Crazy Engineering: Space Claw

MIke Meacham: We've all played these claw games before where it can be really frustrating using a grapple to pull a toy out of a machine. Well, the success of NASA's InSight mission depends upon a grapple. Let's learn about it on this episode of Crazy Engineering!

All right. We are here at the InSight lander surface test bed. This is Nick. He was one of the key engineers on the grapple mechanism. Nick, thanks for joining us.

Nick: Sure.

Mike: You've got this grapple. What does it do? What's its purpose?

NIcholas Haddad: So, its purpose is to grab the instruments so the robotic arm can then lift them and the place them down onto the surface.

Mike: When I play these arcade games, right? They're really hard to get that toy out of the game. And you're using a mechanism that kinda reminds me of that. Is that a good idea?

Nick: So, the mechanisms themselves, although they look similar, are very different. With the arcade game, when you grab that stuffed animal and you pull on that stuffed animal, you actually open the claw fingers and that stuffed animal falls out. With the InSight grapple that mechanism is designed to latch. So once those fingers are closed it's impossible to pull on those fingers to open it.

Mike: So, how does it work?

Nick: So, the grapple has 5 fingers. And we've designed this grapple to maximize our success. It uses a wax actuator to open the fingers. We grab onto little hooks at the top of each instrument. And then the robotic arm picks those instruments up and places them down on the surface.

Mike: You said "wax"--that we're using wax to open and close the grapple?

Nick: Yeah.

Mike: Why do we use wax? Why don't we use a more typical solenoid or an electric motor?

Nick: It's actually a thoroughly proven technology. It's used in space applications like the InSight grapple. But it's also used for decades in things like our car thermostats and our appliances at home. It uses a heater to melt some wax inside of a little housing. And when this wax melts, it expands. And it develops this hydraulic pressure. And that pressure pushes out a rod, which we use to actuate our mechanism.

Mike: Once it's completed its primary function of putting instruments down, what does it do after that? How does it get out of the way for other things you want to do?

Nick: So, there's actually another hook on the side of the robotic arm. And the robotic arm can maneuver itself so the grapple can re-stow itself on the side of the arm. Then the arm is free to essentially do whatever it needs to do.

Mike: Nick, this grapple mechanism is truly unique. It's really fun to learn about. Thank you so much for bringing us into the test bed and answering all these questions.

And, as always, thank you out there for paying attention and check back here for some more Crazy Engineering! Woo hoo hoo!