1
00:00:02,050 --> 00:00:05,780
>> And now we'll take a moment to look
at the future of human space flight

2
00:00:05,780 --> 00:00:08,070
with simulation of an asteroid mission.

3
00:00:08,070 --> 00:00:12,730
We'll go to the facility at the Johnson
Space Center where that's taking place

4
00:00:12,730 --> 00:00:15,540
with Public Affairs Officer Brandi Dean.

5
00:00:15,540 --> 00:00:19,550
>> Good morning, welcome to the Space
Vehicle Mockup Facility, or Building 9,

6
00:00:19,550 --> 00:00:22,340
as it's known here at Johnson Space Center.

7
00:00:22,340 --> 00:00:25,000
We've got some interesting
activities going on here today,

8
00:00:25,000 --> 00:00:27,090
a simulation of a mission to an asteroid.

9
00:00:27,090 --> 00:00:31,290
If you are regularly watching the ISS
update, you know that a lot of what we do is

10
00:00:31,290 --> 00:00:34,920
to get ready for future exploration, and
this is another activity that goes on here

11
00:00:34,920 --> 00:00:36,990
at Johnson Space Center to help us get ready.

12
00:00:36,990 --> 00:00:40,250
And to tell us about today, we've
got astronaut Mike Gernhardt here.

13
00:00:40,250 --> 00:00:41,240
Thanks for coming, Mike.

14
00:00:41,240 --> 00:00:44,470
>> Great. Well, it's nice to be here, and
what we're doing, it's very interesting,

15
00:00:44,470 --> 00:00:48,740
it's what's we call a three-day integrated
asteroid simulation, and we're doing it

16
00:00:48,740 --> 00:00:53,870
with the space exploration vehicle, which, some
of you know, started life as a lunar rover,

17
00:00:53,870 --> 00:00:56,620
and then it's morphed into an in-space vehicle.

18
00:00:56,620 --> 00:00:58,310
We replaced the chassis --

19
00:00:58,310 --> 00:00:59,020
>> The wheels, right?

20
00:00:59,020 --> 00:01:02,570
>> The wheels with a reaction-controlled
jet system.

21
00:01:02,570 --> 00:01:05,370
And so we've worked with the
engineering team here at NASA

22
00:01:05,370 --> 00:01:08,790
and we have developed this really great
integrated sim where we're actually living

23
00:01:08,790 --> 00:01:14,620
in the generation 2A space exploration
vehicle, and we have an asteroid sim,

24
00:01:14,620 --> 00:01:17,840
and we have that projected on a
big screen in front of the cabin,

25
00:01:17,840 --> 00:01:19,810
so we're actually flying around the asteroid.

26
00:01:19,810 --> 00:01:24,010
We have to find some standard protocols where we
do what we call the near-field survey, which is,

27
00:01:24,010 --> 00:01:27,440
we fly all the way around it at
30 to 50 meters off the surface.

28
00:01:27,440 --> 00:01:33,720
And then we have this 100-foot diameter area of
geological interest, and we simulated sampling

29
00:01:33,720 --> 00:01:37,760
with six cones, so we actually have to
fly the vehicle and the arm on the end

30
00:01:37,760 --> 00:01:39,590
of it up and touch the six cones.

31
00:01:39,590 --> 00:01:43,500
And we're measuring handling qualities of
the vehicle, we're looking at prop usage,

32
00:01:43,500 --> 00:01:49,530
we're looking at the, viewing out the windows,
the kinds of rendezvous tools we need.

33

00:01:49,530 --> 00:01:51,440
>> They're actually living in the cabin.

34
00:01:51,440 --> 00:01:55,420
>> They are living in the cabin for three days,
because we just finished building the cabin 2A,

35
00:01:55,420 --> 00:01:58,160
and we want to shake it out, what's
good about it, what's bad it, you know,

36
00:01:58,160 --> 00:02:00,510
what it's like to live and work until the cabin.

37
00:02:00,510 --> 00:02:04,130
>> Okay. And so now you've lived in the cabin
before, not this particular cabin, right.

38
00:02:04,130 --> 00:02:05,510
This is a new version of it.

39
00:02:05,510 --> 00:02:10,050
>> Well, I've lived in the 1A and the 1B up to
two weeks, and in December I lived in this cabin

40
00:02:10,050 --> 00:02:12,640
for three days doing a similar
sim to what we're doing today.

