



1
00:00:02,201 --> 00:00:03,402
>> Good morning.

2
00:00:03,402 --> 00:00:05,337
Welcome to Mission Control
Center here in Houston.

3
00:00:05,337 --> 00:00:08,074
Were' in the International Space
Station Flight Control Room.

4
00:00:08,074 --> 00:00:09,341
And I have one

5
00:00:09,341 --> 00:00:10,743
of our International Space
Station Flight Controllers

6
00:00:10,743 --> 00:00:14,780
with us, Joe Pascucci who is a
Trajectory Operations Officer.

7
00:00:14,780 --> 00:00:16,682
I had trouble with the
word for some reason.

8
00:00:16,682 --> 00:00:19,552
Joe, why don't you tell us a
little bit about what you do.

9
00:00:19,552 --> 00:00:23,923
>> Sure. Just in short my job is
know where the Space Station is

10
00:00:23,923 --> 00:00:28,027
and make sure that it is in
the right place in the future .

11
00:00:28,027 --> 00:00:32,898

For it to be ready to do
anything that we need it to do.

12

00:00:32,898 --> 00:00:35,301

And to protect it from
any debris in space.

13

00:00:35,301 --> 00:00:37,837

And make sure the
astronauts on board stay safe.

14

00:00:37,837 --> 00:00:39,939

>> Great. That's
important stuff.

15

00:00:39,939 --> 00:00:41,073

>> Yes.

16

00:00:41,073 --> 00:00:42,708

>> And now we have
students in Pennsylvania .

17

00:00:42,708 --> 00:00:44,977

AP students who are going
to ask us some questions.

18

00:00:44,977 --> 00:00:46,545

So go ahead.

19

00:00:52,118 --> 00:00:53,652

>>Hi. My name is Lee Ann.

20

00:00:53,652 --> 00:00:57,790

I had a question regarding
the Flight Controller's duty

21

00:00:57,790 --> 00:01:01,060

of monitoring the location
of jettison items in space.

22

00:01:01,060 --> 00:01:03,462

Which are the items that people intentionally throw away during

23

00:01:03,462 --> 00:01:04,897

the extra-vehicular activity.

24

00:01:04,897 --> 00:01:08,200

I was wondering what types of items are typically thrown away

25

00:01:08,200 --> 00:01:12,571

and if that poses a greater risk for space debris later on.

26

00:01:12,571 --> 00:01:13,873

>> That's a great question.

27

00:01:13,873 --> 00:01:16,675

And it's actually one of the things I deal with a lot.

28

00:01:16,675 --> 00:01:20,679

So there's a number of things that we throw away.

29

00:01:20,679 --> 00:01:25,017

During EVA's a lot of times crew will jettison items

30

00:01:25,017 --> 00:01:26,952

that are not safe to bring back inside.

31

00:01:26,952 --> 00:01:30,189

Or maybe will not fit through the hatch to go back inside.

32

00:01:30,189 --> 00:01:32,024

Or there's no place
to store them outside

33

00:01:32,024 --> 00:01:35,294

of the space station, and
they need to be gotten rid of.

34

00:01:35,294 --> 00:01:39,665

So when those things are
thrown away, they do move away.

35

00:01:39,665 --> 00:01:40,933

And we always make sure

36

00:01:40,933 --> 00:01:43,536

that they will be safe
relative to the space station.

37

00:01:43,536 --> 00:01:46,472

And because there actually is
an atmosphere still in the area

38

00:01:46,472 --> 00:01:48,974

of the space station, the
atmosphere actually drags them

39

00:01:48,974 --> 00:01:52,011

down and eventually
they re-enter.

40

00:01:52,011 --> 00:01:55,814

So we keep track of them
through our relationship

41

00:01:55,814 --> 00:01:58,017

with the Air Force
who keeps track of all

42

00:01:58,017 --> 00:01:59,585

of those objects in space.

43

00:01:59,585 --> 00:02:02,121

And we make sure that they
will not pose a safety risk

44

00:02:02,121 --> 00:02:04,356

to the ISS.

45

00:02:04,356 --> 00:02:06,592

>> Thank you.

46

00:02:06,592 --> 00:02:08,928

>>Next question.

47

00:02:08,928 --> 00:02:14,066

>> The TOPO Flight
Controller is responsible

48

00:02:14,066 --> 00:02:16,468

for informing universities
and companies

49

00:02:16,468 --> 00:02:19,405

that have research
cargo avoid the ISS

50

00:02:19,405 --> 00:02:20,940

with updates on its location.

51

00:02:20,940 --> 00:02:24,643

What types of research cargo
are typically brought aboard?

52

00:02:24,643 --> 00:02:27,313

>Well, the last question
was about jettisons.

53

00:02:27,313 --> 00:02:29,081

And one of the other

things that we jettison,

54

00:02:29,081 --> 00:02:32,551

or I prefer to say is
deploy, is payloads.

55

00:02:32,551 --> 00:02:34,954

So there's been a
number of small cubesats

56

00:02:34,954 --> 00:02:38,357

that have been built either
by countries or universities

57

00:02:38,357 --> 00:02:39,925

that have been deployed
by the ISS.

58

00:02:39,925 --> 00:02:41,994

The most recent ones were
deployed a few weeks ago.

59

00:02:41,994 --> 00:02:45,864

We deployed four cubesats
from a deployer that was built

60

00:02:45,864 --> 00:02:48,200

by our international
partner, JAXA.

61

00:02:48,200 --> 00:02:53,939

We provide trajectory
information for those payloads.

62

00:02:53,939 --> 00:02:57,576

Also there's a number of
payloads that are onboard

63

00:02:57,576 --> 00:02:58,978

that have like cameras and stuff

64

00:02:58,978 --> 00:03:00,913

that are looking
down at the earth.

