



1
00:00:25,570 --> 00:00:22,930
we are wrapping up the last of the

2
00:00:31,380 --> 00:00:25,580
vehicle tests and get ready to make it a

3
00:00:36,310 --> 00:00:34,299
it's going to be a big push but that's

4
00:00:38,020 --> 00:00:36,320
kind of how the end game goes we try to

5
00:00:40,210 --> 00:00:38,030
get things ready and every last thing

6
00:00:45,090 --> 00:00:40,220
has to be done and done right it takes a

7
00:00:50,680 --> 00:00:47,500
we have a lot of work to do in the next

8
00:00:52,570 --> 00:00:50,690
two months because although the vehicles

9
00:00:54,210 --> 00:00:52,580
in Florida and we we've stacked it

10
00:00:58,030 --> 00:00:54,220
together just in the last couple of days

11
00:01:00,670 --> 00:00:58,040
the rover's got its rocket jetpack on it

12
00:01:02,920 --> 00:01:00,680
and the jetpack and the rover together

13
00:01:04,450 --> 00:01:02,930

has been put in the back shell of the

14

00:01:08,020 --> 00:01:04,460

vehicle and we're right now we're

15

00:01:10,719 --> 00:01:08,030

putting the cruise stage on top in some

16

00:01:13,930 --> 00:01:10,729

sense that process is actually pre

17

00:01:16,420 --> 00:01:13,940

straightforward the challenge we have

18

00:01:18,430 --> 00:01:16,430

here in Pasadena is finishing up all our

19

00:01:20,590 --> 00:01:18,440

testing all of our testing on it in our

20

00:01:22,120 --> 00:01:20,600

test bed and on the equipment and going

21

00:01:23,560 --> 00:01:22,130

through and looking all the problems we

22

00:01:25,630 --> 00:01:23,570

had on our chest program make sure that

23

00:01:28,209 --> 00:01:25,640

that all the problems we found we're all

24

00:01:38,660 --> 00:01:28,219

solved and that we know what we're going

25

00:01:46,500 --> 00:01:42,980

everyone stand by testing is a lot like

26
00:01:48,600 --> 00:01:46,510
renovating your house you can enumerate

27
00:01:49,860 --> 00:01:48,610
some very large obvious things to do and

28
00:01:51,260 --> 00:01:49,870
then when you do them it becomes clear

29
00:01:53,790 --> 00:01:51,270
that there are some second-order

30
00:01:55,320 --> 00:01:53,800
secondary things to do and then when you

31
00:01:58,230 --> 00:01:55,330
do those you discover a third order

32
00:02:01,080 --> 00:01:58,240
fourth order ad infinitum we require our

33
00:02:02,760 --> 00:02:01,090
system to be able to be robust to

34
00:02:05,610 --> 00:02:02,770
survive a number of different kinds of

35
00:02:09,240 --> 00:02:05,620
faults both internal faults things

36
00:02:11,370 --> 00:02:09,250
breaking on the spacecraft or loss of

37
00:02:14,640 --> 00:02:11,380
Sun data coming into the Sun sensor a

38
00:02:17,550 --> 00:02:14,650

variety of unfortunate circumstances we

39

00:02:19,590 --> 00:02:17,560

try to make our design robust to not

40

00:02:21,270 --> 00:02:19,600

only be driven the rover we've moved its

41

00:02:22,560 --> 00:02:21,280

arm she put us all through its paces but

42

00:02:25,140 --> 00:02:22,570

it's been in the thermal vacuum chamber

43

00:02:27,090 --> 00:02:25,150

and kept very cold if parts of it have

44

00:02:29,250 --> 00:02:27,100

been on through an ascent of huge we've

45

00:02:32,670 --> 00:02:29,260

done drop tests pull tests and drive

46

00:02:34,500 --> 00:02:32,680

tests load test stress tests it's just

47

00:02:36,480 --> 00:02:34,510

amazing amount of testing this vehicle

48

00:02:37,740 --> 00:02:36,490

have gone through we've done shorting

49

00:02:39,780 --> 00:02:37,750

tests we've taken the vehicle and

50

00:02:41,699 --> 00:02:39,790

shorted electronics we've looked to see

51
00:02:43,320 --> 00:02:41,709
that the radios all work together and

52
00:02:45,900 --> 00:02:43,330
that the rover doesn't interact with

53
00:02:47,430 --> 00:02:45,910
itself in bad ways we've tried every way

54
00:02:49,410 --> 00:02:47,440
of operating in the vehicle using the

55
00:02:52,070 --> 00:02:49,420
software literally thousands and

56
00:02:56,100 --> 00:02:52,080
thousands of hours of software testing

57
00:02:58,050 --> 00:02:56,110
it's been just a amazing civil gears

58
00:03:00,360 --> 00:02:58,060
really a constant testing and

59
00:03:02,720 --> 00:03:00,370
development finding problems fixing

60
00:03:05,720 --> 00:03:02,730
those problems and going on to the next

61
00:03:08,520 --> 00:03:05,730
the system is sufficiently complex that

62
00:03:10,589 --> 00:03:08,530
anything you change has to be done with

63
00:03:12,930 --> 00:03:10,599

great care and caution and then tested

64

00:03:15,240 --> 00:03:12,940

thoroughly because of the potential for

65

00:03:20,250 --> 00:03:15,250

side effects unintended consequences of

66

00:03:24,540 --> 00:03:20,260

the fix the first rule of engineering

67

00:03:27,570 --> 00:03:24,550

this late in the game is do no harm this

68

00:03:29,130 --> 00:03:27,580

is a very very complicated Beast this is

69

00:03:29,550 --> 00:03:29,140

by far the most complex thing we've ever

70

00:03:32,250 --> 00:03:29,560

built

71

00:03:34,380 --> 00:03:32,260

it's almost hard to imagine how complex

72

00:03:36,570 --> 00:03:34,390

it is and in fact if you get it get

73

00:03:39,000 --> 00:03:36,580

close up to the vehicle you can see the

74

00:03:40,650 --> 00:03:39,010

richness of detail and in fact this

75

00:03:42,630 --> 00:03:40,660

vehicle almost has fractal like

76

00:03:44,940 --> 00:03:42,640

complexity the more you look at it the

77

00:03:46,800 --> 00:03:44,950

more details that you uncover and yet to

78

00:03:48,780 --> 00:03:46,810

make sure when you're building this

79

00:03:50,610 --> 00:03:48,790

thing and testing and designing it that

80

00:03:52,710 --> 00:03:50,620

those interactions are well understood

81

00:03:54,990 --> 00:03:52,720

and that you and that there is nothing

82

00:03:57,839 --> 00:03:55,000

about the system that will will

83

00:04:00,660 --> 00:03:57,849

interfere with itself and this has been

84

00:04:02,759 --> 00:04:00,670

a real challenge we've had and so every

85

00:04:05,940 --> 00:04:02,769

minute of the time we've had we've been

86

00:04:08,009 --> 00:04:05,950

using that time with incredible

87

00:04:10,949 --> 00:04:08,019

intensity so hopefully we'll take a big

88

00:04:12,809 --> 00:04:10,959

breath in in mid-november before we

89

00:04:15,150 --> 00:04:12,819

launch enable relax and let her let this