41
00:02:12,640 --> 00:02:12,900
>> Okay, okay.

42
00:02:12,900 --> 00:02:13,680
Well, how is it?

43
00:02:13,680 --> 00:02:14,300
What does it feel like?

44
00:02:14,300 --> 00:02:15,350

>> It is really cool.

45
00:02:15,350 --> 00:02:18,910
The asteroid sim is very high fidelity,

46
00:02:18,910 --> 00:02:22,660
and we've integrated the SAFER jet
packs from the virtual reality lab.

47
00:02:22,660 --> 00:02:23,820
>> Explain what SAFER is.

48
00:02:23,820 --> 00:02:27,940
>> So SAFER is a jet pack that we use
on Space Station if we should fall off

49
00:02:27,940 --> 00:02:32,320
and break our tether, it's a way to
fly back with cold gas propellant.

50
00:02:32,320 --> 00:02:38,430
And we have a virtual reality lab where we can
fly these SAFERs around in that environment.

51
00:02:38,430 --> 00:02:45,100
And we've managed to co-sync the
SAFER sim with the MMSEV sim.

52
00:02:45,100 --> 00:02:51,770
So we have one crew member on a jet pack flying
around while the vehicle is monitoring him

53
00:02:51,770 --> 00:02:55,270
and may be coming in and rendezvousing with
him while he gets in the arm to do samples.

54
00:02:55,270 --> 00:02:59,010
So we're really getting a very high
fidelity dynamics understanding

55
00:02:59,010 --> 00:03:01,730
of what it's like to work on an asteroid.

56
00:03:01,730 --> 00:03:04,820
And then we're able to start spinning
the asteroid at different rates

57
00:03:04,820 --> 00:03:06,650
and see what that does to your workload --

58
00:03:06,650 --> 00:03:08,660
>> Because we don't know what
asteroid we're going to yet, or how --

59
00:03:08,660 --> 00:03:11,520
>> We don't know exactly what asteroid we're
going to yet, and we're trying to develop a set

60
00:03:11,520 --> 00:03:15,030
of tools that will allow us to
optimize the hardware depending

61
00:03:15,030 --> 00:03:17,550
on the characteristics of the asteroid.

62
00:03:17,550 --> 00:03:18,310
>> Um-hum, okay.

63
00:03:18,310 --> 00:03:21,350
Well, we're going to be talking with some
more people later in the hour and we'll be

64
00:03:21,350 --> 00:03:24,360
over by the cabin that the crew is living in.

65
00:03:24,360 --> 00:03:27,950
But can you tell us a little bit about
what we've got behind us here right now?

66
00:03:27,950 --> 00:03:31,500
>> Yeah, so the other thing that we're doing
is every time we get out of the vehicle,

67
00:03:31,500 --> 00:03:34,400
we are getting into a suit
through the suit port.

68
00:03:35,780 --> 00:03:35,080
>> A space suit.

69
00:03:35,780 --> 00:03:39,100
This is our generation 2 suit for you,
and we're trying to evaluate the mechanics

70
00:03:39,100 --> 00:03:41,060
and the human factors of those suit ports.

71
00:03:41,060 --> 00:03:43,970
So we typically will do three short EVAs a day,

72
00:03:43,970 --> 00:03:46,550
so we're getting out of the
vehicle three times a day.

73
00:03:46,550 --> 00:03:50,330
Some of the times we go up to the SAFER
VR Lab, and the rest of the time we come

74
00:03:50,330 --> 00:03:55,660
over to this ARGOS facility which is --
it's basically a gravity offload system.

75
00:03:55,660 --> 00:03:55,810
>> Okay.

76
00:03:55,810 --> 00:03:58,200
>> It's an electromechanical control system.

77
00:03:58,200 --> 00:03:59,520
You get in the harness.

78
00:03:59,520 --> 00:04:03,190
We've got a number of different
sampling tasks with rocks here.

79
00:04:03,190 --> 00:04:07,530
We're evaluating different translation
lines, lightweight booms that we anchor

80
00:04:07,530 --> 00:04:10,340
and then move the other end, kind
of inchworm around it and so forth.

81
00:04:10,340 --> 00:04:10,840
>> Okay.

