PATH TO THE PAD

ARTEMIS I

EPISODE TWO: THE SPACECRAFT

1
00:00:06,899 --> 00:00:09,120
What an exciting day at the Kennedy Space Center.

2
00:00:09,120 --> 00:00:12,879
You can see the Orion spaceship coming out of the O&C building where we've been assembling

3
00:00:12,879 --> 00:00:17,500
it for several years.

4
00:00:17,500 --> 00:00:21,660
As big a step as this is for us today, and rolling out and starting the journey of Artemis

5
00:00:21,660 --> 00:00:26,890
I to the Moon and beyond, we're really excited for this test program to get this vehicle

6
00:00:26,890 --> 00:00:33,930
flown and to begin the next steps which are to send humans back to the Moon.

7
00:00:33,930 --> 00:00:39,200
The twin sister of Apollo, Artemis is the name given to the program that will return

8
00:00:39,200 --> 00:00:41,390
humanity to the Moon.

9
00:00:41,390 --> 00:00:47,920
And, named after one of the largest constellations in the night Sky, Orion is the spacecraft

10
00:00:47,920 --> 00:00:50,449
destined to get us there.

11
00:00:50,449 --> 00:00:55,650
Through Artemis missions, NASA will land the

first woman and the first person of color

12
00:00:55,650 --> 00:00:57,510
on the lunar surface.

13
00:00:57,510 --> 00:01:03,580
And, these missions will allow us to explore
more of the Moon than ever before, paving

14
00:01:03,580 --> 00:01:07,020
the way for long-term presence in lunar orbit.

15
00:01:07,020 --> 00:01:11,030
We’re rolling the Orion spacecraft out,
but it’s beginning its journey.

16
00:01:11,030 --> 00:01:15,680
We’re really kind of at the end of the building
process and the beginning of getting ready

17
00:01:15,680 --> 00:01:16,990
to go fly.

18
00:01:16,990 --> 00:01:22,210
But before Orion can travel to our nearest
celestial body, it first must make a few pit

19
00:01:22,210 --> 00:01:26,820
stops along the way to fuel up and get ready
for flight.

20
00:01:26,820 --> 00:01:30,860
As we leave here today, we’re gonna go to
a facility that’ll fuel the spacecraft with

21
00:01:30,860 --> 00:01:35,240
the rocket fuels and propellants it needs,
we’ll put a launch abort system on, we’ll

22

00:01:35,240 --> 00:01:41,280
send it out to be stacked on the rocket and
launched, and it’s really the last few yards

23
00:01:41,280 --> 00:01:43,080
of the game.

24
00:01:43,080 --> 00:01:47,870
Orion’s journey to the Moon began on the
bayou.

25
00:01:47,870 --> 00:01:53,390
NASA’s Michoud Assembly Facility in New
Orleans is where, in 2015, technicians with

26
00:01:53,390 --> 00:01:58,510
Lockheed Martin began welding the pieces of
the spacecraft’s underlying aluminum structure

27
00:01:58,510 --> 00:02:01,330
together.

28
00:02:01,330 --> 00:02:06,430
One year later, it arrived in Florida, taking
up semi-permanent residence inside the Neil

29
00:02:06,430 --> 00:02:12,200
Armstrong Operations and Checkout Building
at NASA’s Kennedy Space Center.

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00:02:12,200 --> 00:02:16,849
Engineers and technicians will spend the next
five years working almost around the clock,

31
00:02:16,849 --> 00:02:22,939
outfitting Orion with thousands of components,
and pushing the capsule through several rounds

32
00:02:22,939 --> 00:02:28,459
of rigorous testing, as teams prepare it for

its flight around the Moon.

33
00:02:28,459 --> 00:02:33,920
The first step though is the crew module's arrival.

34
00:02:33,920 --> 00:02:40,540
When the crew module shows up here at the O&C building, it's really just a welded

35
00:02:40,540 --> 00:02:42,469
shell of the structure.

36
00:02:42,469 --> 00:02:47,769
When it gets here, we put it into a fixture down to my left called the bird cage tool,

37
00:02:47,769 --> 00:02:54,909
and we use that fixture to position and attach all of the mechanically attached primary and

38
00:02:54,909 --> 00:02:58,870
secondary structure for the crew module.

39
00:02:58,870 --> 00:03:03,560
Part of that includes the heat shield, which protects the crew module as it blazes through

40
00:03:03,560 --> 00:03:13,719
Earth's atmosphere at an astonishing speed as it returns home.

41
00:03:13,719 --> 00:03:18,099
Technicians with Lockheed bond those thermal protection system products onto the heat shield

42
00:03:18,099 --> 00:03:23,680
right here in the O&C, and they do the same for the crew module's forward bay cover.

