:38,390
well we actually had a we had a pretty

59
00:02:41,830 --> 00:02:40,239
good heads up about it um

60
00:02:43,830 --> 00:02:41,840
we've got tracking radars all over the

61
00:02:45,990 --> 00:02:43,840
world that keep track of orbital debris

62
00:02:48,070 --> 00:02:46,000
and it's things that are basically

63
00:02:49,670 --> 00:02:48,080

you know in in rough order magnitude

64
00:02:51,589 --> 00:02:49,680
about the size of your fist or bigger

65
00:02:54,229 --> 00:02:51,599
and there are tens of thousands of

66
00:02:56,869 --> 00:02:54,239
things that are tracked and whenever one

67
00:02:59,030 --> 00:02:56,879
gets kind of close to space station if

68
00:03:00,790 --> 00:02:59,040
we have ample time we will actually move

69
00:03:02,070 --> 00:03:00,800
the space station we'll actually do a

70
00:03:03,910 --> 00:03:02,080
burn a

71
00:03:05,830 --> 00:03:03,920
debris avoidance maneuver if you will

72
00:03:06,710 --> 00:03:05,840
and it'll open up that uh that distance

73
00:03:08,470 --> 00:03:06,720
of something a little bit more

74
00:03:10,630 --> 00:03:08,480
comfortable every now and then we'll get

75
00:03:13,190 --> 00:03:10,640
something that's uh that's either small

76
00:03:15,830 --> 00:03:13,200
enough that it only crops up uh very

77
00:03:18,550 --> 00:03:15,840
late or it uh crops up in such a way

78
00:03:20,710 --> 00:03:18,560
that the accuracy is uh is a little bit

79
00:03:22,149 --> 00:03:20,720
unknown and this particular case was

80
00:03:24,309 --> 00:03:22,159
kind of a combination of both there was

81
00:03:25,830 --> 00:03:24,319
a lot of uncertainty in it and it was

82
00:03:27,270 --> 00:03:25,840
also very late there wasn't time to

83
00:03:29,030 --> 00:03:27,280
actually do a burn that would have been

84
00:03:30,550 --> 00:03:29,040
effective and and opening up that

85
00:03:32,390 --> 00:03:30,560
distance to something more comfortable

86
00:03:34,149 --> 00:03:32,400
so for us we talked about it the night

87
00:03:35,670 --> 00:03:34,159
before actually probably a day and a

88
00:03:38,070 --> 00:03:35,680

half before and we knew there wasn't

89
00:03:40,229 --> 00:03:38,080
time to do the burn and certainly in the

90
00:03:42,070 --> 00:03:40,239
12 or so hours leading up to what we

91
00:03:44,229 --> 00:03:42,080
call the shelter in place

92
00:03:46,070 --> 00:03:44,239
we discussed what we'd have to do and

93
00:03:47,910 --> 00:03:46,080
from our perspective here on board it

94
00:03:49,430 --> 00:03:47,920
was actually fairly straightforward we

95
00:03:51,270 --> 00:03:49,440
essentially started from the forward

96
00:03:52,789 --> 00:03:51,280
part of the station worked our way back

97
00:03:55,030 --> 00:03:52,799
after where the soyuz vehicles are

98
00:03:56,869 --> 00:03:55,040
loaded located and we powered down

99
00:03:58,949 --> 00:03:56,879
systems we in the ground did an awful

100
00:04:01,190 --> 00:03:58,959
lot of the systems work there and we

101
00:04:02,869 --> 00:04:01,200
closed all the hatches to isolate as

102
00:04:05,270 --> 00:04:02,879
many of the modules as possible from

103
00:04:07,429 --> 00:04:05,280
each other and then we just waited until

104
00:04:09,670 --> 00:04:07,439
the closest point of approach with the

105
00:04:12,309 --> 00:04:09,680
the debris item and we were each in our

106
00:04:14,869 --> 00:04:12,319
respective soyuz capsules

107
00:04:17,270 --> 00:04:14,879
there uh uh there have been a couple of

108
00:04:19,110 --> 00:04:17,280
big solar flares recently that sent lots

109
00:04:21,110 --> 00:04:19,120
of potentially dangerous

110
00:04:23,350 --> 00:04:21,120
charged particles toward the earth what

111
00:04:25,189 --> 00:04:23,360
precautions do you have do you have in

112
00:04:30,550 --> 00:04:25,199
the space station to shield yourselves

113
00:04:34,150 --> 00:04:31,990

uh earth

114
00:04:35,590 --> 00:04:34,160
we're outside of the atmosphere so you

115
00:04:37,430 --> 00:04:35,600
don't have the protection from earth's

116
00:04:40,390 --> 00:04:37,440
atmosphere like you would on the surface