82
00:04:10,840 --> 00:04:14,800
>> And so we have a standard protocol that we're
doing here that we actually did at NEEMO 15,

83
00:04:14,800 --> 00:04:20,060
so we collected data from under the water and
that environment, which might be somewhat biased

84
00:04:20,060 --> 00:04:22,150
by the drag of this constantly, the water,

85
00:04:22,150 --> 00:04:24,440
and so we're repeating those
same tests here with ARGO.

86
00:04:24,440 --> 00:04:30,950
So they will do a six-sample collection
task here and deploy a seismic instrument.

87
00:04:30,950 --> 00:04:34,220
>> So it looks like they're getting

set up to do the next run now.

88
00:04:34,220 --> 00:04:36,880
Maybe if we draw it out a little bit,
we'll get to see a little bit of it.

89
00:04:36,880 --> 00:04:38,680
>> Maybe you'll get to see some of the suit up.

90
00:04:38,680 --> 00:04:45,320
>> Yeah, but, so this is one of, a suite
of the different ways that NASA looks

91
00:04:45,320 --> 00:04:47,130
at how we would explore an asteroid, right?

92
00:04:47,130 --> 00:04:47,830
>> Exactly.

93
00:04:47,830 --> 00:04:51,270
And we're looking at, you know, all aspects
of that from the robotic precursor to,

94
00:04:51,270 --> 00:04:53,630
you know, the infrastructure that we need.

95
00:04:53,630 --> 00:04:58,370
And right now, our basic plans are to have
a deep space habitat that we actually travel

96
00:04:58,370 --> 00:05:00,990
to the asteroid in, and then once we get there,

97
00:05:00,990 --> 00:05:05,150
we would transfer into the smaller space
exploration vehicle and then excur occur

98
00:05:05,150 --> 00:05:07,670
over to the asteroid and stay there for a week.

99
00:05:07,670 --> 00:05:11,150
And the reason we do that is that it
actually takes a lot of prop to get

100
00:05:11,150 --> 00:05:14,500
from the deep space habitat to the
asteroid if you want to go there fast,

101
00:05:14,500 --> 00:05:17,300
and then if you come back, you
have to take all that energy out.

102
00:05:17,300 --> 00:05:22,020
So it's much more sensible to go
over there and stay there for a week.

103
00:05:22,020 --> 00:05:26,810
So what we're doing in the simulation
is trying to create a high fidelity sim

104
00:05:26,810 --> 00:05:28,490
of what the operation really looks like.

105
00:05:28,490 --> 00:05:29,460
>> Um-hum.

106
00:05:29,460 --> 00:05:33,440
>> That helps us do the habitability
analysis of the cabin.

107
00:05:33,440 --> 00:05:35,930
Because if you were just
sitting in the cabin, you know,

108
00:05:35,930 --> 00:05:39,400
playing Parcheesi all day,
that's not flight-like.

109

00:05:39,400 --> 00:05:44,250
And so, you know, we have a very tight
timeline from morning until night

110
00:05:44,250 --> 00:05:45,960
where we're flying the near-field survey.

111
00:05:45,960 --> 00:05:47,470
We do the ARGOS, we do the SAFER.

112
00:05:47,470 --> 00:05:49,900
We've got a bunch of other stuff
we're doing inside the vehicle.

113
00:05:49,900 --> 00:05:53,700
So to a crew member, it feels
a lot like an asteroid mission.

114
00:05:53,700 --> 00:05:58,270
You know, on top of that, we're
simulating the time delay associated

115
00:05:58,270 --> 00:06:03,130
with the 50 seconds each way that it
would take to talk to the ground --

116
00:06:03,130 --> 00:06:07,400
>> It would take their voice, if we send
something up, that long to get to the crew

117
00:06:07,400 --> 00:06:08,450
in space because it's so far away.

118
00:06:08,450 --> 00:06:09,900
>> It would take that long
to get to the crew in space.

119
00:06:09,900 --> 00:06:13,900
And so we really need to understand what
that means to how we manage our operations,

120
00:06:13,900 --> 00:06:15,400
how we manage our systems and so forth.

121
00:06:15,400 --> 00:06:21,490
And so what our whole team is trying to do
is understand that whole mission at a nuts

122
00:06:21,490 --> 00:06:24,140
and bolts level, and not at an
architectural level, but at the nuts

123
00:06:24,140 --> 00:06:26,050
and bolts, how you would really execute it.