65

00:03:00,913 --> 00:03:05,417

And our trajectory information
is used in conjunction

66

00:03:05,417 --> 00:03:06,552

with those cameras and stuff.

67

00:03:06,552 --> 00:03:08,254

To make sure they are
pointing at the things

68

00:03:08,254 --> 00:03:10,589

that they're interested
in seeing.

69

00:03:10,589 --> 00:03:14,393

Or letting them know what they
saw as they flew over the earth

70

00:03:14,393 --> 00:03:16,662

and were observing the earth.

71

00:03:16,662 --> 00:03:18,364

>> Thank you.

72

00:03:18,364 --> 00:03:19,698

>> Next question.

73

00:03:19,698 --> 00:03:26,305

>> Hi. I'm Melissa and one
of the questions I wanted

74

00:03:26,305 --> 00:03:29,074

to know was how is trajectory

used every day at NASA?

75

00:03:29,074 --> 00:03:34,546

>> Well, without the trajectory
we wouldn't have a space station

76

00:03:34,546 --> 00:03:37,349

because we need to be in orbit
to do our jobs [chuckles].

77

00:03:37,349 --> 00:03:39,418

But the main thing that we do -

78

00:03:39,418 --> 00:03:42,154

we are constantly
monitoring where the ISS is.

79

00:03:42,154 --> 00:03:46,292

We need to keep track of
when the sun is going to rise

80

00:03:46,292 --> 00:03:49,928

and going to set so that we
generate the power that we need.

81

00:03:49,928 --> 00:03:52,331

And we keep the ISS the
temperature that it needs to be.

82

00:03:52,331 --> 00:03:53,732

And we need to keep track

83

00:03:53,732 --> 00:03:56,068

of where our communication
satellites are

84

00:03:56,068 --> 00:03:59,905

so that we have constant or
near constant communication

85

00:03:59,905 --> 00:04:01,006

with the ground.

86

00:04:01,006 --> 00:04:02,741

To Mission Control and
the control centers

87

00:04:02,741 --> 00:04:04,610

around the world.

88

00:04:04,610 --> 00:04:11,850

>> And my next question was
what is the worst-case scenario

89

00:04:11,850 --> 00:04:17,423

if a shuttle, part of the ISS
is launched at a wrong angle?

90

00:04:17,423 --> 00:04:20,392

>> So I guess I'll take
that question in two parts.

91

00:04:20,392 --> 00:04:22,861

If something was
launched at the right time

92

00:04:22,861 --> 00:04:24,897

and the right direction
but at the wrong angle,

93

00:04:24,897 --> 00:04:28,300

the worst thing is it could
not make it into orbit.

94

00:04:28,300 --> 00:04:31,470

The other part, would, getting
a little more technical,

95

00:04:31,470 --> 00:04:33,939

would be if you launched
something into orbit

96

00:04:33,939 --> 00:04:35,974

but you didn't do it
at the right time,

97

00:04:35,974 --> 00:04:39,278

you could put yourself in a
position to be in an orbit

98

00:04:39,278 --> 00:04:42,348

that you couldn't
actually get to the ISS.

99

00:04:42,348 --> 00:04:45,617

Because once you're in space,
in order to move the orbit

100

00:04:45,617 --> 00:04:48,153

around takes a lot of energy.

101

00:04:48,153 --> 00:04:53,659

And there usually is not enough
energy on board a vehicle to be

102

00:04:53,659 --> 00:04:55,027

in the wrong place
at the wrong time.

103

00:04:55,027 --> 00:04:57,963

>> Can I ask a questions
real quick?

104

00:04:57,963 --> 00:04:59,498

Has that ever happened before?

105

00:04:59,498 --> 00:05:03,902

>> In terms of the
US Space Program

106

00:05:03,902 --> 00:05:05,304
or the Russian Space Program,

107

00:05:05,304 --> 00:05:08,107
I don't believe we've
ever launched into orbit

108

00:05:08,107 --> 00:05:09,108
and not been able

109

00:05:09,108 --> 00:05:10,476
to successfully complete
a rendezvous.

110

00:05:10,476 --> 00:05:12,644
>> I imagine that would be
hard with all the safeguards.

111

00:05:12,644 --> 00:05:13,278
Sorry. Go ahead.

112

00:05:13,278 --> 00:05:14,947
The next question.

113

00:05:14,947 --> 00:05:17,416
>> Thank you.

114

00:05:17,416 --> 00:05:20,152
>> Hi. My name's Christine.

115

00:05:20,152 --> 00:05:23,722
What type of degree does
a Trajectory Operations

116

00:05:23,722 --> 00:05:26,225
Officer need?

117

00:05:26,225 --> 00:05:29,294

>> Most of all of the
TOPO's have degrees

118

00:05:29,294 --> 00:05:31,230

in engineering of some kind.

119

00:05:31,230 --> 00:05:34,600

I have a degree in
aerospace engineering.

120

00:05:34,600 --> 00:05:36,368

There are some other
TOPO's who have degrees

121

00:05:36,368 --> 00:05:40,305

in mechanical engineering
or mathematics.

122

00:05:40,305 --> 00:05:41,106

>> Okay. Thank you.

123

00:05:41,106 --> 00:05:42,775

And I have another question.

124

00:05:42,775 --> 00:05:45,978

If you were told as a child
that you would work for NASA

125

00:05:45,978 --> 00:05:50,182

in Mission Control when you grew
up, how would you have reacted?

126

00:05:50,182 --> 00:05:52,251

>> I think I would have
been extremely excited.

127

00:05:52,251 --> 00:05:56,321

I have a very old picture from
when I was probably 7 years old

128

00:05:56,321 --> 00:05:58,557
of me playing with
a space shuttle.

129

00:05:58,557 --> 00:06:00,292
>> That's nice.

130

00:06:00,292 --> 00:06:01,860
Thank you.

