1
00:00:00,546 --> 00:00:03,196
>> Hi. Welcome back
to Building 9,

2
00:00:03,356 --> 00:00:04,946
the Space Vehicle
Mockup Facility.

3
00:00:04,946 --> 00:00:08,506
We're back with the RATS group,
Research and Technology Studies,

4
00:00:08,506 --> 00:00:10,216
and this time we're
talking with Steven Rader,

5
00:00:10,586 --> 00:00:13,086
who is the data manager
for analogs.

6
00:00:13,086 --> 00:00:15,986
Analogs are ways that we
simulate missions here

7
00:00:15,986 --> 00:00:17,556
on the ground, and in this case,

8
00:00:17,556 --> 00:00:20,806
we're doing again an asteroid
simulation, and he is working

9
00:00:20,806 --> 00:00:22,356
on a lot of different
aspects of that.

10
00:00:22,356 --> 00:00:23,856
Why don't you tell us a little
bit about what all you do?

11

00:00:24,096 --> 00:00:24,286
>> Steve Rader: OK.

12
00:00:24,676 --> 00:00:28,046
Well, I work a lot with the
integration of the systems,

13
00:00:28,046 --> 00:00:30,216
making sure that all of
these different projects

14
00:00:30,276 --> 00:00:33,096
that come together for analogs,
that their software can talk,

15
00:00:33,196 --> 00:00:35,346
that all of their systems
can talk on our networks,

16
00:00:36,036 --> 00:00:39,396
and that they will all
work with opposite systems

17
00:00:39,576 --> 00:00:43,346
like control centers and our
little control work stations we

18
00:00:43,346 --> 00:00:44,246
have all around here.

19
00:00:44,786 --> 00:00:48,546
And then I make sure that
we can get all those systems

20
00:00:48,546 --> 00:00:50,116
to work over the delay com.

21
00:00:50,276 --> 00:00:52,886
So what we actually have
is here communications

22
00:00:52,956 --> 00:00:55,556
that are 50-second
delayed one way.

23
00:00:55,716 --> 00:00:58,076
So to the asteroid would
be one way light time,

24
00:00:58,496 --> 00:01:00,526
and back would be
50 seconds as well.

25
00:01:00,596 --> 00:01:03,346
So for me to have a
conversation with you,

26
00:01:03,496 --> 00:01:05,356
it would take 50 seconds
for you to hear me

27
00:01:05,676 --> 00:01:08,476
and then 50 more seconds for
me to hear your response.

28
00:01:08,566 --> 00:01:11,746
So a minute and a half for
any round trip conversations

29
00:01:11,746 --> 00:01:12,076
we have.

30
00:01:12,296 --> 00:01:13,276
>> Should we demonstrate
that [inaudible]?

31
00:01:13,466 --> 00:01:13,906
Maybe not -

32

00:01:13,986 --> 00:01:15,376
>> Steve Rader: It might
be kind of boring -

33
00:01:15,376 --> 00:01:15,836
>> A little boring.

34
00:01:15,836 --> 00:01:17,556
OK. Well, tell us a little bit

35
00:01:17,676 --> 00:01:20,456
about why we're delaying
the communications at all.

36
00:01:20,456 --> 00:01:20,566
>> Steve Rader: Right -

37
00:01:21,026 --> 00:01:21,116
>> What -

38
00:01:21,116 --> 00:01:21,296
>> Steve Rader: Sure.

39
00:01:21,296 --> 00:01:23,846
Well, like I said, the light
time, the time it takes light

40
00:01:23,986 --> 00:01:26,006
to travel, which is the time
it takes our radio signals

41
00:01:26,056 --> 00:01:29,476
to travel increases as
we go out from Earth.

42
00:01:29,886 --> 00:01:31,566
And so, for instance,
Curiosity is going

43

00:01:31,566 --> 00:01:33,366
to be landing here
in a few weeks.

44
00:01:33,606 --> 00:01:35,786
It's on Mars, and at
this point in its orbit,

45
00:01:35,786 --> 00:01:39,096
it's about 14 minutes for
light to travel all the way

46
00:01:39,096 --> 00:01:40,276
out to Mars from the Earth.

