
PAO
POSN 4730

1
00:00:02,216 --> 00:00:02,906
>> Kylie Clem: Well, hello.

2
00:00:02,906 --> 00:00:07,236
We would like to welcome you to mission control,
Houston for the Digital Learning Network event

3
00:00:07,236 --> 00:00:10,176
where we're speaking with
sixth grade students in Texas.

4
00:00:10,576 --> 00:00:12,336
With me is Amy Brezinski.

5
00:00:12,336 --> 00:00:16,376
She is a flight controller here in mission
control, and we're going to talk a little bit

6
00:00:16,376 --> 00:00:19,406
about Amy's background before we
take questions from the students.

7
00:00:20,156 --> 00:00:23,006
So, Amy, what do you do as a flight
controller here at mission control?

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00:00:23,696 --> 00:00:26,506
>> Amy Brezinski: As a flight
controller in ISS mission control,

9
00:00:26,936 --> 00:00:31,866
I'm responsible for monitoring my
system and performing actions with it.

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00:00:31,866 --> 00:00:34,206
My system is the computer
system we call the Command

11
00:00:34,206 --> 00:00:36,986

and Data Handling System,
and my call sign is ODIN.

12
00:00:37,136 --> 00:00:39,156
Every discipline has a call sign.

13
00:00:39,216 --> 00:00:45,476
So my job in particular is to watch over over
forty-eight computers on the space station

14
00:00:45,476 --> 00:00:48,856
that are running right now and make
sure that they are operating normally

15
00:00:49,036 --> 00:00:55,056
and then uploading software for all the other
systems, activities and also get certain pieces

16
00:00:55,056 --> 00:00:57,046
of data down after those activities.

17
00:00:57,556 --> 00:01:00,636
So the computer systems, responsible for
interfacing with all the other systems

18
00:01:00,706 --> 00:01:03,236
to make sure that the crew
can get data on those systems

19
00:01:03,236 --> 00:01:05,096
and that the ground can get
data on those systems.

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00:01:06,116 --> 00:01:09,856
>> Kylie Clem: A lot of people may be familiar
with how the space shuttle was operated

21
00:01:09,856 --> 00:01:14,396
where the crew flipped switches and that's
how things are commanded, but, really,

22
00:01:14,396 --> 00:01:19,236
with the space station, the computers operate
everything, and they interface with the laptops.

23
00:01:19,956 --> 00:01:20,846
>> Amy Brezinski: That's right.

24
00:01:20,986 --> 00:01:24,656
So there are a lot more computers
than there were on shuttle,

25
00:01:25,136 --> 00:01:27,616
and we do a lot of commanding,
actually, from the ground.

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00:01:27,726 --> 00:01:31,546
So a lot of the flight controllers
send commands, but I'm also responsible

27
00:01:31,546 --> 00:01:36,656
for making sure that those commands go through
and the computers process them correctly.

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00:01:36,656 --> 00:01:40,926
And then the crew can interface with the
systems through laptops onboard as well.

29
00:01:41,526 --> 00:01:45,076
>> Kylie Clem: And what kind
of background led you to here,

30
00:01:45,076 --> 00:01:46,696
to Johnson's Space Center, Mission Control?

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00:01:47,076 --> 00:01:49,616
>> Amy Brezinski: It all
started when I turned about 12.

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00:01:50,156 --> 00:01:56,176
I saw the movie Apollo 13, and I kind of fell in
love with human space flight and what NASA did,

33
00:01:56,596 --> 00:02:02,166
and it prompted me to continue studying space
in general and then also later on in high school

34
00:02:02,166 --> 00:02:04,926
and college, math and science and engineering.

35
00:02:05,526 --> 00:02:09,906
So I ended up going to MIT and studying
aeronautical and astronautical engineering,

36
00:02:10,356 --> 00:02:14,576
and I got my bachelor's degree, and
then I decided that I really wanted

37
00:02:14,576 --> 00:02:18,946
to get a master's degree and also
co-op here at JSC at the same time.

38
00:02:19,936 --> 00:02:24,696
So I studied human factors engineering,
looking at how people interface

39
00:02:24,746 --> 00:02:28,456
with autonomy, with semi-automatic systems.

40
00:02:29,076 --> 00:02:31,896
And then I co-oped here in the
life support training group,

41
00:02:32,346 --> 00:02:36,716
and the operations support officer group
that do a lot of maintenance on the station.

42
00:02:37,626 --> 00:02:39,506
And then once I finished my master's degree,

43
00:02:39,506 --> 00:02:44,116
I got hired on into the ODIN
group to work with the computers.

44
00:02:44,976 --> 00:02:48,166
>> Kylie Clem: And the co-op program
is a great opportunity for students,

45
00:02:48,166 --> 00:02:52,846
we would like to point out, because that's
a great way that a lot of people get hired

46
00:02:53,076 --> 00:02:57,736
at NASA is starting sort of as an intern
while you're still in school at college.