131

00:06:05,998 --> 00:06:06,565
>> Good afternoon.

132

00:06:06,565 --> 00:06:07,933
My name's Matt.

133

00:06:07,933 --> 00:06:10,102
The question I have for you
today is have there any living

134

00:06:10,102 --> 00:06:13,305
organisms been found
in outer space?

135

00:06:13,305 --> 00:06:16,308
>> I'm not the best person
to answer that question.

136

00:06:16,308 --> 00:06:18,977
But I don't believe
I've ever heard of that.

137

00:06:18,977 --> 00:06:20,078
>> I think that's right.

138

00:06:20,078 --> 00:06:22,414
I think we haven't found
any living organisms

139

00:06:22,414 --> 00:06:24,917

that we didn't put there anyway.

140

00:06:24,917 --> 00:06:25,584

>> All right.

141

00:06:25,584 --> 00:06:28,787

Thank you very much.

142

00:06:28,787 --> 00:06:31,356

> Hi. My name's Adam.

143

00:06:31,356 --> 00:06:33,625

And I was just wondering

how often do you have

144

00:06:33,625 --> 00:06:36,762

to change the direction

of the space station?

145

00:06:36,762 --> 00:06:42,267

And how often is that because

of debris from NASA missions?

146

00:06:42,267 --> 00:06:44,937

>> I don't have the answer

147

00:06:44,937 --> 00:06:48,740

for how often it's specifically

debris from NASA missions.

148

00:06:48,740 --> 00:06:51,743

In general, the space

station has been maneuvered

149

00:06:51,743 --> 00:06:55,614

about once per year

due to debris in space

150

00:06:55,614 --> 00:06:57,449

that we're trying
to get away from.

151

00:06:57,449 --> 00:06:59,785

As a normal part of our process

152

00:06:59,785 --> 00:07:02,321

of making sure the space
station is going to be

153

00:07:02,321 --> 00:07:05,157

in the right place at
the right time for all

154

00:07:05,157 --> 00:07:08,393

of the trajectory events
that we have, we usually do -

155

00:07:08,393 --> 00:07:11,563

we call them reboots
- about once a month.

156

00:07:11,563 --> 00:07:13,765

We actually just performed
a reboot yesterday.

157

00:07:13,765 --> 00:07:16,802

And we're planning on
performing another one tomorrow.

158

00:07:17,769 --> 00:07:20,072

>>Thank you.

159

00:07:23,642 --> 00:07:26,812

>> Hey. My name's Morgan and
my two questions have to deal

160

00:07:26,812 --> 00:07:29,781
with space in general rather
than the space station.

161
00:07:29,781 --> 00:07:32,851
But I was wonder if
there's any way of knowing

162
00:07:32,851 --> 00:07:35,521
of anything beyond our universe?

163
00:07:36,622 --> 00:07:38,590
>> I don't know that
I'm the right person

164
00:07:38,590 --> 00:07:39,892
to ask that question to.

165
00:07:39,892 --> 00:07:42,861
That seems like a question
for a theoretical physicist.

166
00:07:42,861 --> 00:07:45,931
>> I think we've got a
lot of different things

167
00:07:45,931 --> 00:07:48,734
like the Hubble Space Telescope
and we're getting ready

168
00:07:48,734 --> 00:07:51,169
to launch something called
the James Webb Space Telescope

169
00:07:51,169 --> 00:07:52,638
that give us just that
kind of information.

170
00:07:52,638 --> 00:07:55,707
They can look far beyond,

you know, what we're able

171

00:07:55,707 --> 00:07:57,576
to see from here on earth.

172

00:07:57,576 --> 00:08:00,812
And give us all kinds of
information about our universe.

173

00:08:00,812 --> 00:08:03,982
Where it came from; how it
started; things like that.

174

00:08:03,982 --> 00:08:07,119
So there's lots of
information online at nas.gov

175

00:08:07,119 --> 00:08:09,388
if you want to go look that up.

176

00:08:09,388 --> 00:08:09,955
>> All right.

177

00:08:09,955 --> 00:08:11,089
Awesome. Thanks.

178

00:08:11,089 --> 00:08:16,395
And is space infinite
or does it have an end?

179

00:08:16,395 --> 00:08:18,497
>> That's another that
would be really hard

180

00:08:18,497 --> 00:08:19,431
for me to answer [laughter].

181

00:08:19,431 --> 00:08:20,899
Sorry.

182

00:08:20,899 --> 00:08:21,667

>> It's okay.

183

00:08:21,667 --> 00:08:23,468

Thank you [laughs].

184

00:08:23,468 --> 00:08:25,270

>> [laughs] Next question.

185

00:08:26,605 --> 00:08:27,306

>> Hello again.

186

00:08:27,306 --> 00:08:29,041

The question that I want

187

00:08:29,041 --> 00:08:31,543

to ask is [laughter]

what is the future plans

188

00:08:31,543 --> 00:08:36,014

for the ISS and NASA?

189

00:08:36,014 --> 00:08:38,817

>> Well, so we've got a lot
of things going on at NASA.

190

00:08:38,817 --> 00:08:41,720

Here in the Human Space Flight
Program, which is basically

191

00:08:41,720 --> 00:08:44,389

where we work and
know the most about,

192

00:08:44,389 --> 00:08:46,291

we've got a few different
things going on.

193

00:08:46,291 --> 00:08:48,560

First of all, of course, there's
the International Space Station

194

00:08:48,560 --> 00:08:51,296

where we have people
living 24, 7 and have had

195

00:08:51,296 --> 00:08:53,365

for more than a decade.

196

00:08:53,365 --> 00:08:54,533

That's going on right now.

197

00:08:54,533 --> 00:08:56,768

They're doing a lot of
really cool research.

198

00:08:56,768 --> 00:08:59,972

And you can find out more about
that at [nasa.gov slash station](http://nasa.gov/station).

