
NASA EXPLORERS
SPACE SCHOOL

1
00:00:08,875 --> 00:00:09,843
(music throughout) As an aquanaut.

2
00:00:09,843 --> 00:00:11,811
That was just just an awesome experience.

3
00:00:11,811 --> 00:00:16,583
Definitely once in a lifetime
to be able to go spend nine days,

4
00:00:16,583 --> 00:00:21,421
about 60 feet below
the surface in an underwater habitat,

5
00:00:23,123 --> 00:00:24,524
and we would do a full end

6
00:00:24,524 --> 00:00:27,627
to end mission scenario
simulating the Moon and Mars.

7
00:00:27,694 --> 00:00:30,030
That's
where we really got to put to the test.

8
00:00:30,397 --> 00:00:33,299
What is exploration
of these planetary bodies

9
00:00:33,299 --> 00:00:41,574
going to look like?

10
00:00:46,980 --> 00:00:48,114
So when we have these

11
00:00:48,114 --> 00:00:51,384
what we call aquanauts
living in this underwater habitat,

12
00:00:51,384 --> 00:00:54,788
we can simulate some of the conditions
that the astronauts will experience.

13
00:00:54,788 --> 00:00:55,655
And we're actually able

14
00:00:55,655 --> 00:01:00,160
to have these aquanauts conduct, EVAs
or extravehicular activities.

15
00:01:00,360 --> 00:01:03,530
Simply put, spacewalks
outside of this habitat.

16
00:01:03,663 --> 00:01:06,833
So really being able to see that process

17
00:01:06,833 --> 00:01:10,036
from multiple different angles
I think will be really beneficial

18
00:01:10,036 --> 00:01:15,442
as we start to nail down exactly what
that's going to look like for Artemis.

19
00:01:17,177 --> 00:01:18,678
Artemis is taking humans for

20
00:01:18,678 --> 00:01:20,980
the first time to the Moon's
South Pole region.

21
00:01:22,816 --> 00:01:24,150
This area of the moon features

22
00:01:24,150 --> 00:01:28,455
some of the coldest temperatures
in the solar system.

23
00:01:29,089 --> 00:01:32,092
Artemis Astronauts
will look for signs of frozen water

24
00:01:32,492 --> 00:01:34,861
and gather clues
about the young solar system.

25
00:01:35,128 --> 00:01:39,365
When the planets and moons
were just forming, flash forward

26
00:01:39,365 --> 00:01:42,836
to astronauts exploring the lunar surface
with the Artemis program.

27
00:01:43,069 --> 00:01:44,838
You know,
they're going to be doing exploration.

28
00:01:44,838 --> 00:01:46,706
They're going to be visiting a site
on the moon

29
00:01:46,706 --> 00:01:48,975
that no human being
has ever visited before.

30
00:01:48,975 --> 00:01:52,479
And they're going to be taking pictures
and describing rocks that they see.

31
00:01:52,612 --> 00:01:55,215
You know, collecting samples,
deploying instruments.

32
00:01:56,049 --> 00:01:59,018
And we want to, you know,
have them experience all of these things

33
00:01:59,018 --> 00:02:03,123
here on Earth,
of course, before they fly to the moon.

34
00:02:03,990 --> 00:02:07,360
NASA has been training astronauts
in geology in geoscience

35
00:02:07,360 --> 00:02:10,029
for decades.

36
00:02:10,363 --> 00:02:13,366
These scientific fields
help us understand the evolution

37
00:02:13,366 --> 00:02:16,769
of the physical
and chemical makeup of planets and moons

38
00:02:19,172 --> 00:02:19,539
from their

39
00:02:19,539 --> 00:02:22,742
deep interiors to their surfaces
and atmospheres.

40
00:02:23,576 --> 00:02:27,147
Apollo astronauts had hundreds of hours
of training in geology

41
00:02:27,647 --> 00:02:29,649
or the equivalent of a master's degree.

