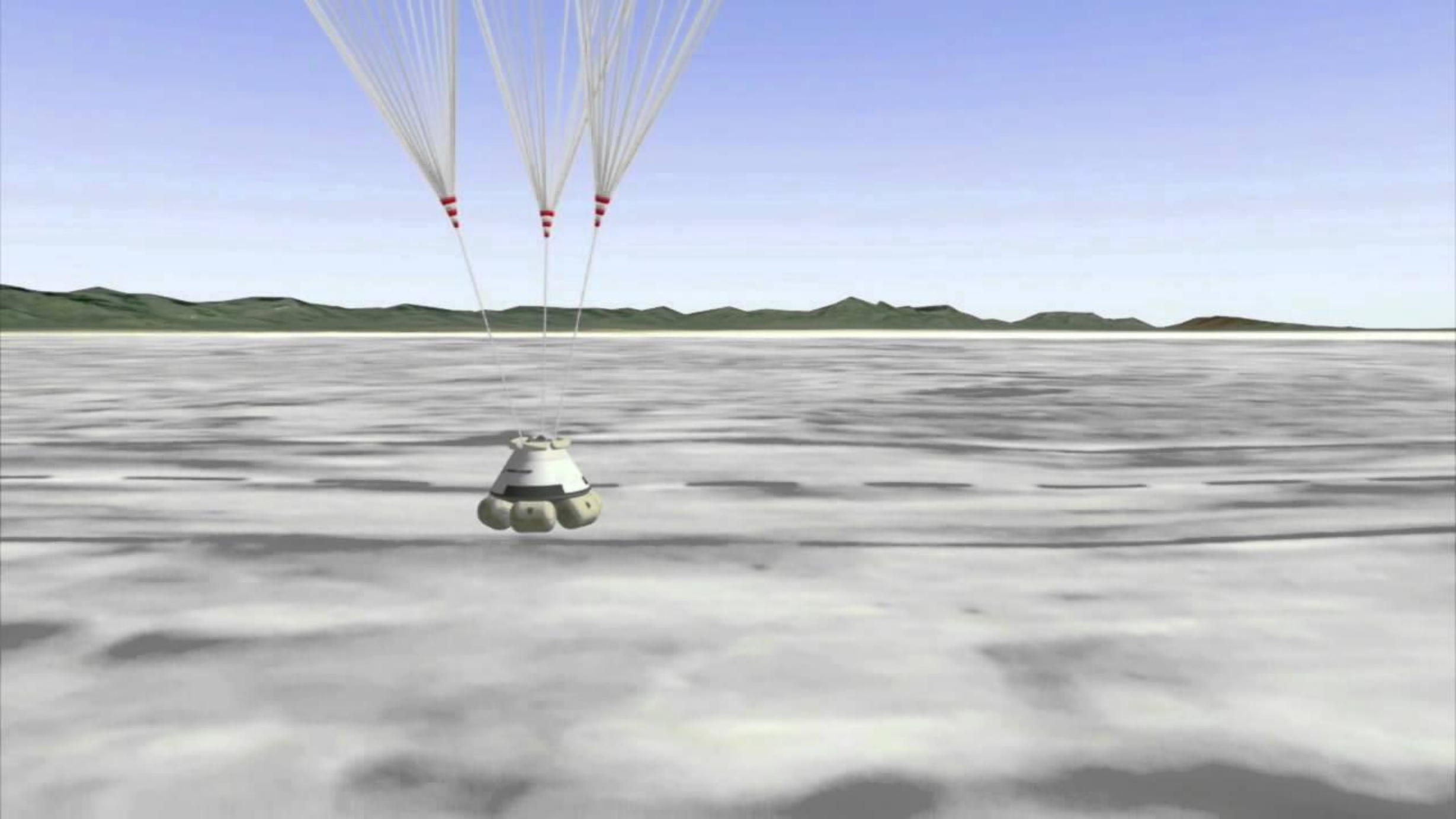

1
00:00:02,390 --> 00:00:05,640
NARRATOR: Rocket and spacecraft designers build some of the most complex machinery

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00:00:05,640 --> 00:00:10,240
imaginable and make it work in metal-melting heat and absolute cold.

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00:00:10,240 --> 00:00:16,210
Their vehicles have to keep their occupants alive in a vacuum and as they plunge into thick air.

4
00:00:16,210 --> 00:00:21,370
Out of all the situations engineers plan for, one of the most challenging things to do is come up

5
00:00:21,370 --> 00:00:26,680
with a safe system to rescue a crew and spacecraft from a failing rocket just before it launches

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00:00:26,680 --> 00:00:31,680
or as it soars through the atmosphere at speeds approaching Mach 25.