199

00:08:59,972 --> 00:09:02,741

Meanwhile, we're also working
with commercial companies

200

00:09:02,741 --> 00:09:05,911

to develop new vehicles
to take cargo and people

201

00:09:05,911 --> 00:09:07,346

up to the space station.

202

00:09:07,346 --> 00:09:09,715

And letting those
commercial companies come take

203

00:09:09,715 --> 00:09:11,550

over that gives us the ability

204

00:09:11,550 --> 00:09:14,519

to focus more on
future missions.

205

00:09:14,519 --> 00:09:17,489

Which we are building
the Orion spacecraft for.

206

00:09:17,489 --> 00:09:18,957

That's going to be
launching, actually,

207

00:09:18,957 --> 00:09:20,592

on its first mission next year.

208

00:09:20,592 --> 00:09:22,060

It's going to be un-crew.

209

00:09:22,060 --> 00:09:23,795

There won't be people on
it for this first time.

210

00:09:23,795 --> 00:09:26,732

But it's going to go actually
about 15 times farther

211

00:09:26,732 --> 00:09:28,433

than the International
Space Station orbits.

212

00:09:28,433 --> 00:09:31,169

And farther than
any spacecraft built

213

00:09:31,169 --> 00:09:32,804

for human has been in 40 years.

214

00:09:32,804 --> 00:09:35,774

So that's called the
Exploration Flight Test-1.

215
00:09:35,774 --> 00:09:37,509
And it's scheduled
for next fall.

216
00:09:37,509 --> 00:09:39,344
So you should definitely
pay attention to that.

217
00:09:39,344 --> 00:09:41,680
And then we'll be doing
one more flight test

218
00:09:41,680 --> 00:09:44,316
with the Space Launch
System, which NASA's building.

219
00:09:44,316 --> 00:09:47,486
It's a new rocket that's
going to let us launch Orion

220
00:09:47,486 --> 00:09:48,854
out of low earth orbit.

221
00:09:48,854 --> 00:09:51,890
The low earth orbit is
where the space station is

222
00:09:51,890 --> 00:09:53,392
and where the space
shuttle flew as well.

223
00:09:53,392 --> 00:09:55,093
So it's been awhile since
we've had people outside

224
00:09:55,093 --> 00:09:56,061
of low earth orbit.

225

00:09:56,061 --> 00:09:57,562

And we're really
excited about that.

226

00:09:57,562 --> 00:09:59,431

That's going to be in 2017.

227

00:09:59,431 --> 00:10:00,966

And then in 2021 we'll be able

228

00:10:00,966 --> 00:10:03,502

to send people onboard
Orion outside

229

00:10:03,502 --> 00:10:04,803

of low earth orbit
for the first time.

230

00:10:04,803 --> 00:10:08,040

So I lots of cool
stuff coming up.

231

00:10:08,040 --> 00:10:08,707

>> Oh, wow.

232

00:10:08,707 --> 00:10:09,207

That's really cool.

233

00:10:09,207 --> 00:10:09,975

Thank you.

234

00:10:14,579 --> 00:10:16,181

>> Hello. My name is Madison.

235

00:10:16,181 --> 00:10:19,384

And I was wondering what type
of interaction do you have

236

00:10:19,384 --> 00:10:22,888

with the other countries
involved with the ISS?

237

00:10:22,888 --> 00:10:24,556

>> We actually have quite
a bit of interaction

238

00:10:24,556 --> 00:10:27,492

with the other countries
involved.

239

00:10:27,492 --> 00:10:31,563

Course, a major part of managing
our trajectory is performing

240

00:10:31,563 --> 00:10:33,498

maneuvers or reboosts
like I said earlier.

241

00:10:33,498 --> 00:10:36,168

And the propulsion system
on the ISS is actually

242

00:10:36,168 --> 00:10:37,169

in the Russian segment.

243

00:10:37,169 --> 00:10:39,337

So we have a very
close relationship

244

00:10:39,337 --> 00:10:41,406

with our counterparts in Russia.

245

00:10:41,406 --> 00:10:44,409

And also we have visiting
vehicles that come

246

00:10:44,409 --> 00:10:48,680

from the European Space Agency
and the Japanese Space Agency.

247

00:10:48,680 --> 00:10:51,116
The ATV and HTV.

248

00:10:51,116 --> 00:10:52,217
Plus commercial partners

249

00:10:52,217 --> 00:10:54,519
that are now sending
vehicles to the ISS.

250

00:10:54,519 --> 00:10:57,556
So we have relationships
with all of them

251

00:10:57,556 --> 00:10:59,791
with their visiting
vehicles to make sure

252

00:10:59,791 --> 00:11:02,627
that we can support
them successfully.

253

00:11:02,627 --> 00:11:04,596
>> Okay. Thank you.

254

00:11:06,431 --> 00:11:08,266
>> Hello. My name's Emily.

255

00:11:08,266 --> 00:11:11,636
I was wondering if NASA
if currently searching

256

00:11:11,636 --> 00:11:14,473
for new planets and
solar systems

257

00:11:14,473 --> 00:11:16,241
that can sustain human life.

258

00:11:16,241 --> 00:11:20,746
And has NASA found any so far?

259

00:11:20,746 --> 00:11:24,816
>> NASA does have some various
instruments that are looking

260

00:11:24,816 --> 00:11:26,118
for exactly that sort of thing.

261

00:11:26,118 --> 00:11:29,621
And I think I just recently
had announced about a new,

262

00:11:29,621 --> 00:11:31,556
earth-like planet that we found.

263

00:11:31,556 --> 00:11:32,924
That's another thing

264

00:11:32,924 --> 00:11:34,359
that probably we're not the
best people to tell you about.

265

00:11:34,359 --> 00:11:38,430
But there's lots of good
information on nasa.gov.