42
00:02:30,150 --> 00:02:33,920
And Artemis astronauts will, too.

43
00:02:34,120 --> 00:02:35,388
NASA's astronaut corps

44
00:02:35,388 --> 00:02:39,559
includes geologists
like astronaut Jessica Watkins.

45
00:02:39,559 --> 00:02:45,031
Yes, so my job title is now astronaut,
NASA astronaut.

46
00:02:45,298 --> 00:02:48,067
We all come into the astronaut office
with, you know,

47
00:02:48,234 --> 00:02:51,171
a whole career in the
in the rearview mirror in a lot of senses.

48
00:02:51,404 --> 00:02:54,507
For me,
the way that I ended up kind of sitting in

49
00:02:54,507 --> 00:02:57,544
this seat
was by keeping it in the back of my mind.

50
00:02:57,577 --> 00:03:02,849
So I became interested in Mars
at a pretty young age, actually.

51
00:03:03,116 --> 00:03:04,417
I'm not sure.

52
00:03:04,517 --> 00:03:06,252
Somewhere around fifth grade.

53
00:03:06,252 --> 00:03:09,322
So this is
this was in a defining time for my life.

54

00:03:09,322 --> 00:03:13,860
But I remember for some school project,
you know, making a little book about Marty

55
00:03:13,860 --> 00:03:19,699
The Martian, that love kind of carried
through in college when I found geology,

56
00:03:19,866 --> 00:03:24,938
because I learned that there's
this thing called planetary geology.

57
00:03:24,938 --> 00:03:29,075
And the idea of being able
to study the surface of another planet

58
00:03:29,108 --> 00:03:32,378
was just the coolest thing to me
as somebody who who loved Mars

59
00:03:34,881 --> 00:03:37,083
Geology training on our home planet covers

60
00:03:37,083 --> 00:03:40,687
just one aspect of what it would be like
to scientifically explore the moon.

61
00:03:41,254 --> 00:03:45,091
Lower gravity, extreme temperatures
and a bulky spacesuit

62
00:03:45,358 --> 00:03:48,728
make operating tools
and collecting rocks a great challenge.

63
00:03:49,429 --> 00:03:53,833
NASA's scientists and engineers
work hard to design and build custom tools

64
00:03:53,900 --> 00:03:58,271

that will work well in the extreme
environment of the Moon's South Polar

65
00:03:58,271 --> 00:03:59,405
region.

66
00:03:59,405 --> 00:04:04,577
Making any sort of hardware that flies in
space is a huge team effort.

67
00:04:04,711 --> 00:04:06,613
I help to lead a team of people

68
00:04:06,613 --> 00:04:10,450
who are building moon tools
and so specifically the tools

69
00:04:10,450 --> 00:04:14,821
that are going to take samples of the moon
and bring them back to Earth

70
00:04:14,821 --> 00:04:18,658
to the scientists,
can study them for generations to come.

71
00:04:19,692 --> 00:04:22,228
At Johnson Space Center,
we have what's called the rock yard,

72
00:04:22,328 --> 00:04:25,531
which is essentially kind of
a, you know, large, you know, open space

73
00:04:25,531 --> 00:04:30,737
where we've imported rocks,
basically a large human sized sandbox.

74
00:04:30,737 --> 00:04:34,607
It's great at the rock yard
we get astronauts to come out to be test

75
00:04:34,607 --> 00:04:38,344
subjects, but we also get engineers
and scientists and operators

76
00:04:38,444 --> 00:04:42,115
to be test subjects as well
so that we can fully understand

77
00:04:42,315 --> 00:04:45,685
what it's like to be in that crew
perspective.

78
00:04:46,219 --> 00:04:49,956
So understanding,
you know what what our priorities are,

79
00:04:49,956 --> 00:04:53,760
what types of rocks we're interested
in and why, but also to start

80
00:04:53,760 --> 00:04:56,863
using the tools that we'll be using
to collect those samples.

