
NASA

1
00:00:00,160 --> 00:00:04,190
Here at the Goddard Space Flight

2
00:00:04,210 --> 00:00:08,380
Center in Greenbelt Maryland, we are building the most advanced

3
00:00:08,400 --> 00:00:12,500
and largest space telescope ever constructed

4
00:00:12,520 --> 00:00:16,620
the James Webb Space Telescope. With the big game right around the

5
00:00:16,640 --> 00:00:20,650
corner, we thought, it'd be pretty cool to use a football to demonstrate

6
00:00:20,670 --> 00:00:24,750
some of the testing we do here at Goddard to make sure that Webb is ready for

7
00:00:24,770 --> 00:00:28,780
its mission. Launch is the most intense part

8
00:00:28,800 --> 00:00:32,890
of any spacecraft's mission and we need to make sure Webb can survive

9
00:00:32,910 --> 00:00:37,090
its ride on the very powerful Ariane V rocket.

10
00:00:37,110 --> 00:00:41,170
Ben Lovera, 2016 Maryland High School Field

11
00:00:41,190 --> 00:00:45,220
Goal leader will help us demonstrate.

12
00:00:45,240 --> 00:00:49,350
Ben's kick imparts a force on the football

13
00:00:49,370 --> 00:00:53,500

of slightly more than four Gs.

14
00:00:53,520 --> 00:00:57,580
One G is the force you feel standing on Earth.

15
00:00:57,600 --> 00:01:01,650
During launch, Webb telescope components can experience

16
00:01:01,670 --> 00:01:05,780
forces up to 19 Gs or 19

17
00:01:05,800 --> 00:01:09,900
times their weight. Imagine your legs holding up 19 times your

18
00:01:09,920 --> 00:01:14,090
body weight - for humans, that's physically impossible.

19
00:01:14,110 --> 00:01:18,190
Webb's composite structure and components

20
00:01:18,210 --> 00:01:22,270
are built and tested to handle that. We put the Telescope, and

21
00:01:22,290 --> 00:01:26,440
all of its components, through a series of tests to prove

22
00:01:26,460 --> 00:01:30,520
that it can withstand the rigors of launch. These tests include:

23
00:01:30,540 --> 00:01:34,640
vibration tests

24
00:01:34,660 --> 00:01:38,830
music

25
00:01:38,850 --> 00:01:42,970
centrifuge tests

26
00:01:42,990 --> 00:01:47,070
and acoustic tests. We use this giant acoustic chamber

27
00:01:47,090 --> 00:01:51,200
and its very powerful sound system to mimic the sound pressure and

28
00:01:51,220 --> 00:01:55,270
frequencies we see on the Ariane V rocket during launch.

29
00:02:03,360 --> 00:01:59,310
music

30
00:02:03,380 --> 00:02:07,490
Sound pressure waves can cause vibrations

31
00:02:07,510 --> 00:02:11,540
which may be very damaging. We test in this chamber

32
00:02:11,560 --> 00:02:15,730
to make sure the rocket noise won't break anything.

33
00:02:15,750 --> 00:02:19,910
We test every material used to build Webb

34
00:02:19,930 --> 00:02:23,980
to make sure it can withstand the stresses of launch and properly function

35
00:02:24,000 --> 00:02:28,160
in space.

36
00:02:28,180 --> 00:02:32,350
music

37
00:02:32,370 --> 00:02:36,440
Webb's instruments are designed to detect infrared

38
00:02:36,460 --> 00:02:40,550

light from the farthest objects in the Universe. Our eyes can't detect infrared

39
00:02:40,570 --> 00:02:44,620
light, but we can feel it as heat. Here's the heat where my hand

40
00:02:44,640 --> 00:02:48,720
warmed up this football and left a heat print on it.

41
00:02:48,740 --> 00:02:52,770
To perform it's mission, Webb's instruments need to be

42
00:02:52,790 --> 00:02:56,870
extremely cold - very near absolute zero

43
00:02:56,890 --> 00:03:00,900
or minus 459 degrees Fahrenheit.

44
00:03:00,920 --> 00:03:05,020
We don't want their own heat influencing the images so we test

45
00:03:05,040 --> 00:03:09,180
everything cryogenically in large test chambers.

46
00:03:09,200 --> 00:03:13,290
And make sure everything works as it should in the freezing environment of space.

47
00:03:13,310 --> 00:03:17,360
Materials can change dramatically

48
00:03:17,380 --> 00:03:21,420
at these cryogenic temperatures. Not always how you'd expect.

49
00:03:21,440 --> 00:03:25,460
Let's see what happens to this football in Liquid Nitrogen, which is still

50
00:03:25,480 --> 00:03:29,610
about 70 to 100 degree warmer than some of Webb's instruments.

51
00:03:29,630 --> 00:03:33,760
The ball's inner rubber bladder shattered

52
00:03:33,780 --> 00:03:37,880
at this temperature but, wow, the outer shell holds

53
00:03:37,900 --> 00:03:41,930
together! Webb’s instruments on the other hand are built to

54
00:03:41,950 --> 00:03:46,000
withstand such extreme temperatures. Not the sledgehammer

55
00:03:46,020 --> 00:03:50,130
by the way! Test, test and test

56
00:03:50,150 --> 00:03:54,230
again is the key. We’d rather have something break during

57
00:03:54,250 --> 00:03:58,350
a test on the ground where we can understand the problem and fix it, than

58
00:03:58,370 --> 00:04:02,500
in space. Soon the Telescope will be heading to Johnson Space Center

59
00:04:02,520 --> 00:04:06,600
in Houston Texas for some more testing before it heads to

60
00:04:06,620 --> 00:04:10,720
to Northrop Grumman in California to be assembled and packed into a rocket.

61
00:04:10,740 --> 00:04:14,870
The Telescope will be launched from French Guiana in 2018.

62
00:04:14,890 --> 00:04:19,060
This football may not be space worthy, but

63
00:04:19,080 --> 00:04:23,170

it sure works well here on Earth! Check out

64
00:04:23,190 --> 00:04:27,250
nasa.gov/jwst to learn more about this