
PATH TO THE PAD
ARTEMIS I
EPISODE ONE: THE ROCKET
ARTEMIS

1
00:00:06,960 --> 00:00:12,640
■NASA is preparing for a journey back to the Moon,\h
and after that, we're setting our sights on Mars.\h\h

2
00:00:14,880 --> 00:00:19,040
To get there, we need tons of rocket power,\h
coming from our Space Launch System.
\h

3
00:00:21,520 --> 00:00:24,640
When it comes to how much power this thing\h
can push out, this thing is massive.
\h

4
00:00:24,640 --> 00:00:33,920
It's going to be mesmerizing to stand next\h
to this massive vehicle. The immensity of it,\h\h

5
00:00:33,920 --> 00:00:43,840
knowing that this thing is going to be propelling\h
a rocket into space and around the moon.
\h

6
00:00:45,440 --> 00:00:48,240
Hang on, it's probably best to\h
start back at the beginning.
\h

7
00:00:53,280 --> 00:00:58,000
It all started in Promontory, Utah,\h
where Northrop Grumman manufactured\h\h

8
00:00:58,000 --> 00:01:00,560
each of the segments that\h
make up the rocket's boosters.\h\h

9
00:01:05,520 --> 00:01:10,080
After a 10-day, cross-country journey, the\h
booster segments were delivered to Kennedy\h\h

10

00:01:10,080 --> 00:01:18,160
Space Center’s Rotation, Processing, and Surge\h
Facility, or RPSF. If this all sounds familiar,\h\h

11
00:01:18,160 --> 00:01:23,200
that’s because it’s the same facility that was\h
used to process shuttle booster segments, which\h\h

12
00:01:23,200 --> 00:01:31,040
all came from Utah. Then, they’re ready to go\h
into the iconic Vehicle Assembly Building, or VAB,\h\h

13
00:01:31,600 --> 00:01:36,720
where the rest of the motor segments are assembled\h
and stacked on top of the mobile launcher.
\h

14
00:01:38,960 --> 00:01:43,040
The one thing about this vehicle,\h
of course, it's produced all across\h\h

15
00:01:43,040 --> 00:01:48,480
the country. The components all come here.\h
They may be built around the country, but\h\h

16
00:01:48,480 --> 00:01:51,280
they all come together right here\h
in the Vehicle Assembly Building.
\h

17
00:01:52,960 --> 00:01:58,960
Our SLS rocket will generate 8.8 million\h
pounds of thrust to break through Earth’s\h\h

18
00:01:58,960 --> 00:02:07,840
gravitational pull. That’s more power than the\h
Space Shuttle and the Saturn V rocket used.
\h

19
00:02:12,240 --> 00:02:16,080
Teams with NASA’s Exploration Ground\h

Systems are responsible for assembling\h\h

20
00:02:16,080 --> 00:02:23,440
the boosters that will house the majority of\h
that power. The twin solid rocket boosters,\h\h

21
00:02:23,440 --> 00:02:29,120
made up of 10 total motor segments, will stand\h
nearly 17 stories tall when fully stacked.
\h

22
00:02:31,840 --> 00:02:36,000
First, teams inspect and prep the\h
hardware. Next, they’re ready to start\h\h

23
00:02:36,000 --> 00:02:40,320
stacking the segments – a process that\h
takes time, patience, and a steady hand.
\h

24
00:02:42,160 --> 00:02:48,400
Once we have everything done in High Bay 4,\h
we pick up the segment with a 325 foot crane,\h\h

25
00:02:48,400 --> 00:02:52,400
pick it up over the 16th floor\h
crossover to where you see it now,\h\h

26
00:02:53,120 --> 00:02:57,920
and we begin stacking the segments. Each\h
segment we lift over the 16th floor crossover\h\h

27
00:02:57,920 --> 00:03:01,760
and stack it. Once we stack it, we\h
put it on top of the segment below,\h\h

28
00:03:01,760 --> 00:03:07,667
and we put about 177 pins all the way around\h
the whole thing to attach each segment.
\h

29
00:03:08,320 --> 00:03:12,400
And, the pressure to perform the operation\h
flawlessly can test the team’s nerves.
\h

30
00:03:13,760 --> 00:03:18,560
There's a tremendous responsibility involved\h
with processing flight hardware like this. It's\h\h

31
00:03:20,320 --> 00:03:28,640
nerve-racking at times, but it's exciting. There's\h
zero appetite for risk in a program like this.
\h