47
00:02:57,736 --> 00:03:02,746
You can come here and spend a semester and work
at different areas and learn about what it's

48
00:03:02,746 --> 00:03:05,796
like to work here before you
actually come and hopefully get hired.

49
00:03:06,286 --> 00:03:07,566
How was that experience for you?

50
00:03:07,906 --> 00:03:11,196
>> Amy Brezinski: I really liked it,
especially because you get to work in lots

51
00:03:11,196 --> 00:03:12,576
of different groups when you're a co-op.

52
00:03:12,966 --> 00:03:17,116
You can kind of try on the job and find
where you would like to work most in NASA.

53

00:03:17,526 --> 00:03:22,666
And I had a feeling that I wanted to either
train astronauts or be a flight controller.

54
00:03:23,026 --> 00:03:26,606
And so I got to do both of those things,
actually, as a co-op, and then I decided

55
00:03:26,606 --> 00:03:30,506
when I got hired on full on that I
wanted to be a flight controller.

56
00:03:30,586 --> 00:03:32,766
But maybe I'll get to train
astronauts some day again.

57
00:03:32,956 --> 00:03:37,776
>> Kylie Clem: And what kind of schooling
did you do at MIT that brought you here?

58
00:03:38,426 --> 00:03:41,076
>> Amy Brezinski: Oh, studying
aeronautical and astronautical engineering,

59
00:03:41,076 --> 00:03:44,326
which is kind of a mouthful, so we call
it aero-astro engineering for short.

60
00:03:44,686 --> 00:03:50,946
I got a lot of basic education in engineering
principles, such as, fluid mechanics,

61
00:03:51,206 --> 00:03:57,626
structures, thermal dynamics, signals
and systems, how computers work,

62
00:03:57,626 --> 00:04:00,086
and then I got to work on projects with teams.

63
00:04:00,566 --> 00:04:07,816

We actually, while I was at MIT, designed a
modular wireless spacecraft, and we designed it,

64
00:04:07,926 --> 00:04:09,746
we built it, and we worked as a team.

65
00:04:09,746 --> 00:04:14,076
And that was very important because
flight control is a team sport.

66
00:04:14,526 --> 00:04:15,846
You're never working on your own.

67
00:04:15,846 --> 00:04:20,116
You're always working with lots of other people
who have knowledge in areas different than you.

68
00:04:20,576 --> 00:04:24,656
And if you take all of them and combine them
together, you fly the space station together.

69
00:04:24,696 --> 00:04:27,906
So that experience of building a spacecraft

70
00:04:28,416 --> 00:04:30,906
in college really prepared me
for the team environment here.

71
00:04:32,216 --> 00:04:35,136
>> Kylie Clem: That sounds great, and I think
we're ready to take questions from the students.

72
00:04:36,886 --> 00:04:46,176
>> What is human supervisory control of
multiple autonomous vehicles all about?

73
00:04:47,136 --> 00:04:48,006
>> Amy Brezinski: That's a good question.

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00:04:48,066 --> 00:04:50,926
So that actually goes back to my days at MIT.

75
00:04:50,926 --> 00:04:53,596
I think somebody has been doing their homework.

76
00:04:53,926 --> 00:04:57,926
So what that means is, when
you have multiple vehicles,

77
00:04:58,346 --> 00:05:02,386
and you can make them partially
autonomous, so they can fly themselves.

78
00:05:02,906 --> 00:05:05,956
Because we understand how
to do that with software,

79
00:05:05,956 --> 00:05:08,196
and so you can have them fly themselves,

80
00:05:08,196 --> 00:05:12,046
and you can have a person giving them
high-level instructions, such as,

81
00:05:12,086 --> 00:05:15,496
you know, go here, or go do that there.

82
00:05:15,966 --> 00:05:18,786
And so if you can give them
high-level instructions,

83
00:05:18,846 --> 00:05:22,806
that means that you can probably have one
person supervising more than one vehicle.

84
00:05:23,336 --> 00:05:26,896
However, if you get a lot of
vehicles and one person supervising,

85
00:05:26,896 --> 00:05:32,236
that can pose some pretty interesting challenges
to make sure that the person is keeping track

86
00:05:32,236 --> 00:05:33,886
of all the vehicles, what they're doing.

87
00:05:33,886 --> 00:05:37,596
And if you're in a situation where there are
time-critical things that need to happen,

88
00:05:37,596 --> 00:05:41,926
you need to make sure that the person can make
good decision about what the vehicles are doing.

89
00:05:42,466 --> 00:05:46,296
What my research looked at
was tools that I could provide

90
00:05:46,456 --> 00:05:52,956
to a person supervising high-level multiple
vehicles in a time-critical environment

91
00:05:53,476 --> 00:05:56,476
and giving them tools to help
them make decisions for things

92
00:05:56,476 --> 00:05:58,146
that were going to happen into the future.

