



**SPACESTATION
LIVE**

1
00:00:08,629 --> 00:00:06,630
dna testing aboard the space station

2
00:00:10,150 --> 00:00:08,639
typically requires that we collect

3
00:00:12,310 --> 00:00:10,160
biological samples and then return them

4
00:00:14,629 --> 00:00:12,320
to earth well that could soon change a

5
00:00:16,470 --> 00:00:14,639
device called the biomolecular sequencer

6
00:00:18,870 --> 00:00:16,480
will demonstrate for the very first time

7
00:00:21,269 --> 00:00:18,880
whether dna sequencing is possible in

8
00:00:22,790 --> 00:00:21,279
microgravity i spoke with sarah wallace

9
00:00:25,029 --> 00:00:22,800
one of the co-investigators of this

10
00:00:26,710 --> 00:00:25,039
experiment at johnson space center to

11
00:00:29,189 --> 00:00:26,720
learn how they're going to test this

12
00:00:31,589 --> 00:00:29,199
tiny piece of hardware and its big

13
00:00:32,950 --> 00:00:31,599

impact to station life

14

00:00:34,470 --> 00:00:32,960

we're flying

15

00:00:36,389 --> 00:00:34,480

samples that are ready to go so they've

16

00:00:37,430 --> 00:00:36,399

already been prepared in our lab on the

17

00:00:39,990 --> 00:00:37,440

ground

18

00:00:41,190 --> 00:00:40,000

and the samples contain a whole genome

19

00:00:43,750 --> 00:00:41,200

of a virus

20

00:00:45,750 --> 00:00:43,760

a mouse and a bacteria and so all will

21

00:00:48,069 --> 00:00:45,760

be sequenced at the same time

22

00:00:49,910 --> 00:00:48,079

and the technology that's enabling this

23

00:00:52,150 --> 00:00:49,920

is a commercial off-the-shelf

24

00:00:54,470 --> 00:00:52,160

dna sequencer called the minion by

25

00:00:56,549 --> 00:00:54,480

oxford nanopore technologies and it's

26
00:00:57,910 --> 00:00:56,559
actually smaller than a small smartphone

27
00:00:59,990 --> 00:00:57,920
so i tell people it's just a little bit

28
00:01:03,510 --> 00:01:00,000
bigger than a fun-sized snickers bar and

29
00:01:04,789 --> 00:01:03,520
that's what's enabling this capability

30
00:01:06,070 --> 00:01:04,799
it's got to be really exciting to the

31
00:01:09,510 --> 00:01:06,080
science community that they're going to

32
00:01:12,630 --> 00:01:09,520
be able to sequence this in space yes

33
00:01:14,710 --> 00:01:12,640
we're i've been saying that we're um

34
00:01:17,590 --> 00:01:14,720
at the the dawn of the molecular space

35
00:01:19,990 --> 00:01:17,600
age um we had the first molecular

36
00:01:21,590 --> 00:01:20,000
biology experiment done um and that was

37
00:01:22,870 --> 00:01:21,600
the genes in space mini pcr that

38
00:01:24,789 --> 00:01:22,880

everyone's familiar with that was april

39

00:01:26,149 --> 00:01:24,799

of this year so we're already jumping

40

00:01:27,749 --> 00:01:26,159

all the way to sequencing so we're going

41

00:01:29,990 --> 00:01:27,759

to have this full suite of molecular

42

00:01:33,270 --> 00:01:30,000

capabilities aboard the iss

43

00:01:35,350 --> 00:01:33,280

and dna sequencing as a microbiologist

44

00:01:36,710 --> 00:01:35,360

for me is really going to enable things

45

00:01:38,310 --> 00:01:36,720

like

46

00:01:40,149 --> 00:01:38,320

as microbiologists one of the things we

47

00:01:41,429 --> 00:01:40,159

get we get pictures back from the crew

48

00:01:43,990 --> 00:01:41,439

of things that are

49

00:01:45,749 --> 00:01:44,000

maybe growing on the walls or came out

50

00:01:47,270 --> 00:01:45,759

of a water line and they say is this

51
00:01:48,870 --> 00:01:47,280
biological

52
00:01:50,950 --> 00:01:48,880
that's really hard thing to answer off

53
00:01:52,789 --> 00:01:50,960
just a picture so we're really excited

54
00:01:55,190 --> 00:01:52,799
to have this capability to be able to

55
