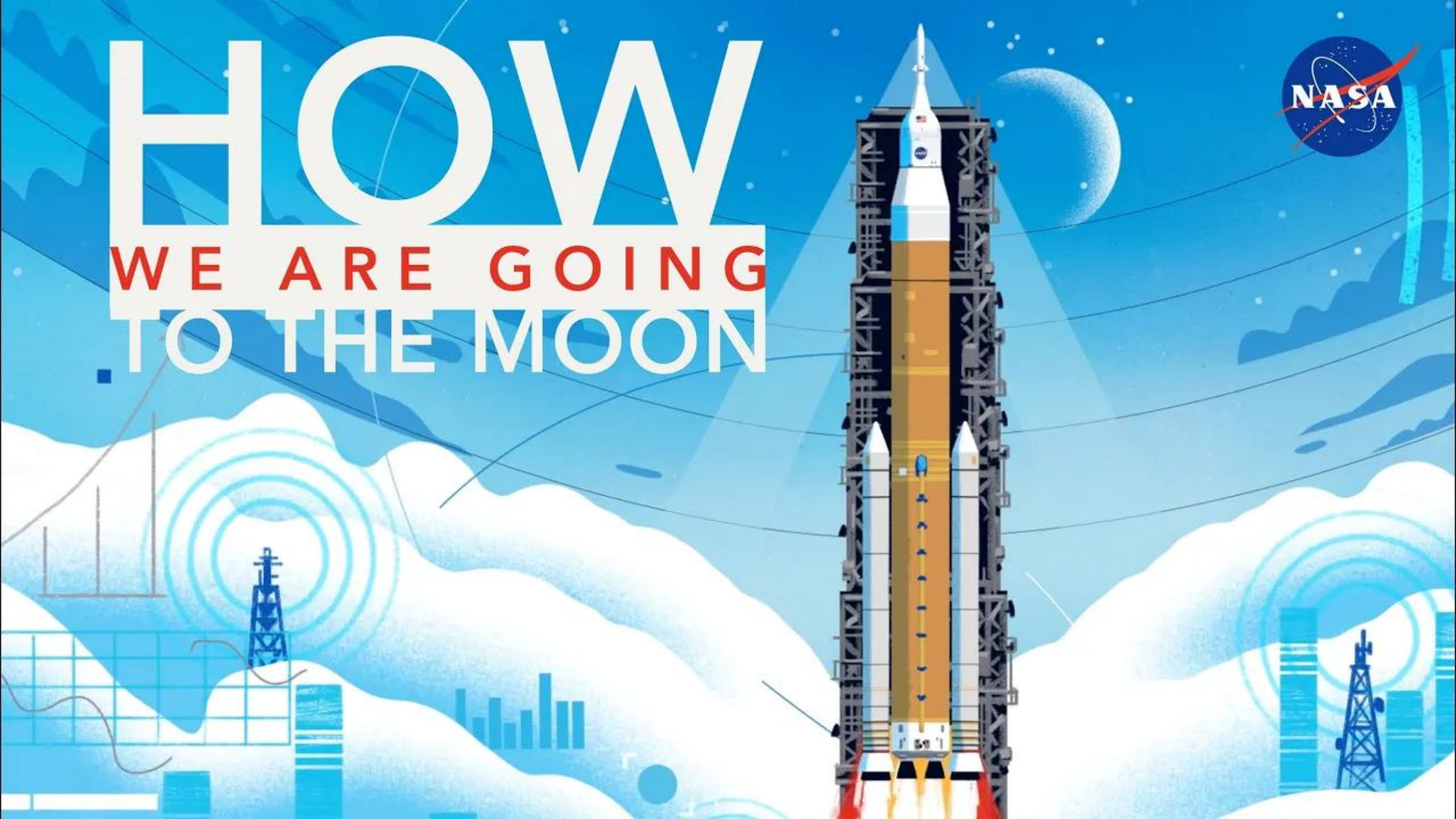
HOW WE ARE GOING TO THE MOON



1
00:00:01,310 --> 00:00:08,700
Between 1968 and 1972, America launched 9
human missions to the Moon, 6 of which successfully

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00:00:08,700 --> 00:00:12,900
touched down, allowing 12 men to walk on the
lunar surface.