266

00:11:38,430 --> 00:11:40,198
>> Okay. Thank you.

267

00:11:45,070 --> 00:11:46,605
>> Hello again.

268

00:11:46,605 --> 00:11:48,206
I'm backtracking a little bit.

269

00:11:48,206 --> 00:11:51,676

But I was wondering if
reboots are performed manually

270

00:11:51,676 --> 00:11:56,047

by the people aboard the ISS
or if you guys manage them?

271

00:11:56,047 --> 00:11:58,150

>> We actually manage
them from the ground.

272

00:11:58,150 --> 00:12:00,719

So the crew is aware of when
they're going to happen.

273

00:12:00,719 --> 00:12:03,955

But there's actually no
crew involvement necessary.

274

00:12:03,955 --> 00:12:06,224

For reboots, as a matter of
fact, there have been times

275

00:12:06,224 --> 00:12:08,393

when reboots have been
performed while the crew

276

00:12:08,393 --> 00:12:09,728

is sleeping.

277

00:12:09,728 --> 00:12:12,631

And the acceleration is so low

278

00:12:12,631 --> 00:12:15,534

that the crew doesn't even
realize it's going on.

279

00:12:15,534 --> 00:12:17,936

There are some great videos
that you can find on YouTube

280

00:12:17,936 --> 00:12:21,506

that the crews have done
of what it's like to be

281

00:12:21,506 --> 00:12:24,609

on board the ISS
during a reboost.

282

00:12:25,811 --> 00:12:27,212

>> Thank you.

283

00:12:34,052 --> 00:12:35,687

>> Hi. My name's Kana
[assumed spelling].

284

00:12:35,687 --> 00:12:38,557

And my question is what are
some of the things NASA is doing

285

00:12:38,557 --> 00:12:43,829

to make travel time to
other planets quicker?

286

00:12:43,829 --> 00:12:47,032

>> Well, we travel to
another planet is going

287

00:12:47,032 --> 00:12:49,734

to take a long time at least
for the foreseeable future.

288

00:12:49,734 --> 00:12:51,269

It's not a quick process.

289

00:12:51,269 --> 00:12:53,805

But what we're doing is

we're building spacecrafts

290

00:12:53,805 --> 00:12:56,575

that will support the crew
over that long journey.

291

00:12:56,575 --> 00:12:58,577

Not just necessarily
a spacecraft even.

292

00:12:58,577 --> 00:13:03,548

If we went to Mars we need
not only the Orion Capsule

293

00:13:03,548 --> 00:13:05,150

that we're building that
I mentioned earlier.

294

00:13:05,150 --> 00:13:07,352

But also a habitat
for the crew to live

295

00:13:07,352 --> 00:13:09,120

in to give them a little
more space to move around.

296

00:13:09,120 --> 00:13:12,624

Because it can be several months
to get to, just for instance,

297

00:13:12,624 --> 00:13:15,527

Mars, which is the
closest planet for us.

298

00:13:17,062 --> 00:13:18,463

>> Thank you.

299

00:13:29,341 --> 00:13:34,446

>> How long does it take
for the ISS to recharge

300
00:13:34,446 --> 00:13:38,717
like under the sun's rays?

301
00:13:38,717 --> 00:13:40,185
>> The solar rays?

302
00:13:40,185 --> 00:13:41,453
>> Yeah. The solar rays.

303
00:13:41,453 --> 00:13:44,356
So as the ISS passes

304
00:13:44,356 --> 00:13:49,060
into daylight it always has
its solar rays tracking--

305
00:13:49,060 --> 00:13:51,129
>> Got a picture of
the solar rays here.

306
00:13:51,129 --> 00:13:52,898
>> -- and pointing at the sun.

307
00:13:52,898 --> 00:13:54,132
So, that's okay.

308
00:13:54,132 --> 00:13:56,635
So at there are certain
times where we actually need

309
00:13:56,635 --> 00:13:59,371
to stop moving with solar rays.

310
00:13:59,371 --> 00:14:00,839
Say when a vehicle
is approaching

311

00:14:00,839 --> 00:14:02,240
or departing the ISS.

312
00:14:02,240 --> 00:14:06,811
Or for other reasons
that essentially.

313
00:14:06,811 --> 00:14:08,146
Because we're not
tracking the sun.

314
00:14:08,146 --> 00:14:10,715
We're not charging
batteries as efficiently

315
00:14:10,715 --> 00:14:12,417
as they could be charged.

316
00:14:12,417 --> 00:14:15,453
And the ISS can stay
in that condition

317
00:14:15,453 --> 00:14:17,455
for a fair amount of time.

318
00:14:17,455 --> 00:14:20,492
I think at least an orbit
or two before it needs

319
00:14:20,492 --> 00:14:22,794
to be pointing its
rays back at the sun

320
00:14:22,794 --> 00:14:24,863
to maintain charging
the batteries.

321
00:14:24,863 --> 00:14:26,097
>> Thank you.

322

00:14:26,097 --> 00:14:28,199

>> And an orbit takes
about 90 minutes.

323

00:14:28,199 --> 00:14:29,467

So.

324

00:14:29,467 --> 00:14:34,739

>> Yeah. One orbit of the
earth is about 92 minutes.

325

00:14:34,739 --> 00:14:36,207

>> Hello. My name is Shannon.

326

00:14:36,207 --> 00:14:39,911

And I wanted to know if you knew
about any asteroids or comets

327

00:14:39,911 --> 00:14:44,182

that could impact the path of
the ISS in the near future?

328

00:14:44,182 --> 00:14:47,352

>> I am not aware of
any comets or asteroids

329

00:14:47,352 --> 00:14:48,687

that we're concerned about.

330

00:14:48,687 --> 00:14:53,024

The main thing that we are
constantly tracking is the stuff

331

00:14:53,024 --> 00:14:56,761

that people have put in
space that threaten the ISS.