117
00:04:43,390 --> 00:04:40,400
of earth however we're still well within

118
00:04:47,749 --> 00:04:43,400
earth's magneto

119
00:04:50,550 --> 00:04:47,759
magnetosphere and that deflects a lot of

120
00:04:51,350 --> 00:04:50,560
these particles so that they don't

121
00:04:53,510 --> 00:04:51,360
uh

122
00:04:55,030 --> 00:04:53,520
pose a real threat we do have a higher

123
00:04:57,110 --> 00:04:55,040
level of radiation up here but we're

124
00:04:59,510 --> 00:04:57,120
still very much under the protection of

125
00:05:02,230 --> 00:04:59,520
mother earth and

126
00:05:04,469 --> 00:05:02,240
with very few exceptions life just goes

127
00:05:08,550 --> 00:05:04,479
on normally on space station

128
00:05:11,189 --> 00:05:08,560
with or without a solar proton event and

129
00:05:14,629 --> 00:05:11,199
what we do notice these events bring out

130
00:05:16,629 --> 00:05:14,639
wonderful displays of aurora

131
00:05:19,189 --> 00:05:16,639
let's talk about some of the interesting

132
00:05:22,070 --> 00:05:19,199
experiments that you folks are doing up

133
00:05:25,430 --> 00:05:22,080
there uh one in particular that

134
00:05:27,670 --> 00:05:25,440
that interests me is a a flame

135
00:05:29,189 --> 00:05:27,680
experiment we all know what a flame

136
00:05:30,550 --> 00:05:29,199
looks like on earth here and how it

137
00:05:33,909 --> 00:05:30,560
behaves

138
00:05:35,990 --> 00:05:33,919

but uh from pictures i've seen in zero g

139
00:05:41,350 --> 00:05:36,000
it looks totally different and how are

140
00:05:46,310 --> 00:05:43,510
well one of the racks this rack right

141
00:05:49,189 --> 00:05:46,320
here is a combustion rack for

142
00:05:51,749 --> 00:05:49,199
investigating various uh

143
00:05:53,670 --> 00:05:51,759
combustion processes where you're

144
00:05:56,309 --> 00:05:53,680
looking at the nitty-gritty details of

145
00:05:59,350 --> 00:05:56,319
how flames burn the rack right next to

146
00:06:01,749 --> 00:05:59,360
it is a glove box where i currently have

147
00:06:03,430 --> 00:06:01,759
a flame experiment set up there and

148
00:06:06,469 --> 00:06:03,440
basically

149
00:06:07,909 --> 00:06:06,479
flames have a healthy appetite for

150
00:06:12,710 --> 00:06:07,919
oxygen

151
00:06:15,270 --> 00:06:12,720
literally by fanning the flame and

152
00:06:17,670 --> 00:06:15,280
gravity helps fan the flame because of

153
00:06:20,710 --> 00:06:17,680
gravity driven

154
00:06:23,749 --> 00:06:20,720
convection the flame is hot the hot air

155
00:06:26,150 --> 00:06:23,759
rises cold air rushes in and and that

156
00:06:27,270 --> 00:06:26,160
brings fresh oxygen next to the flame if

157
00:06:30,150 --> 00:06:27,280
you try to burn a flame in

158
00:06:32,150 --> 00:06:30,160
weightlessness with no uh air motion

159
00:06:34,870 --> 00:06:32,160
around it it'll burn for a few seconds

160
00:06:38,390 --> 00:06:34,880
and snuff itself out so the whole

161
00:06:40,070 --> 00:06:38,400
dynamics of what happens with flames is

162
00:06:41,189 --> 00:06:40,080
different in a weightless environment

163
00:06:43,110 --> 00:06:41,199

and so

164
00:06:45,510 --> 00:06:43,120
the microgravity environment here on

165
00:06:47,430 --> 00:06:45,520
space station is a wonderful place to

166
00:06:48,390 --> 00:06:47,440
investigate fundamental aspects of

167
00:06:50,870 --> 00:06:48,400
combustion

168
00:06:53,350 --> 00:06:50,880
it's basically another experimental knob

169
00:06:56,629 --> 00:06:53,360
we can tweak

170
00:06:58,950 --> 00:06:56,639
and help uh figure out what's going on

171
00:07:00,870 --> 00:06:58,960
when something burns

172
00:07:03,670 --> 00:07:00,880
and you're saying that if you leave the

173
00:07:09,510 --> 00:07:03,680
flame to itself it will snuff itself out

174
00:07:13,029 --> 00:07:11,510
it is and i was doing some combustion

175
00:07:15,589 --> 00:07:13,039
experiments last week where we were

176
00:07:17,830 --> 00:07:15,599
burning little spheres of plastic they

177
00:07:19,909 --> 00:07:17,840
were poly methyl methacrylate it's the

178
