
PAO

1
00:00:05,430 --> 00:00:03,350
well hello we'd like to welcome you to

2
00:00:06,630 --> 00:00:05,440
mission control houston for the digital

3
00:00:08,790 --> 00:00:06,640
learning network event where we're

4
00:00:12,070 --> 00:00:08,800
speaking with sixth grade students in

5
00:00:13,509 --> 00:00:12,080
texas with me is amy brzezinski she is a

6
00:00:15,190 --> 00:00:13,519
flight controller here in mission

7
00:00:17,189 --> 00:00:15,200
control and we're going to talk a little

8
00:00:19,029 --> 00:00:17,199
bit about amy's background before we

9
00:00:20,790 --> 00:00:19,039
take questions from the students

10
00:00:22,870 --> 00:00:20,800
so amy uh what do you do as a flight

11
00:00:25,029 --> 00:00:22,880
controller here at mission control

12
00:00:27,349 --> 00:00:25,039
so as a flight controller in iss mission

13
00:00:30,710 --> 00:00:27,359

control i'm responsible for monitoring

14
00:00:32,549 --> 00:00:30,720
my system uh and performing actions with

15
00:00:33,830 --> 00:00:32,559
it my system is the computer system we

16
00:00:34,709 --> 00:00:33,840
call the command and data handling

17
00:00:36,389 --> 00:00:34,719
system

18
00:00:38,790 --> 00:00:36,399
and my call sign is odin every

19
00:00:40,950 --> 00:00:38,800
discipline has a call sign so my job in

20
00:00:42,709 --> 00:00:40,960
particular is to

21
00:00:44,549 --> 00:00:42,719
watch over the over

22
00:00:45,990 --> 00:00:44,559
48 computers on the space station that

23
00:00:47,350 --> 00:00:46,000
are running right now

24
00:00:49,910 --> 00:00:47,360
and make sure that they're operating

25
00:00:51,590 --> 00:00:49,920
normally and then uploading software for

26
00:00:54,069 --> 00:00:51,600
all the other systems

27
00:00:56,549 --> 00:00:54,079
activities and also get certain pieces

28
00:00:58,069 --> 00:00:56,559
of data down after those activities so

29
00:00:59,670 --> 00:00:58,079
the computer system is responsible for

30
00:01:01,510 --> 00:00:59,680
interfacing with all the other systems

31
00:01:03,189 --> 00:01:01,520
to make sure that the crew can get data

32
00:01:05,030 --> 00:01:03,199
on those systems and that the ground can

33
00:01:07,030 --> 00:01:05,040
get data on those systems

34
00:01:08,950 --> 00:01:07,040
a lot of people may be uh familiar with

35
00:01:11,429 --> 00:01:08,960
how the space shuttle was operated where

36
00:01:12,390 --> 00:01:11,439
the crew flips switches and that's how

37
00:01:13,910 --> 00:01:12,400
things are

38
00:01:16,230 --> 00:01:13,920

commanded but really with the space

39
00:01:19,350 --> 00:01:16,240
station the computers operate everything

40
00:01:21,429 --> 00:01:19,360
and they interface with the laptops

41
00:01:22,550 --> 00:01:21,439
that's right so

42
00:01:25,109 --> 00:01:22,560
there are a lot more computers than

43
00:01:26,630 --> 00:01:25,119
there were on on shuttle and we do a lot

44
00:01:28,789 --> 00:01:26,640
of commanding actually from the ground

45
00:01:30,550 --> 00:01:28,799
so um all out of the fight controllers

46
00:01:31,670 --> 00:01:30,560
send commands but i'm also responsible

47
00:01:34,550 --> 00:01:31,680
for making sure that those those

48
00:01:36,310 --> 00:01:34,560
commands go through and uh the computers

49
00:01:37,590 --> 00:01:36,320
process them correctly

50
00:01:41,429 --> 00:01:37,600
and then the crew can interface with the

51
00:01:43,749 --> 00:01:41,439
system through laptops on board as well

52
00:01:45,350 --> 00:01:43,759
and what kind of background led you to

53
00:01:47,990 --> 00:01:45,360
here to johnson space center mission

54
00:01:51,429 --> 00:01:48,000
control it all started when i turned

55
00:01:53,670 --> 00:01:51,439
about 12 i saw the movie apollo 13 and i

56
00:01:56,389 --> 00:01:53,680
kind of fell in love with human space

57
00:01:58,709 --> 00:01:56,399
flight and what nasa did and i prompted

58
00:02:00,550 --> 00:01:58,719
me to continue studying

59
00:02:02,469 --> 00:02:00,560
space in general and then also later on

60
00:02:04,550 --> 00:02:02,479
in high school and college

61
00:02:06,789 --> 00:02:04,560
math and science and engineering so i

62
00:02:08,389 --> 00:02:06,799
ended up going to mit and studying

63
00:02:09,910 --> 00:02:08,399

aeronautical and astronautical

64
00:02:12,229 --> 00:02:09,920
engineering

65
00:02:13,910 --> 00:02:12,239
and i got my my bachelor's degree and

66
00:02:16,309 --> 00:02:13,920
then i decided that i really wanted to

67
00:02:18,869 --> 00:02:16,319
get a master's degree and also co-op

68
00:02:22,150 --> 00:02:18,879
here at jsc at the same time

69
00:02:24,550 --> 00:02:22,160
so i i studied human factors engineering

70
00:02:25,949 --> 00:02:24,560
looking at how people interface with

71
00:02:28,869 --> 00:02:25,959
autonomy with

72
00:02:31,350 --> 00:02:28,879
semi-automatic systems and then i co-opt

73
00:02:33,430 --> 00:02:31,360
here in the life support training group

74
00:02:36,710 --> 00:02:33,440
and the operations support officer group

75
00:02:38,229 --> 00:02:36,720
that do a lot of maintenance on station

76
00:02:40,390 --> 00:02:38,239
and then once i finished my master's

77
00:02:42,229 --> 00:02:40,400
degree i got hired on into the into the

78
00:02:43,910 --> 00:02:42,239
odin group to uh to

79
00:02:46,070 --> 00:02:43,920
work with the computers

80
00:02:47,830 --> 00:02:46,080
and the the co-op program is a great