32
00:03:28,640 --> 00:03:33,120
We have a bunch of shuttle guys that are here to\h
show us along the way. If we get stuck, they're\h\h

33
00:03:33,120 --> 00:03:38,080
there to guide us. At the beginning of stacking,\h
it was very of nerve-racking. With each segment\h\h

34
00:03:38,080 --> 00:03:43,200
that we stacked, a little bit of the nerve comes\h
off. By the third or fourth one, it's easy-peasy.\h\h

35
00:03:43,200 --> 00:03:47,365
We're pushing through, all the jitters are gone,\h
and we're just excited to get finished with it.
\h

36
00:03:48,320 --> 00:03:53,840
With all 10 booster segments now fully stacked\h
on the mobile launcher, there’s just one final\h\h

37
00:03:53,840 --> 00:03:59,840
piece of the puzzle to round out the power needed\h
to get SLS off the ground and send it to space:\h\h

38
00:04:01,200 --> 00:04:01,920

core stage.
\h

39
00:04:04,240 --> 00:04:10,160
After a 900-mile voyage aboard NASA’s\h
Pegasus barge, the SLS core stage – the\h\h

40
00:04:10,160 --> 00:04:14,960
largest rocket stage NASA has ever built\h
– has made it to Kennedy Space Center.
\h

41
00:04:16,400 --> 00:04:21,600
Today is a huge day. This is the last\h
piece of big hardware that we need for\h\h

42
00:04:21,600 --> 00:04:26,640
Artemis 1 hard processing. And we’ve just\h
been waiting a long time for this part of\h\h

43
00:04:26,640 --> 00:04:30,960
the vehicle to arrive so that we can get going\h
on the next steps of our stacking operations.
\h

44
00:04:31,920 --> 00:04:39,280
Standing an impressive 212 feet tall,\h
and weighing a whopping 188,000 pounds,\h\h

45
00:04:39,280 --> 00:04:45,600
the core stage came all the way from Stennis Space\h
Center in Mississippi. The core stage went through\h\h

46
00:04:45,600 --> 00:04:51,840
round after round of rigorous testing, including\h
what’s called its Green Run series, truly putting\h\h

47
00:04:51,840 --> 00:05:00,000
its performance to the test. The series involved\h
eight rounds that looked at systems individually\h\h

48
00:05:00,000 --> 00:05:06,160
before culminating in pure power.
With over 700,000 gallons of propellant\h\h

49
00:05:06,160 --> 00:05:12,160
flowing through the core stage, and its RS-25\h
engines firing for eight minutes straight,\h\h

50
00:05:12,160 --> 00:05:16,320
the successful final test resulted\h
in some big emotions from the team.
\h

51
00:05:16,320 --> 00:05:20,320
We cried, we laughed, and we cheered\h
because it was so emotional to see\h\h

52
00:05:20,960 --> 00:05:25,680
the years of culmination coming through.
And, that victory did not come without\h\h

53
00:05:25,680 --> 00:05:31,931
overcoming a few challenges, proving why at NASA\h
we test as frequently and as hard as we do.
\h

54
00:05:37,280 --> 00:05:40,320
We actually did a one-minute\h
test on the first hot-fire test\h\h

55
00:05:41,040 --> 00:05:46,720
and then we learned a lot from that. We understood\h
the vehicle more, we made a few changes, and then\h\h

56
00:05:46,720 --> 00:05:53,360
we got back into our second hot-fire test.
There was a lot of joy and workmanship and\h\h

57
00:05:53,360 --> 00:05:58,720
ownership of being able to work that process\h

and be able to get it done. When we went for\h\h

58
00:05:58,720 --> 00:06:05,840
the second hot fire, and we went for the 500\h
seconds, that was just pure exhilaration.
\h

59
00:06:21,440 --> 00:06:26,160
Following its arrival at Kennedy, teams\h
moved the core stage into the VAB,\h\h

60
00:06:26,160 --> 00:06:30,800
where it was lifted by crane and placed\h
in between the twin solid rocket boosters.\h\h

61
00:06:31,600 --> 00:06:35,760
Serving as the backbone of the rocket,\h
the core stage will provide more than\h\h

62
00:06:35,760 --> 00:06:41,520
2 million pounds of thrust to help send the\h
Orion spacecraft on its trip around the Moon.
\h

63
00:06:44,560 --> 00:06:49,040
Essentially, we have these two massive\h
cranes that are located inside of the VAB,\h\h