47
00:01:40,596 --> 00:01:43,986
And so for them, it takes 14
minutes for a command to go

48
00:01:43,986 --> 00:01:45,676
to that vehicle, and it
takes another 14 minutes

49
00:01:45,796 --> 00:01:46,896
for data to come back.

50
00:01:47,366 --> 00:01:50,336
So we're practicing for an
asteroid that's not quite

51
00:01:50,416 --> 00:01:53,276
that far out but still
significantly far out.

52
00:01:53,616 --> 00:01:55,606
The moon is about four seconds.

53
00:01:56,146 --> 00:01:59,196
And so because we're
sending crews,

54
00:01:59,196 --> 00:02:01,796
we have an additional
dynamic of humans in the loop,

55
00:02:02,286 --> 00:02:04,156
and those humans are,
for the most part,

56
00:02:04,316 --> 00:02:06,186
used to a conversation
with the ground,

57
00:02:06,386 --> 00:02:07,686
the ground control,
mission control.

58
00:02:08,206 --> 00:02:12,606
And so we're trying to
develop new ways to communicate

59
00:02:12,606 --> 00:02:15,546
and to understand how
much autonomy they need,

60
00:02:15,966 --> 00:02:18,156
what their roles are
versus the ground role,

61
00:02:18,186 --> 00:02:20,146
and then when they
do have interactions,

62
00:02:20,146 --> 00:02:21,176
how do we best do that.

63
00:02:21,536 --> 00:02:23,646
So a good example of
that would be texting.

64
00:02:24,166 --> 00:02:27,236
We actually don't use
texting currently very much

65
00:02:27,346 --> 00:02:29,876
on the space station because
we can have those real-time

66
00:02:29,946 --> 00:02:32,226
conversations, but we started

67
00:02:32,346 --> 00:02:35,486
in the analogs testing
using texting as a way

68
00:02:35,546 --> 00:02:37,656
to communicate better
because people are really used

69
00:02:37,726 --> 00:02:41,276
to that paradigm of using
asynchronous messaging

70
00:02:41,276 --> 00:02:44,776
or messages that get there not
when you're expecting them,

71
00:02:44,876 --> 00:02:46,646
and you read them a little
later and then you respond,

72
00:02:47,046 --> 00:02:49,526
and how that message
flow works and how

73
00:02:49,526 --> 00:02:50,466
that works with operations.

74
00:02:50,996 --> 00:02:52,936

>> And you've done this a
few times now with, I guess,

75
00:02:52,936 --> 00:02:54,506
maybe desert RATS last year,

76
00:02:54,626 --> 00:02:55,996
and certainly the Nemo
mission this year -

77
00:02:56,116 --> 00:02:58,306
>> Steve Rader: Yeah, and then
the resolve payloads as well

78
00:02:58,306 --> 00:02:59,716
that we've been doing
[crosstalk].

79
00:03:00,046 --> 00:03:01,936
All of these analogs,
and they all kind

80
00:03:01,936 --> 00:03:04,916
of converge towards answering
some of those questions

81
00:03:05,016 --> 00:03:07,476
and helping us develop
the right tools to deal

82
00:03:07,476 --> 00:03:08,326
with these situations -

83
00:03:08,456 --> 00:03:09,756
>> And it sounds
like a small thing.

84
00:03:09,886 --> 00:03:11,106
You know, you just
wait a few minutes,

85
00:03:11,106 --> 00:03:13,556
and you get your answer,
but, I mean, it's a big deal.

86
00:03:13,626 --> 00:03:14,846
It's something we have to figure

87
00:03:14,846 --> 00:03:16,746
out before we go to,
say, Mars, right -

88
00:03:16,746 --> 00:03:17,156
>> Steve Rader: It is.

89
00:03:17,156 --> 00:03:21,036
Absolutely, because it changes
depending on what you're doing,

90
00:03:21,126 --> 00:03:23,306
how important that thing
is, how [inaudible].