00:07:22,070 --> 00:07:19,919
the clear plastic that you see things

179
00:07:24,230 --> 00:07:22,080
made out of and we were burning spheres

180
00:07:26,469 --> 00:07:24,240
of that and we were going to

181
00:07:28,629 --> 00:07:26,479
uh we had a fan blowing on it to add

182
00:07:30,550 --> 00:07:28,639
convection we're going to

183
00:07:33,749 --> 00:07:30,560
put the flame out by purging it with

184
00:07:35,909 --> 00:07:33,759
nitrogen which uh would should stop the

185
00:07:38,550 --> 00:07:35,919
flame it turns out it didn't stop the

186
00:07:40,950 --> 00:07:38,560
flame because the nitrogen entrained

187
00:07:42,390 --> 00:07:40,960
enough air in it that it that it just

188
00:07:44,950 --> 00:07:42,400

kept feeding uh

189
00:07:46,710 --> 00:07:44,960
sufficient oxygen to the burning plastic

190
00:07:48,869 --> 00:07:46,720
and what snuffed the plastic out in a

191
00:07:51,189 --> 00:07:48,879
matter of seconds was turning the fan

192
00:07:53,510 --> 00:07:51,199
off and the flame consumed all the

193
00:07:55,990 --> 00:07:53,520
oxygen around it and and it just went

194
00:07:59,110 --> 00:07:56,000
out on its own and i tell kids this is

195
00:08:02,390 --> 00:07:59,120
the space equivalent of what we tell our

196
00:08:04,790 --> 00:08:02,400
school kids of stop drop and roll if you

197
00:08:07,670 --> 00:08:04,800
happen to catch on fire but the space

198
00:08:09,270 --> 00:08:07,680
version of that is stop

199
00:08:10,869 --> 00:08:09,280
and float

200
00:08:15,270 --> 00:08:10,879
and of course you don't need to drop

201
00:08:17,270 --> 00:08:15,280
because there's no place to drop to

202
00:08:19,270 --> 00:08:17,280
very very interesting let's talk about

203
00:08:20,790 --> 00:08:19,280
another experiment is it is it true that

204
00:08:23,029 --> 00:08:20,800
you have like

205
00:08:25,270 --> 00:08:23,039
a little distillery

206
00:08:27,670 --> 00:08:25,280
up there in space you're doing a sort of

207
00:08:32,790 --> 00:08:27,680
a a malt experiment are you going to

208
00:08:36,149 --> 00:08:33,990
you know i

209
00:08:38,949 --> 00:08:36,159
heard about that but that experiment

210
00:08:40,630 --> 00:08:38,959
hasn't made it on space station yet and

211
00:08:42,949 --> 00:08:40,640
and and i don't really know what the

212
00:08:46,470 --> 00:08:42,959
details are i think it's just uh

213
00:08:48,070 --> 00:08:46,480

bringing some uh materials up and and

214
00:08:49,350 --> 00:08:48,080
maybe mashing them and then bringing

215
00:08:52,070 --> 00:08:49,360
them back down to earth i don't think

216
00:08:54,470 --> 00:08:52,080
there's any plans for distilling however

217
00:08:57,030 --> 00:08:54,480
we do have a distillation

218
00:09:00,310 --> 00:08:57,040
process here on space station a

219
00:09:03,590 --> 00:09:00,320
distillation apparatus and and can you

220
00:09:05,990 --> 00:09:03,600
guess what we distill with it there

221
00:09:07,670 --> 00:09:06,000
i'm afraid to ask

222
00:09:09,750 --> 00:09:07,680
i'm afraid to

223
00:09:12,949 --> 00:09:09,760
okay it's part of what we call our

224
00:09:15,670 --> 00:09:12,959
regenerative life support system which i

225
00:09:18,230 --> 00:09:15,680
like to refer to as the coffee machine

226
00:09:20,790 --> 00:09:18,240
because and it consists of three pieces

227
00:09:23,670 --> 00:09:20,800
of equipment we have a toilet

228
00:09:26,150 --> 00:09:23,680
we have this big piece of equipment

229
00:09:28,470 --> 00:09:26,160
that that the toilet is plumbed into

230
00:09:30,550 --> 00:09:28,480
which contains a distillation apparatus

231
00:09:32,630 --> 00:09:30,560
and then we have a galley

232
00:09:34,070 --> 00:09:32,640
and you go in and use the toilet and

233
00:09:35,990 --> 00:09:34,080
then this big piece of equipment goes

234
00:09:37,509 --> 00:09:36,000
chugga chugga chugga chugga chugga and

235
00:09:40,070 --> 00:09:37,519
then you go to the galley and you get

236
00:09:41,509 --> 00:09:40,080
yourself a bag of coffee and and so i

237
00:09:43,509 --> 00:09:41,519
like to refer to this as a coffee

