1
00:00:01,040 --> 00:00:01,770
>> Again, we're back in here

2
00:00:01,770 --> 00:00:03,990
in the Space Vehicle Mock-Up
Facility in building nine,

3
00:00:03,990 --> 00:00:06,470
and this time we're
over in the ARGOS area

4
00:00:06,470 --> 00:00:09,270
with the ARGOS project
manager, Larry Duncan.

5
00:00:09,270 --> 00:00:10,410
Thanks for coming and
talking with us, Larry.

6
00:00:10,410 --> 00:00:11,350
>> Thanks for coming over.

7
00:00:11,350 --> 00:00:12,870
>> So ARGOS, it's an acronym.

8
00:00:12,870 --> 00:00:13,830
What does that stand for?

9
00:00:13,830 --> 00:00:16,770
>> It's the Active Response
Gravity Offload System.

10
00:00:16,770 --> 00:00:19,280
So what we basically do is
we make you feel like you're

11
00:00:19,280 --> 00:00:21,380
on the moon, Mars,
or microgravity

12
00:00:21,380 --> 00:00:22,730
with a full robotic system.

13
00:00:22,730 --> 00:00:23,920
So this whole entire,

14
00:00:23,920 --> 00:00:27,180
large structure is a large
motion-based platform.

15
00:00:27,180 --> 00:00:29,750
And so what we're doing,
we have a crewmember

16
00:00:29,750 --> 00:00:31,010
in the system today.

17
00:00:31,010 --> 00:00:33,390
He is in microgravity
doing asteroid simulation.

18
00:00:33,390 --> 00:00:35,130
And he we have him
in microgravity,

19
00:00:35,130 --> 00:00:38,170
so we're offloading 100
percent of his weight.

20
00:00:38,170 --> 00:00:40,400
>> So he feels, basically, like
he's in space, then, right?

21
00:00:40,400 --> 00:00:41,640
>> Basically like
he is in space.

22
00:00:41,640 --> 00:00:45,460

>> Wow. So -- and we use
that to simulate space walks?

23
00:00:45,460 --> 00:00:46,160
>> Space walks.

24
00:00:46,160 --> 00:00:47,200
We can do crew training.

25
00:00:47,200 --> 00:00:48,740
We can do equipment testing.

26
00:00:48,740 --> 00:00:50,290
We can actually do what's
called mass hailing,

27
00:00:50,290 --> 00:00:52,870
where we can float an object
and have people feel like it's

28
00:00:52,870 --> 00:00:55,240
to move a large item
around in space.

29
00:00:55,240 --> 00:00:57,340
We've done robotic legs.

30
00:00:57,340 --> 00:00:57,920
>> Very cool.

31
00:00:57,920 --> 00:01:01,260
So what are we using
it for for RATS?

32
00:01:01,260 --> 00:01:03,990
>> It is being used
for EDAs simulations,

33
00:01:03,990 --> 00:01:04,460

so what they're doing --

34
00:01:04,460 --> 00:01:04,870
>> Spacewalk.

35
00:01:04,870 --> 00:01:05,550
>> Spacewalks.

36
00:01:05,550 --> 00:01:08,390
So yesterday they came out of
the cabin and did a spacewalk

37
00:01:08,390 --> 00:01:10,350
in ARGOS, and then we
go back into the cabin.

38
00:01:10,350 --> 00:01:11,570
We're doing the same
thing tomorrow.

39
00:01:11,570 --> 00:01:13,540
>> So the cabin is the
space exploration vehicle.

40
00:01:13,540 --> 00:01:16,290
That's kind of their home
away from home for a short one

41
00:01:16,290 --> 00:01:18,730
or two week excursion, but
they probably want to get

42
00:01:18,730 --> 00:01:21,090
out of the vehicle and
actually do some hands on work

43
00:01:21,090 --> 00:01:23,020
with the surface
of the asteroid.

44
00:01:23,020 --> 00:01:24,150
And that's where the
spacewalks come in.

45
00:01:24,150 --> 00:01:25,410
>> Right. That's correct.

46
00:01:25,410 --> 00:01:27,830
And today, we're doing a
stand-alone simulation that's

47
00:01:27,830 --> 00:01:30,910
actually comparing ARGOS
to the NEMO simulation

48
00:01:30,910 --> 00:01:32,460
that was done earlier
this summer

49
00:01:32,460 --> 00:01:33,660
down in Key Largo, Florida.

50
00:01:33,660 --> 00:01:36,000
>> NEMO, of course,
our underwater analog.

51
00:01:36,000 --> 00:01:39,020
RATS is our wood analog,
and NEMO is another one,

52
00:01:39,020 --> 00:01:41,320
go underwater to simulate
a mission to an asteroid.

53
00:01:41,320 --> 00:01:42,180
>> So one of the
things we're looking

54
00:01:42,180 --> 00:01:46,180

at is each analog has
its own pros and cons,

55
00:01:46,180 --> 00:01:47,840
and so we're doing a
comparision of the two of them

56
00:01:47,840 --> 00:01:49,510
with the simulation today.

