
NO SMALL
STEPS
with Stephen Granade

1
00:00:00,481 --> 00:00:01,978
(upbeat music)

2
00:00:01,978 --> 00:00:03,681
- NASA's mission to deep space and beyond

3
00:00:03,681 --> 00:00:04,907
has already started,

4
00:00:04,907 --> 00:00:07,298
with the Space Launch System
being built as we speak.

5
00:00:07,298 --> 00:00:08,482
For its mission to be successful

6
00:00:08,482 --> 00:00:10,485
each of its parts must
work both individually

7
00:00:10,485 --> 00:00:12,730
and in harmony with all of the others.

8
00:00:12,730 --> 00:00:14,395
It's kind of like a stage play.

9
00:00:14,395 --> 00:00:16,477
Each individual performer
has to know their lines,

10
00:00:16,477 --> 00:00:17,882
and they all have to be on the same page

11
00:00:17,882 --> 00:00:20,433
so they're telling the same
story when the curtain goes up.

12
00:00:20,433 --> 00:00:21,744

So, how do we make sure that SLS

13
00:00:21,744 --> 00:00:23,885
is ready to perform on opening night?

14
00:00:23,885 --> 00:00:25,976
Well, the rocket science version
of practice makes perfect

15
00:00:25,976 --> 00:00:29,104
is testing, testing, and more testing.

16
00:00:29,104 --> 00:00:31,092
- [Neil] It's one small step for man.

17
00:00:31,092 --> 00:00:32,855
(upbeat music)

18
00:00:32,855 --> 00:00:34,485
- Traveling through space is hard.

19
00:00:34,485 --> 00:00:36,244
That's why NASA's Space Launch System

20
00:00:36,244 --> 00:00:39,006
will have to be the most
powerful rocket in the world.

21
00:00:39,006 --> 00:00:40,478
How is SLS able to meet the challenges

22
00:00:40,478 --> 00:00:42,515
of exploring deep space?

23
00:00:42,515 --> 00:00:45,295
Well, when it comes to our
journey to Mars and beyond

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00:00:45,295 --> 00:00:47,378
there are no small steps.

25
00:00:49,390 --> 00:00:52,195
So, SLS is very far
along, which is exciting.

26
00:00:52,195 --> 00:00:54,738
However, before NASA sends
humans out into deep space,

27
00:00:54,738 --> 00:00:57,097
the rocket has to undergo
thorough testing procedures,

28
00:00:57,097 --> 00:00:59,188
and there's just no way to rush that.

29
00:00:59,188 --> 00:01:00,329
Before SLS is boarded,

30
00:01:00,329 --> 00:01:01,162
each of its parts must pass

31
00:01:01,162 --> 00:01:03,045
a strenuous certification process.

32
00:01:03,045 --> 00:01:04,986
Now, the rocket's been
designed, so we have our script,

33
00:01:04,986 --> 00:01:06,412
and all the roles have been cast

34
00:01:06,412 --> 00:01:09,252
but we're not ready for
a debut performance yet.

35
00:01:09,252 --> 00:01:10,660

In our other episodes we've talked about

36
00:01:10,660 --> 00:01:12,379
how many different forces are at play

37
00:01:12,379 --> 00:01:13,932
during launch and space travel.

38
00:01:13,932 --> 00:01:15,160
The effects of each of those forces

39
00:01:15,160 --> 00:01:18,130
must be rehearsed, from the
biggest to the smallest role.

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00:01:18,130 --> 00:01:20,694
One recent rehearsal was the
Qualification Motor Firing,

41
00:01:20,694 --> 00:01:21,527
or QM-2,

42
00:01:22,901 --> 00:01:24,926
which tested a major
player in the SLS cast,

43
00:01:24,926 --> 00:01:26,606
the Solid Rocket Booster.

44
00:01:26,606 --> 00:01:28,191
Now, as fun as all the smoke and fire

45
00:01:28,191 --> 00:01:29,989
of an event like QM-2 can be,

46
00:01:29,989 --> 00:01:32,782
most testing is less dramatic,
but it's still important.

47
00:01:32,782 --> 00:01:34,530
A light goes on during engine tests

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00:01:34,530 --> 00:01:35,748
and it's easy to see
that parts of the rocket

49
00:01:35,748 --> 00:01:36,772
are under pressure.

50
00:01:36,772 --> 00:01:38,314
But a failed stress test on a fuel tank

51
00:01:38,314 --> 00:01:40,900
might reveal a barely-visible
hairline fracture

52
00:01:40,900 --> 00:01:44,019
which, despite its size, could
still threaten the mission.

53
00:01:44,019 --> 00:01:46,503
It's kind of like how if Romeo
doesn't hit his big line...

54
00:01:46,503 --> 00:01:49,384
- But soft, what light through yonder...

55
00:01:49,384 --> 00:01:52,929
- Then Juliet doesn't
get the cue for her line.

56
00:01:52,929 --> 00:01:54,760
Considering the various roles on SLS,

57
00:01:54,760 --> 00:01:56,471
let's take a look at
some of the many tests

58
00:01:56,471 --> 00:01:59,442
that it has undergone, or has coming up.

59
00:01:59,442 --> 00:02:02,489
Thermal vacuum, electrical
discharge, debris impact,

60
00:02:02,489 --> 00:02:04,652
avionics power quality,
thermal protection system,

61
00:02:04,652 --> 00:02:07,043
engine adaption, acoustic,
wind tunnel, fit checks,

62
00:02:07,043 --> 00:02:09,377
actuator, base heating,
materials, structures, green run,

63
00:02:09,377 --> 00:02:11,632
cold flow, controller,
ultrasonic, valves, x-ray imaging,

64
00:02:11,632 --> 00:02:15,644
flight test, pyrotechnics,
shell buckling knockdown factor.

65
00:02:15,644 --> 00:02:17,832
So, yeah, there's a good
amount of work to be done.

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00:02:17,832 --> 00:02:19,476
That brings us back to an earlier point.

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00:02:19,476 --> 00:02:20,581
NASA engineers have developed

68
00:02:20,581 --> 00:02:22,984
extremely effective testing

processes over the years,

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00:02:22,984 --> 00:02:24,477
and they're dedicated to taking the time

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00:02:24,477 --> 00:02:25,673
to combine these powerful parts

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00:02:25,673 --> 00:02:27,985
with the care and precision they require.

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00:02:27,985 --> 00:02:29,068
As with any performance,

73
00:02:29,068 --> 00:02:31,435
we only get one chance to
make a first impression.

74
00:02:31,435 --> 00:02:33,668
Because of all of this
thoughtful and rigorous testing,

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00:02:33,668 --> 00:02:35,345
NASA expects the Space Launch System

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00:02:35,345 --> 00:02:37,142
to get a standing ovation.