81
00:02:50,150 --> 00:02:47,840
opportunity for students we'd like to

82
00:02:52,710 --> 00:02:50,160
point out because that's a great way

83
00:02:55,030 --> 00:02:52,720
that a lot of people get hired at nasa

84
00:02:57,110 --> 00:02:55,040
is starting sort of as an intern while

85
00:02:58,869 --> 00:02:57,120
you're still in school at college you

86
00:03:01,350 --> 00:02:58,879
can come here and spend a semester and

87
00:03:02,790 --> 00:03:01,360
work at different areas and learn about

88
00:03:05,190 --> 00:03:02,800

what it's like to work here before you

89
00:03:07,270 --> 00:03:05,200
actually come and hopefully get hired

90
00:03:08,309 --> 00:03:07,280
how was that experience for you i really

91
00:03:09,910 --> 00:03:08,319
liked it

92
00:03:11,190 --> 00:03:09,920
especially because you get to work in

93
00:03:13,589 --> 00:03:11,200
lots of different groups when you're a

94
00:03:15,589 --> 00:03:13,599
co-op you can kind of try on the job and

95
00:03:17,750 --> 00:03:15,599
find where you would like to work most

96
00:03:20,790 --> 00:03:17,760
in nasa and i had a feeling that i

97
00:03:22,630 --> 00:03:20,800
wanted to either train astronauts or be

98
00:03:24,789 --> 00:03:22,640
a flight controller and so i got to do

99
00:03:26,630 --> 00:03:24,799
both of those things actually as a co-op

100
00:03:29,110 --> 00:03:26,640
and then i decided when i got hired on

101
00:03:30,390 --> 00:03:29,120
full on that i wanted to be a flight

102
00:03:33,030 --> 00:03:30,400
controller but maybe i'll get to train

103
00:03:35,270 --> 00:03:33,040
astronauts someday again

104
00:03:37,830 --> 00:03:35,280
and what uh kind of schooling did you do

105
00:03:39,670 --> 00:03:37,840
at mit that brought you here

106
00:03:40,710 --> 00:03:39,680
well um studying aeronautical and

107
00:03:42,390 --> 00:03:40,720
astronomical engineering which is kind

108
00:03:43,910 --> 00:03:42,400
of a mouthful so we call it aeroastro

109
00:03:45,270 --> 00:03:43,920
engineering for short

110
00:03:46,789 --> 00:03:45,280
i got a lot of

111
00:03:48,949 --> 00:03:46,799
a lot of a basic education and

112
00:03:51,750 --> 00:03:48,959
engineering principles such as

113
00:03:54,470 --> 00:03:51,760

fluid mechanics structures

114
00:03:56,630 --> 00:03:54,480
thermodynamics

115
00:03:58,630 --> 00:03:56,640
signals and systems how computers work

116
00:03:59,670 --> 00:03:58,640
and then i got to work on projects with

117
00:04:02,309 --> 00:03:59,680
teams

118
00:04:03,030 --> 00:04:02,319
we actually while i was at mit designed

119
00:04:15,030 --> 00:04:03,040
a

120
00:04:16,789 --> 00:04:15,040
you're never working on your own you're

121
00:04:18,629 --> 00:04:16,799
always working with lots of other people

122
00:04:20,789 --> 00:04:18,639
who have knowledge in areas different

123
00:04:22,870 --> 00:04:20,799
than you and if you take all of them and

124
00:04:25,110 --> 00:04:22,880
combine them together you fly the space

125
00:04:27,510 --> 00:04:25,120
station together so that experience of

126
00:04:29,189 --> 00:04:27,520
building a building a spacecraft in

127
00:04:31,110 --> 00:04:29,199
college really prepared me for the team

128
00:04:32,710 --> 00:04:31,120
environment here

129
00:04:33,830 --> 00:04:32,720
that sounds great and i think we're

130
00:04:38,950 --> 00:04:33,840
ready to take questions from the

131
00:04:45,990 --> 00:04:42,150
what is human supervisory control of

132
00:04:47,590 --> 00:04:46,000
multiple autonomous vehicles all about

133
00:04:49,990 --> 00:04:47,600
that's a good question so that actually

134
00:04:51,110 --> 00:04:50,000
goes back to uh to my days at mit i

135
00:04:52,790 --> 00:04:51,120
think somebody's been doing their

136
00:04:54,790 --> 00:04:52,800
homework

137
00:04:57,430 --> 00:04:54,800
so what that means is

138
00:04:59,510 --> 00:04:57,440

when you have multiple vehicles

139
00:05:03,029 --> 00:04:59,520
you can make them partially autonomous

140
00:05:04,469 --> 00:05:03,039
so they can fly themselves because

141
00:05:06,710 --> 00:05:04,479
we understand how to do that with

142
00:05:08,390 --> 00:05:06,720
software and so you can have them fly

143
00:05:10,710 --> 00:05:08,400
themselves and you can have a person

144
00:05:14,150 --> 00:05:10,720
giving them high level instructions such

145
00:05:16,790 --> 00:05:14,160
as you know go here or um or go do that

146
00:05:18,550 --> 00:05:16,800
there and so if you can give them high

147
00:05:20,710 --> 00:05:18,560
level instructions that means you can

148
00:05:22,310 --> 00:05:20,720
probably have one person supervising

149
00:05:24,629 --> 00:05:22,320
more than one vehicle

150
00:05:26,469 --> 00:05:24,639
however if you get a lot of vehicles and

151
00:05:29,029 --> 00:05:26,479
one person's supervising that can pose

152
00:05:30,950 --> 00:05:29,039
some pretty interesting challenges to

153
00:05:32,469 --> 00:05:30,960
make sure that the person is keeping

154
00:05:34,710 --> 00:05:32,479
track of all the vehicles what they're

155
00:05:36,070 --> 00:05:34,720
doing and if you're in a situation where

156
00:05:37,990 --> 00:05:36,080
there are time critical things that need

157
00:05:39,830 --> 00:05:38,000
to happen you need to make sure that the

158
00:05:41,670 --> 00:05:39,840
person can make good decisions about

159
00:05:43,909 --> 00:05:41,680
what the vehicles are doing