64
00:06:49,040 --> 00:06:53,280
where we go ahead and we pick two points at\h
the end of the core stage - one on the back\h\h

65
00:06:53,280 --> 00:06:57,680
portion of it and on the front portion of it –\h
we lift it up to the point where we’re able to\h\h

66
00:06:57,680 --> 00:07:04,080
transition it from a horizontal position over into\h
a vertical position, and then essentially bring it\h\h

67

00:07:04,080 --> 00:07:08,560
way up to the top of the Vehicle Assembly Building\h
and cross it over into High Bay 3, in which we\h\h

68
00:07:08,560 --> 00:07:12,720
ensure that we don’t damage any part of the\h
vehicle as it’s incoming into its position.
\h

69
00:07:14,720 --> 00:07:19,760
NASA’s largest rocket stage, now fully\h
integrated with the twin boosters,\h\h

70
00:07:19,760 --> 00:07:25,360
is ready to get Orion off the Earth. But, it\h
will take one more critical component to give\h\h

71
00:07:25,360 --> 00:07:31,200
the capsule that extra push it needs to journey\h
tens of thousands of miles beyond the Moon.\h\h

72
00:07:33,440 --> 00:07:38,640
With just a single RL10 engine, the\h
interim cryogenic propulsion stage,\h\h

73
00:07:38,640 --> 00:07:45,840
or ICPS, will provide over 20,000 pounds of\h
thrust to send Orion on the ride of a lifetime.
\h

74
00:07:47,440 --> 00:07:53,920
To connect the ICPS with the rocket stack, teams\h
next added the launch vehicle stage adapter to the\h\h

75
00:07:53,920 --> 00:07:57,440
core stage, followed by the ICPS.
7:50
\h

76
00:07:57,440 --> 00:08:02,080
The ICPS is the interim cryogenic propulsion\h

stage and essentially, it’s somewhat of the\h\h

77
00:08:02,080 --> 00:08:08,080
upper stage of the entire SLS vehicle. And what\h
that will do is propel the Orion capsule along\h\h

78
00:08:08,080 --> 00:08:12,560
with the service module over to its destination,\h
which at this point in time will be the Moon.
\h

79
00:08:12,560 --> 00:08:18,400
But, before the spacecraft can be attached to the\h
rocket, teams will conduct a series of tests to\h\h

80
00:08:18,400 --> 00:08:23,520
ensure all of SLS’s components communicate\h
properly with one another, plus the ground\h\h

81
00:08:23,520 --> 00:08:30,480
systems equipment, the Launch Control System\h
and its software. Adding to the challenge, those\h\h

82
00:08:30,480 --> 00:08:34,400
methods for testing have changed significantly\h
since the days of the Apollo Program.
\h

83
00:08:36,400 --> 00:08:40,480
Initially built in the 1960s to\h
house assembly of the Saturn V,\h\h

84
00:08:41,040 --> 00:08:42,560
the largest rocket made by humans at the time for\h
Apollo missions to the Moon, the VAB has undergone\h\h

85
00:08:42,560 --> 00:08:46,800
some major modifications to support several\h
different kinds of rockets and spacecraft,\h\h

86

00:08:47,840 --> 00:08:51,280
whether they’re going into low-Earth\h
orbit or venturing to deep space.
\h

87
00:08:52,480 --> 00:08:59,520
This high bay was shuttle heritage. Before that\h
it was Apollo heritage. There's upgrades that\h\h

88
00:08:59,520 --> 00:09:07,840
are still occurring today to include upgrades\h
that will support Artemis II and Artemis III.
\h

89
00:09:10,000 --> 00:09:17,040
When SLS blasts off from Kennedy’s Launch Pad\h
39B, Orion isn’t the only thing it will be sending\h\h

90
00:09:17,040 --> 00:09:24,400
to space. Hitching a ride with Orion are tiny,\h
shoe-box sized satellites – called CubeSats – that\h\h

91
00:09:24,400 --> 00:09:30,480
were loaded into the Orion stage adapter in\h
Kennedy’s Space Station Processing Facility. The\h\h

92
00:09:30,480 --> 00:09:36,960
extra room in the stage adapter provides a rare\h
opportunity to send those CubeSats to deep space\h\h

93
00:09:36,960 --> 00:09:43,600
to conduct science and research of their own.\h
And, these CubeSats are on tap to study a range\h\h