238
00:09:46,230 --> 00:09:43,519

machine because it takes yesterday's

239
00:09:48,230 --> 00:09:46,240
coffee and turns it into today's coffee

240
00:09:50,389 --> 00:09:48,240
and the key element one of the key

241
00:09:53,430 --> 00:09:50,399
elements in that is a fractional

242
00:09:55,269 --> 00:09:53,440
distillation process and a normal

243
00:09:56,710 --> 00:09:55,279
process like that wouldn't work in a

244
00:09:58,550 --> 00:09:56,720
weightless environment because all our

245
00:10:00,949 --> 00:09:58,560
stills on earth require gravity to

246
00:10:03,750 --> 00:10:00,959
separate the vapor from the liquid

247
00:10:04,550 --> 00:10:03,760
and this uses rotation

248
00:10:08,630 --> 00:10:04,560
it

249
00:10:11,190 --> 00:10:08,640
uses a rotating body to uh help

250
00:10:13,030 --> 00:10:11,200
add centrifugal force to separate the

251
00:10:16,630 --> 00:10:13,040
vapor from the liquid and perform the

252
00:10:19,590 --> 00:10:16,640
distillation so it's really a neat piece

253
00:10:21,990 --> 00:10:19,600
of engineering research

254
00:10:23,430 --> 00:10:22,000
very very very very interesting to learn

255
00:10:25,990 --> 00:10:23,440
how that works

256
00:10:28,190 --> 00:10:26,000
uh dan burbank what are you hoping to

257
00:10:33,670 --> 00:10:28,200
learn through your integrated

258
00:10:36,630 --> 00:10:35,190
well that's an experiment that's got a

259
00:10:39,990 --> 00:10:36,640
lot of different aspects to it and

260
00:10:43,269 --> 00:10:40,000
fundamentally the the uh the main goal

261
00:10:45,030 --> 00:10:43,279
is to understand how humans um adapt to

262
00:10:47,990 --> 00:10:45,040
the weightless environment of space and

263
00:10:50,310 --> 00:10:48,000

uh and how we can mitigate the negative

264
00:10:51,750 --> 00:10:50,320
effects of that so for all of us here

265
00:10:53,590 --> 00:10:51,760
you know our bodies are just as strong

266
00:10:55,110 --> 00:10:53,600
as they need to be for the environment

267
00:10:57,269 --> 00:10:55,120
that we're operating in so if we don't

268
00:10:59,590 --> 00:10:57,279
exercise and we're on planet earth we

269
00:11:01,509 --> 00:10:59,600
will get flabby and we'll will lose

270
00:11:04,150 --> 00:11:01,519
muscle mass if you're up here in space

271
00:11:05,670 --> 00:11:04,160
and you don't exercise considerably

272
00:11:07,750 --> 00:11:05,680
you're since you're never counteracting

273
00:11:09,509 --> 00:11:07,760
the force of gravity walking around as

274
00:11:11,430 --> 00:11:09,519
you would on earth up here you would

275
00:11:13,269 --> 00:11:11,440
lose a lot of muscle mass you'd lose a

276
00:11:15,350 --> 00:11:13,279
lot of minerals from your bones

277
00:11:16,949 --> 00:11:15,360
your heart volume the the size of the

278
00:11:19,829 --> 00:11:16,959
heart muscle would get smaller and

279
00:11:21,430 --> 00:11:19,839
smaller and those would all be fine if

280
00:11:23,269 --> 00:11:21,440
you were going to live and essentially

281
00:11:24,630 --> 00:11:23,279
be a long-term creature of space but

282
00:11:27,269 --> 00:11:24,640
since we're going to return to planet

283
00:11:29,110 --> 00:11:27,279
earth sometime we'd like to uh to

284
00:11:31,269 --> 00:11:29,120
minimize that as much as possible so

285
00:11:33,030 --> 00:11:31,279
integrated cardiovascular kind of looks

286
00:11:35,190 --> 00:11:33,040
at a holistic

287
00:11:37,030 --> 00:11:35,200
um in a holistic way at how the body

288
00:11:38,870 --> 00:11:37,040

adapts to here and we do everything from

289
00:11:40,790 --> 00:11:38,880
ultrasound where we're scanning our

290
00:11:42,710 --> 00:11:40,800
hearts and our blood vessels

291
00:11:45,430 --> 00:11:42,720
we've got a lot of exercise components

292
00:11:47,190 --> 00:11:45,440
to this we're doing uh blood pressure um

293
00:11:50,590 --> 00:11:47,200
and um and

294
00:11:53,110 --> 00:11:50,600
a 24 hour actually 48 hour

295
00:11:55,110 --> 00:11:53,120
electrocardiogram to understand how from

296
00:11:56,949 --> 00:11:55,120
electrical standpoint how the human body