43
00:03:23,680 --> 00:03:30,919
We bond that on here, and basically this covers
the forward bay of the crew module such that

44
00:03:30,919 --> 00:03:35,860
once we come back into the atmosphere, this
gets jettisoned, and all of the landing system

45
00:03:35,860 --> 00:03:41,129
– i.e. parachutes – get deployed and slows
the crew module down so that when it touches

46
00:03:41,129 --> 00:03:45,069
down in the ocean, it’s only going a few
miles an hour.

47
00:03:45,069 --> 00:03:51,269
With the primary and secondary structures
all attached, the crew module is tested to

48
00:03:51,269 --> 00:03:53,769
see how everything holds up.

49
00:03:53,769 --> 00:03:58,439
Orion is pressurized, stressing the welds
to ensure they’ll hold up under the proper

50
00:03:58,439 --> 00:03:59,620
loading.

51
00:03:59,620 --> 00:04:05,189
Afterwards, nondestructive evaluation of those
welds is conducted to check for any voids

52
00:04:05,189 --> 00:04:09,069
or cracks.

53
00:04:09,069 --> 00:04:13,510
Once the structure is deemed strong enough,

the crew module is moved just a few spaces

54
00:04:13,510 --> 00:04:22,720
down into the O&C's clean room for its next
round of integrations.

55
00:04:22,720 --> 00:04:28,169
We bring that structure into our clean room,
which is what you see behind me, because we

56
00:04:28,169 --> 00:04:33,350
need to start integrating the propulsion system,
and elements of the environmental control

57
00:04:33,350 --> 00:04:38,520
and life support subsystems, and those systems
require a cleaner environment than the one

58
00:04:38,520 --> 00:04:40,789
we're standing in out here.

59
00:04:40,789 --> 00:04:45,820
When all of that is done, the crew module
is on the move again, to the crew module integration

60
00:04:45,820 --> 00:04:46,840
station.

61
00:04:46,840 --> 00:04:53,650
There, all of the electrical systems, including
wire harnesses and avionics boxes that control

62
00:04:53,650 --> 00:04:59,229
the crew module's guidance navigation, communications,
and its power subsystems, are integrated.

63
00:04:59,229 --> 00:05:04,430
Next, it's time to bring the spacecraft
to life.

64
00:05:04,430 --> 00:05:09,240
We power it up, and then we go into a whole
series of functional tests to make sure all

65
00:05:09,240 --> 00:05:13,300
of the subsystems we've integrated up to
that point are functioning properly.

66
00:05:13,300 --> 00:05:17,560
But, the crew module isn't the only thing
that makes up the Orion spacecraft.

67
00:05:17,560 --> 00:05:24,560
All the people, the work, the components that
have gone into this vehicle, it's just an

68
00:05:24,560 --> 00:05:26,449
amazing feat.

69
00:05:26,449 --> 00:05:31,289
Teams also worked closely with the European
Space Agency to build the service module – the

70
00:05:31,289 --> 00:05:36,840
element that will power Orion on its journey
around the Moon.

71
00:05:36,840 --> 00:05:42,280
Once that arrives from Bremen, Germany, Lockheed
moves forward with integrating the two.

72
00:05:42,280 --> 00:05:45,970
The service module has a very similar lifecycle
to the crew module.

73
00:05:45,970 --> 00:05:50,820
We build it up structurally, we integrate
the propulsion system and the other fluid

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00:05:50,820 --> 00:05:56,360
systems, and then we integrate it electrically,
and power it up, and do functional tests on

75
00:05:56,360 --> 00:05:57,360
it.

76
00:05:57,360 --> 00:06:01,139
And when we have a full service module, and
a full crew module, then we stack the two

77
00:06:01,139 --> 00:06:07,039
together and we have what's called the crew
service module for Artemis I.

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00:06:07,039 --> 00:06:12,500
Under the Artemis program, NASA plans to not
only return to the Moon, but to use that as

79
00:06:12,500 --> 00:06:19,949
a stepping stone to go farther than any human
has ever gone before: Mars.

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00:06:19,949 --> 00:06:25,699
To get there, it's truly a cross-country
and international effort among thousands of

81
00:06:25,699 --> 00:06:26,699
individuals.

82
00:06:26,699 --> 00:06:32,069
When you consider all the people at the Johnson
Space Center, Marshall Space Flight Center,

83
00:06:32,069 --> 00:06:39,820
all across the agency, SLS, Orion, the European
Service Module, Boeing and their team, Lockheed

84
00:06:39,820 --> 00:06:44,580
Martin and their team, and to see all of that

come together on that launch when we send

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00:06:44,580 --> 00:06:48,340
it on its way to the Moon, it’s gonna be
absolutely amazing, and we’re gonna have

86
00:06:48,340 --> 00:06:52,080
a lot of really proud, happy people.