160
00:05:46,390 --> 00:05:43,919
my research looked at was

161
00:05:50,310 --> 00:05:46,400
tools that i could provide to a person

162
00:05:52,390 --> 00:05:50,320
supervising high level multiple vehicles

163
00:05:53,990 --> 00:05:52,400

in a time critical environment

164
00:05:55,990 --> 00:05:54,000
and giving them tools to help them make

165
00:05:57,749 --> 00:05:56,000
decisions for things that were going to

166
00:05:59,830 --> 00:05:57,759
happen into the future so if something

167
00:06:01,830 --> 00:05:59,840
unexpected came up to be able to give

168
00:06:15,510 --> 00:06:01,840
them a decision-making tool to to change

169
00:06:21,670 --> 00:06:18,469
um why did you choose to become an odin

170
00:06:25,510 --> 00:06:21,680
and who was your inspiration

171
00:06:27,510 --> 00:06:25,520
so i like to say that odin chose me um i

172
00:06:29,670 --> 00:06:27,520
wanted to be a flight controller and at

173
00:06:31,830 --> 00:06:29,680
the time they really needed people to to

174
00:06:34,629 --> 00:06:31,840
to be an odin to to monitor the

175
00:06:36,390 --> 00:06:34,639
computers so i actually ended up odin

176
00:06:38,870 --> 00:06:36,400
actually chose me but i really liked it

177
00:06:41,110 --> 00:06:38,880
i work with a fantastic group of people

178
00:06:43,110 --> 00:06:41,120
we do really complex things like

179
00:06:46,070 --> 00:06:43,120
changing out the software on the

180
00:06:47,830 --> 00:06:46,080
computers on space station

181
00:06:49,990 --> 00:06:47,840
actually recently we changed out the

182
00:06:51,189 --> 00:06:50,000
hardware on the computers on space

183
00:06:52,950 --> 00:06:51,199
station the

184
00:06:55,110 --> 00:06:52,960
expedition 30 crew helped us out with

185
00:06:57,110 --> 00:06:55,120
that and it was kind of like performing

186
00:06:59,350 --> 00:06:57,120
brain surgery on the space station we

187
00:07:01,749 --> 00:06:59,360
changed out seven computers

188
00:07:04,469 --> 00:07:01,759

hardware and almost half of the computer

189
00:07:05,990 --> 00:07:04,479
software and that's very exciting it's a

190
00:07:08,550 --> 00:07:06,000
very complex

191
00:07:09,670 --> 00:07:08,560
um and it's very satisfying it went very

192
00:07:11,830 --> 00:07:09,680
smoothly

193
00:07:13,350 --> 00:07:11,840
in terms of my inspiration i think i've

194
00:07:15,350 --> 00:07:13,360
i've been inspired by all the flight

195
00:07:17,430 --> 00:07:15,360
controllers and flight directors and

196
00:07:19,510 --> 00:07:17,440
astronauts that have come before me and

197
00:07:21,430 --> 00:07:19,520
in particular i had a very good mentor

198
00:07:23,029 --> 00:07:21,440
when i started here at nasa

199
00:07:24,309 --> 00:07:23,039
his name was colin peterson and he

200
00:07:26,790 --> 00:07:24,319
taught me a lot about being a good

201
00:07:28,230 --> 00:07:26,800
flight controller and uh and gave me a

202
00:07:38,309 --> 00:07:28,240
lot of lessons that i still use to this

203
00:07:42,070 --> 00:07:39,430
um

204
00:07:44,070 --> 00:07:42,080
how many computers are needed to run all

205
00:07:47,749 --> 00:07:44,080
the networks

206
00:07:49,589 --> 00:07:47,759
that's a very good question so right now

207
00:07:50,469 --> 00:07:49,599
there are 48 computers that are powered

208
00:07:52,790 --> 00:07:50,479
on

209
00:07:55,350 --> 00:07:52,800
41 computers that are running the space

210
00:07:57,350 --> 00:07:55,360
station systems and getting data and

211
00:07:59,990 --> 00:07:57,360
sending commands and then we have seven

212
00:08:02,869 --> 00:08:00,000
computers laptop computers that the crew

213
00:08:04,469 --> 00:08:02,879

can interface with the other computers

214
00:08:06,309 --> 00:08:04,479
and they can send commands and get data

215
00:08:08,629 --> 00:08:06,319
from those laptops

216
00:08:10,869 --> 00:08:08,639
so um that's on an average day sometimes

217
00:08:24,629 --> 00:08:10,879
we can have more uh computers running

218
00:08:28,790 --> 00:08:26,550
what do the multiple

219
00:08:31,749 --> 00:08:28,800
autonomous vehicles do if you lose

220
00:08:33,750 --> 00:08:31,759
communication with them

221
00:08:35,829 --> 00:08:33,760
so that's actually an interesting

222
00:08:37,829 --> 00:08:35,839
question and one that i didn't look at

223
00:08:39,430 --> 00:08:37,839
when i was uh studying multiple

224
00:08:40,790 --> 00:08:39,440
autonomous vehicles but i think that

225
00:08:43,110 --> 00:08:40,800
it's one that people will need to

226
00:08:45,110 --> 00:08:43,120
research later i can tell you what what

227
00:08:47,110 --> 00:08:45,120
we do when the iss has a loss of

228
00:08:48,630 --> 00:08:47,120
communications

229
00:08:50,470 --> 00:08:48,640
those are usually understood ahead of

230
00:08:52,550 --> 00:08:50,480
time and planned we aren't in contact

231
00:08:53,750 --> 00:08:52,560
with the iss all the time

232
00:08:55,350 --> 00:08:53,760
but we usually know ahead of time when

233
00:08:57,990 --> 00:08:55,360
we're not going to have contact with the

234
00:09:00,150 --> 00:08:58,000
iss and when that happens we we can't

235
00:09:02,710 --> 00:09:00,160
actually talk to the crew and we don't

236
00:09:04,310 --> 00:09:02,720
get data down and we can't send commands

237
00:09:06,150 --> 00:09:04,320
but the space station with all its

238
00:09:08,870 --> 00:09:06,160

computers is pretty smart and it can

239