93
00:05:58,146 --> 00:06:02,126
So if something unexpected came up, to be
able to give them the decision-making tool

94
00:06:02,206 --> 00:06:17,096
to change what the vehicles were doing.

95
00:06:17,096 --> 00:06:21,146
>> Why did you choose to become an

ODIN, and who was your inspiration?

96
00:06:22,706 --> 00:06:25,346
>> Amy Brezinski: I like
to say that ODIN chose me.

97
00:06:25,516 --> 00:06:31,376
I wanted to be a flight controller, and at the
time, they really needed people to be an ODIN

98
00:06:31,376 --> 00:06:36,416
and to monitor the computers, so I
actually ended up...ODIN actually chose me,

99
00:06:36,416 --> 00:06:37,466
but I really liked it.

100
00:06:37,466 --> 00:06:39,366
I work with a fantastic group of people.

101
00:06:39,926 --> 00:06:45,786
We do really complex things like changing out
the software on the computers on space station.

102
00:06:46,546 --> 00:06:51,436
Actually, recently, we changed out the
hardware on the computers on the space station.

103
00:06:51,436 --> 00:06:54,166
The Expedition 30 crew helped us out with that,

104
00:06:54,586 --> 00:06:57,866
and it was kind of like performing
brain surgery on the space station.

105
00:06:57,996 --> 00:07:03,186
We changed out seven computers' hardware
and almost half of the computers' software.

106

00:07:03,186 --> 00:07:04,866
And that's very exciting.

107
00:07:05,096 --> 00:07:06,286
It's very complex.

108
00:07:06,986 --> 00:07:08,986
And it's very satisfying.

109
00:07:08,986 --> 00:07:10,026
It went very smoothly.

110
00:07:10,516 --> 00:07:14,966
In terms of my inspiration, I think I've
been inspired by all the flight controllers

111
00:07:15,436 --> 00:07:17,906
and flight directors and
astronauts that have come before me.

112
00:07:18,346 --> 00:07:21,806
And, in particular, I had a very good
mentor when I started here at NASA.

113
00:07:22,306 --> 00:07:26,176
His name was Colin Peterson, and he taught
me a lot about being a good flight controller

114
00:07:26,566 --> 00:07:34,396
and gave me a lot of lessons
that I still use to this day.

115
00:07:34,696 --> 00:07:41,786
>> How many computers are
needed to run all the networks?

116
00:07:41,826 --> 00:07:46,226
>> Amy Brezinski: That's a very good question.

117

00:07:46,336 --> 00:07:52,476
So right now, there are forty-eight computers
that are powered on, forty-one computers

118
00:07:52,536 --> 00:07:57,176
that are running the space station systems
and getting data and sending commands,

119
00:07:57,596 --> 00:08:02,006
and then we have seven computers, laptop
computers, that the crew can interface

120
00:08:02,006 --> 00:08:08,096
with through other computers, and they can
send commands and get data from those laptops.

121
00:08:08,226 --> 00:08:09,306
So that's on an average day.

122
00:08:09,306 --> 00:08:12,786
Sometimes we can have more computers
running, but it's quite a few.

123
00:08:13,516 --> 00:08:25,546
[Silence]

124
00:08:26,046 --> 00:08:30,896
>> What do the multiple autonomous vehicles
do if you lose communication with them?

125
00:08:31,906 --> 00:08:36,586
>> Amy Brezinski: So that's actually an
interesting question, and one that I didn't look

126
00:08:36,586 --> 00:08:40,816
at when I was studying multiple autonomous
vehicles, but I think that it's one

127
00:08:40,816 --> 00:08:42,686
that people will need to research later.

128
00:08:43,076 --> 00:08:46,896
I can tell you what we do when
ISS has lost its communications.

129
00:08:46,896 --> 00:08:50,426
Those are usually understood
ahead of time and planned.

130
00:08:50,606 --> 00:08:54,726
We aren't in contact with the ISS all the
time, but we usually know ahead of time

131
00:08:54,726 --> 00:08:56,646
when we're not going to have
contact with the ISS.

132
00:08:57,206 --> 00:09:00,116
And when that happens, we can't
actually talk to the crew,

133
00:09:00,526 --> 00:09:03,196
and we don't get data down,
and we can't send commands.

134
00:09:03,606 --> 00:09:06,736
But the space station, with all
its computers, is pretty smart,

135
00:09:06,796 --> 00:09:10,336
and it can continue flying
and monitoring its systems.

136
00:09:10,696 --> 00:09:13,836
And if anything would happen while the
ground can't talk to the space station,

137
00:09:13,836 --> 00:09:16,486
the crew would receive notification,
and they're trained

138
00:09:16,486 --> 00:09:18,906
to take action based on those notifications.