332

00:14:56,761 --> 00:15:00,799

And we're watching for

that stuff all the time.

333

00:15:00,799 --> 00:15:02,167

>> Thank you.

334

00:15:07,539 --> 00:15:08,640

>> Hi. I'm Markice

[assumed spelling].

335

00:15:08,640 --> 00:15:12,477

And what happened to

Apollo 18, 19, and 20?

336

00:15:12,477 --> 00:15:18,717

>> Those would be the Apollo

missions that were never flown.

337

00:15:18,717 --> 00:15:22,187

>> Right. Those - we

cancelled those missions

338

00:15:22,187 --> 00:15:23,888

so we could go ahead

and get started on work

339

00:15:23,888 --> 00:15:24,923

for the space shuttle.

340

00:15:24,923 --> 00:15:26,858

Which then went on

to fly for 30 years

341

00:15:26,858 --> 00:15:29,794

and help us build

the space station.

342

00:15:30,996 --> 00:15:33,565

>> Okay. And I have

another question [laughter].

343

00:15:33,565 --> 00:15:35,734

When is NASA planning
on landing on Mars

344

00:15:35,734 --> 00:15:38,603

and what will the
role of the TOPO be?

345

00:15:38,603 --> 00:15:40,071

>> Oh, okay.

346

00:15:41,272 --> 00:15:46,177

So NASA plans - I think
we would be going to Mars

347

00:15:46,177 --> 00:15:51,349

in probably the 2030s are
our thoughts at this point.

348

00:15:51,349 --> 00:15:53,151

And as for what the
TOPO would do,

349

00:15:53,151 --> 00:15:54,886

that would probably
be a question for you.

350

00:15:54,886 --> 00:15:56,154

>> So the role of
the TOPO would be

351

00:15:56,154 --> 00:15:59,157

to manage the trajectory
to get us to Mars.

352

00:15:59,157 --> 00:16:01,893

To make sure that we were
flying a safe trajectory

353

00:16:01,893 --> 00:16:05,563
and the most efficient
trajectory that we could follow.

354
00:16:05,563 --> 00:16:08,366
>> Okay. Thank you.

355
00:16:14,272 --> 00:16:16,374
Hi. My name is Monica.

356
00:16:16,374 --> 00:16:18,743
And have there been
recent discoveries of UFOs

357
00:16:18,743 --> 00:16:21,446
or suspicious objects?

358
00:16:21,446 --> 00:16:25,950
And with our current technology,
how easy is it for NASA

359
00:16:25,950 --> 00:16:28,186
to define these objects?

360
00:16:29,287 --> 00:16:30,522
>> Suspicious objects?

361
00:16:30,522 --> 00:16:31,756
I don't think I've heard

362
00:16:31,756 --> 00:16:35,260
of any suspicious objects
that have been found.

363
00:16:35,260 --> 00:16:38,430
We, obviously, keep an eye
on a lot of different things

364
00:16:38,430 --> 00:16:40,832

in space and in the universe.

365

00:16:40,832 --> 00:16:43,034

But I haven't heard of
anything that's suspicious.

366

00:16:43,034 --> 00:16:45,703

>> And I would agree with that.

367

00:16:45,703 --> 00:16:47,605

>> Okay. Thank you.

368

00:16:56,047 --> 00:16:57,816

>> Hello. I have a question.

369

00:16:57,816 --> 00:17:01,219

The International Space
Station is constantly falling.

370

00:17:01,219 --> 00:17:03,755

And because of this,
do astronauts

371

00:17:03,755 --> 00:17:06,458

on the ISS have the
constant feeling

372

00:17:06,458 --> 00:17:09,727

of weightlessness while
on the space station?

373

00:17:09,727 --> 00:17:14,065

Like feeling of weightlessness
like on a rollercoaster?

374

00:17:15,900 --> 00:17:17,535

>> Yes. They do have
the constant feeling

375

00:17:17,535 --> 00:17:20,305
of weightlessness
while they're in orbit.

376
00:17:20,305 --> 00:17:23,374
And, as a matter of fact,

377
00:17:23,374 --> 00:17:29,481
as long as they stay
near the center of ISS,

378
00:17:29,481 --> 00:17:32,484
they're in an area that we refer
to as the microgravity envelope.

379
00:17:32,484 --> 00:17:37,989
Where it truly does feel
like there's no gravity.

380
00:17:37,989 --> 00:17:41,092
There's actually - you can move
away from the center of the ISS

381
00:17:41,092 --> 00:17:44,262
and actually begin to see
the effects of the fact

382
00:17:44,262 --> 00:17:47,665
that you actually still
are in a gravity field.

383
00:17:49,234 --> 00:17:51,035
>> Okay. Thank you.

384
00:17:55,039 --> 00:17:56,074
>> Hello again.

385
00:17:56,074 --> 00:17:58,743
I was wondering what
is the protocol if

386

00:17:58,743 --> 00:18:02,580

or when the ISS gets
hits with debris?

387

00:18:02,580 --> 00:18:06,317

>> That's a great question.

388

00:18:06,317 --> 00:18:10,155

I'll start with not letting
it get hit with debris.

389

00:18:10,155 --> 00:18:14,192

So we're constantly monitoring
through our relationship

390

00:18:14,192 --> 00:18:17,395

with the Air Force all of
the debris that's in space

391

00:18:17,395 --> 00:18:20,298

and whether or not it's
a threat to the ISS.

392

00:18:20,298 --> 00:18:24,636

And if we do find debris
that is a threat to the ISS,

393

00:18:24,636 --> 00:18:27,572

we begin planning to
move the ISS to make sure

394

00:18:27,572 --> 00:18:29,207

that debris is not a threat.