00:09:10,790 --> 00:09:08,880
continue flying and monitoring its

240
00:09:12,470 --> 00:09:10,800
systems and if anything would happen

241
00:09:14,150 --> 00:09:12,480
while the ground can't talk to the space

242
00:09:15,829 --> 00:09:14,160
station the crew would receive

243
00:09:18,070 --> 00:09:15,839
notification and they're trained to take

244
00:09:20,070 --> 00:09:18,080
action based on those notifications so

245
00:09:24,630 --> 00:09:20,080
it's a pretty robust spacecraft it can

246
00:09:28,070 --> 00:09:25,670
and

247
00:09:30,550 --> 00:09:28,080
if odin develops a problem how do you

248
00:09:32,070 --> 00:09:30,560
fix it

249
00:09:33,990 --> 00:09:32,080
that's a very good question that's

250
00:09:35,269 --> 00:09:34,000
definitely a big part of my job is if

251
00:09:37,509 --> 00:09:35,279
there's anything that happens in the

252
00:09:39,750 --> 00:09:37,519
computer system i'm the person who's

253
00:09:41,430 --> 00:09:39,760
supposed to make sure i can fix it

254
00:09:43,350 --> 00:09:41,440
you can have two types of problems in

255
00:09:45,030 --> 00:09:43,360
the computer system you can have a

256
00:09:47,269 --> 00:09:45,040
software problem or you can have a

257
00:09:48,310 --> 00:09:47,279
hardware problem and we can actually

258
00:09:50,070 --> 00:09:48,320
address

259
00:09:52,710 --> 00:09:50,080
most of the software problems from the

260
00:09:54,630 --> 00:09:52,720
ground we can send commands to uh to fix

261
00:09:56,550 --> 00:09:54,640
the software or we can cycle the

262
00:09:58,230 --> 00:09:56,560
software if needed and for hardware

263
00:10:00,550 --> 00:09:58,240

problems we have some ability to deal

264
00:10:02,310 --> 00:10:00,560
with that too to address particular

265
00:10:03,910 --> 00:10:02,320
hardware problems but sometimes if

266
00:10:05,590 --> 00:10:03,920
something would really really fail in

267
00:10:07,269 --> 00:10:05,600
one of the computers and we might need

268
00:10:09,350 --> 00:10:07,279
to change it out with a spare we have on

269
00:10:11,430 --> 00:10:09,360
board and so in that case we would ask

270
00:10:13,350 --> 00:10:11,440
the crew to help us out since we can't

271
00:10:14,949 --> 00:10:13,360
go do it ourselves here from the ground

272
00:10:16,550 --> 00:10:14,959
and they're trained to do that and they

273
00:10:18,069 --> 00:10:16,560
would go and they would take out that

274
00:10:22,949 --> 00:10:18,079
piece of hardware and put in one of the

275
00:10:22,959 --> 00:10:28,310
what is it

276
00:10:34,550 --> 00:10:30,630
what is a beautiful day of work life on

277
00:10:40,550 --> 00:10:36,790
i think that was i think you just asked

278
00:10:43,350 --> 00:10:40,560
what is a typical day like on iss

279
00:10:44,310 --> 00:10:43,360
so uh i'll try to try to tell you what

280
00:10:46,389 --> 00:10:44,320
the crew

281
00:10:48,389 --> 00:10:46,399
a typical crew day is like

282
00:10:50,870 --> 00:10:48,399
they're doing a lot of science right now

283
00:10:52,790 --> 00:10:50,880
they do a lot of experiments multiple

284
00:10:54,870 --> 00:10:52,800
experiments every day

285
00:10:55,829 --> 00:10:54,880
they work monday through friday

286
00:10:57,509 --> 00:10:55,839
and then

287
00:10:59,670 --> 00:10:57,519
when they're not doing experiments

288
00:11:01,269 --> 00:10:59,680

they're exercising they exercise two

289
00:11:02,150 --> 00:11:01,279
hours every day

290
00:11:03,590 --> 00:11:02,160
and

291
00:11:05,590 --> 00:11:03,600
sometimes they also do some maintenance

292
00:11:07,190 --> 00:11:05,600
tests for us um you know just like your

293
00:11:10,069 --> 00:11:07,200
house at home you've got to clean the

294
00:11:11,190 --> 00:11:10,079
space stations they do some cleaning and

295
00:11:14,069 --> 00:11:11,200
there's some regular maintenance they

296
00:11:15,190 --> 00:11:14,079
need to do to keep the systems running

297
00:11:16,630 --> 00:11:15,200
and then

298
00:11:17,910 --> 00:11:16,640
sometimes if something breaks or

299
00:11:19,509 --> 00:11:17,920
something's not working quite right

300
00:11:28,870 --> 00:11:19,519
we'll have them go take care of that as

301
00:11:32,949 --> 00:11:29,750
um

302
00:11:34,550 --> 00:11:32,959
what do you do for fun on the iss

303
00:11:36,310 --> 00:11:34,560
so i think that thing that the

304
00:11:38,230 --> 00:11:36,320
astronauts do the most for fun when they

305
00:11:40,790 --> 00:11:38,240
have free time is look out the window

306
00:11:42,630 --> 00:11:40,800
and watch the world go by

307
00:11:44,550 --> 00:11:42,640
if if you haven't had a chance to

308
00:11:46,630 --> 00:11:44,560
receive pictures from the space station

309
00:11:50,870 --> 00:11:46,640
there's definitely a lot on uh on

310
00:11:53,269 --> 00:11:50,880
nasa.gov and uh pictures of earth from

311
00:11:54,949 --> 00:11:53,279
in daytime and night time are just

312
00:11:56,790 --> 00:11:54,959
beautiful they take a lot of pictures

313
00:11:59,190 --> 00:11:56,800

and you can see

314
00:12:00,470 --> 00:11:59,200
cities lit up at night

315
00:12:02,949 --> 00:12:00,480
you can see

316
00:12:04,550 --> 00:12:02,959
major uh major

317
00:12:05,910 --> 00:12:04,560
structures that humans have built i

318
00:12:07,990 --> 00:12:05,920
think they can actually see the great

319
00:12:09,590 --> 00:12:08,000
wall of china so they like to spend a

320
00:12:11,350 --> 00:12:09,600