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00:00:12,900 --> 00:00:18,890
NASA's next chapter of lunar exploration,
called Artemis, has the task of not just going

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00:00:18,890 --> 00:00:24,470
to the Moon, to create a long-term human presence
on and around it, but also to prepare for

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00:00:24,470 --> 00:00:27,679
ever-more-complex human missions to Mars.

6
00:00:27,679 --> 00:00:33,320
In short, everything we must be able to do
here, we must first do here.

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00:00:33,320 --> 00:00:38,890
So, what will an Artemis mission look like?

8
00:00:38,890 --> 00:00:44,210
Everything is designed and tested with our
most important element in mind: the astronauts.

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00:00:44,210 --> 00:00:50,170
This is their deep space, human-rated spacecraft
called Orion, built in 3 parts: the crew module,

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00:00:50,170 --> 00:00:54,570
where up to 4 astronauts will live and work
throughout the flight; the service module,

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00:00:54,570 --> 00:00:58,870

with life support systems for the crew and
its own engine and fuel reserves; and a launch

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00:00:58,870 --> 00:01:03,330
abort system, with engines capable of pulling
the crew module to safety during launch, should

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00:01:03,330 --> 00:01:04,820
anything go wrong.

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00:01:04,820 --> 00:01:09,509
To accomplish the task of launching our crew
and heavy payloads, NASA is building the Space

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00:01:09,509 --> 00:01:14,170
Launch System, comprising of a cargo hold,
an Exploration Upper Stage, a massive core

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00:01:14,170 --> 00:01:16,840
stage and 2 extended solid rocket boosters.

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00:01:16,840 --> 00:01:20,210
All together, this is the world's most powerful
rocket.

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00:01:20,210 --> 00:01:25,590
And it exceeds the legendary Saturn V of the
Apollo era in numerous ways.

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00:01:25,590 --> 00:01:30,759
Sitting on the launch pad, the entire rocket,
fully fueled, weighs just over 6 million pounds,

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00:01:30,759 --> 00:01:33,969
5.2 million of which is just the fuel.

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00:01:33,969 --> 00:01:37,409
Once ignited, there is no stopping what comes
next.

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00:01:37,409 --> 00:01:43,030
All 4 RS-25 engines and the 2 solid rocket
boosters come to life, thundering our crew

23
00:01:43,030 --> 00:01:44,030
upwards.

24
00:01:44,030 --> 00:01:47,469
Two minutes after ignition, the solid rocket
boosters are spent and released.

25
00:01:47,469 --> 00:01:52,090
Eight minutes after launch, the core stage
is depleted and separated.

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00:01:52,090 --> 00:01:57,240
The upper stage fires briefly, placing Orion
into a parking orbit around the Earth.

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00:01:57,240 --> 00:02:01,880
Here, the crew reconfigure the spacecraft
and check systems to confirm everything is

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00:02:01,880 --> 00:02:03,829
ready for deep space travel.

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00:02:03,829 --> 00:02:09,710
With a "go" from Mission Control, the crew
reignite the Exploration Upper Stage engines

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00:02:09,710 --> 00:02:14,310
to leave Earth entirely.The exact timing of
this maneuever is critical to reach a speed

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00:02:14,310 --> 00:02:19,849
that can escape Earth's gravitational pull,
but also put Orion on a course that will intersect

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00:02:19,849 --> 00:02:22,069

the Moon days later.

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00:02:22,069 --> 00:02:26,390
Once this burn is complete, the upper stage
of the SLS is jettisoned and the crew on board

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00:02:26,390 --> 00:02:31,420
Orion coast for several days toward all that
awaits them at the Moon.

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00:02:31,420 --> 00:02:36,260
Approaching the Moon, we see the fundamental
differences between Artemis and Apollo.

