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00:00:01,280 --> 00:00:04,530  
>> We're back here in Building 9  
this time talking with Zack Crues,

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00:00:04,530 --> 00:00:06,050  
who is the modeling and simulation lead.

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00:00:06,050 --> 00:00:08,740  
He is going to tell us about  
what's going on behind us here

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00:00:08,740 --> 00:00:10,890  
with the space exploration vehicle mock up.

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00:00:10,890 --> 00:00:12,560  
Thank so much for joining us, Zack.

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00:00:12,560 --> 00:00:13,780  
>> Zack Crues: It's my pleasure.

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00:00:13,780 --> 00:00:17,210  
>> Okay. So, tell us a little bit about  
modeling and simulation, what that means

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00:00:17,210 --> 00:00:19,770  
and what it has to do with this test.

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00:00:19,770 --> 00:00:22,820  
>> Zack Crues: The importance of  
modeling and simulation in this test is

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00:00:22,820 --> 00:00:25,220  
that we really can't be in deep space.

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00:00:25,220 --> 00:00:30,240  
We've never been there before and  
so in order to set up an environment

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00:00:30,240 --> 00:00:33,880

which we can get information about the next missions that we're going to go forward,

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00:00:33,880 --> 00:00:37,830

we need to set that up in a digital environment or computer environment

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00:00:37,830 --> 00:00:40,440

that we can immerse the astronauts in.

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00:00:40,440 --> 00:00:43,790

And so this is the space exploration vehicle mock up that we have here.

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00:00:43,790 --> 00:00:45,630

>> This is where two people are living for three days.

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00:00:45,630 --> 00:00:46,790

>> Zack Crues: That is correct.

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00:00:46,790 --> 00:00:50,230

And we have that hooked up to a series of computers that are right behind it

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00:00:50,230 --> 00:00:53,470

that drive the display in front and what that does is it gives kind

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00:00:53,470 --> 00:00:58,310

of a next generation Star Trek holodeck environment that they can go into

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00:00:58,310 --> 00:01:02,480

and they can fly the SEV and they can get information about the performance

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00:01:02,480 --> 00:01:07,470

of the space exploration vehicle in how

much mass it's gonna have to have as far

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00:01:07,470 --> 00:01:11,620  
as propellant to understand the operational  
environment that they're going to be working

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00:01:11,620 --> 00:01:15,210  
in around the asteroid, things  
that we have never done before

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00:01:15,210 --> 00:01:20,360  
but we're taking the experiences that we had  
in human space flight for the shuttle program

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00:01:20,360 --> 00:01:23,700  
for the space station program,  
for the constellation program

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00:01:23,700 --> 00:01:27,910  
and taking those technologies specifically  
the models and sims that we have

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00:01:27,910 --> 00:01:30,820  
and our operational experience  
and merging those together

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00:01:30,820 --> 00:01:33,820  
and exploring the next steps  
in exploration for NASA.

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00:01:33,820 --> 00:01:34,360  
>> Very interesting.

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00:01:34,360 --> 00:01:36,670  
And you've been doing this for  
different vehicles for a while, right?

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00:01:36,670 --> 00:01:37,180  
>> Zack Crues: Yes, I have.

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00:01:37,180 --> 00:01:42,140

I've been involved in shuttle modeling  
and simulation, space station modeling

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00:01:42,140 --> 00:01:45,350

and simulation constellation and  
now I've got the pleasure of working

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00:01:45,350 --> 00:01:47,880

on our next generation space  
exploration vehicle.

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00:01:47,880 --> 00:01:49,840

>> It's definitely cool work.

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00:01:49,840 --> 00:01:55,730

So I don't know how well people can see it  
behind us here there's a projection screen

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00:01:55,730 --> 00:01:58,140

that has a view of the asteroid I guess.

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00:01:58,140 --> 00:01:58,610

>> Zack Crues: That's correct.

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00:01:58,610 --> 00:02:01,930

>> And we're seeing the back of  
the space exploration vehicle cabin

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00:02:01,930 --> 00:02:05,190

with the space suit hanging off of  
it and on the front is the window

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00:02:05,190 --> 00:02:07,320

where they actually see what they're exploring.

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00:02:07,320 --> 00:02:07,770

>> Zack Crues: That's correct.

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00:02:07,770 --> 00:02:12,990  
So, we have a projector that you can actually  
see projecting an image that pertains

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00:02:12,990 --> 00:02:15,920  
to the view that the astronaut  
would see sitting in the seats.

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00:02:15,920 --> 00:02:19,720  
We have to tune it very specifically for where  
they are in the cabin and what they're looking

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00:02:19,720 --> 00:02:26,640  
at and then we actually have a simulation that  
goes and reproduces the dynamics of the vehicle

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00:02:26,640 --> 00:02:28,550  
as they put in fluster commands, as they fly

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00:02:28,550 --> 00:02:32,360  
around the asteroid it gives them the  
perspective including the digital readouts

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00:02:32,360 --> 00:02:35,450  
on the control systems so that they  
can understand how they want to go

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00:02:35,450 --> 00:02:37,490  
about flying and investigation an asteroid.

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00:02:37,490 --> 00:02:41,550  
>> So as they simulate flying the rover  
round even though we're not seeing it moving,

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00:02:41,550 --> 00:02:42,870  
the picture in the window is moving.

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00:02:42,870 --> 00:02:43,100  
>> Zack Crues: Right.

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00:02:43,100 --> 00:02:47,020  
So they think they're moving even though it's  
a fixed base here they think they're moving

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00:02:47,020 --> 00:02:53,050  
because every input they put into the system  
results in a change in the view out the screen.

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00:02:53,050 --> 00:02:55,680  
We have the same environment that  
we have here on the flat floor.

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00:02:55,680 --> 00:03:00,070  
We can also do in a big dome environment  
that we have over in Building 16 here at JFC.

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00:03:00,070 --> 00:03:03,540  
>> Right. And we've taken  
the previous generations

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00:03:03,540 --> 00:03:05,730  
of the rover out to the field on wheels.

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00:03:05,730 --> 00:03:05,900  
>> Zack Crues: Correct.

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00:03:05,900 --> 00:03:07,710  
>> Obviously it does not work on an asteroid.

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00:03:07,710 --> 00:03:08,540  
>> Zack Crues: Right.

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00:03:08,540 --> 00:03:12,370  
The difference is that when you're out in the  
field you're really limited to two dimensions.

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00:03:12,370 --> 00:03:17,480  
There's a little bit of terrain but here

it's very much a 6-dimensional environment.

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00:03:17,480 --> 00:03:22,230  
When I say that, that's because you can  
move anywhere around as well as turn around.

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00:03:22,230 --> 00:03:25,920  
You can fly upside down, you can fly right  
side up, backwards, forwards, all of that.

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00:03:25,920 --> 00:03:27,140  
>> All right and that's what you do.

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00:03:27,140 --> 00:03:27,620  
>> Zack Crues: That is what I do.

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00:03:27,620 --> 00:03:27,990  
>> Thank you so much.

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00:03:27,990 --> 00:03:28,950  
I really appreciate your time.

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00:03:28,950 --> 00:03:31,090  
I wish we could talk longer  
but we're out of time.

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00:03:31,090 --> 00:03:31,450  
>> Zack Crues: Any time.

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00:03:31,450 --> 00:03:31,770  
Thank you.