00:01:57,350 --> 00:01:55,200
actually take that sample and and do

56
00:01:58,950 --> 00:01:57,360
sequencing on it to see what's there

57
00:02:01,590 --> 00:01:58,960
it's a capability we don't have on board

58
00:02:03,910 --> 00:02:01,600
right now so in order we have microbial

59
00:02:05,270 --> 00:02:03,920
requirements um the crew the astronauts

60
00:02:06,870 --> 00:02:05,280
are gonna go around and they're gonna

61
00:02:08,630 --> 00:02:06,880
take samples from the air the water and

62
00:02:10,869 --> 00:02:08,640
the surfaces and they're actually going

63
00:02:12,229 --> 00:02:10,879

to culture up the microorganisms that

64

00:02:13,830 --> 00:02:12,239

are there

65

00:02:15,750 --> 00:02:13,840

we can know about how many but we have

66

00:02:17,589 --> 00:02:15,760

no idea what they are until we get those

67

00:02:19,910 --> 00:02:17,599

samples back in our lab

68

00:02:21,510 --> 00:02:19,920

so with this technology we could down

69

00:02:23,589 --> 00:02:21,520

the road be able to sequence those and

70

00:02:25,190 --> 00:02:23,599

know exactly what it is

71

00:02:27,190 --> 00:02:25,200

that same line of thinking infectious

72

00:02:29,350 --> 00:02:27,200

disease diagnosis we currently have no

73

00:02:31,830 --> 00:02:29,360

way to diagnose infectious disease

74

00:02:33,350 --> 00:02:31,840

onboard the iss so again this would give

75

00:02:36,229 --> 00:02:33,360

us that capability to know what it is

76
00:02:37,750 --> 00:02:36,239
and right now we're able to resupply the

77
00:02:40,150 --> 00:02:37,760
things that we use to clean up the

78
00:02:41,670 --> 00:02:40,160
environment and in antibiotics and such

79
00:02:44,229 --> 00:02:41,680
for the crew but as we move away from

80
00:02:45,670 --> 00:02:44,239
iss we won't have that capability so i

81
00:02:47,990 --> 00:02:45,680
feel strongly that this is something

82
00:02:49,910 --> 00:02:48,000
that's very much needed before we lose

83
00:02:52,790 --> 00:02:49,920
our ability to resupply antibiotics and

84
00:02:55,110 --> 00:02:52,800
disinfectants and and things like that

85
00:02:56,949 --> 00:02:55,120
kind of in another way of thinking

86
00:02:58,790 --> 00:02:56,959
my colleague dr aaron burton who's also

87
00:03:01,110 --> 00:02:58,800
at the johnson space center

88
00:03:04,390 --> 00:03:01,120

he is in the astrobiology realm and he

89

00:03:06,390 --> 00:03:04,400

wants to use the sequencer to look for

90

00:03:08,550 --> 00:03:06,400

nucleic acid-based life elsewhere in the

91

00:03:10,630 --> 00:03:08,560

universe and so that's really exciting

92

00:03:12,390 --> 00:03:10,640

that this this one small piece of

93

00:03:14,229 --> 00:03:12,400

equipment could potentially do all of

94

00:03:16,149 --> 00:03:14,239

this you hope there aren't challenges

95

00:03:19,270 --> 00:03:16,159

but you think there may be yeah so some

96

00:03:21,670 --> 00:03:19,280

of the challenges that we is with the

97

00:03:23,830 --> 00:03:21,680

fluid and how the the flow cell which is

98

00:03:24,789 --> 00:03:23,840

where all the sequencing chemistry takes

99

00:03:27,430 --> 00:03:24,799

place

100

00:03:28,630 --> 00:03:27,440

um there's there's some buffer in there

101
00:03:30,789 --> 00:03:28,640
and then of course the sample that we're

102
00:03:32,390 --> 00:03:30,799
injecting is liquid and we've seen on

103
00:03:35,110 --> 00:03:32,400
the ground that there may be some issues

104
00:03:38,149 --> 00:03:35,120
with with a bubble um impacting those

105
00:03:39,910 --> 00:03:38,159
biological proteins um the nanopores and

106
00:03:41,750 --> 00:03:39,920
so on earth we're kind of concerned

107
00:03:43,589 --> 00:03:41,760
