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00:00:01,236 --> 00:00:02,566

[Pat Ryan] Today we're going to learn more

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00:00:02,566 --> 00:00:05,736

about the High Rate Communication
System from Diego Serna.

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00:00:05,936 --> 00:00:09,846

He is one of the CATO officers here in the
International Space Station Flight Control Room.

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00:00:10,346 --> 00:00:13,626

Diego, we'll get you to start
by telling me what a CATO is.

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00:00:13,866 --> 00:00:16,946

What parts of the station's
system are you responsible?

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00:00:17,456 --> 00:00:17,746

[Diego Serna] Yes.

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00:00:18,616 --> 00:00:24,806

We basically manage and troubleshoot all
the onboard ISS communication systems.

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00:00:25,276 --> 00:00:31,126

Basically, the systems are the audio and
video system, which basically distribute audio

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00:00:31,126 --> 00:00:32,986

and video throughout the space station.

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00:00:34,296 --> 00:00:39,826

We also manage the S-band system which is our
primary form of communication with the crew.

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00:00:40,306 --> 00:00:45,046

We use the, the two space-to-ground

voice loops, as well as command

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00:00:45,046 --> 00:00:46,596

and telemetry through that system.

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00:00:47,736 --> 00:00:54,996

We do also manage the Ultra-High Frequency System which is used for a command link

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00:00:54,996 --> 00:00:59,146

between the station and the crew during a spacewalk.

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00:00:59,856 --> 00:01:04,606

And the last subsystem that we carry is the Ku-Band subsystem, which is basically the one

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00:01:04,606 --> 00:01:08,976

that we use to downlink all the video and all the payload experimental data

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00:01:09,566 --> 00:01:16,556

which basically is a subsystem that will get the greater bulk of the updates

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00:01:16,556 --> 00:01:19,356

with this new High Rate Communication System updates.

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00:01:19,356 --> 00:01:19,456

[Pat] Okay.

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00:01:19,456 --> 00:01:22,376

So, you know, that's an awful lot of different systems

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00:01:22,376 --> 00:01:26,276

but the High Rate Communication System upgrade is in just a portion of that right?

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00:01:26,276 --> 00:01:27,456

What is it going to add?

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00:01:28,336 --> 00:01:34,486

[Diego] Well, basically like I said, the Ku-band system will be the primary system

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00:01:34,486 --> 00:01:35,206

that gets upgraded.

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00:01:35,206 --> 00:01:40,666

But for the most part as the upgrades go we will basically be adding two additional

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00:01:40,666 --> 00:01:42,976

space-to-ground voice so we can talk to the crew.

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00:01:43,416 --> 00:01:44,216

We currently have two.

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00:01:44,216 --> 00:01:44,896

We will go to four.

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00:01:45,476 --> 00:01:49,806

We will add two more video channels to downlink all the video that we have.

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00:01:49,846 --> 00:01:50,626

Currently, we have four.

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00:01:50,626 --> 00:01:52,576

We will go up to six.

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00:01:52,926 --> 00:02:02,416

We will also have the capability to downlink up to 64 different experiments at one time.

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00:02:02,416 --> 00:02:04,096
Currently, we only can do eight.

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00:02:04,866 --> 00:02:10,326
One of the major changes, though, is the fact that we will double our downlink rates

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00:02:10,326 --> 00:02:14,316
from 150 megabits per second to 300 megabits per second.

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00:02:14,316 --> 00:02:17,306
So things will be downloaded a lot quicker.

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00:02:17,506 --> 00:02:19,696
Our uplink file capability will go

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00:02:19,696 --> 00:02:24,586
from 6 megabits per second to up to 25 megabits per second.

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00:02:24,586 --> 00:02:31,286
[Pat] So it's not just the additional channels, but it's also a pretty big increase in the speed

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00:02:31,416 --> 00:02:33,076
that everything's going to be communicated?

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00:02:33,076 --> 00:02:34,176
[Diego] And that is correct.

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00:02:34,176 --> 00:02:40,396
We will definitely do all this downlink and uplink rather quicker than we do today.

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00:02:40,976 --> 00:02:46,116
[Pat] Is this a result of technology or hardware that wasn't available

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00:02:46,116 --> 00:02:48,386
when the space station was built?

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00:02:48,806 --> 00:02:50,316
[Diego] Well, partly it is.

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00:02:50,316 --> 00:02:52,736
Most of the HRCS technology is new.

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00:02:53,036 --> 00:03:00,536
But we do have to make this technology work with
the onboard technology, if you want to say that.