57
00:01:49,510 --> 00:01:52,140
So what he's doing right
now is coming down a boom

58
00:01:52,140 --> 00:01:56,590
that he would have deployed off
of a vehicle and is coming down

59
00:01:56,590 --> 00:02:01,060
and preparing to take a core
sample or deploy a geological

60
00:02:01,060 --> 00:02:03,440
or a geophysical instrument.

61
00:02:03,440 --> 00:02:04,050
>> Very cool.

62
00:02:04,050 --> 00:02:06,830
So this -- tell us a
little bit about booms.

63
00:02:06,830 --> 00:02:08,880
Why -- you know, one of the
things about asteroids is

64
00:02:08,880 --> 00:02:10,540
that they're hard
to move around on.

65
00:02:10,540 --> 00:02:11,540
What is that about?

66
00:02:11,540 --> 00:02:13,580
>> In microgravity,
it's very hard to move

67
00:02:13,580 --> 00:02:16,280
around because you don't have
any ground reaction force.

68
00:02:16,280 --> 00:02:18,520
If you push off something,
you will float away.

69
00:02:18,520 --> 00:02:20,320
So the boom gives
you a work surface.

70
00:02:20,320 --> 00:02:22,810
On Space Station, they have
handrails and tether points,

71
00:02:22,810 --> 00:02:25,810
and all that was built
before the ISS was launched.

72
00:02:25,810 --> 00:02:27,060
>> Built for people to use --

73
00:02:27,060 --> 00:02:27,170
>> Yes.

74
00:02:27,170 --> 00:02:28,280
>> -- Specifically
for that reason.

75
00:02:28,280 --> 00:02:29,040
>> For that reason.

76
00:02:29,040 --> 00:02:29,520
>> Asteroids, not so much.

77
00:02:29,520 --> 00:02:31,850
>> Asteroids are going to be
a little bit more challenging.

78
00:02:31,850 --> 00:02:34,020
So the idea is with the boom
is you can come off the back

79
00:02:34,020 --> 00:02:36,530
of the vehicle, deploy, let's
say, a large robotic arm

80
00:02:36,530 --> 00:02:39,300
or a boom, and then you could go
out and use that to work off of.

81
00:02:39,300 --> 00:02:41,260
Kind of like a workbench
or a work platform.

82
00:02:41,260 --> 00:02:42,850
>> Okay, kind of just
like he was doing,

83
00:02:42,850 --> 00:02:44,390
moving hand-over-hand --

84
00:02:44,390 --> 00:02:46,230
>> Hand-over-hand.

85
00:02:46,230 --> 00:02:48,040
>> -- Along the boom to
get to different areas

86
00:02:48,040 --> 00:02:48,860

that he might be interested in.

87
00:02:48,860 --> 00:02:49,680
>> Yes. That's correct.

88
00:02:49,680 --> 00:02:51,930
>> Okay. And then what
do you do once you get

89
00:02:51,930 --> 00:02:52,990
to where you want to go?

90
00:02:52,990 --> 00:02:53,920
>> Like, what he's getting ready

91
00:02:53,920 --> 00:02:57,130
to do here is deploy a
simulated geological instrument

92
00:02:57,130 --> 00:02:58,630
that you would leave
behind on the asteroid

93
00:02:58,630 --> 00:03:00,930
to take future readings,
similar, like, what we've left

94
00:03:00,930 --> 00:03:02,660
on the moon when we went there.

95
00:03:02,660 --> 00:03:03,030
>> Okay. All right.

96
00:03:03,030 --> 00:03:05,000
And that's one of
the many things

97
00:03:05,000 --> 00:03:06,580
that you all are simulating

during these spacewalks.

98
00:03:06,580 --> 00:03:07,500
What are some of the other ones?

99
00:03:07,500 --> 00:03:09,630
>> We're simulating doing
sample collections of rocks.

100
00:03:09,630 --> 00:03:10,520
How do you pick up rocks?

101
00:03:10,520 --> 00:03:13,150
How do you pick up all
different types of rocks?

102
00:03:13,150 --> 00:03:14,820
We're not really sure
what an asteroid is.

103
00:03:14,820 --> 00:03:15,740
It can be gravel.

104
00:03:15,740 --> 00:03:17,500
It could be large
pieces of rock.

105
00:03:17,500 --> 00:03:19,370
It can be, like, sand-like.

106
00:03:19,370 --> 00:03:21,320
So what they do is they come
in and take different samples

107
00:03:21,320 --> 00:03:24,620
of picking up the rock, taking,
like, a core sample in sand,

108
00:03:24,620 --> 00:03:25,830

where you're maybe
wanting to get a piece

109
00:03:25,830 --> 00:03:27,730
from a couple feet
under the ground.

110
00:03:27,730 --> 00:03:29,920
And then, also, if you've got
a really big rock that's really

111
00:03:29,920 --> 00:03:32,280
interesting, how do
you break a chip off

112
00:03:32,280 --> 00:03:33,060
of that and bring it home?