139
00:09:18,996 --> 00:09:21,026
So it's a pretty robust spacecraft.

140
00:09:22,436 --> 00:09:25,576
It can fly itself.

141
00:09:25,636 --> 00:09:30,606
>> And if ODIN develops a
problem, how do you fix it?

142
00:09:31,206 --> 00:09:32,866
>> Amy Brezinski: That's a very good question.

143
00:09:32,866 --> 00:09:36,136
That's definitely a big part of my job
is if there's anything that happens

144
00:09:36,136 --> 00:09:40,096
in the computer system, I'm the person
who is supposed to make sure I can fix it.

145
00:09:40,306 --> 00:09:43,486
You can have two types of
problems in the computer system.

146
00:09:43,696 --> 00:09:46,836
You can have a software problem or
you can have a hardware problem.

147
00:09:47,276 --> 00:09:51,406
And we can actually address most of
the software problems from the ground.

148
00:09:51,406 --> 00:09:56,426
We can send commands to fix the software

or we can cycle the software if needed.

149
00:09:56,816 --> 00:09:59,986
And for hardware problems, we have
some ability to deal with that too,

150
00:10:00,276 --> 00:10:02,366
to address particular hardware problems.

151
00:10:02,706 --> 00:10:05,816
But sometimes if something would really
really fail, one of the computers,

152
00:10:06,046 --> 00:10:08,566
and we might need to change that
with a spare we have on board.

153
00:10:08,926 --> 00:10:11,146
And so in that case, we would
ask the crew to help us

154
00:10:11,146 --> 00:10:15,676
out since we can't go do it ourselves here from
the ground, and they're trained to do that.

155
00:10:15,676 --> 00:10:19,386
And they would go, and they would take out that
piece of hardware and put in one of the spares.

156
00:10:21,506 --> 00:10:33,976
>> What is a typical day of what it's
like on the International Space Station?

157
00:10:34,996 --> 00:10:41,416
>> Amy Brezinski: I think that was...I think you
just asked, what is a typical day like on ISS.

158
00:10:41,556 --> 00:10:46,686
So I'll try to tell you what the
crew, what a typical crew day is like.

159
00:10:47,196 --> 00:10:49,416
They're doing a lot of science right now.

160
00:10:49,416 --> 00:10:53,116
They do a lot of experiments,
multiple experiments every day.

161
00:10:53,766 --> 00:10:54,976
They work Monday through Friday.

162
00:10:54,976 --> 00:10:59,566
And then when they're not doing
experiments, they're exercising.

163
00:10:59,676 --> 00:11:05,426
They exercise two hours every day, and sometimes
they also do some maintenance tasks for us,

164
00:11:05,536 --> 00:11:07,266
you know, just like your house at home,

165
00:11:07,266 --> 00:11:09,766
you got to clean the space
station, so they do some cleaning.

166
00:11:10,196 --> 00:11:13,946
And there's some regular maintenance they
need to do to keep the systems running.

167
00:11:15,086 --> 00:11:18,876
And then sometimes if something breaks or
if something's not working quite right,

168
00:11:18,876 --> 00:11:24,176
we'll have them go take care of that
as well and fix it or replace it.

169
00:11:26,016 --> 00:11:32,706

>> What do you do for fun on the ISS?

170
00:11:33,976 --> 00:11:37,076
>> Amy Brezinski: So I think the thing
that the astronauts do the most for fun

171
00:11:37,076 --> 00:11:40,676
when they have free time is look out
the window and watch the world go by.

172
00:11:41,396 --> 00:11:46,886
If you haven't had a chance to receive pictures
from the space station, there's definitely a lot

173
00:11:46,886 --> 00:11:54,696
on NASA.gov, and pictures of Earth in the
daytime and nighttime are just beautiful.

174
00:11:54,696 --> 00:11:59,056
They take a lot of pictures, and
you can see cities lit up at night.

175
00:11:59,686 --> 00:12:05,576
You can see major structures
that humans have built.

176
00:12:05,576 --> 00:12:07,626
I think they can actually
see the Great Wall of China.

177
00:12:08,076 --> 00:12:11,526
So they like to spend a long time looking
at the Earth because they only get to look

178
00:12:11,526 --> 00:12:13,006
at the Earth while they're up there.

179
00:12:13,436 --> 00:12:16,736
But I do know they do things for fun
that you would do at home, you know,

180
00:12:16,736 --> 00:12:20,116
on your weekends, like they
like to watch movies.

181
00:12:20,406 --> 00:12:22,906
They talk a lot to their family and friends.

182
00:12:22,906 --> 00:12:23,606
They can call them.

183
00:12:23,606 --> 00:12:26,606
They can also do video conferences.