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00:03:00,586 --> 00:03:07,776
For example, we will still be floating video,
but we will be using the latest video encoder

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00:03:07,776 --> 00:03:13,266
so that we can get better
quality at a lower bandwidth rate.

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00:03:13,266 --> 00:03:17,176
If you want to talk about
technology that is brand new

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00:03:17,176 --> 00:03:21,956
to space station we could have
currently all our video recording

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00:03:21,956 --> 00:03:25,696
and all our payload experiment
data has to happen in tapes.

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00:03:26,106 --> 00:03:29,796
Well, when the HRCS goes up there we
will be able to do all this storage,

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00:03:29,796 --> 00:03:35,256
all this recording using the mass memory
recording, so basically solid-state.

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00:03:36,456 --> 00:03:40,386

[Pat] We're looking right
now at the live video coming

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00:03:40,386 --> 00:03:43,696

down as the crew members
are laying cable, as I said.

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00:03:43,916 --> 00:03:48,696

Can you give us a sense, I know you're not
looking at it, but what cables are they laying?

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00:03:48,696 --> 00:03:52,046

Is this the transmitted or to
connect up different modules?

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00:03:52,496 --> 00:03:57,756

[Diego] Well, this is a starting point
to what we're going to basically set

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00:03:57,756 --> 00:04:00,316

up the cables for the arrival of the HRCS.

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00:04:00,316 --> 00:04:04,526

We call it the Ku-comm unit.

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00:04:04,576 --> 00:04:09,606

Basically, the ORU that has
eight functionalities and so on.

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00:04:09,836 --> 00:04:13,946

And so were laying up that part, that
work right now to put the cables in there

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00:04:13,946 --> 00:04:20,736

so that we'll be ready for it, for the Ku-comm
unit to, once it gets onboard, to be installed.

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00:04:21,336 --> 00:04:25,816

[Pat] With the addition of extra channels
how do you anticipate that they are used?

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00:04:25,816 --> 00:04:30,426

What's the design for how this extra, these
extra routes of communication will be used.

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00:04:30,636 --> 00:04:35,996

[Diego] Well, we'll try to keep our ops
concepts rather simple at the very beginning.

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00:04:35,996 --> 00:04:43,066

But for example, the audio channels will be,
will be set as a alternate voice channels

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00:04:43,066 --> 00:04:46,116

to the primary current ones
that we have on S-band.

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00:04:46,686 --> 00:04:51,426

We will try to use them as a, you know, if we
have overflow of conversations we can always go

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00:04:51,426 --> 00:04:54,716

to them, do private medicals on those.

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00:04:54,896 --> 00:05:01,026

Things that we are not critical right
now will be used as a, as an alternate.

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00:05:01,986 --> 00:05:06,366

[Pat] Was this system then going to be
in use throughout the space station?

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00:05:06,366 --> 00:05:08,776

Or will it be primarily in the U.S. segment?

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00:05:09,246 --> 00:05:14,176

[Diego] Well, the HRCS is going to

interface with our current onboard equipment.

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00:05:14,756 --> 00:05:22,686

So the benefits will go through the whole space station and including benefits that will carry

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00:05:22,686 --> 00:05:26,876

on through different ground stations or international partners.

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00:05:27,206 --> 00:05:33,136

[Pat] So they'll, this extra high, extra communication and the high rate will be not just

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00:05:33,136 --> 00:05:35,216

with Houston, but with all of the control centers.

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00:05:35,216 --> 00:05:35,946

[Diego] That's affirmative.

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00:05:36,176 --> 00:05:41,606

Specifically, our international partners, our folks in Marshall,

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00:05:41,606 --> 00:05:47,006

which run most of the payload data, they will be able to perform more experiments now

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00:05:47,006 --> 00:05:52,506

that we have cleared up this, this bottleneck that we had for eight channels up to 64.

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00:05:52,796 --> 00:05:57,146

[Pat] That's a part that I really wasn't familiar with and that's quite an expansion of,

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00:05:57,146 --> 00:06:00,096

have they been asking for that extra capability?

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00:06:00,636 --> 00:06:01,416

[Diego] Well, I think we...

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00:06:01,416 --> 00:06:02,606

[Pat] Crying for it?

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00:06:02,606 --> 00:06:06,376

[Diego] Well, I think we've known
for a while now that there has been,

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00:06:06,376 --> 00:06:08,726

there is a limit in channels
that we currently have.

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00:06:09,516 --> 00:06:13,336

We've basically been somewhat
at a max for a while now.

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00:06:13,336 --> 00:06:19,926

So I think the HRCS comes at a time that
I'm, it's going to be at a perfect time

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00:06:19,926 --> 00:06:23,506

where we can now expand and
start doing more experiments

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00:06:23,556 --> 00:06:27,826

as the station evolves into
that type of space station.