113
00:03:33,060 --> 00:03:34,660
It's a whole lot
harder than just taking

114
00:03:34,660 --> 00:03:35,840
and hitting a rock on the earth.

115
00:03:35,840 --> 00:03:37,660
>> We don't have enough room
to bring the big rocks with us.

116
00:03:37,660 --> 00:03:38,120
>> That's right.

117
00:03:38,120 --> 00:03:39,850
>> And I think you've
got some stuff to show us

118
00:03:39,850 --> 00:03:42,470
with ways we could do that.

119

00:03:43,600 --> 00:03:46,750
>> So this here is some of the
rocks that we take samples with.

120
00:03:46,750 --> 00:03:48,480
We've done simulations on
this where they have to come

121
00:03:48,480 --> 00:03:50,170
in with a bag and pick them up.

122
00:03:50,170 --> 00:03:54,800
And it's -- you know, the Apollo
astronauts had several thousand

123
00:03:54,800 --> 00:03:57,320
hours of geology training before
they ever went to the moon.

124
00:03:57,320 --> 00:03:59,880
It would be the similar training
if they went to an asteroid,

125
00:03:59,880 --> 00:04:01,520
and they would be taught
how to pick up rocks,

126
00:04:01,520 --> 00:04:02,920
how not to contaminate them.

127
00:04:02,920 --> 00:04:03,290
>> Okay.

128
00:04:03,290 --> 00:04:05,290
>> One of the real
challenges of an asteroid

129
00:04:05,290 --> 00:04:07,410
versus the moon is how
do you take a rock sample

130
00:04:07,410 --> 00:04:09,630
of something that
will float away?

131
00:04:09,630 --> 00:04:14,070
So another group has developed
a bag that is literally, it's --

132
00:04:14,070 --> 00:04:15,870
the idea is that it's got
wire in it to stiffen it,

133
00:04:15,870 --> 00:04:19,150
and you would wrap this around a
rock, and then you could come in

134
00:04:19,150 --> 00:04:22,480
and do hammer chipping and
chip a piece off and have

135
00:04:22,480 --> 00:04:25,270
that rock chip contained
inside of this area.

136
00:04:25,270 --> 00:04:28,920
And then you could take it away
and then collect your sample.

137
00:04:28,920 --> 00:04:30,460
>> Otherwise, you start
banging at the rocks.

138
00:04:30,460 --> 00:04:32,310
They fly into pieces, and
you've lost them, right?

139
00:04:32,310 --> 00:04:33,360
>> It's just going
to go all over.

140
00:04:33,360 --> 00:04:34,580
>> Okay. So there's lots

141
00:04:34,580 --> 00:04:36,050
of different things we
need learn before we go

142
00:04:36,050 --> 00:04:36,720
to an asteroid.

143
00:04:36,720 --> 00:04:37,310
>> That's correct.

144
00:04:37,310 --> 00:04:39,730
>> And RATS is a great
way to get started on some

145
00:04:39,730 --> 00:04:41,650
of those lessons
we need to learn.

146
00:04:41,650 --> 00:04:43,510
>> Right. And some of it
is you're building early

147
00:04:43,510 --> 00:04:44,380
prototype tools.

148
00:04:44,380 --> 00:04:46,960
You can test out the tools,
see if they need improvement.

149
00:04:46,960 --> 00:04:49,000
You know, you really
have to design, build,

150
00:04:49,000 --> 00:04:50,410
and test something

to understand it.

151
00:04:50,410 --> 00:04:52,020
>> And then, I guess,
with ARGOS in particular,

152
00:04:52,020 --> 00:04:54,870
it's more do we have
the stuff we need

153
00:04:54,870 --> 00:04:58,060
to simulate an asteroid
spacewalk before send people

154
00:04:58,060 --> 00:04:59,280
out to go do one.

155
00:04:59,280 --> 00:05:00,070
>> That's correct.

156
00:05:00,070 --> 00:05:01,100
>> And so far, so good?

157
00:05:01,100 --> 00:05:01,740
>> So far, so good.

158
00:05:01,740 --> 00:05:03,410
This is our second-generation
system.

159
00:05:03,410 --> 00:05:05,540
We actually started the
project about five years ago.

160
00:05:05,540 --> 00:05:08,490
Our generation-one system
worked very well, but we came in

161
00:05:08,490 --> 00:05:09,790

and made a lot of improvements.

162
00:05:09,790 --> 00:05:12,090
The system we have here,
we brought online right

163
00:05:12,090 --> 00:05:16,580
after Christmas, and it's been
used very heavily since then.

164
00:05:16,580 --> 00:05:16,990
>> Very heavily.

165
00:05:16,990 --> 00:05:18,310
I know we've been
here a few times now.

166
00:05:18,310 --> 00:05:20,000
So thank you so much,
Larry, for coming

167
00:05:20,000 --> 00:05:20,920
and talking with us again.

168
00:05:20,920 --> 00:05:24,240
Larry Duncan, who is the project
manager for the ARGOS system,