297
00:11:59,030 --> 00:11:56,959
is changing and all these things will

298
00:12:00,790 --> 00:11:59,040
help us leave low earth orbit and go on

299
00:12:03,190 --> 00:12:00,800
into deep space to go back to the moon

300
00:12:05,030 --> 00:12:03,200
long term and to go on to the asteroids

301
00:12:07,190 --> 00:12:05,040
and mars and i think that's

302
00:12:08,389 --> 00:12:07,200
a key part of what space station can do

303
00:12:10,230 --> 00:12:08,399
for us

304
00:12:12,310 --> 00:12:10,240
i had heard that there had been some

305
00:12:14,790 --> 00:12:12,320
talk at nasa i was reading about it this

306
00:12:17,190 --> 00:12:14,800
week and maybe you can talk about it

307
00:12:20,069 --> 00:12:17,200
about using the space station as a

308
00:12:22,710 --> 00:12:20,079
simulation for for going to mars a sort

309
00:12:24,550 --> 00:12:22,720
of a a long-term simulation mode of what

310
00:12:26,069 --> 00:12:24,560
the trip would be like and how it might

311
00:12:30,790 --> 00:12:26,079
affect your body

312
00:12:34,150 --> 00:12:32,710
yeah there's a lot of discussion about

313
00:12:36,150 --> 00:12:34,160

it right now and that's a that's a

314
00:12:37,829 --> 00:12:36,160
really interesting um

315
00:12:39,750 --> 00:12:37,839
part of it you know one thing that's

316
00:12:41,430 --> 00:12:39,760
fundamentally different about what we do

317
00:12:43,590 --> 00:12:41,440
here on space station and our experience

318
00:12:44,949 --> 00:12:43,600
here on space station from uh from what

319
00:12:47,030 --> 00:12:44,959
it would be like to go to the moon long

320
00:12:48,550 --> 00:12:47,040
term and certainly to go to mars now

321
00:12:50,069 --> 00:12:48,560
rough word of magnitude the moon's about

322
00:12:52,150 --> 00:12:50,079
a thousand times further from the earth

323
00:12:54,790 --> 00:12:52,160
than the space station mars is about

324
00:12:57,190 --> 00:12:54,800
another thousand times further uh you

325
00:12:58,949 --> 00:12:57,200
know than the moon is so you've got a

326
00:13:00,550 --> 00:12:58,959
lot of different aspects to what it's

327
00:13:03,110 --> 00:13:00,560
like to leave

328
00:13:05,110 --> 00:13:03,120
the close confines of planet earth here

329
00:13:06,870 --> 00:13:05,120
we essentially have a permanent

330
00:13:09,509 --> 00:13:06,880
logistics stream from earth if something

331
00:13:12,150 --> 00:13:09,519
breaks on station as you know all too

332
00:13:13,910 --> 00:13:12,160
frequently will happen um we've always

333
00:13:15,190 --> 00:13:13,920
got the ability to fly new parts if

334
00:13:16,550 --> 00:13:15,200
you're going to the moon they're going

335
00:13:18,389 --> 00:13:16,560
to be there long term if you're going to

336
00:13:20,949 --> 00:13:18,399
mars you can't do that you're going to

337
00:13:23,350 --> 00:13:20,959
basically rely on yourself

338
00:13:25,350 --> 00:13:23,360

now the psychological aspect of going to

339
00:13:28,470 --> 00:13:25,360
mars there's another whole wrinkle to

340
00:13:31,829 --> 00:13:28,480
that and that is the uh the the time it

341
00:13:34,470 --> 00:13:31,839
takes to transmit a a signal from earth

342
00:13:36,310 --> 00:13:34,480
to the crew on mars or vice versa and

343
00:13:38,710 --> 00:13:36,320
you're limited by the speed of light and

344
00:13:40,870 --> 00:13:38,720
it'll be a long long time earth will

345
00:13:43,189 --> 00:13:40,880
become vanishingly small it'll almost be

346
00:13:45,350 --> 00:13:43,199
you know be indistinguishable from a lot

347
00:13:47,590 --> 00:13:45,360
of the brighter stars so you'll feel

348
00:13:49,509 --> 00:13:47,600
very remote so the psychological part of

349
00:13:51,350 --> 00:13:49,519
it would be kind of an interesting thing

350
00:13:53,350 --> 00:13:51,360
to simulate that on station that would

351
00:13:55,829 --> 00:13:53,360
probably involve

352
00:13:57,910 --> 00:13:55,839
essentially introducing a time lag

353
00:14:00,150 --> 00:13:57,920
between when the crew calls the ground

354
00:14:02,949 --> 00:14:00,160
and when the ground responds it would

