



1
00:00:10,139 --> 00:00:11,139

MUSIC
When you're

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00:00:11,139 --> 00:00:15,379
building the most powerful rocket ever
there are lots of things to think about.

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00:00:15,379 --> 00:00:18,870
One of the things that we think about
is how do we point this launch vehicle

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00:00:18,870 --> 00:00:21,590
very, very precisely.

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00:00:21,590 --> 00:00:24,599
In order to do this
we have taken the pieces of our control

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00:00:24,599 --> 00:00:29,030
system that have been flight proven
and we are adding a new piece that we

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00:00:29,030 --> 00:00:34,460
call adaptive augmenting control to help
us to do this even more effectively.

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00:00:34,460 --> 00:00:38,510
When you consider the basic design
envelope that you want to fly through,

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00:00:38,510 --> 00:00:41,390
you really don't see a need for adaptive control.

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00:00:41,390 --> 00:00:43,710
The basic control system can get the job done.

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00:00:43,710 --> 00:00:46,579
But when you talk about failure scenarios

or a stack

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00:00:46,579 --> 00:00:51,219

up of unknown unknowns, adaptive control can provide a lot more

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00:00:51,219 --> 00:00:52,219

performance.

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00:00:52,219 --> 00:00:55,219

When NASA develops new technologies for launch vehicles we

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00:00:55,219 --> 00:00:58,640

need mature this technology through flight testing.

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00:00:58,640 --> 00:01:01,960

What we've done is we've partnered with other NASA entities in

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00:01:01,960 --> 00:01:06,800

order to test our SLS flight control system on an F-18 aircraft.

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00:01:06,800 --> 00:01:10,990

The really key capability that the Armstrong Flight Research Center

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00:01:10,990 --> 00:01:15,640

offered to SLS was the ability to take the SLS math models, of how it pitches

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00:01:15,640 --> 00:01:19,049

throughout its flight regime, put those SLS math models on the F-18

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00:01:19,049 --> 00:01:22,380

and have it act like the SLS in flight.

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00:01:22,380 --> 00:01:28,590

We were able to fly many SLS scenarios, everything from a nominal vehicle and

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00:01:28,590 --> 00:01:32,560

a nominal environment, to really challenging scenarios where we would

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00:01:32,560 --> 00:01:38,439

have sloshing propellant, or we would have a huge wind shear event.

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00:01:38,439 --> 00:01:40,420

We even simulated things where we would

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00:01:40,420 --> 00:01:45,430

have the core engines actually stick in one direction and not be able to move

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00:01:45,430 --> 00:01:48,860

them and then the rest of the control system had the responsibility of

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00:01:48,860 --> 00:01:50,570

compensating for those issues.

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00:01:50,570 --> 00:01:54,680

As we were in the control room looking at the data coming in from these many

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00:01:54,680 --> 00:01:59,840

trajectories, we could quickly see that our adaptive control performed just as

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00:01:59,840 --> 00:02:04,310

expected, increasing the performance of the basic control system.

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00:02:04,310 --> 00:02:05,970

Coming

out of this flight campaign we were

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00:02:05,970 --> 00:02:10,979

able to meet all of our test objectives
multiple times.

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00:02:10,979 --> 00:02:14,400

This is on top of the
millions of simulated trajectories that

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00:02:14,400 --> 00:02:21,200

we've already flown, all leading up to
the first unmanned flight test of SLS,