184
00:12:26,606 --> 00:12:27,326
They read.

185
00:12:27,326 --> 00:12:28,176
They blog.

186
00:12:29,256 --> 00:12:30,156
They tweet.

187
00:12:30,156 --> 00:12:32,126
They write emails.

188
00:12:32,656 --> 00:12:36,186
So kind of similar things that
you would do at home for fun.

189
00:12:37,256 --> 00:12:40,596
>> A normal day but in space [inaudible]

190
00:12:40,676 --> 00:12:41,066
>> Amy Brezinski: I'm sorry.

191
00:12:42,656 --> 00:12:46,856
Can you repeat that question again?

192
00:12:48,376 --> 00:12:53,396
>> Like so it's pretty much like a normal
day like on the weekend, except for in space?

193
00:12:54,596 --> 00:12:55,156
>> Amy Brezinski: Exactly.

194
00:12:57,316 --> 00:12:57,676
Exactly.

195
00:12:58,886 --> 00:13:03,456
>> What are some things that you can say
that you miss on Earth that are not in space?

196
00:13:03,456 --> 00:13:05,466
>> Amy Brezinski: I think the
first thing that astronauts say

197
00:13:05,466 --> 00:13:09,246
that they miss most is they miss
their families and their friends.

198
00:13:09,866 --> 00:13:14,286
So when astronauts go up to the space station,
they're up there for about anywhere from four

199
00:13:14,286 --> 00:13:18,296
to six months, so it's a pretty long time away
from your family and friends even though you get

200
00:13:18,296 --> 00:13:20,996
to call them and you get to see
them on the video conferences.

201
00:13:21,406 --> 00:13:23,726
So I think that they miss that the most.

202
00:13:24,476 --> 00:13:28,926

I think that they also probably
miss, you know, being outside.

203
00:13:28,926 --> 00:13:35,136
You can't open a window on the space station, so
they probably miss fresh air and wind and rain.

204
00:13:35,276 --> 00:13:39,246
The weather is always the same every day
on the space station, same temperature.

205
00:13:39,576 --> 00:13:42,166
There's no rain on the space station,
so they probably miss that too.

206
00:13:42,636 --> 00:13:46,816
Then they probably miss, you know,
things like certain foods that they like.

207
00:13:46,816 --> 00:13:53,586
They do have a very wide variety of food, but if
you're, you know, craving a certain type of food

208
00:13:53,586 --> 00:13:55,926
that you didn't pack for your
trip, then you're going to have

209
00:13:55,926 --> 00:13:57,176
to wait until you go home to eat it.

210
00:13:57,176 --> 00:13:59,256
But they do get a lot of
different kinds of food,

211
00:13:59,296 --> 00:14:03,676
but then sometimes they miss certain
restaurants from home, from Earth.

212
00:14:04,516 --> 00:14:17,626
[Silence]

213
00:14:18,126 --> 00:14:21,886
>> How are accidents prevented on the ISS?

214
00:14:22,576 --> 00:14:22,946
>> Amy Brezinski: I'm sorry.

215
00:14:22,986 --> 00:14:24,446
Can you repeat your question one more time?

216
00:14:24,446 --> 00:14:25,326
I didn't quite get that.

217
00:14:26,656 --> 00:14:29,306
>> How are accidents prevented on the ISS?

218
00:14:29,306 --> 00:14:29,466
>> Amy Brezinski: Okay.

219
00:14:29,466 --> 00:14:33,886
That's a very good question, how
are accidents prevented on the ISS.

220
00:14:34,256 --> 00:14:38,466
So one thing we do is, we do a lot of
planning, and we do a lot of training,

221
00:14:38,756 --> 00:14:42,606
and we do a lot of assessing things
that we are going to do on space station

222
00:14:42,666 --> 00:14:45,696
to make sure they're safe because
safety is our number one priority.

223
00:14:46,216 --> 00:14:50,336
So anything that the crew is going to do,
anything that the ground is going to do,

224
00:14:50,336 --> 00:14:53,316
remotely, we take a look at and make
sure that it's going to be safe.

225
00:14:53,756 --> 00:14:59,356
And then we also do a lot of training on certain
activities to make sure that they are safe.

226
00:14:59,916 --> 00:15:04,446
Then if anything comes up that surprises
us, like an emergency, we have procedures

227
00:15:04,966 --> 00:15:09,796
that we train a lot on the ground, and
the crew also trains to know what to do,

228
00:15:09,796 --> 00:15:15,186
exactly what to do in an emergency, kind of
like you do for at school with a fire drill.

229
00:15:15,306 --> 00:15:18,756
You know, you have fire drills, and you
know which way you're supposed to leave

230
00:15:18,756 --> 00:15:22,376
and where you're supposed to meet and
so forth, so the crew does that as well.