94
00:09:43,600 --> 00:09:49,840
of topics – from the Moon, to asteroids, to the\h
effect of space radiation on living organisms.
\h

95
00:09:52,480 --> 00:09:58,480
At this point, the stack is nearly complete –\h

all that’s missing is the spacecraft itself,\h\h

96
00:09:58,480 --> 00:10:02,080
which has been in the Launch Abort\h
System Facility getting outfitted with\h\h

97
00:10:02,080 --> 00:10:06,880
one of the spacecraft’s most crucial pieces.
The launch abort system is kind of that pointy\h\h

98
00:10:06,880 --> 00:10:11,520
solid rocket motor that’s at the top of Orion,\h
and it’s there to protect the crew in the event\h\h

99
00:10:11,520 --> 00:10:16,320
of an emergency so it’s a very important system.
Fully integrated with its launch abort system,\h\h

100
00:10:16,320 --> 00:10:20,960
the Orion spacecraft slowly makes its\h
way to the VAB in the overnight hours.\h\h

101
00:10:23,280 --> 00:10:28,320
Upon its arrival, teams carefully lift\h
and lower it onto the Orion stage adapter.\h\h

102
00:10:31,200 --> 00:10:38,244
With this operation, stacking the most\h
powerful rocket the world has ever seen\h\his complete

103
00:10:39,182 --> 00:10:41,962
– and, what a sight to behold.
\h

104
00:10:43,360 --> 00:10:47,520
We’re trying to decide what does exploration\h
look like in the future when we retire shuttle?\h\h

105
00:10:47,520 --> 00:10:50,880
You know, what does our nation want to do? Where\h

do we want to go? How do we want to explore?\h\h

106
00:10:51,760 --> 00:10:56,960
To see it go from those days of words and ideas\h
in people’s heads to the three programs we have\h\h

107
00:10:56,960 --> 00:11:02,800
today and the Artemis mission and all the hardware\h
that’s been produced in factories ranging from,\h\h

108
00:11:02,800 --> 00:11:06,560
big aerospace companies to little mom and\h
pop shops all over the country and the world,\h\h

109
00:11:06,560 --> 00:11:08,960
it’s unbelievable. I’m just really proud.
\h

110
00:11:10,480 --> 00:11:15,840
Before SLS and Orion can launch our nation\h
into a new era of space exploration,\h\h

111
00:11:16,400 --> 00:11:23,120
a series of tests need to take place inside\h
the VAB, validating the rocket and spacecraft\h\h

112
00:11:23,120 --> 00:11:29,760
as an integrated system and paving the way for\h
one, final milestone: wet dress rehearsal.
\h

113
00:11:33,520 --> 00:11:42,240
The 322-foot-tall, fully integrated rocket will\h
roll out to Launch Pad 39B for a full test,\h\h

114
00:11:47,200 --> 00:11:50,960
allowing the launch team to run\h
through a full launch countdown\h\h

115
00:11:50,960 --> 00:11:55,840

but stopping just short of firing the engines.
\h

116
00:11:57,680 --> 00:12:00,960
I think we're going to be so proud\h
when it rolls out of the VAB.\h\h

117
00:12:00,960 --> 00:12:06,080
I will personally be probably crying a little\h
bit because it's such a big event. We worked\h\h

118
00:12:06,080 --> 00:12:11,520
so hard to get us to the day of rolling out. I'm\h
probably going to be bawling when we launch it,\h\h

119
00:12:12,880 --> 00:12:19,680
see it through my tears, because it's just a\h
culmination of so much work from everybody.
\h

120
00:12:20,960 --> 00:12:27,360
We owe the advancement of science\h
and research and technology to\h\h

121
00:12:27,360 --> 00:12:34,640
what we're doing here. And, this is a\h
big opportunity for us as a nation to\h\h

122
00:12:34,640 --> 00:12:39,120
reclaim our spot at the forefront of\h
human space flight and exploration.
\h

123
00:12:42,000 --> 00:12:44,160
Artemis is going to be a major part of history.\h\h

124
00:12:45,200 --> 00:12:49,200
It most definitely is going to rock\h
the space industry when it flies.
\h

125
00:12:50,320 --> 00:12:55,280
This program is going to go to the Moon.\h
It's going to go to Mars. We need that.\h\h

126
00:12:55,920 --> 00:13:00,720
This country needs that. This world needs that.
I'm so excited. It's going to be a lot of work,\h\h