Crazy Engineering Mars Helicopter Transcript

Hey guys! We've all seen these RC helicopters before. They're everywhere. They're a ton of fun. But we were thinking at JPL, could we fly one of these on Mars? We're going to talk about that on this episode of Crazy Engineering.

(Music)

So why would we want to put a helicopter on Mars? If I'm the rover right now, I can't really see the terrain behind me. But if I had a helicopter with a camera on it, all of a sudden, I can see a whole lot more.

If our rover was equipped with its very own helicopter that could see over tall objects in front of it, it would allow us to make decisions much more efficiently on which way to command the rover.

You might think it's actually easier to fly one of these helicopters on Mars because it's actually 3/8th the gravity we have here on Earth, but it's a hundred times less atmosphere.

The way any of these helicopters work is the rotor blades spin up and they produce lift because of the density of the atmosphere. So once you lose that density, you've got to spin even faster or get bigger rotor blades or get lighter.

How are we going to solve that problem if we go to Mars? Let's go talk to an expert and see if we can figure this out.

All right guys, I think we found our expert. This is Bob. Bob, can you tell us where we're at right now?
This is one of our robotics labs at JPL where we have a full scale mockup of one of the Mars helicopters we've been working on.

What are the challenges you have to overcome in order to produce lift on the surface?

Right, so there is the challenge of the very low density of the atmosphere. There's the challenge of keeping the whole mass of the system small so that we don't overwhelm the lift capability of this system.
It has to be autonomous in terms of being able to fly and maintain stable flight. And then this system has to repeatedly take off and land on natural rocky terrain like you see out here. And then the other one is that it has to survive the harsh environment of Mars.

So we're early in the design stages of this thing. What kind of testing, what kinds of results have you seen so far?

So over the course of the last year we have done a number of tests in our 25-foot vacuum chamber using scale models where we pump down to Mars densities, demonstrating lift of these kinds of blades.

So how fast do these blades have to spin to produce lift?

They have to spin at about 2400 rpm to provide lift.

Could you tell us a little bit about this helicopter's capabilities when it's on Mars?

So the system is designed to fly for 2-3 minutes every day. There's a solar panel on the top and that provides us with enough energy for that short flight, as well as to keep us warm through the night. So in those 2-3 minutes, we expect to have daily flights of about half a kilometer or so.

What are the next steps? How do we get this thing ready for a future rover mission?

Because this thing is going to take off every day and land every day, we want to make sure we have a bulletproof landing system, and landing is the riskiest part of any mission.
EDL had 7 minutes of terror. We have 7 seconds of terror everyday.

Bob thanks so much for teaching us about the helicopter.
I hope you guys out there had as much fun as we did learning about this and check back soon for more Crazy Engineering.