355
00:14:04,949 --> 00:14:02,959
involve you know potentially

356
00:14:06,470 --> 00:14:04,959
limiting the crew's view out the window

357
00:14:09,110 --> 00:14:06,480
so you're not seeing planet earth you

358
00:14:11,509 --> 00:14:09,120
don't feel physically as close to it and

359
00:14:13,590 --> 00:14:11,519
it might involve even going so far as to

360
00:14:16,550 --> 00:14:13,600
letting the crew deal with

361
00:14:18,790 --> 00:14:16,560
emergencies and and system malfunctions

362
00:14:21,189 --> 00:14:18,800
and work the way through them

363
00:14:23,110 --> 00:14:21,199

to a greater and a more independent

364
00:14:24,710 --> 00:14:23,120
degree than we currently might on space

365
00:14:26,150 --> 00:14:24,720
station and

366
00:14:27,670 --> 00:14:26,160
there's a lot of discussion about how

367
00:14:30,150 --> 00:14:27,680
you might do that it might be something

368
00:14:31,110 --> 00:14:30,160
that would be applicable but i don't

369
00:14:33,509 --> 00:14:31,120
know

370
00:14:36,550 --> 00:14:33,519
yet about any immediate near-term

371
00:14:38,710 --> 00:14:36,560
concrete steps in that direction

372
00:14:41,910 --> 00:14:38,720
don pettit you're going to be involved

373
00:14:42,949 --> 00:14:41,920
in the tracking and capture of elon

374
00:14:45,590 --> 00:14:42,959
musk's

375
00:14:48,150 --> 00:14:45,600
spacex commercial resupply ship which is

376
00:14:50,629 --> 00:14:48,160
actually a an historic event the the

377
00:14:52,470 --> 00:14:50,639
dragon capsule in a few days what's

378
00:14:58,069 --> 00:14:52,480
what's going to be your exact role and

379
00:15:02,710 --> 00:15:00,069
uh the short answer to looking forward

380
00:15:06,069 --> 00:15:02,720
to it is yes it's going to be

381
00:15:09,110 --> 00:15:06,079
really exciting to have uh a u.s

382
00:15:13,829 --> 00:15:11,910
unmanned vehicle come and and a

383
00:15:16,310 --> 00:15:13,839
rendezvous was stationed and then we

384
00:15:18,710 --> 00:15:16,320
will lasso it with the arm and berth it

385
00:15:21,110 --> 00:15:18,720
to one of our common birthing ports

386
00:15:24,150 --> 00:15:21,120
and so that is going to be a real neat

387
00:15:25,670 --> 00:15:24,160
piece of technology plus the the idea

388
00:15:27,910 --> 00:15:25,680

that we can have these vehicles come up

389
00:15:30,389 --> 00:15:27,920
and bring needed supplies so so all of

390
00:15:32,870 --> 00:15:30,399
that aspect is really really good in

391
00:15:35,509 --> 00:15:32,880
terms of what we're doing to prepare

392
00:15:38,069 --> 00:15:35,519
uh andre kuipers and i are going to be

393
00:15:38,949 --> 00:15:38,079
doing the robotics to

394
00:15:42,230 --> 00:15:38,959
to

395
00:15:45,430 --> 00:15:42,240
lasso the dragon vehicle and then birth

396
00:15:47,670 --> 00:15:45,440
it to one of our ports and i'll be

397
00:15:49,749 --> 00:15:47,680
flying the arm for the lasso part and

398
00:15:51,829 --> 00:15:49,759
andre will be flying the arm for the

399
00:15:53,509 --> 00:15:51,839
birthing to space station so we're

400
00:15:58,310 --> 00:15:53,519
sharing the duties and backing each

401
00:16:00,470 --> 00:15:58,320
other up for this uh approach uh uh

402
00:16:02,790 --> 00:16:00,480
track and capture and then birthing the

403
00:16:05,350 --> 00:16:02,800
station

404
00:16:07,030 --> 00:16:05,360
having having lived i'll address this to

405
00:16:09,269 --> 00:16:07,040
both of you having lived up there for

406
00:16:12,150 --> 00:16:09,279
for many months and having prepared so

407
00:16:14,310 --> 00:16:12,160
long for the your your voyage in your in

408
00:16:16,790 --> 00:16:14,320
your life in the space station

409
00:16:18,550 --> 00:16:16,800
what did you find that you were not

410
00:16:21,670 --> 00:16:18,560
quite prepared for what are some of the

411
00:16:23,749 --> 00:16:21,680
unexpected things that that you say gee

412
00:16:26,470 --> 00:16:23,759
you know i can pass this knowledge along

413
00:16:29,189 --> 00:16:26,480

to the next person or i found out more

414
00:16:32,710 --> 00:16:29,199