124
00:06:26,050 --> 00:06:31,110
And from that knowledge, we can then design
the right hardware from the beginning instead

125
00:06:31,110 --> 00:06:35,160
of having, you know, develop this hardware
and then you start doing some ops with it

126
00:06:35,160 --> 00:06:36,780
and you say, I don't like, I don't like that.

127
00:06:36,780 --> 00:06:39,190
>> You don't want to get the asteroid and
figure out you don't have the right tools.

128
00:06:39,190 --> 00:06:39,870
>> Exactly.

129
00:06:39,870 --> 00:06:40,150
>> Okay.

130
00:06:40,150 --> 00:06:43,780
>> So we're working years ahead of
that to understand those things.

131
00:06:43,780 --> 00:06:46,820
>> Well, along that line, I guess this
is Jose Hurtado who is getting set up,

132
00:06:46,820 --> 00:06:50,610
a geologist with the University
in El Paso, right?

133
00:06:50,610 --> 00:06:51,770
>> Exactly, yeah.

134
00:06:51,770 --> 00:06:54,370
>> So why have a geologist involved?

135
00:06:54,370 --> 00:06:55,450
>> That's a good question.

136
00:06:55,450 --> 00:06:58,940
I actually lived in the rover
with Jose a couple of summers ago,

137
00:06:58,940 --> 00:07:04,120
and we're trying to really understand, and we
do this at Desert RATS, but we do real geology.

138
00:07:04,120 --> 00:07:05,620
And we actually have metrics

139
00:07:05,620 --> 00:07:10,590
where the professional geologists score how
productive we are and the conclusions we reach

140
00:07:10,590 --> 00:07:15,100
so we can evaluate different combinations
of cameras and tools and so forth.

141
00:07:15,100 --> 00:07:20,830
And so I think it's very important to engage the

scientific community in this evolving process

142
00:07:20,830 --> 00:07:25,670
so that we can, you know, really do the
best science we can when we get there.

143
00:07:25,670 --> 00:07:30,270
>> Okay. And the other half of the
crew this time is astronaut Alvin Drew.

144
00:07:30,270 --> 00:07:30,750
>> Exactly.

145
00:07:30,750 --> 00:07:32,460
>> And we also want the astronaut
perspective, I'm sure.

146
00:07:32,460 --> 00:07:33,030
>> Absolutely.

147
00:07:33,030 --> 00:07:35,960
And so that's what we've done traditionally
in Desert RATS is team an astronaut

148
00:07:35,960 --> 00:07:41,470
up with a professional geologist, and that kind
of helps us learn geology, which, you know,

149
00:07:41,470 --> 00:07:45,640
that's kind of where the astronaut
obviously is going is to become, you know,

150
00:07:45,640 --> 00:07:48,140
an observational scientist
as well as an astronaut.

151
00:07:48,140 --> 00:07:51,760
Because any one of these exploration
missions, whether it be the moon, Mars,

152
00:07:51,760 --> 00:07:55,840
meteors and so forth, we're going to need
to become good observational scientists.

153
00:07:55,840 --> 00:07:59,830
And the scientists say that we're actually
the best scientific instrument they have.

154
00:07:59,830 --> 00:08:05,550
And so we're trying to get that cultural change
from, you know, test pilots and farm operators

155
00:08:05,550 --> 00:08:10,930
and very procedure-oriented folks to do more
of the operational observational science.

156
00:08:10,930 --> 00:08:13,080
>> All right, well lots of
cool stuff going on there.

157
00:08:13,080 --> 00:08:14,050
>> You bet, you bet.

158
00:08:14,050 --> 00:08:15,290
>> Okay. Thanks so much for talking with us.

159
00:08:15,290 --> 00:08:16,390
>> Okay. Nice to see you.

160
00:08:16,390 --> 00:08:19,530
>> Okay, and this is all
part of the RATS, or Research

161
00:08:19,530 --> 00:08:22,680
and Technology Studies series
of tests that we do.

162
00:08:22,680 --> 00:08:27,890
So if you want to go and find out more

online, you can visit NASA.gov/desertrats.

163
00:08:27,890 --> 00:08:31,260
Again, that's NASA.gov/desertrats, and
we'll go back to Kiley [phonetic] for now,