231
00:15:22,376 --> 00:15:27,386
They have a set pattern of what they do if
there was a particular type of emergency.

232
00:15:27,976 --> 00:15:40,466
>> Was there ever a time in mission operations
when there was a critical life and death moment?

233
00:15:42,166 --> 00:15:45,796
>> Amy Brezinski: There have been times
where there has been critical and life

234
00:15:45,796 --> 00:15:50,036
and death situations, and
if you study space history,

235
00:15:50,036 --> 00:15:54,446
you'll earn that there have been
times when we have lost astronauts.

236
00:15:54,856 --> 00:16:01,586
Apollo 1, for example, and Challenger in the
1980s and Columbia not too many years ago,

237
00:16:01,996 --> 00:16:06,656
and we remember these times, and we learn
from them, and we miss these people very much,

238
00:16:06,656 --> 00:16:08,446
and we're never going to forget them.

239
00:16:08,446 --> 00:16:09,626
We think about them every day.

240
00:16:10,256 --> 00:16:15,166
But, again, you know, we try our
best to make sure everything is safe,

241
00:16:15,706 --> 00:16:18,406
and we have these procedures and plans in place.

242
00:16:18,456 --> 00:16:23,016
So we make sure that if there is a critical
situation, we can react to it on the ground

243
00:16:23,016 --> 00:16:25,706
to help out the crew, and the crew
can react to it appropriately.

244
00:16:25,706 --> 00:16:29,856
So that's something you never really

want to run into, and we do our best

245
00:16:29,856 --> 00:16:31,416
to prevent those types of situations.

246
00:16:32,516 --> 00:16:44,766
[Silence]

247
00:16:45,266 --> 00:16:48,146
>> What breakthrough or research
findings have you found

248
00:16:48,226 --> 00:16:52,466
through the International Space Station?

249
00:16:52,466 --> 00:16:56,496
>> Amy Brezinski: This is a really exciting
time because we are doing so much research

250
00:16:56,496 --> 00:17:00,986
on the space station, and this
particular expedition, Expedition 30,

251
00:17:01,356 --> 00:17:08,166
they have been doing thirty-five hours a week of
research on space station, and that's a record.

252
00:17:08,206 --> 00:17:12,156
That's a target that we set for
ourselves, and we made that target.

253
00:17:12,156 --> 00:17:16,436
We could probably talk about all the
different kinds of research for hours,

254
00:17:16,486 --> 00:17:20,136
but I'll focus on some of the human research,

255
00:17:20,136 --> 00:17:22,116

some of the human health
research that we're doing.

256
00:17:22,546 --> 00:17:27,736
So one thing that we're working on is
looking at doing experiments to try to come

257
00:17:27,736 --> 00:17:30,376
up with a vaccine for salmonella.

258
00:17:30,806 --> 00:17:34,176
So salmonella is a type of bacteria that
you can get, that can make you sick.

259
00:17:34,276 --> 00:17:36,606
It's a food-poisoning type bacteria,

260
00:17:37,146 --> 00:17:39,796
so it's possible that we could
prevent that with a vaccine.

261
00:17:40,176 --> 00:17:43,416
So there's work on ISS being used
to try to develop that vaccine.

262
00:17:43,836 --> 00:17:50,156
ISS is kind of a unique place because you can
grow protein crystals differently than on Earth.

263
00:17:50,226 --> 00:17:52,646
They actually grow in a completely
different structure.

264
00:17:53,116 --> 00:17:56,746
So we can use those protein crystals
to try to come up with treatments

265
00:17:56,746 --> 00:17:58,356
for certain diseases, such as, cancer.

266
00:17:59,186 --> 00:18:02,786
And then finally, we have a lot of
really cool robots on the space station.

267
00:18:02,786 --> 00:18:07,046
We've got a robotic arm, and we've
got a robotic hand called Dexter.

268
00:18:07,586 --> 00:18:08,836
And we also have Robonaut.

269
00:18:09,376 --> 00:18:14,646
And so we remotely operate those
robotic arms and equipment.

270
00:18:15,076 --> 00:18:19,806
And that knowledge of how to remotely operate
robotics can actually help people on Earth,

271
00:18:20,206 --> 00:18:25,206
doctors in particular, learn how to conduct
surgeries remotely with robotic arms.

272
00:18:25,266 --> 00:18:30,566
So you could have a doctor in one city
and a patient in a very remote area

273
00:18:31,026 --> 00:18:34,486
in a different city or, you know, out
somewhere where there isn't a city,

274
00:18:34,836 --> 00:18:39,086
and you could have the doctor conduct
surgery on that patient with use

275
00:18:39,176 --> 00:18:41,876
of a remotely operated robotic arm.

276
00:18:42,296 --> 00:18:45,976

So those are just some of the cool
examples of the really neat research

277
00:18:45,976 --> 00:18:48,436
and technology development going on on the ISS.