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00:06:28,146 --> 00:06:31,946

[Pat] And a station with more labs and more
crew members that are doing more science.

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00:06:32,136 --> 00:06:32,616

[Diego] That's correct.

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00:06:33,016 --> 00:06:36,246

[Pat] Is all of the hardware onboard

just waiting to be installed now?

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00:06:36,686 --> 00:06:42,216

[Diego] Well, there's several units that are critical in the path of the HRCS activation.

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00:06:43,216 --> 00:06:47,376

Currently, we have automatic payload switch.

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00:06:47,376 --> 00:06:53,626

Which is an ORU unit that's fully installed, has been upgraded and it's currently working

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00:06:53,626 --> 00:06:57,176

with the crew operated equipment, the legacy equipment.

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00:06:57,976 --> 00:07:02,646

We are still waiting for the Ku-comm unit which has the bulk of the updates

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00:07:02,646 --> 00:07:04,836

to get up there and get installed.

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00:07:06,366 --> 00:07:10,026

Probably next couple of months it will be onboard.

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00:07:10,496 --> 00:07:14,186

[Pat] And when do you foresee the system being installed and ready

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00:07:14,186 --> 00:07:16,176

to flip the switch and be operational?

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00:07:16,956 --> 00:07:19,236

[Diego] Well, currently our timeline is

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00:07:19,236 --> 00:07:24,826

to have the HRCS fully operational
by late October this year.

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00:07:25,636 --> 00:07:25,906

[Pat] Okay.

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00:07:26,676 --> 00:07:31,586

There, the other thing that occurred to me
is that as you listen to the communications

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00:07:31,586 --> 00:07:34,086

between the station and the ground.

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00:07:34,366 --> 00:07:37,676

You here, sometimes are people talking at
the same time on the multiple channels.

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00:07:38,426 --> 00:07:41,526

Already, with just two if you're
going to add space-to-ground channels,

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00:07:41,526 --> 00:07:45,046

you're going to add extra video channels,
are there going to be new protocols

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00:07:45,046 --> 00:07:49,876

for how that's used so all the new capabilities
aren't stepping on top of each other?

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00:07:50,606 --> 00:07:53,666

[Diego] Well, we do know there's going
to be, there's always a learning curve

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00:07:53,816 --> 00:07:56,316

and when we have new technology
and new things to use for.

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00:07:56,806 --> 00:08:02,816

But currently I believe our ops concept which
is to maintain our current, for example,

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00:08:02,816 --> 00:08:09,706

onboard audio channels as primary channels
and using the additional ones as alternate,

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00:08:09,936 --> 00:08:15,856

to feed any of our full conversations to
it probably will ease on the transition.

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00:08:17,056 --> 00:08:17,396

[Pat] Okay.

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00:08:17,746 --> 00:08:21,096

We started by saying that you
work at the CATO console here.

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00:08:21,326 --> 00:08:24,596

I bet a lot of people are
wondering where CATO's come from.

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00:08:24,706 --> 00:08:28,256

Tell me about your own education,
your professional background.

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00:08:28,256 --> 00:08:31,236

How does one end up in the
spot like you're in now.

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00:08:31,296 --> 00:08:35,916

[Diego] Well, I mean, I got, I received
my degree from, a Bachelor of Science

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00:08:35,916 --> 00:08:39,046

in Electrical Engineering from the
University of Texas in San Antonio.

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00:08:39,876 --> 00:08:43,496

I've been a CATO for about, and a
flight control for about 13 years.

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00:08:44,046 --> 00:08:46,666

And, you know, I believe I ended up as a CATO

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00:08:47,106 --> 00:08:54,306

to the fact I had some radio frequency
communications background and I'm assuming

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00:08:54,486 --> 00:08:57,746

that was part of the reasoning I became a CATO.

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00:08:57,926 --> 00:09:00,736

[Pat] Have you been at NASA
ever since you finished college?

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00:09:01,166 --> 00:09:01,506

[Diego] Yes.

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00:09:01,506 --> 00:09:02,966

Right out of college, 13 years.

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00:09:03,606 --> 00:09:07,026

[Pat] It's, I take it you're enjoying yourself.

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00:09:07,476 --> 00:09:08,866

[Diego] I do a lot, everyday.

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00:09:09,336 --> 00:09:13,186

[Pat] Diego I appreciate you taking the
time to let us know about the system today.

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00:09:13,406 --> 00:09:14,076

Thank you very much.

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00:09:14,406 --> 00:09:18,016

Diego Serna is one of the
Communications in Tracking Officers here