

animal house



1
00:00:00,400 --> 00:00:01,968
[■]

2
00:00:08,674 --> 00:00:10,243
Mike Meacham: We've all played
these claw games before

3
00:00:10,276 --> 00:00:12,345
where it can be really
frustrating using a grapple

4
00:00:12,378 --> 00:00:14,380
to pull a toy out of a machine.

5
00:00:14,413 --> 00:00:16,649
Well, the success of
NASA's InSight mission

6
00:00:16,682 --> 00:00:18,251
depends upon a grapple.

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00:00:18,284 --> 00:00:21,187
Let's learn about it on this
episode of Crazy Engineering!

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00:00:21,220 --> 00:00:22,488
[■]

9
00:00:27,860 --> 00:00:29,829
Crazy Engineering:
Space Claw

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00:00:31,330 --> 00:00:33,599
All right. We are here at
the InSight lander

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00:00:33,632 --> 00:00:35,001
surface test bed.

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00:00:35,034 --> 00:00:36,769

This is Nick. He was one of the key engineers

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00:00:36,802 --> 00:00:38,137

on the grapple mechanism.

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00:00:38,170 --> 00:00:39,238

Nick, thanks for joining us.

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00:00:39,271 --> 00:00:40,506

Sure.

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00:00:40,539 --> 00:00:42,175

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

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00:00:42,208 --> 00:00:45,011

Nicholas Haddad: So, its purpose is to grab the instruments

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00:00:45,044 --> 00:00:46,679

so the robotic arm can then lift them

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00:00:46,712 --> 00:00:48,514

and the place them down onto the surface.

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00:00:48,547 --> 00:00:50,683

Mike: When I play these arcade games, right? They're really

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00:00:50,716 --> 00:00:53,019

hard to get that toy out of the game.

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00:00:53,052 --> 00:00:55,655

And you're using a mechanism

that kinda reminds me of that.

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00:00:55,688 --> 00:00:57,023

Is that a good idea?

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00:00:57,056 --> 00:00:58,691

Nick: So, the mechanisms
themselves,

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00:00:58,724 --> 00:01:01,461

although they look
similar, are very different.

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00:01:01,494 --> 00:01:04,230

With the arcade game, when you
grab that stuffed animal

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00:01:04,263 --> 00:01:06,032

and you pull on that
stuffed animal,

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00:01:06,065 --> 00:01:07,633

you actually open
the claw fingers

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00:01:07,666 --> 00:01:09,569

and that stuffed
animal falls out.

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00:01:09,602 --> 00:01:11,104

With the InSight grapple

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00:01:11,137 --> 00:01:13,406

that mechanism is
designed to latch.

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00:01:13,439 --> 00:01:15,441

So once those fingers are closed

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00:01:15,474 --> 00:01:18,611

it's impossible to pull on
those fingers to open it.

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00:01:18,644 --> 00:01:19,745

Mike: So, how does it work?

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00:01:19,778 --> 00:01:21,347

Nick: So, the grapple
has 5 fingers.

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00:01:21,380 --> 00:01:24,750

And we've designed this grapple
to maximize our success.

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00:01:24,783 --> 00:01:27,787

It uses a wax actuator to open
the fingers.

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00:01:27,820 --> 00:01:30,723

We grab onto little hooks at
the top of each instrument.

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00:01:30,756 --> 00:01:33,059

And then the robotic arm
picks those instruments up

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00:01:33,092 --> 00:01:34,727

and places them down
on the surface.

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00:01:34,760 --> 00:01:35,828

Mike: You said "wax"--

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00:01:35,861 --> 00:01:38,397

that we're using wax to open
and close the grapple?

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00:01:38,430 --> 00:01:39,264

Nick: Yeah.

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00:01:39,298 --> 00:01:40,299

Mike: Why do we use wax?

Why don't we use

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00:01:40,332 --> 00:01:42,468

a more typical solenoid

or an electric motor?

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00:01:42,501 --> 00:01:44,704

Nick: It's actually a thoroughly
proven technology.

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00:01:44,737 --> 00:01:47,707

It's used in space applications
like the InSight grapple.

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00:01:47,740 --> 00:01:50,009

But it's also used for
decades in things like

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00:01:50,042 --> 00:01:52,845

our car thermostats and
our appliances at home.

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00:01:52,878 --> 00:01:57,183

It uses a heater to melt some
wax inside of a little housing.

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00:01:57,216 --> 00:01:59,619

And when this wax melts,
it expands.

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00:01:59,652 --> 00:02:01,921

And it develops this
hydraulic pressure.

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00:02:01,954 --> 00:02:04,423

And that pressure
pushes out a rod

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00:02:04,456 --> 00:02:06,692

which we use to actuate
our mechanism.

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00:02:07,793 --> 00:02:09,662

Mike: Once it's completed
its primary function of

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00:02:09,695 --> 00:02:11,631

putting instruments down,
what does it do after that?

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00:02:11,664 --> 00:02:13,900

How does it get out of the way
for other things you want to do?

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00:02:13,933 --> 00:02:15,401

Nick: So, there's actually
another hook

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00:02:15,434 --> 00:02:17,270

on the side of the robotic arm.

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00:02:17,303 --> 00:02:19,906

And the robotic arm can maneuver
itself so the grapple can

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00:02:19,939 --> 00:02:22,175

restow itself on the
side of the arm.

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00:02:22,208 --> 00:02:24,210

Then the arm is free
to essentially do

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00:02:24,243 --> 00:02:25,545

whatever it needs to do.

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00:02:26,646 --> 00:02:28,114

Mike: Nick, this grapple
mechanism is truly unique.

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00:02:28,147 --> 00:02:29,882

It's really fun to learn about.
Thank you so much

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00:02:29,915 --> 00:02:31,250

for bringing us into
the test bed and

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00:02:31,283 --> 00:02:32,451
answering all these questions.

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00:02:32,484 --> 00:02:34,720

And, as always, thank you out
there for paying attention

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00:02:34,753 --> 00:02:37,557

and check back here for some
more Crazy Engineering!

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00:02:37,590 --> 00:02:39,625

[■]

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00:02:43,829 --> 00:02:44,964

Woo hoo hoo!

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00:02:44,997 --> 00:02:46,132

[■]

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00:02:51,637 --> 00:02:53,873

Crazy Engineering

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00:02:53,906 --> 00:02:56,142

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