lot of time looking at the earth because

321
00:12:12,629 --> 00:12:11,360
they only get to look at the earth while

322
00:12:14,470 --> 00:12:12,639
they're up there

323
00:12:16,310 --> 00:12:14,480
but i do know that they do things for

324
00:12:19,350 --> 00:12:16,320
fun that you would do at home on your

325
00:12:21,350 --> 00:12:19,360
weekends like they like to watch movies

326
00:12:22,949 --> 00:12:21,360
they talk a lot to their their family

327
00:12:25,350 --> 00:12:22,959
and friends they can call them they can

328
00:12:28,230 --> 00:12:25,360
also do video conferences

329
00:12:30,470 --> 00:12:28,240
they read they blog

330
00:12:32,710 --> 00:12:30,480
they tweet they tweet

331
00:12:34,069 --> 00:12:32,720
they write emails so

332
00:12:35,990 --> 00:12:34,079
kind of similar things that you would do

333
00:12:38,470 --> 00:12:36,000
at home for fun

334
00:12:44,150 --> 00:12:38,480
a normal day

335
00:12:47,350 --> 00:12:45,670
i'm sorry can you repeat that question

336
00:12:49,350 --> 00:12:47,360
again

337
00:12:51,750 --> 00:12:49,360
oh like so it's pretty much like a

338
00:12:53,590 --> 00:12:51,760

normal day uh like on the weekend except

339
00:12:57,829 --> 00:12:53,600
you're in space

340
00:13:01,110 --> 00:12:59,590
what are some things that you can say

341
00:13:02,470 --> 00:13:01,120
that you miss on earth that are not in

342
00:13:04,230 --> 00:13:02,480
space

343
00:13:06,310 --> 00:13:04,240
i think the first thing that astronauts

344
00:13:09,509 --> 00:13:06,320
say that they miss most is they miss

345
00:13:11,110 --> 00:13:09,519
their families and their friends

346
00:13:12,470 --> 00:13:11,120
so when it starts go up to the space

347
00:13:14,790 --> 00:13:12,480
station they're up there for about

348
00:13:16,310 --> 00:13:14,800
anywhere from four to six months so it's

349
00:13:17,670 --> 00:13:16,320
a pretty long time away from your family

350
00:13:18,870 --> 00:13:17,680
and friends even though you get to call

351
00:13:21,110 --> 00:13:18,880
them and you get to see them on the

352
00:13:23,829 --> 00:13:21,120
video conferences

353
00:13:26,629 --> 00:13:23,839
so i think that they miss that the most

354
00:13:28,470 --> 00:13:26,639
i think that they also probably miss

355
00:13:30,550 --> 00:13:28,480
you know being outside you can't open a

356
00:13:32,470 --> 00:13:30,560
window on the space station so they

357
00:13:34,389 --> 00:13:32,480
probably missed fresh air

358
00:13:36,069 --> 00:13:34,399
and wind and rain

359
00:13:38,470 --> 00:13:36,079
the weather is always the same every day

360
00:13:39,910 --> 00:13:38,480
on space station same temperature

361
00:13:42,230 --> 00:13:39,920
there's no rain on the space station so

362
00:13:43,350 --> 00:13:42,240
they probably miss that too

363
00:13:44,629 --> 00:13:43,360

and then they probably miss you know

364
00:13:46,069 --> 00:13:44,639
things like

365
00:13:48,870 --> 00:13:46,079
certain foods that they like they do

366
00:13:51,590 --> 00:13:48,880
have a very wide variety of food

367
00:13:53,269 --> 00:13:51,600
but if you're you know craving a

368
00:13:54,710 --> 00:13:53,279
certain type of food that you didn't

369
00:13:56,150 --> 00:13:54,720
pack for your trip then you're going to

370
00:13:57,350 --> 00:13:56,160
have to wait till you go home to eat it

371
00:13:58,629 --> 00:13:57,360
but they do get they do get a lot of

372
00:14:00,389 --> 00:13:58,639
different kinds of food but i know

373
00:14:21,750 --> 00:14:00,399
sometimes they miss certain certain

374
00:14:25,590 --> 00:14:22,949
i'm sorry can you repeat your question

375
00:14:28,790 --> 00:14:25,600
one more time i didn't quite get that

376
00:14:30,389 --> 00:14:28,800
more accidents prevented on the iss okay

377
00:14:33,269 --> 00:14:30,399
it's a very good question how are how

378
00:14:35,829 --> 00:14:33,279
are accidents prevented on the iss

379
00:14:37,829 --> 00:14:35,839
so one thing we do is we we do a lot of

380
00:14:40,230 --> 00:14:37,839
planning and we do a lot of training and

381
00:14:41,750 --> 00:14:40,240
we do a lot of assessing things that

382
00:14:43,509 --> 00:14:41,760
we're going to do on space station to

383
00:14:46,069 --> 00:14:43,519
make sure they're safe because safety is

384
00:14:47,590 --> 00:14:46,079
our number one priority so anything that

385
00:14:49,269 --> 00:14:47,600
the crew is going to do anything that

386
00:14:51,189 --> 00:14:49,279
the ground is going to do

387
00:14:53,110 --> 00:14:51,199
remotely we'll take a look at make sure

388
00:14:55,430 --> 00:14:53,120

that it's going to be safe and then we

389
00:14:57,670 --> 00:14:55,440
also do a lot of training

390
00:14:59,030 --> 00:14:57,680
on certain activities to make sure that

391
00:15:00,629 --> 00:14:59,040
they are safe

392
00:15:02,710 --> 00:15:00,639
and then if anything comes up that

393
00:15:04,310 --> 00:15:02,720
surprises us like an emergency we have

394
00:15:06,230 --> 00:15:04,320
procedures

395
00:15:07,910 --> 00:15:06,240
that we train a lot on the ground and

396
00:15:09,750 --> 00:15:07,920
the crew also trains

397
00:15:12,389 --> 00:15:09,760
to know what to do exactly what to do in

398
00:15:14,389 --> 00:15:12,399
an emergency kind of like um like you do

399
00:15:16,710 --> 00:15:14,399
for at school with a fire drill you know

400
00:15:17,990 --> 00:15:16,720