395

00:18:29,207 --> 00:18:34,812

If something were to happen that
we were not able to move the ISS

396

00:18:34,812 --> 00:18:38,149
in time or we found out too
late, we do have procedures

397
00:18:38,149 --> 00:18:41,419
in place to shelter the crew

398
00:18:41,419 --> 00:18:44,122
in the two Soyuz
vehicles onboard the ISS.

399
00:18:44,122 --> 00:18:45,857
Which are the - well,
it's the vehicles

400
00:18:45,857 --> 00:18:47,458
that they use to get to the ISS.

401
00:18:47,458 --> 00:18:50,762
But they would be also their
emergency escape vehicles

402
00:18:50,762 --> 00:18:53,598
to get away from the ISS.

403
00:18:53,598 --> 00:18:57,001
And they do that and they're,
essentially, ready to undock

404
00:18:57,001 --> 00:18:58,903
and leave the ISS if
it were to get hit

405
00:18:58,903 --> 00:19:02,106
by debris in an emergency.

406
00:19:02,106 --> 00:19:05,109
>>Okay. Thank you.

407

00:19:11,749 --> 00:19:13,851

>> When will the
Robonaut 2 be finished?

408

00:19:13,851 --> 00:19:19,157

And when what will
it be able to do?

409

00:19:19,157 --> 00:19:21,392

>> Unfortunately, I have
to turn to you to answer--

410

00:19:21,392 --> 00:19:22,560

>> I can handle a little
bit about that one.

411

00:19:22,560 --> 00:19:23,928

>> -- questions about Robonaut

412

00:19:23,928 --> 00:19:26,497

>> So you may have heard that
just this week we announced

413

00:19:26,497 --> 00:19:28,800

that Robonaut, which has
been on the space station

414

00:19:28,800 --> 00:19:32,971

since STS-133 is going to
be getting some legs sent

415

00:19:32,971 --> 00:19:37,041

up on a future space vehicle
that's going up in February.

416

00:19:37,041 --> 00:19:41,045

So that'll get it a little
farther along on the journey.

417

00:19:41,045 --> 00:19:44,249

As far as being really
complete, you know,

418

00:19:44,249 --> 00:19:46,050

Robonaut's kind of
a test project.

419

00:19:46,050 --> 00:19:47,252

So I don't know that
there's a point

420

00:19:47,252 --> 00:19:48,653

where you really
say it's complete.

421

00:19:48,653 --> 00:19:54,492

We'll probably keep sending up
changes and new ideas to try out

422

00:19:54,492 --> 00:19:57,228

and then see what
we end up with.

423

00:19:57,228 --> 00:20:00,865

>> Okay. Thank you.

424

00:20:05,036 --> 00:20:10,308

>> How do learn to deal with
the stress of Mission Control?

425

00:20:10,308 --> 00:20:12,210

>> Is it stressful here?

426

00:20:12,210 --> 00:20:15,913

>> It can be a little
stressful sometimes.

427

00:20:15,913 --> 00:20:21,753

Well, it's a matter of learning
and knowing about yourself

428

00:20:21,753 --> 00:20:24,055

and how you deal
with that stress.

429

00:20:24,055 --> 00:20:25,089

It's--

430

00:20:25,089 --> 00:20:28,760

>>What's the most
stress - I'm sorry.

431

00:20:28,760 --> 00:20:29,994

>> Go ahead.

432

00:20:29,994 --> 00:20:32,897

>> What's the most stressful
you've ever experienced

433

00:20:32,897 --> 00:20:36,234

in Mission Control
and with trajectory?

434

00:20:36,234 --> 00:20:39,537

>> I'd say the most stressful
experiences I've had here

435

00:20:39,537 --> 00:20:41,439

in Mission Control
since I've been working

436

00:20:41,439 --> 00:20:44,342

on the space station as a
TOPO have been the times

437

00:20:44,342 --> 00:20:47,712

when there is a piece of
debris threatening the ISS

438

00:20:47,712 --> 00:20:49,914
that we are monitoring.

439
00:20:49,914 --> 00:20:51,482
And whether or not
we're actually going

440
00:20:51,482 --> 00:20:54,952
to maneuver the ISS
to get away from it.

441
00:20:54,952 --> 00:20:57,722
>> And it's probably different
for different positions

442
00:20:57,722 --> 00:21:00,024
in the flight control
team; right?

443
00:21:00,024 --> 00:21:02,794
Spacewalk Officer might say
the spacewalk is the most

444
00:21:02,794 --> 00:21:04,128
stressful time.

445
00:21:04,128 --> 00:21:07,198
Or for a public affairs person
like me is when I'm trying

446
00:21:07,198 --> 00:21:09,067
to talk about something
that's really complicated.

447
00:21:09,067 --> 00:21:11,069
So I guess it just depends
on what you're doing.

448
00:21:11,069 --> 00:21:11,836
>> I would agree.

449

00:21:11,836 --> 00:21:12,937

That's probably very true.

450

00:21:12,937 --> 00:21:14,038

>>And probably about
the same for every job.

451

00:21:14,038 --> 00:21:15,173

There's times that are exciting.

452

00:21:15,173 --> 00:21:17,475

And it's kind of what
you like about the job.

453

00:21:17,475 --> 00:21:21,979

But they're a little
stressful too.

454

00:21:21,979 --> 00:21:24,816

>> Yesterday the
cooling capacitor -

455

00:21:24,816 --> 00:21:26,250

something went wrong with it.

456

00:21:26,250 --> 00:21:32,757

Is there any new news that
you can tell me about that?

457

00:21:32,757 --> 00:21:34,792

>> Sure. I can take that.

458

00:21:34,792 --> 00:21:38,930

So like you said, we
have two cooling lifts,

459

00:21:38,930 --> 00:21:40,164

actually, on the space station.

460

00:21:40,164 --> 00:21:42,500

And one of them had
a problem yesterday

461

00:21:42,500 --> 00:21:45,370

that caused it to shut down.