91
00:03:23,396 --> 00:03:25,936
You know, in other words,
if there's a problem,

92
00:03:26,436 --> 00:03:29,416
how long it takes
something bad to happen.

93
00:03:29,756 --> 00:03:31,116
So we call that time to effect.

94
00:03:31,556 --> 00:03:33,336
If, there's a valve you turn,

95
00:03:33,336 --> 00:03:36,546
and you start hearing a

hissing noise, is that going

96
00:03:36,546 --> 00:03:38,936
to affect me in a
minute or five minutes -

97
00:03:39,136 --> 00:03:40,526
>> Do you have the 14 minutes -

98
00:03:40,706 --> 00:03:40,916
>> Steve Rader: Right.

99
00:03:40,956 --> 00:03:43,016
Do I have time [crosstalk]
to ask a question

100
00:03:43,016 --> 00:03:45,526
and get an answer before
that bad thing happens.

101
00:03:45,526 --> 00:03:48,166
So you kind of have to think
through all of that in terms

102
00:03:48,166 --> 00:03:50,686
of what you train crews
for, but also the tool set

103
00:03:50,686 --> 00:03:52,166
that you provide them.

104
00:03:52,166 --> 00:03:55,356
We did some simulations on Nemo
where we were using the crews,

105
00:03:55,726 --> 00:03:58,056
and we were using five-minute
and ten-minute delays

106

00:03:58,476 --> 00:04:01,326
where we had emergencies,
and during those emergencies,

107
00:04:01,326 --> 00:04:03,586
what we found is if
we weren't careful,

108
00:04:03,586 --> 00:04:08,316
the ground would acknowledge a
message from the crew and say,

109
00:04:08,316 --> 00:04:09,496
you know, we heard that.

110
00:04:09,546 --> 00:04:10,316
Now do this.

111
00:04:10,716 --> 00:04:13,436
By the time the crew
got that direction,

112
00:04:13,686 --> 00:04:15,646
their situation had
changed significantly,

113
00:04:15,956 --> 00:04:17,406
and that was actually
the wrong direction

114
00:04:17,406 --> 00:04:18,436
to give them at that point.

115
00:04:18,866 --> 00:04:22,026
And so a better understanding
of the context of what,

116
00:04:22,386 --> 00:04:24,116
when somebody says
something and why.

117
00:04:24,576 --> 00:04:27,976
Is tools we're working
on how to facilitate

118
00:04:28,026 --> 00:04:28,786
that if that make sense -

119
00:04:28,786 --> 00:04:29,846
>> Right. So do you feel

120
00:04:29,846 --> 00:04:31,416
like we're making good
progress, and we're going to -

121
00:04:31,456 --> 00:04:31,596
>> Steve Rader: Yeah -

122
00:04:31,786 --> 00:04:33,116
>> Learn a lot that's going
to help us in the future?

123
00:04:33,186 --> 00:04:33,866
>> Steve Rader: Absolutely.

124
00:04:33,866 --> 00:04:37,136
We're working on several
mitigation techniques,

125
00:04:37,246 --> 00:04:39,406
several studies to
understand impact,

126
00:04:39,856 --> 00:04:42,816
and those we're actually
starting to meet together

127
00:04:43,246 --> 00:04:44,666
with all of the different

analogs

128
00:04:44,796 --> 00:04:48,956
to really understand that, and
then some of that will be used

129
00:04:49,046 --> 00:04:51,846
in our testing, our new analog
that we'll be doing iStar,

130
00:04:52,156 --> 00:04:53,616
which will actually
have crew members

131
00:04:53,676 --> 00:04:56,696
on the space station using
delayed com back to Earth

132
00:04:57,186 --> 00:04:59,116
in a more operational scenario -

133
00:04:59,226 --> 00:05:01,016
>> Right. So it just
keeps getting more

134
00:05:01,016 --> 00:05:02,096
and more realistic, right -

135
00:05:02,346 --> 00:05:02,516
>> Steve Rader: Right.