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00:00:00,000 --> 00:00:03,000

Sound of rover.

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00:00:03,000 --> 00:00:06,000

Kevin Hand: One environment on Earth that might serve as a useful analog

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00:00:06,000 --> 00:00:14,000

for the exploration of Europa's ocean, which is trapped beneath a... a thick ice shelf, is the Arctic.

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00:00:14,000 --> 00:00:20,000

And, so our team developed this under-ice rover to study these methane-rich lakes

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00:00:20,000 --> 00:00:23,000

up along the Alaskan permafrost.

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00:00:23,000 --> 00:00:27,000

Natural sounds.

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00:00:27,000 --> 00:00:31,000

Dan Berisford: Here we're just taking an expedition out to a northern Arctic lake

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00:00:31,000 --> 00:00:34,000

up near the northernmost point in Alaska.

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So, we're drivin' on snow machines out to take our robot underneath the ice.

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00:00:38,000 --> 00:00:44,000

Sub-zero temperatures, Arctic ice, biting winds, polar bears and robots.

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00:00:44,000 --> 00:00:46,000

God, I love this job.

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00:00:46,000 --> 00:00:50,000

Natural sounds.

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00:00:50,000 --> 00:00:55,000

John Leichty: The early testing we did tethered, which is our lifeline back to the surface.

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00:00:55,000 --> 00:00:57,000

We didn't know whether this thing was going to sink or float

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00:00:57,000 --> 00:00:59,000

whether the systems were going to work.

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00:00:59,000 --> 00:01:02,000

And, so we're checking out the wheels, the cameras, the lights.

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00:01:02,000 --> 00:01:05,000

Just making sure everything works before we go wireless.

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00:01:05,000 --> 00:01:09,000

Hand: And, if we do eventually deploy in a world like Europa,

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00:01:09,000 --> 00:01:10,000

we're not gonna have a tether.

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00:01:10,000 --> 00:01:13,000

We're gonna need to be able to do remote operations untethered.

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00:01:13,000 --> 00:01:18,000

Natural sounds.

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00:01:18,000 --> 00:01:21,000

Andy Klesh: Now, we specifically go out there during times when the ice is thin

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00:01:21,000 --> 00:01:24,000

to find out where these methane seeps are.

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00:01:24,000 --> 00:01:27,000

I'm actually poking at the ice, trying to find a trail for us

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00:01:27,000 --> 00:01:30,000

that is safe for us to deploy the rover on.

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00:01:30,000 --> 00:01:32,000

Berisford: Yeah, it's dangerous business walking around on this thin ice.

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00:01:32,000 --> 00:01:35,000

I mean, this is why we thought of the rover to begin with.

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We thought, 'Oh, we'll just invert the surface.'

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00:01:37,000 --> 00:01:40,000

Instead of a rover that drives on the ground,

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00:01:40,000 --> 00:01:42,000

we'll have a rover that drives on the ceiling.'

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00:01:42,000 --> 00:01:45,000

And, 'What are we gonna do to do that? We just make it buoyant.'

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00:01:45,000 --> 00:01:48,000

So, it floats and essentially drives on the ceiling, which is the ice surface.

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00:01:48,000 --> 00:01:51,000

And, here's a good shot of a methane seep

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00:01:51,000 --> 00:01:53,000

where it's actually bubbling up from the lake floor

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00:01:53,000 --> 00:01:55,000

and keeping the ice from freezing right there.

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00:01:55,000 --> 00:01:57,000

Sound of rover motor.

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00:01:57,000 --> 00:02:02,000

Hand: And the two different side lobes of the rover can be controlled independently.

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00:02:02,000 --> 00:02:06,000

And, so the cameras can look down at the lake bed

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00:02:06,000 --> 00:02:08,000

and map out where some of the methane seeps are forming.

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00:02:08,000 --> 00:02:12,000

And, they can also be turned up to look at those methane bubbles

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00:02:12,000 --> 00:02:17,000

and study what's actually happening at the ice/water interface.

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00:02:17,000 --> 00:02:19,000

Berisford: And, so the rover just drives right along upside-down

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00:02:19,000 --> 00:02:23,000

using buoyancy instead of weight and gets up close and personal

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00:02:23,000 --> 00:02:27,000

to be able to image and also sample these methane bubbles.

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00:02:27,000 --> 00:02:29,000

Leichty: The later testing we've done untethered,

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00:02:29,000 --> 00:02:32,000

so the rover is communicating through the ice back to a base station

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and then from that base station up to satellites,

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00:02:35,000 --> 00:02:38,000

back to operators at JPL or really anywhere in the world.

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00:02:38,000 --> 00:02:43,000

And this is about the closest you can get to Europa-like operations on Earth.

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Hand: Our research up in the Arctic has this win-win

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where, by studying the methane that's trapped in these lakes

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and coming out of the permafrost, we're helping to quantify the

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00:02:53,000 --> 00:02:57,000

the greenhouse gas emissions that are affecting climate change,

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while simultaneously building a vehicle and a scientific platform

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that serves as a precursor for something that may someday fly to Europa or Enceladus