278
00:18:48,436 --> 00:18:49,956
It's a very exciting time.

279
00:18:50,516 --> 00:19:00,076
[Silence]

280
00:19:00,576 --> 00:19:10,766
>> Since we have like space junk in space
[inaudible] a way to clear the space junk?

281
00:19:10,816 --> 00:19:13,096
>> Amy Brezinski: Yeah, this
is some stuff up in space.

282
00:19:13,096 --> 00:19:14,876
Some people call it space junk.

283
00:19:14,926 --> 00:19:16,386
We call it debris.

284
00:19:16,996 --> 00:19:25,016
It is a concern for the space station, so we
haven't developed any ways to try to eliminate

285
00:19:25,246 --> 00:19:27,896
that space debris yet, but
people do work on that.

286
00:19:28,056 --> 00:19:31,076
But what we try to do on the
space station is, we avoid it.

287
00:19:31,546 --> 00:19:36,296

So if we see a piece of space debris
might be coming close to the station,

288
00:19:36,296 --> 00:19:41,496
and we have certain parameters that tell
us what means close to the space station,

289
00:19:41,896 --> 00:19:43,356
we'll do what's called a reboost.

290
00:19:43,536 --> 00:19:46,516
We'll take the space station,
and we'll fire some thrusters,

291
00:19:46,926 --> 00:19:52,846
and the space station will move its orbit
higher, and that will avoid the space debris.

292
00:19:53,476 --> 00:19:54,886
So we do a lot of tracking.

293
00:19:54,886 --> 00:19:58,506
We track a lot of space debris to make sure
that's not coming too close to the station.

294
00:19:58,506 --> 00:20:00,476
And then if it is, we do a reboost.

295
00:20:01,516 --> 00:20:10,126
[Silence]

296
00:20:10,626 --> 00:20:15,716
>> What is your vision for human space flight?

297
00:20:15,716 --> 00:20:21,626
>> Amy Brezinski: My vision is that in
my lifetime I will see humanity go back

298
00:20:21,666 --> 00:20:25,726

to the moon, go back to Mars, and
maybe even have a space station someday

299
00:20:25,726 --> 00:20:26,956
around another planet.

300
00:20:27,166 --> 00:20:29,796
I think that would be pretty neat.

301
00:20:30,826 --> 00:20:31,296
Excuse me.

302
00:20:31,746 --> 00:20:35,306
I really hope that I get to go into
space someday, and I hope that all

303
00:20:35,306 --> 00:20:40,156
of you have the ability to go visit space
someday because I think it's a really cool place

304
00:20:40,476 --> 00:20:45,476
to go visit, and I think we're going to
start seeing further and further exploration

305
00:20:45,476 --> 00:20:50,376
out from low Earth orbit, go to
asteroids, and we'll learn more

306
00:20:50,376 --> 00:20:51,976
about our universe, and that's very exciting.

307
00:20:52,516 --> 00:21:03,636
[Silence]

308
00:21:04,136 --> 00:21:07,996
>> When the International Space Station
starts to decommission and slowly lower down,

309
00:21:07,996 --> 00:21:10,366

how do you plan to safely lower it?

310
00:21:11,806 --> 00:21:16,366
>> Amy Brezinski: So the space station partners,
all the international partners and NASA,

311
00:21:16,686 --> 00:21:21,176
have agreed to operate the space station
until 2020 and maybe even longer.

312
00:21:21,676 --> 00:21:25,496
But someday we will have to say
goodbye to our space station.

313
00:21:25,826 --> 00:21:28,306
And what we'll do then is, we'll
use thrusters to kind of go

314
00:21:28,306 --> 00:21:30,156
in the opposite direction of a reboost.

315
00:21:30,676 --> 00:21:35,456
We'll use the thrusters to lower the orbit
of the space station, and we'll bring it

316
00:21:35,456 --> 00:21:38,976
down in a very controlled, planned
manner, probably in an ocean.

317
00:21:39,516 --> 00:21:49,686
[Silence]

318
00:21:50,186 --> 00:22:00,436
>> Have you ever wanted to go to the ISS?

319
00:22:01,816 --> 00:22:02,146
>> Amy Brezinski: Yes.

320
00:22:02,546 --> 00:22:04,506

I would love to go to the ISS.

321
00:22:04,756 --> 00:22:09,686
I think it is one of the most
amazing places off this planet

322
00:22:09,686 --> 00:22:11,126
because I can't say it's on the planet.

323
00:22:11,286 --> 00:22:14,466
In fact, when people ask me, you know,
where...if you could go anywhere in the world,

324
00:22:14,466 --> 00:22:18,396
where would you go, and I always
say, well can I go off the world?

325
00:22:18,806 --> 00:22:20,026
Is that an option?