81
00:04:56,896 --> 00:04:59,899
Let's just start with
the most simple tool, the geology hammer.

82
00:05:00,033 --> 00:05:02,101
You all know what a hammer looks like,

83
00:05:02,602 --> 00:05:05,705
but in the South Pole, it's
going to be really cold there.

84
00:05:05,872 --> 00:05:09,075
And so we need to make sure
that we're using a material

85
00:05:09,075 --> 00:05:12,545
that doesn't break
at very cold temperatures.

86
00:05:12,578 --> 00:05:16,883
So we create a test plan that includes
putting it through environmental testing.

87
00:05:16,983 --> 00:05:21,220
So putting the tools in very hot
conditions, in very cold conditions

88
00:05:21,220 --> 00:05:22,288
and making sure they work.

89
00:05:22,288 --> 00:05:25,458
We can't just go to the hardware store
and buy a hammer.

90
00:05:25,591 --> 00:05:27,493
We have to go make a special one.

91
00:05:27,493 --> 00:05:30,563
And then we have testing
like ergonomic testing to make sure

92
00:05:30,563 --> 00:05:35,134
that it actually works with the astronauts
and that it fits their gloved hand

93
00:05:35,134 --> 00:05:38,237
when they're in the spacesuits
not to exhausting for them.

94
00:05:38,371 --> 00:05:42,375
There's all of these little different
nuances of being in the spacesuit

95
00:05:42,375 --> 00:05:45,411

that are hard to fully appreciate
unless you get in there.

96
00:05:45,778 --> 00:05:48,815
As anyone who's worn
a spacesuit will tell you, it feels like

97
00:05:48,815 --> 00:05:51,684
wearing a balloon
that's constantly pushing down on you.

98
00:05:52,352 --> 00:05:54,520
Spacesuits have to meet many demands.

99
00:05:54,654 --> 00:05:56,622
They must be sturdy enough
to keep astronauts

100
00:05:56,622 --> 00:05:59,826
safe in the low gravity and high radiation
environment of the Moon.

101
00:05:59,892 --> 00:06:03,229
But they also have to be nimble enough
to allow astronauts

102
00:06:03,229 --> 00:06:05,932
to squeeze, poke and pound their tools.

103
00:06:06,332 --> 00:06:08,468
It's tough to describe, honestly.

104
00:06:08,468 --> 00:06:09,202
It's large.

105
00:06:09,202 --> 00:06:11,270
It's, you know, about 300 pounds, I think.

106
00:06:11,471 --> 00:06:14,841

You're kind of operating your own
personal spacecraft in a lot of ways.

107
00:06:14,874 --> 00:06:18,578
You know, the intent is for you to be able
to manipulate your arms

108
00:06:18,578 --> 00:06:21,547
and legs in a
in a way that you would on the ground.

109
00:06:21,581 --> 00:06:26,552
So we have a large pool here at the NBL
the Neutral Buoyancy

110
00:06:26,552 --> 00:06:30,690
Laboratory here on site
and in the corner we now have a moon area.

111
00:06:30,723 --> 00:06:34,160
So we've imported
sand and rocks down there

112
00:06:34,160 --> 00:06:39,065
and we've started to do runs
trying to approximate one sixth gravity.

113
00:06:39,132 --> 00:06:41,734
It's kind of a lot of moving pieces,
but it's really fun.

114
00:06:41,734 --> 00:06:43,669
It's one of the coolest things
we get to do.

115
00:06:43,669 --> 00:06:46,806
And I'll tell you what,
some of my most favorite moments at NASA

116
00:06:46,806 --> 00:06:50,176

have been when I see these engineers
start to get excited about the science

117
00:06:50,176 --> 00:06:53,846
that we're doing and start to, you know,
learn some of the geology terminology,

118
00:06:54,046 --> 00:06:56,416
because that really is
what creates an effective team.