you have fire drills and you know which

401
00:15:20,310 --> 00:15:18,000
way you're supposed to leave and where

402
00:15:22,389 --> 00:15:20,320
you're supposed to meet and so forth so

403
00:15:23,189 --> 00:15:22,399
crew does that as well they they have a

404
00:15:24,870 --> 00:15:23,199
set

405
00:15:34,389 --> 00:15:24,880
pattern of what they do if there is a

406
00:15:38,470 --> 00:15:36,069
was there ever a time in mission

407
00:15:41,110 --> 00:15:38,480
operations when there was a critical

408
00:15:43,110 --> 00:15:41,120
life and death moment

409
00:15:45,110 --> 00:15:43,120
there have been times where there's been

410
00:15:47,350 --> 00:15:45,120
critical in life life and death

411
00:15:49,590 --> 00:15:47,360
situations and

412
00:15:50,389 --> 00:15:49,600
if you study space history you'll learn

413
00:15:52,829 --> 00:15:50,399

that

414
00:15:56,389 --> 00:15:52,839
there have been times where we have lost

415
00:15:59,030 --> 00:15:56,399
astronauts now apollo 1 for example

416
00:16:01,749 --> 00:15:59,040
and challenger in the 1980s and

417
00:16:03,670 --> 00:16:01,759
colombia not too many years ago and we

418
00:16:05,670 --> 00:16:03,680
remember these times and we learn from

419
00:16:06,389 --> 00:16:05,680
them and we miss these people very much

420
00:16:07,509 --> 00:16:06,399
and

421
00:16:09,670 --> 00:16:07,519
we're never going to forget them we

422
00:16:12,710 --> 00:16:09,680
think about them every day

423
00:16:15,189 --> 00:16:12,720
but again you know we we try our best to

424
00:16:16,710 --> 00:16:15,199
to make sure everything's safe

425
00:16:18,470 --> 00:16:16,720
and we have these procedures and our

426
00:16:20,710 --> 00:16:18,480
plans in place so we make sure that if

427
00:16:22,389 --> 00:16:20,720
there is a critical situation we can

428
00:16:24,069 --> 00:16:22,399
react to it on the ground to help out

429
00:16:25,829 --> 00:16:24,079
the crew and the crew can react to it

430
00:16:28,069 --> 00:16:25,839
appropriately so it's something you

431
00:16:29,430 --> 00:16:28,079
never really want to run into

432
00:16:44,230 --> 00:16:29,440
and we do our best to prevent those

433
00:16:48,550 --> 00:16:46,310
what breakthrough research foundation

434
00:16:51,110 --> 00:16:48,560
have you found through the

435
00:16:52,949 --> 00:16:51,120
international space station

436
00:16:55,110 --> 00:16:52,959
oh there's this is a really exciting

437
00:16:57,189 --> 00:16:55,120
time because um we are doing so much

438
00:17:00,389 --> 00:16:57,199

research on the space station and this

439
00:17:03,590 --> 00:17:00,399
this particular expedition expedition 30

440
00:17:06,630 --> 00:17:03,600
they've been doing 35 hours a week of

441
00:17:08,390 --> 00:17:06,640
research on space station and uh that's

442
00:17:10,630 --> 00:17:08,400
a record that that's a target that we

443
00:17:12,309 --> 00:17:10,640
set for ourselves and uh and we made

444
00:17:13,669 --> 00:17:12,319
that target

445
00:17:15,590 --> 00:17:13,679
we could probably talk about all the

446
00:17:17,350 --> 00:17:15,600
different kinds of research for hours

447
00:17:19,429 --> 00:17:17,360
but i'll focus on

448
00:17:21,990 --> 00:17:19,439
some of the human research some of the

449
00:17:23,909 --> 00:17:22,000
human health research that we're doing

450
00:17:25,189 --> 00:17:23,919
so one thing that we're working on is

451
00:17:27,029 --> 00:17:25,199
looking at

452
00:17:28,470 --> 00:17:27,039
doing experiments to try to come up with

453
00:17:30,710 --> 00:17:28,480
a vaccine

454
00:17:32,870 --> 00:17:30,720
for salmonella so salmonella is a type

455
00:17:33,990 --> 00:17:32,880
of bacteria that you can get that can

456
00:17:36,390 --> 00:17:34,000
make you sick

457
00:17:37,909 --> 00:17:36,400
a food poisoning type bacteria and so

458
00:17:40,630 --> 00:17:37,919
it's possible that we could prevent that

459
00:17:41,830 --> 00:17:40,640
with a vaccine so there's work on iss

460
00:17:43,110 --> 00:17:41,840
being used to try to develop that

461
00:17:45,029 --> 00:17:43,120
vaccine

462
00:17:46,630 --> 00:17:45,039
isis is kind of a unique place because

463
00:17:48,870 --> 00:17:46,640

you can grow

464
00:17:49,750 --> 00:17:48,880
protein crystals differently than on

465
00:17:50,789 --> 00:17:49,760
earth

466
00:17:52,870 --> 00:17:50,799
they actually grow in a completely

467
00:17:55,270 --> 00:17:52,880
different structure so we can use those

468
00:17:56,950 --> 00:17:55,280
protein crystals to try to come up with

469
00:17:58,390 --> 00:17:56,960
treatments for certain diseases such as

470
00:18:00,150 --> 00:17:58,400
cancer

471
00:18:02,549 --> 00:18:00,160
and then finally we have a lot of really

472
00:18:05,270 --> 00:18:02,559
cool robots on space station we've got a

473
00:18:06,789 --> 00:18:05,280
robotic arm and we've got a robotic hand

474
00:18:09,190 --> 00:18:06,799
called dexter

475
00:18:11,590 --> 00:18:09,200
we also have a robonaut and so we

476
00:18:15,190 --> 00:18:11,600
remotely operate those robotic

477
00:18:16,710 --> 00:18:15,200
robotic arms and equipment and that

478
00:18:18,470 --> 00:18:16,720
knowledge and how to remotely operate

479
00:18:19,430 --> 00:18:18,480
robotics can actually help people on

480
00:18:21,190 --> 00:18:19,440
earth

481
00:18:23,110 --> 00:18:21,200
doctors in particular

482
00:18:25,270 --> 00:18:23,120