326
00:22:20,396 --> 00:22:22,296
It's really an amazing place.

327
00:22:22,296 --> 00:22:23,776
It's very big.

328
00:22:24,196 --> 00:22:28,546
It's bigger than, I think, a
three or four bedroom house.

329
00:22:29,106 --> 00:22:31,166
And it's amazing that we built it.

330
00:22:31,256 --> 00:22:36,076
You know, I remember when it was, the
first pieces were launched back when I was

331
00:22:36,076 --> 00:22:39,956
in high school, and it's been neat

to see it continue to build up,

332
00:22:39,956 --> 00:22:40,956
so I would love to visit someday.

333
00:22:41,516 --> 00:22:46,856
[Silence]

334
00:22:47,356 --> 00:22:56,026
>> Since you're a coordinator, how difficult
is it to handle the issues in space?

335
00:22:56,026 --> 00:22:57,096
>> Kylie Clem: Could you repeat the question?

336
00:22:58,366 --> 00:23:05,886
>> Since you're a collaborative coordinator,
how hard is it to handle the issues in space?

337
00:23:06,026 --> 00:23:07,316
>> Amy Brezinski: That's a very good question.

338
00:23:07,316 --> 00:23:12,396
It's a very good way to describe being a
flight controller, collaborative coordinator.

339
00:23:13,776 --> 00:23:17,006
So it's not difficult to work issues.

340
00:23:17,256 --> 00:23:21,206
We all learn how to communicate with
people that do the different systems,

341
00:23:21,556 --> 00:23:26,286
and we learn about how our system, in particular
my system, the computer system interfaces

342
00:23:26,286 --> 00:23:30,946
with things like a life support

system, the thermal system

343
00:23:30,946 --> 00:23:33,076
that keeps things cool, and the power system.

344
00:23:33,506 --> 00:23:39,026
So when an issue arises, we're all trained to
work together to figure out what the problem is

345
00:23:39,606 --> 00:23:43,206
and then what the impact is to the entire
team and the space station as a whole

346
00:23:43,506 --> 00:23:48,556
and the mission objectives and the crew, very
importantly, and then what the work around is,

347
00:23:48,556 --> 00:23:50,456
what do we need to do to try and fix the issue.

348
00:23:50,896 --> 00:23:53,296
And we practice this.

349
00:23:53,296 --> 00:23:57,856
We always say in our heads, we always think when
we see an issue, failure, impact, work around.

350
00:23:58,276 --> 00:24:03,456
And so based on that, we actually can work
very easily together to come up with a solution

351
00:24:03,456 --> 00:24:06,866
to issues that affect multiple systems
in a very collaborative manner.

352
00:24:07,516 --> 00:24:14,956
[Silence]

353
00:24:15,456 --> 00:24:18,036

>> When will we be able to
launch a spaceship from the ISS?

354
00:24:20,096 --> 00:24:21,106
>> Amy Brezinski: That's a good question.

355
00:24:21,606 --> 00:24:25,876
Right now we don't have any plans yet
to launch spacecrafts from the ISS,

356
00:24:26,716 --> 00:24:30,196
but we do have some spacecrafts
that are launching to the ISS

357
00:24:30,196 --> 00:24:32,006
that are very new that are coming this year.

358
00:24:32,626 --> 00:24:34,056
You may have heard about one of them.

359
00:24:34,536 --> 00:24:35,686
It's called Dragon.

360
00:24:35,746 --> 00:24:41,766
It's a resupply spacecraft that's been...being
launching by Space X, which is a US company,

361
00:24:42,346 --> 00:24:46,956
and we hope to see that resupply
spacecraft visit us this month.

362
00:24:47,636 --> 00:24:52,146
And then later on, later this year or
next year, we'll see the Cygnus resupply,

363
00:24:52,146 --> 00:24:58,096
an unmanned spacecraft, visit, and that's
another spacecraft that's produced by Orbital.

364

00:24:58,096 --> 00:24:59,226
It's another US company.

365
00:24:59,226 --> 00:25:05,626
So it's kind of exciting because we're having
new vehicles come to the ISS and getting more

366
00:25:05,626 --> 00:25:12,016
and more groups and companies involved with
space exploration and ISS in particular.

367
00:25:12,716 --> 00:25:15,856
>> Kylie Clem: I understand that was
our last question from the students,

368
00:25:15,856 --> 00:25:18,356
so we would like to thank the
students for joining us today.

369
00:25:18,356 --> 00:25:21,366
We hope you learned a lot, and you
had some really great questions.

370
00:25:21,736 --> 00:25:23,696
Amy, did you have any closing remarks?

371
00:25:24,016 --> 00:25:26,186
>> Amy Brezinski: Thanks so much
for your wonderful questions,

372
00:25:26,186 --> 00:25:28,546
and it was very good to talk to you today.