119
00:06:56,416 --> 00:06:57,750
And so hearing, you know,

120
00:06:57,750 --> 00:07:01,120
tools engineer out of me start to say,
wow, this looks like a basalt

121
00:07:01,120 --> 00:07:04,223
that has lots of vesicles
with olivine phenocrysts in it

122
00:07:04,424 --> 00:07:06,993
just make me incredibly excited
because it means that,

123
00:07:07,160 --> 00:07:09,228
you know, we're learning
to speak each other's languages

124
00:07:12,465 --> 00:07:21,140
(beatboxing) Yeah,

125
00:07:21,307 --> 00:07:24,510
I just like to do weird and unique things.

126
00:07:24,510 --> 00:07:28,080
So I've always found those,
you know, those odd hobbies,

127
00:07:28,080 --> 00:07:32,418
like learning to juggle
or learning to beatbox or do improv.

128
00:07:32,418 --> 00:07:35,188
I was watching TV
and I saw the TV show American

129
00:07:35,188 --> 00:07:38,024
Ninja Warrior, and I was just like,
I want to do that.

130
00:07:38,224 --> 00:07:41,360
And so I started to train
to be a ninja warrior.

131
00:07:41,961 --> 00:07:45,164
That's how I decided
that I should be called the Space Ninja.

132
00:07:45,498 --> 00:07:48,067
And so I would just share
my interest of space.

133
00:07:48,067 --> 00:07:51,671
I got selected
and got to go out there and compete.

134
00:07:52,438 --> 00:07:55,041
So I think we would limit ourselves

135
00:07:55,041 --> 00:07:59,045
if we only have one vision
of what exploration looks like.

136
00:07:59,045 --> 00:08:02,348
Being a part of the NASA
team has really showed me what that means

137

00:08:02,348 --> 00:08:05,551
and what exploration really
looks like on a daily basis.

138
00:08:05,585 --> 00:08:09,622
But I do enjoy creative writing, short
stories, poems

139
00:08:09,622 --> 00:08:11,958
sometimes when I can, you know,
find the time.

140
00:08:11,958 --> 00:08:16,262
It's just an enjoyable way for me
to explore what I'm thinking and feeling

141
00:08:16,796 --> 00:08:19,232
and really kind of,
you know, use the other side of my brain.

142
00:08:20,066 --> 00:08:23,769
Now, whenever I take a step back to
I think about what I do.

143
00:08:23,769 --> 00:08:27,640
I mean, it is just it is surreal and it is

144
00:08:27,740 --> 00:08:32,478
it's just it's thrilling and realize that
I have a leadership role in this, too,

145
00:08:32,612 --> 00:08:36,315
and I get to influence
what we're going to do on the Moon.

146
00:08:36,315 --> 00:08:40,820
For me, I think why it is so important
for us as humans to explore

147
00:08:40,953 --> 00:08:43,856

is that exploration kind of forces us

148
00:08:43,856 --> 00:08:47,894
to push ourselves
to the limits of our capacities.

149
00:08:48,227 --> 00:08:51,330
I think that that's really important
for us to do so that we can,

150
00:08:51,831 --> 00:08:55,301
you know, find those boundaries
and push them forward and see

151
00:08:55,301 --> 00:08:58,604
what's out there, see what we're made of,
see what the universe is made

152
00:08:58,604 --> 00:08:59,972
of and where we fit into it.

153
00:09:01,908 --> 00:09:04,744
The Moon's South Pole is an ideal location
for many reasons.

154
00:09:05,244 --> 00:09:08,180
One reason is that we've collected
more information about this

155
00:09:08,180 --> 00:09:11,484
region of the moon
than any other from a NASA orbiter

156
00:09:11,484 --> 00:09:15,354
that's been circling the moon
for more than a decade.

157
00:09:15,454 --> 00:09:18,791
On the next episode of NASA Explorers
Why the South Pole?

158
00:09:19,559 --> 00:09:23,262
What remaining questions do scientists
have about the moon and solar system