about that but the bubble isn't really a

108
00:03:45,990 --> 00:03:43,599
problem because it stays to the top and

109
00:03:47,990 --> 00:03:46,000
doesn't really impact the neopores in

110
00:03:50,789 --> 00:03:48,000
microgravity we're not sure what's going

111
00:03:52,949 --> 00:03:50,799
to happen with the bubbles so we're

112
00:03:54,710 --> 00:03:52,959
we're really interested to see how the

113
00:03:56,550 --> 00:03:54,720

fluid is introduced to the flow cell how

114

00:03:58,789 --> 00:03:56,560

it flows throughout and what the fluid

115

00:04:00,630 --> 00:03:58,799

dynamics look like inside the sequencer

116

00:04:02,390 --> 00:04:00,640

so this first

117

00:04:05,030 --> 00:04:02,400

experiment will really just look at how

118

00:04:06,869 --> 00:04:05,040

it works yes yeah and then they'll be

119

00:04:08,789 --> 00:04:06,879

follow-on yeah so

120

00:04:11,670 --> 00:04:08,799

this one is just a tech demo so we're

121

00:04:13,509 --> 00:04:11,680

flying up the the mouse and the bacteria

122

00:04:14,390 --> 00:04:13,519

and the virus that i mentioned

123

00:04:15,750 --> 00:04:14,400

are all

124

00:04:18,069 --> 00:04:15,760

all types that have had their genome

125

00:04:19,189 --> 00:04:18,079

sequenced a whole lot so we know exactly

126

00:04:21,110 --> 00:04:19,199

what it should look like it won't be

127

00:04:22,629 --> 00:04:21,120

running ground controls at the same time

128

00:04:24,870 --> 00:04:22,639

so it's really how does the ground

129

00:04:26,230 --> 00:04:24,880

sequencing data compare and contrast

130

00:04:28,469 --> 00:04:26,240

from the flight data

131

00:04:31,110 --> 00:04:28,479

the dna sequencer will be splashing down

132

00:04:34,390 --> 00:04:31,120

to nemo which is nasa's extreme

133

00:04:36,790 --> 00:04:34,400

environment um or one of them located

134

00:04:38,710 --> 00:04:36,800

off the coast of key largo and it sits

135

00:04:40,230 --> 00:04:38,720

about 62 feet down on the bottom of the

136

00:04:41,430 --> 00:04:40,240

ocean and it's called the aquarius

137

00:04:44,790 --> 00:04:41,440

habitat

138

00:04:46,390 --> 00:04:44,800

and so while the astronauts on iss are

139

00:04:49,189 --> 00:04:46,400

sequencing dna we're actually going to

140

00:04:51,749 --> 00:04:49,199

have the aquanauts on nemo go through

141

00:04:53,350 --> 00:04:51,759

that entire sample prep so that's the

142

00:04:55,590 --> 00:04:53,360

piece that's missing right now is to be

143

00:04:57,189 --> 00:04:55,600

able to take a sample and go all the way

144

00:04:59,110 --> 00:04:57,199

through to get the dna ready to be

145

00:05:01,270 --> 00:04:59,120

sequenced and as i mentioned we're

146

00:05:02,629 --> 00:05:01,280

having the dna already ready when we fly

147

00:05:04,469 --> 00:05:02,639

it so we're going to see if the

148

00:05:05,909 --> 00:05:04,479

aquanauts can follow our protocol that

149

00:05:07,510 --> 00:05:05,919

we've made to make it a spaceflight

150

00:05:10,710 --> 00:05:07,520

compatible protocol to go all the way

151
00:05:12,629 --> 00:05:10,720
from collecting a sample dna extraction

152
00:05:14,230 --> 00:05:12,639
amplification and then modification for

153
00:05:16,710 --> 00:05:14,240
sequencing and actually go all the way

154
00:05:18,790 --> 00:05:16,720
from sample to sequencer so a lot's

155
00:05:20,550 --> 00:05:18,800
going to be happening we're very excited

156
00:05:22,230 --> 00:05:20,560
because a few months from now we hope to

157
00:05:24,629 --> 00:05:22,240
have a lot of data to start piecing

158
00:05:26,550 --> 00:05:24,639
together how possible is this to put in

159
00:05:28,790 --> 00:05:26,560
in the researchers hands and enable a