87
00:06:52,080 --> 00:06:57,270
Building a spacecraft destined for deep-space
exploration from the ground up is no easy

88
00:06:57,270 --> 00:07:04,121
task, and the fact that these teams have been
able to come together and do just that in

89
00:07:04,121 --> 00:07:08,629
the midst of a global pandemic is nothing
short of amazing.

90
00:07:08,629 --> 00:07:11,590
It really is a testament to the workforce.

91
00:07:11,590 --> 00:07:14,800
If think about what we’ve been through over
the years that they’ve been putting this

92
00:07:14,800 --> 00:07:18,550
together, and particularly, think about the
environment that this team was dealing with.

93
00:07:18,550 --> 00:07:22,020
We’re dealing with covid, and we’re asking
these folks to come into work every day and

94
00:07:22,020 --> 00:07:24,300
finish this spacecraft so we can keep this
mission going.

95
00:07:24,300 --> 00:07:26,449
And we're ready, I mean we're excited.

96
00:07:26,449 --> 00:07:30,520
So as they turn this over to us, we're ready
to get going.

97
00:07:30,520 --> 00:07:34,810
And really, this is only the start of Orion's
path to the pad.

98
00:07:34,810 --> 00:07:40,479
It's a little hard to put into words, and
when you think about the fact that we are

99
00:07:40,479 --> 00:07:48,370
in the first flow of what will be our nation's
deep space exploration program, it hits you

100
00:07:48,370 --> 00:07:49,370
in the heart.

101
00:07:49,370 --> 00:07:58,600
And it really speaks to why we all are doing
what we're doing.

102
00:07:58,600 --> 00:08:05,550
I never thought as a little kid growing up
I'd be part of something like this today.

103
00:08:05,550 --> 00:08:10,889
Now as a dad of 2 young girls, to be able
to tell them what I do and to be able to have

104
00:08:10,889 --> 00:08:15,100
them someday watch the first woman stand on
the Moon is pretty amazing to me personally.

105
00:08:15,100 --> 00:08:20,669

As the Orion spacecraft departs the O&C, its
next stop is the Multi-Payload Processing

106
00:08:20,669 --> 00:08:27,810
Facility, or MPPF, where teams with NASA's
Exploration Ground Systems and prime contractor

107
00:08:27,810 --> 00:08:33,240
Jacobs will perform the next set of milestones:
fueling and servicing the spacecraft.

108
00:08:33,240 --> 00:08:40,220
We have a few months of hard but rewarding
work ahead of us to get to launch.

109
00:08:40,220 --> 00:08:41,700
But this is it.

110
00:08:41,700 --> 00:08:43,330
This is our year.

111
00:08:43,330 --> 00:08:46,680
This is our time, and what folks have worked
so hard for.

112
00:08:46,680 --> 00:08:52,010
Now, we're going to continue with processing,
get that thing check out and fueled, get the

113
00:08:52,010 --> 00:08:53,790
launch abort motor stuck on top of it.

114
00:08:53,790 --> 00:08:58,870
With fueling of Orion's crew and service
modules complete, the spacecraft moves from

115
00:08:58,870 --> 00:09:02,880
the MPPF into the Launch Abort System Facility.

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00:09:02,880 --> 00:09:07,450
We just finished fueling the spaceship and
we moved it to the LASF facility - the Launch

117
00:09:07,450 --> 00:09:12,920
Abort System Facility to put the launch abort
system on the top of Orion.

118
00:09:12,920 --> 00:09:19,390
And in July 2019, teams completed a critical
test – the Ascent Abort-2 flight test – to

119
00:09:19,390 --> 00:09:29,980
validate the launch abort system works as
expected.

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00:09:29,980 --> 00:09:35,290
After reaching an altitude of about six miles,
where the test spacecraft experienced high-stress

121
00:09:35,290 --> 00:09:39,480
conditions expected during launch, the abort
sequence triggered.

122
00:09:39,480 --> 00:09:45,140
Within milliseconds, the abort motor fired
to pull the crew module away to safety.

123
00:09:45,140 --> 00:09:49,820
Its attitude control motor flipped the capsule
into the proper orientation, and the jettison

124
00:09:49,820 --> 00:09:55,489
motor fired to release the crew module for
a splashdown in the Atlantic Ocean.

125
00:09:55,489 --> 00:10:02,070
I feel just honored and humbled every day
to be able to work on this stuff.

126

00:10:02,070 --> 00:10:05,210
This rocket is absolutely amazing.

127
00:10:05,210 --> 00:10:11,520
Now that the spacecraft’s launch abort system
is securely in place, Orion is ready for the

128
00:10:11,520 --> 00:10:17,120
next stop on its path to the pad: the Vehicle
Assembly Building.