learn how to conduct surgeries remotely

483
00:18:28,549 --> 00:18:25,280
with robotic arms so you could have a

484
00:18:31,270 --> 00:18:28,559
doctor in one city and a patient in a

485
00:18:32,870 --> 00:18:31,280
very remote area in a different city or

486
00:18:35,029 --> 00:18:32,880
you know out out somewhere where there

487
00:18:37,590 --> 00:18:35,039
isn't a city and you could have the

488
00:18:38,710 --> 00:18:37,600

doctor conduct surgery on that patient

489
00:18:41,430 --> 00:18:38,720
with the use of

490
00:18:42,950 --> 00:18:41,440
a remotely operated robotic arm

491
00:18:45,110 --> 00:18:42,960
so those are just some of the cool

492
00:18:47,350 --> 00:18:45,120
examples of the really neat research and

493
00:18:59,510 --> 00:18:47,360
technology development going on on the

494
00:19:05,510 --> 00:19:03,350
um since we have like space junk face is

495
00:19:09,270 --> 00:19:05,520
with more creations heading has nasa

496
00:19:11,590 --> 00:19:09,280
come the way to clear the space junk

497
00:19:13,510 --> 00:19:11,600
so yeah there is there is some stuff up

498
00:19:14,870 --> 00:19:13,520
in space uh some people call it space

499
00:19:16,070 --> 00:19:14,880
junk some people call it we call it

500
00:19:18,549 --> 00:19:16,080
debris

501
00:19:21,750 --> 00:19:18,559
um it is a concern for the space station

502
00:19:24,390 --> 00:19:21,760
uh so we we haven't developed any ways

503
00:19:26,630 --> 00:19:24,400
to um to try to eliminate that space the

504
00:19:28,549 --> 00:19:26,640
space debris yet but people do work on

505
00:19:30,789 --> 00:19:28,559
that but what we try to do on the space

506
00:19:32,950 --> 00:19:30,799
station is we we avoid it

507
00:19:34,789 --> 00:19:32,960
so if we we see that piece of space

508
00:19:37,029 --> 00:19:34,799
debris might be coming close to the

509
00:19:38,390 --> 00:19:37,039
station and we have certain parameters

510
00:19:40,070 --> 00:19:38,400
that tell us

511
00:19:42,870 --> 00:19:40,080
what's what means close to the space

512
00:19:44,470 --> 00:19:42,880
station we'll do what's called a reboost

513
00:19:47,029 --> 00:19:44,480

we'll take the space station and we'll

514
00:19:50,070 --> 00:19:47,039
fire some thrusters and the space

515
00:19:52,710 --> 00:19:50,080
station will move its orbit higher and

516
00:19:54,630 --> 00:19:52,720
that will avoid the space debris

517
00:19:56,070 --> 00:19:54,640
so we do a lot of tracking we track a

518
00:19:57,590 --> 00:19:56,080
lot of space debris to make sure that

519
00:20:09,669 --> 00:19:57,600
it's not coming too close to station and

520
00:20:14,390 --> 00:20:12,149
what is your vision for human space

521
00:20:17,990 --> 00:20:14,400
flight

522
00:20:19,350 --> 00:20:18,000
oh my vision is that in my lifetime i

523
00:20:22,070 --> 00:20:19,360
will see

524
00:20:24,230 --> 00:20:22,080
humanity go back to the moon go back to

525
00:20:26,390 --> 00:20:24,240
mars and maybe even have a space station

526
00:20:29,750 --> 00:20:26,400
someday around another planet i think

527
00:20:32,870 --> 00:20:31,029
excuse me

528
00:20:34,789 --> 00:20:32,880
i really hope that i get to go into

529
00:20:37,110 --> 00:20:34,799
space someday and i hope that all of you

530
00:20:38,549 --> 00:20:37,120
have the ability to go visit space

531
00:20:41,430 --> 00:20:38,559
someday because i think it's a really

532
00:20:43,430 --> 00:20:41,440
cool place to go visit and i think we're

533
00:20:45,750 --> 00:20:43,440
going to start seeing further and

534
00:20:46,630 --> 00:20:45,760
further exploration out from low earth

535
00:20:49,350 --> 00:20:46,640
orbit

536
00:20:50,710 --> 00:20:49,360
go to asteroids and we'll learn more

537
00:21:03,110 --> 00:20:50,720
about our universe and that's very

538
00:21:06,870 --> 00:21:04,789

when the international space station

539
00:21:10,789 --> 00:21:06,880
starts to decommission slowly lower down

540
00:21:14,710 --> 00:21:13,029
so the space station

541
00:21:17,110 --> 00:21:14,720
partners all the international partners

542
00:21:19,750 --> 00:21:17,120
and nasa have agreed to to operate the

543
00:21:21,029 --> 00:21:19,760
space station until 2020 and maybe even

544
00:21:22,950 --> 00:21:21,039
longer

545
00:21:24,870 --> 00:21:22,960
but someday we will have to we'll have

546
00:21:26,149 --> 00:21:24,880
to say goodbye to our space station and

547
00:21:27,990 --> 00:21:26,159
what we'll do then is we'll use

548
00:21:29,990 --> 00:21:28,000
thrusters to kind of go in the opposite

549
00:21:32,390 --> 00:21:30,000
direction of a reboost we'll use the

550
00:21:34,789 --> 00:21:32,400
thrusters to lower the orbit of the

551
00:21:37,430 --> 00:21:34,799
space station and we'll bring it down in

552
00:21:57,510 --> 00:21:37,440
a very controlled planned manner

553
00:22:03,909 --> 00:22:00,870
have you ever wanted to go into the iss

554
00:22:05,190 --> 00:22:03,919
yes i would love to go to the iss i

555
00:22:07,830 --> 00:22:05,200
think it is

556
00:22:09,590 --> 00:22:07,840
one of the most amazing places

557
00:22:11,430 --> 00:22:09,600
off this planet because i can't say it's

558
00:22:12,950 --> 00:22:11,440
on the planet in fact when people ask me

559
00:22:14,310 --> 00:22:12,960
you know where if you could go anywhere

560
00:22:16,470 --> 00:22:14,320
in the world where would you go and i

561
00:22:18,630 --> 00:22:16,480