about myself from being up here for this

415
00:16:39,350 --> 00:16:36,230
i i i that's a good question and i've

416
00:16:41,910 --> 00:16:39,360
got a little example one of these small

417
00:16:43,990 --> 00:16:41,920
details that you can never train for and

418
00:16:45,829 --> 00:16:44,000
you are just surprised when you come up

419
00:16:48,790 --> 00:16:45,839
to orbit that it could be this way and

420
00:16:51,269 --> 00:16:48,800
it has to do with our trash cans our

421
00:16:53,030 --> 00:16:51,279
waste baskets and we have these really

422
00:16:55,990 --> 00:16:53,040
nice weight baskets

423
00:16:58,629 --> 00:16:56,000
and if you open up the lid to put a

424
00:17:00,069 --> 00:16:58,639
small piece of something in there

425
00:17:01,829 --> 00:17:00,079
that little small piece of something

426
00:17:03,670 --> 00:17:01,839
will just be floating right under that

427
00:17:05,829 --> 00:17:03,680
lid and then the next person opens that

428
00:17:07,350 --> 00:17:05,839
lid up all these little small pieces

429
00:17:08,230 --> 00:17:07,360
come floating out and it makes a big

430
00:17:11,029 --> 00:17:08,240
mess

431
00:17:12,789 --> 00:17:11,039
and so the wastebaskets are great for a

432
00:17:14,549 --> 00:17:12,799
big chunk of something but all these

433
00:17:16,870 --> 00:17:14,559
little tiny things like little pieces of

434
00:17:18,470 --> 00:17:16,880
tape and and little little strings and

435
00:17:20,309 --> 00:17:18,480
things like that you don't want to put

436
00:17:22,069 --> 00:17:20,319
them in a wastebasket or they just make

437
00:17:23,429 --> 00:17:22,079
a mess for the next guy

438
00:17:25,110 --> 00:17:23,439

so what we do

439
00:17:27,110 --> 00:17:25,120
is we take one of our little wet wipe

440
00:17:28,710 --> 00:17:27,120
containers which is just like the wet

441
00:17:30,470 --> 00:17:28,720
wipes that you use for wiping baby

442
00:17:32,710 --> 00:17:30,480
bottoms on earth and we use the same

443
00:17:34,789 --> 00:17:32,720
ones up here they come in a little

444
00:17:36,789 --> 00:17:34,799
plastic pouch with a little

445
00:17:38,789 --> 00:17:36,799
lid a little doorway that you can open

446
00:17:41,190 --> 00:17:38,799
up and when we have one of those things

447
00:17:43,669 --> 00:17:41,200
empty we stick it on the wall and we use

448
00:17:46,150 --> 00:17:43,679
it for a small items

449
00:17:47,669 --> 00:17:46,160
waste basket and you can open that

450
00:17:49,110 --> 00:17:47,679
little lid you can put little tiny

451
00:17:50,470 --> 00:17:49,120
things in there and close the lid and

452
00:17:52,950 --> 00:17:50,480
you don't need to worry about all of

453
00:17:55,029 --> 00:17:52,960
these seeds swimming out and and i never

454
00:17:57,029 --> 00:17:55,039
would have thought that that you'd do

455
00:18:00,150 --> 00:17:57,039
that you'd use something like this for a

456
00:18:02,789 --> 00:18:00,160
little trash can and it's it's uh it's

457
00:18:04,070 --> 00:18:02,799
an elegant solution to the problem and

458
00:18:05,909 --> 00:18:04,080
these are the kinds of things that you

459
00:18:08,630 --> 00:18:05,919
only learn once

460
00:18:14,310 --> 00:18:08,640
once you show up in space and dan what

461
00:18:18,070 --> 00:18:16,950
yeah i guess um if if i were to think

462
00:18:19,669 --> 00:18:18,080
back on the thing that probably

463
00:18:21,909 --> 00:18:19,679

surprised me the most you know even

464
00:18:24,710 --> 00:18:21,919
having been up here twice on on shuttle

465
00:18:26,630 --> 00:18:24,720
missions is how difficult it is to keep

466
00:18:27,750 --> 00:18:26,640
track of everything that you have on a

467
00:18:29,430 --> 00:18:27,760
shuttle mission it's a little bit

468
00:18:32,230 --> 00:18:29,440
smaller volume you do spend time in the

469
00:18:34,549 --> 00:18:32,240
station but you're you don't spend as

470
00:18:36,150 --> 00:18:34,559
much time here that you don't get

471
00:18:38,870 --> 00:18:36,160
necessarily

472
00:18:40,710 --> 00:18:38,880
exquisitely good about keeping track of

473