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00:02:36,260 --> 00:02:40,600
Instead of requiring Orion to serve as an
expendable lunar command module or carry a

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00:02:40,600 --> 00:02:45,420
constrained lunar lander, the Artemis missions
will take advantage of a different approach:

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00:02:45,420 --> 00:02:47,209
pre-staging.

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00:02:47,209 --> 00:02:50,510
Everything needed for lunar missions will
be positioned in advance by commercial and

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00:02:50,510 --> 00:02:52,689
international partners.

41
00:02:52,689 --> 00:02:56,610
This includes rovers, science experiments
and human-rated systems on the surface.

42
00:02:56,610 --> 00:03:01,849
But it also includes a dedicated lunar station
in orbit around the Moon, called Gateway.

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00:03:01,849 --> 00:03:07,579
Here at the station, we can pre-stage a robust
lunar lander and establish a strong communications

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00:03:07,579 --> 00:03:09,019
relay.

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00:03:09,019 --> 00:03:13,409
Designed with open standards, the Gateway
can be expanded as new missions and partnerships

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00:03:13,409 --> 00:03:17,909
develop, allowing multiple human missions
on the Moon at the same time, and enabling

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00:03:17,909 --> 00:03:21,830
ongoing science to be conducted even between
human missions.

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00:03:21,830 --> 00:03:26,720
The Gateway is also capable of adjusting its
orbit to allow access to every part of the

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00:03:26,720 --> 00:03:28,930
Moon, something the Apollo missions could
not do.

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00:03:28,930 --> 00:03:33,890
But the real key in this approach is placing
Gateway in a unique halo orbit to perfect

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00:03:33,890 --> 00:03:35,859
the maneuvers needed for Mars missions.

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00:03:35,859 --> 00:03:41,140
And, with a growing list of commercial and
international opportunities, Gateway is the

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00:03:41,140 --> 00:03:44,720

ideal hub between Earth and all that lies
beyond.

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00:03:44,720 --> 00:03:49,129
Returning to our crew as they approach Gateway,
the Orion must match the elliptical orbit

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00:03:49,129 --> 00:03:51,620
of the station in order to successfully dock.

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00:03:51,620 --> 00:03:56,370
Once on board, preselected crew members transfer
to the lunar lander while those assigned to

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00:03:56,370 --> 00:03:57,650
Gateway remain on station.

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00:03:57,650 --> 00:04:04,310
The lunar lander system itself is built for
3 unique steps: descending from the halo orbit

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00:04:04,310 --> 00:04:10,379
of Gateway down to a low lunar orbit; descending
from low lunar orbit to the surface; and once

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00:04:10,379 --> 00:04:14,870
the lunar mission is complete, launching from
the surface of the Moon and ascending all

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00:04:14,870 --> 00:04:22,590
the way back to the orbiting Gateway.

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00:04:22,590 --> 00:04:26,620
Once back aboard the Orion spacecraft and
undocked from Gateway, the crew fire their

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00:04:26,620 --> 00:04:32,190
engines to break out of the halo orbit and
once again to sling the spacecraft around

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00:04:32,190 --> 00:04:37,860
the Moon, placing it on a multi-day trajectory
back towards Earth.

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00:04:37,860 --> 00:04:42,220
As they near the end of this journey, the
service module is released and the crew module

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00:04:42,220 --> 00:04:44,800
is oriented heat shield-first.

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00:04:44,800 --> 00:04:49,759
Entering Earth's atmosphere at 25,000 miles
per hour, the friction of air slows Orion

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00:04:49,759 --> 00:04:54,930
considerably, while also subjecting it to
temperatures of 5,000 degrees.

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00:04:54,930 --> 00:05:00,470
With the Orion now at just 300 miles per hour,
a series of parachutes uniquely tested and

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00:05:00,470 --> 00:05:07,450
produced for this moment deploy, decelerating
the craft to just 20 miles per hour for splashdown.

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00:05:07,450 --> 00:05:14,819
With each successful mission, Artemis ushers
in the next wave of men and women to explore

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00:05:14,819 --> 00:05:15,819
our Moon.