would i'd always say well can i go can i

562
00:22:21,590 --> 00:22:18,640
go off the world is that is that an

563
00:22:25,190 --> 00:22:21,600

option it's really an amazing place it's

564
00:22:26,950 --> 00:22:25,200
um it's very big it's bigger than uh

565
00:22:29,669 --> 00:22:26,960
then i think a three or four bedroom

566
00:22:31,750 --> 00:22:29,679
house um and and it's amazing that we

567
00:22:33,430 --> 00:22:31,760
built it i mean it you know i remember

568
00:22:36,470 --> 00:22:33,440
when it was the first pieces were

569
00:22:38,470 --> 00:22:36,480
launched back when i was in high school

570
00:22:40,149 --> 00:22:38,480
and uh it's been neat to see it continue

571
00:22:46,390 --> 00:22:40,159
to build up so i would love to visit

572
00:22:54,870 --> 00:22:48,549
since you're a coordinator

573
00:23:00,549 --> 00:22:57,669
could you repeat the question

574
00:23:03,270 --> 00:23:00,559
um since you're a collaborative

575
00:23:04,950 --> 00:23:03,280
coordinator how hard is it to handle the

576
00:23:06,710 --> 00:23:04,960
issues in space

577
00:23:09,110 --> 00:23:06,720
that's a very good question it's a very

578
00:23:10,789 --> 00:23:09,120
it's a very good way to describe being a

579
00:23:12,710 --> 00:23:10,799
flight controller a collaborative

580
00:23:13,750 --> 00:23:12,720
coordinator um

581
00:23:16,230 --> 00:23:13,760
so

582
00:23:17,909 --> 00:23:16,240
it's it's not difficult to work issues

583
00:23:19,350 --> 00:23:17,919
we all learn how to um how to

584
00:23:21,590 --> 00:23:19,360
communicate with people that do the

585
00:23:23,430 --> 00:23:21,600
different systems and we learn about how

586
00:23:24,630 --> 00:23:23,440
our system in particular my system the

587
00:23:26,310 --> 00:23:24,640
computer system

588
00:23:28,950 --> 00:23:26,320

interfaces with things like the life

589
00:23:30,710 --> 00:23:28,960
support system the um

590
00:23:32,950 --> 00:23:30,720
the thermal system that keeps things

591
00:23:36,070 --> 00:23:32,960
cool and the power system so when an

592
00:23:37,430 --> 00:23:36,080
issue arises we're all trained to to

593
00:23:39,669 --> 00:23:37,440
work together to figure out what the

594
00:23:41,669 --> 00:23:39,679
problem is and then what the impact is

595
00:23:43,590 --> 00:23:41,679
to the entire team in the space station

596
00:23:44,870 --> 00:23:43,600
as a whole and the mission objectives

597
00:23:46,630 --> 00:23:44,880
and the crew

598
00:23:48,310 --> 00:23:46,640
very importantly and then what the

599
00:23:51,029 --> 00:23:48,320
workaround is what do we need to do to

600
00:23:52,230 --> 00:23:51,039
try to fix the issue and we practice

601
00:23:54,149 --> 00:23:52,240
this

602
00:23:55,909 --> 00:23:54,159
we always say in our heads we always

603
00:23:58,710 --> 00:23:55,919
think when we see an issue failure

604
00:24:00,149 --> 00:23:58,720
impact work around and so based on that

605
00:24:02,630 --> 00:24:00,159
we actually can work very easily

606
00:24:04,789 --> 00:24:02,640
together to come up with a solution to

607
00:24:14,390 --> 00:24:04,799
issues that affect multiple systems in a

608
00:24:19,029 --> 00:24:15,830
when will we be able to launch a

609
00:24:20,870 --> 00:24:19,039
spaceship from the iss

610
00:24:23,110 --> 00:24:20,880
that's a good question

611
00:24:25,990 --> 00:24:23,120
right now we don't have any plans yet to

612
00:24:27,990 --> 00:24:26,000
launch spacecraft from the iss

613
00:24:29,909 --> 00:24:28,000

but we do have some spacecraft that are

614
00:24:31,590 --> 00:24:29,919
launching to the iss that are very new

615
00:24:33,510 --> 00:24:31,600
that are coming this year

616
00:24:35,909 --> 00:24:33,520
you may have heard about one of them

617
00:24:38,310 --> 00:24:35,919
it's called dragon it's a resupply

618
00:24:40,390 --> 00:24:38,320
spacecraft that's been uh

619
00:24:42,950 --> 00:24:40,400
being launched by spacex which is a us

620
00:24:44,149 --> 00:24:42,960
company and we hope to see that

621
00:24:46,710 --> 00:24:44,159
resupply

622
00:24:48,950 --> 00:24:46,720
spacecraft visit us this month

623
00:24:51,510 --> 00:24:48,960
and then later on later this year next

624
00:24:53,510 --> 00:24:51,520
year we'll see the cygnus resupply of

625
00:24:56,630 --> 00:24:53,520
unmanned spacecraft visit and that's

626
00:24:58,789 --> 00:24:56,640
another spacecraft that's produced by

627
00:25:00,470 --> 00:24:58,799
orbital which is another u.s company so

628
00:25:03,750 --> 00:25:00,480
it's kind of exciting because we're

629
00:25:06,390 --> 00:25:03,760
having new vehicles come to the iss and

630
00:25:08,789 --> 00:25:06,400
getting more more groups and companies

631
00:25:12,390 --> 00:25:08,799
involved with uh with

632
00:25:14,070 --> 00:25:12,400
space exploration and iss in particular

633
00:25:15,750 --> 00:25:14,080
i understand that was our last question

634
00:25:17,430 --> 00:25:15,760
from the students so we'd like to thank

635
00:25:18,789 --> 00:25:17,440
the students for joining us today we

636
00:25:21,350 --> 00:25:18,799
hope you learned a lot and you had some

637
00:25:23,190 --> 00:25:21,360
really great great questions amy did you

638
00:25:24,789 --> 00:25:23,200

have any closing remarks

639
00:25:26,710 --> 00:25:24,799
thanks so much for your wonderful

640
00:25:28,789 --> 00:25:26,720
questions and uh it was very good to