00:18:42,390 --> 00:18:40,720
things and up here you know the first

474
00:18:44,950 --> 00:18:42,400
couple of weeks that were around

475
00:18:47,190 --> 00:18:44,960
uh it is so easy for things even that

476
00:18:49,430 --> 00:18:47,200
are velcroed and attached and so forth

477
00:18:51,190 --> 00:18:49,440
to just fly away get bumped and jostled

478
00:18:52,630 --> 00:18:51,200
you know we we joke about you know new

479
00:18:54,789 --> 00:18:52,640
crews coming onboard space station

480
00:18:57,990 --> 00:18:54,799
shuttle crews included creating a wake

481
00:18:59,909 --> 00:18:58,000
of swimming parts and cameras and

482
00:19:02,390 --> 00:18:59,919
notebooks and procedures and so forth

483
00:19:04,070 --> 00:19:02,400
behind them when they go by um it gets

484
00:19:06,070 --> 00:19:04,080
to the point up here where everything

485
00:19:07,110 --> 00:19:06,080
that you do you're constantly thinking

486
00:19:08,549 --> 00:19:07,120
planning

487
00:19:10,230 --> 00:19:08,559
or at least in the back your mind how to

488
00:19:11,830 --> 00:19:10,240

keep track of everything and and if

489
00:19:13,990 --> 00:19:11,840
you're going to take something apart to

490
00:19:15,990 --> 00:19:14,000
fix it for example keeping track of

491
00:19:17,990 --> 00:19:16,000
bolts and washers and nuts and having a

492
00:19:19,909 --> 00:19:18,000
little piece of tape stage by and having

493
00:19:21,270 --> 00:19:19,919
all your tools organized is something

494
00:19:23,029 --> 00:19:21,280
that's kind of part and parcel with your

495
00:19:25,110 --> 00:19:23,039
life up here

496
00:19:27,270 --> 00:19:25,120
one last question dan burbank you're

497
00:19:29,110 --> 00:19:27,280
going to be coming back in a few days is

498
00:19:31,029 --> 00:19:29,120
adjusting to life back on earth going to

499
00:19:32,230 --> 00:19:31,039
be difficult are you how are you looking

500
00:19:33,990 --> 00:19:32,240
forward to it are you going to be

501
00:19:38,150 --> 00:19:34,000
nostalgic about missing the space

502
00:19:40,470 --> 00:19:39,270
i think for everybody that's had a

503
00:19:42,390 --> 00:19:40,480
chance to be up here i think you're

504
00:19:43,909 --> 00:19:42,400
always going to have just a little piece

505
00:19:45,430 --> 00:19:43,919
of your heart that's uh that's still

506
00:19:47,190 --> 00:19:45,440
here that you're going to miss these

507
00:19:49,830 --> 00:19:47,200
views miss just the

508
00:19:51,669 --> 00:19:49,840
the the nature of life in space

509
00:19:53,909 --> 00:19:51,679
i'm really looking forward to seeing my

510
00:19:56,230 --> 00:19:53,919
family again family and friends being

511
00:19:58,549 --> 00:19:56,240
able to to see them again will be great

512
00:20:00,390 --> 00:19:58,559
the thing that'll be really hard is by

513
00:20:02,870 --> 00:20:00,400

at least by all reports is getting used

514
00:20:04,310 --> 00:20:02,880
to uh to planet earth's gravity and

515
00:20:05,909 --> 00:20:04,320
getting used to fighting it all the time

516
00:20:08,149 --> 00:20:05,919
we spend a lot of time exercising up

517
00:20:09,909 --> 00:20:08,159
here but i wonder if it'll ever really

518
00:20:13,110 --> 00:20:09,919
be enough to make those first couple of

519
00:20:15,270 --> 00:20:13,120
weeks as easy as i hope they would be

520
00:20:16,789 --> 00:20:15,280
well commander burbank and flight

521
00:20:19,029 --> 00:20:16,799
engineer don pettit i want to thank you

522
00:20:21,590 --> 00:20:19,039
both for taking time to be with us today

523
00:20:23,510 --> 00:20:21,600
and and good luck to you and and and

524
00:20:25,029 --> 00:20:23,520
welcome back when you get back to earth

525
00:20:26,630 --> 00:20:25,039
thank you for joining us on science

526
00:20:30,230 --> 00:20:26,640
friday from the international space

527
00:20:37,350 --> 00:20:31,750
ira thank you it's great talking to you

528
00:20:42,789 --> 00:20:39,750
station this is houston acr thank you

529
00:20:44,789 --> 00:20:42,799
that concludes the event

530
00:20:46,870 --> 00:20:44,799
thank you national public radio station