462

00:21:45,370 --> 00:21:46,604

And so the teams here

463

00:21:46,604 --> 00:21:48,005

on the ground have been
working real hard to figure

464

00:21:48,005 --> 00:21:50,074

out what exactly
caused the shutdown.

465

00:21:50,074 --> 00:21:51,476

And what they're
going to do to fix it.

466

00:21:51,476 --> 00:21:52,910

So there's still a
lot of work going

467

00:21:52,910 --> 00:21:54,979

on to determine what
the next steps are.

468

00:21:54,979 --> 00:21:57,548

But people are working
pretty hard.

469

00:21:57,548 --> 00:22:00,351

And in the meantime the
crew is doing just fine

470

00:22:00,351 --> 00:22:01,753
on board the space station.

471
00:22:01,753 --> 00:22:03,488
They've got several things
that they're able to work

472
00:22:03,488 --> 00:22:05,590
on today while they
wait for the team here

473
00:22:05,590 --> 00:22:08,559
on the ground to
work through that.

474
00:22:08,559 --> 00:22:09,794
>> Okay. Thank you.

475
00:22:09,794 --> 00:22:14,399
And what are hours for
working in Mission Control?

476
00:22:14,399 --> 00:22:18,202
>> The hours can be
anything that is required.

477
00:22:18,202 --> 00:22:20,705
For my counsel, specifically,

478
00:22:20,705 --> 00:22:24,509
we normally work
daytime hours only.

479
00:22:24,509 --> 00:22:27,311
And then when we're
required for overnight

480
00:22:27,311 --> 00:22:30,848
or evening shifts we come
and take care of that.

481

00:22:30,848 --> 00:22:33,384

We're also on call

24 hours a day.

482

00:22:33,384 --> 00:22:34,519

Again, associated

483

00:22:34,519 --> 00:22:37,889

with protecting the ISS

from debris in space.

484

00:22:37,889 --> 00:22:39,891

>> But the space station

crew actually gets

485

00:22:39,891 --> 00:22:41,993

up at midnight central time.

486

00:22:41,993 --> 00:22:45,630

So they'll have to be teams

in here to help them for that

487

00:22:45,630 --> 00:22:47,031

in the middle of

the night for us,

488

00:22:47,031 --> 00:22:48,900

which is just the

beginning of their morning.

489

00:22:48,900 --> 00:22:51,702

And we actually have

three different teams

490

00:22:51,702 --> 00:22:53,104

that overlap by an hour.

491

00:22:53,104 --> 00:22:55,273

And so each of their shifts
are nine hours apiece.

492

00:22:55,273 --> 00:22:58,509

And so the first one comes
in and stays for nine hours.

493

00:22:58,509 --> 00:23:00,111

And for the last
hour they're handing

494

00:23:00,111 --> 00:23:01,679

over to somebody who's
taking their place

495

00:23:01,679 --> 00:23:03,948

and telling them
what's been going on.

496

00:23:05,082 --> 00:23:06,951

>>Okay. Thank you.

497

00:23:13,090 --> 00:23:14,992

>> Hi. I have one more question.

498

00:23:14,992 --> 00:23:18,563

I was wondering what type of
software or technology you use

499

00:23:18,563 --> 00:23:23,334

to do your job on a daily basis?

500

00:23:23,334 --> 00:23:27,071

>> So we have several pieces
of software that we use

501

00:23:27,071 --> 00:23:31,709

to do analysis on
the ISS trajectory.

502

00:23:31,709 --> 00:23:36,814

Most of them have been
built in house at NASA.

503

00:23:36,814 --> 00:23:40,618

Some are specialized for
working in the control room.

504

00:23:40,618 --> 00:23:42,854

They're specialized to
be fast and allow us

505

00:23:42,854 --> 00:23:46,324

to perform computations
very quickly

506

00:23:46,324 --> 00:23:49,193

with like a reasonable level
of accuracy to do things

507

00:23:49,193 --> 00:23:50,761

in the immediate future.

508

00:23:50,761 --> 00:23:53,731

We have other higher fidelity
software that is slower

509

00:23:53,731 --> 00:23:56,734

and takes more time to run
that we use off console

510

00:23:56,734 --> 00:23:59,303

when doing precise analysis.

511

00:23:59,303 --> 00:24:02,673

>> Okay. Thank you.

512

00:24:07,011 --> 00:24:10,381

>> What was your favorite

subject in high school?

513

00:24:10,381 --> 00:24:14,051

>> In high school I would say
I recall my favorite subject

514

00:24:14,051 --> 00:24:16,988

being physics.

515

00:24:16,988 --> 00:24:18,523

>> Okay.

516

00:24:18,523 --> 00:24:21,526

>> Probably followed
by chemistry.

517

00:24:21,526 --> 00:24:24,095

>> This will be the
last question.

518

00:24:24,095 --> 00:24:27,832

>> Okay. What was the highest
level math you've ever taken?

519

00:24:27,832 --> 00:24:32,336

>> The highest level
math was just referred

520

00:24:32,336 --> 00:24:34,338

to as engineering mathematics.

521

00:24:34,338 --> 00:24:38,476

But that would be a class
above differential equations.

522

00:24:40,111 --> 00:24:41,913

>> Okay. Thank you.

523

00:24:43,180 --> 00:24:44,248

>> Thanks so much, guys.

524

00:24:44,248 --> 00:24:45,550

We really appreciate
your questions.

525

00:24:45,550 --> 00:24:48,386

And, again, we enjoyed
answering them.

526

00:24:48,386 --> 00:24:50,988

And you should check out
nasa.gov for more information

527

00:24:50,988 --> 00:24:52,490

on some of the things
we were able

528

00:24:52,490 --> 00:24:54,559

to fill you incompletely on.

529

00:24:54,559 --> 00:24:55,593

Thanks again.