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00:00:31,680 --> 00:00:37,190
It's called a launch abort system. Just as a fighter pilot has an ejection seat to lift him out of a

8
00:00:37,190 --> 00:00:42,740
crashing airplane, a launch abort system, or LAS, lifts a spacecraft away from a rocket that is

9
00:00:42,740 --> 00:00:45,630
suffering a catastrophic failure.

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00:00:45,630 --> 00:00:49,190
GERACE: A launch abort system is basically, you can think of it as a smaller rocket

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00:00:49,190 --> 00:00:54,480
that's been integrated into the launch vehicle to get the crew off in case of an emergency.

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00:00:54,480 --> 00:00:59,230
What that really enables you to do is you're really taking the safety, the overall safety,

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00:00:59,230 --> 00:01:03,970

of the system up in order of magnitude. It's a much more effective way to spend your money

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00:01:03,970 --> 00:01:09,170
than just rolling that back into a more reliable launch vehicle. I mean, you want a reliable launch

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00:01:09,170 --> 00:01:17,770
vehicle, no doubt about it, but a reliable abort system combined gives you a much more safe

16
00:01:17,770 --> 00:01:18,920
system.

17
00:01:18,920 --> 00:01:23,350
Cheryl Malloy: We often talk about the philosophy of a robotic mission or a defense mission

18
00:01:23,350 --> 00:01:28,240
always presses to orbit. In the case of human spaceflight, if something's going wrong with the

19
00:01:28,240 --> 00:01:32,030
rocket or the spacecraft, we need to abort and bring that crew home safely.

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00:01:32,030 --> 00:01:36,630
It's a very basic definition of how we have to change how we're thinking about human

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00:01:36,630 --> 00:01:38,000
spaceflight.

22
00:01:38,000 --> 00:01:41,780
NARRATOR: What makes designing an LAS difficult is that it has to work in a lot of different

23
00:01:41,780 --> 00:01:46,250
environments, sometimes automatically, sometimes on command from the astronauts or

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00:01:46,250 --> 00:01:49,670
ground controllers.

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00:01:49,670 --> 00:01:54,880
GERACE: So, an abort system has to be able to account for a wide range of scenarios that

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00:01:54,880 --> 00:01:59,840
might go wrong in a launch vehicle. Some of those things, like a loss of thrust, your engines

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00:01:59,840 --> 00:02:06,170
shut down, those are actually fairly benign situations that give you a fair amount of time to react

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00:02:06,170 --> 00:02:11,760
and get off the launch vehicle. Other situations, a tank exploding, or something like that,

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00:02:11,760 --> 00:02:15,610
you've got to get off the rocket just like that. In literally milliseconds.

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00:02:15,610 --> 00:02:19,590
NARRATOR: A team of NASA engineers are working closely with aerospace companies under

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00:02:19,590 --> 00:02:25,280
the agency's Commercial Crew Program to outfit their designs with an effective escape system.

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00:02:25,280 --> 00:02:30,000
NASA is not designing specific systems for them, but has written a list of requirements

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00:02:30,000 --> 00:02:34,700
companies must meet if the craft is chosen to carry the agency's astronauts.

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00:02:34,700 --> 00:02:39,200
GERACE: We actually had a lot of things that we could draw on for a basis for requirements

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00:02:39,200 --> 00:02:43,730
when we started this development process. Of course NASA has an enormous amount of

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00:02:43,730 --> 00:02:49,180
experience in manned spaceflight. And so, that technical experience really provided the bedrock

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00:02:49,180 --> 00:02:55,690
for the knowledge of what we needed from a requirements standpoint. There was also a fair

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00:02:55,690 --> 00:03:01,950

amount of experience that we had developing a similar system with the OSP Program,

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00:03:01,950 --> 00:03:07,490
Orbital Space Plane, several years ago and that helped us guide these requirements as well.

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00:03:07,490 --> 00:03:13,680
We also are looking at our primary stakeholders, such as ISS, the International Space Station.

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00:03:13,680 --> 00:03:19,260
The mission is to get our crew to the space station and back and so their needs drove a lot of

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00:03:19,260 --> 00:03:21,630
our requirements as well.

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00:03:21,630 --> 00:03:24,650
NARRATOR: Abort systems have been an integral part of NASA spacecraft since

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00:03:24,650 --> 00:03:28,070
Alan Shepard's launch on May 5, 1961.

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00:03:28,070 --> 00:03:32,590
A small rocket on top of his capsule would've fired to lift the spacecraft and Shepard away from

46
00:03:32,590 --> 00:03:35,800
the Redstone booster if anything had gone wrong.

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00:03:35,800 --> 00:03:40,350
The Apollo Program used the same concept, called a tractor rocket, for its design.

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00:03:40,350 --> 00:03:44,530
In fact, the rocket on top of the capsule was more powerful than the main booster

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00:03:44,530 --> 00:03:46,730
that lifted Shepard.

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00:03:46,730 --> 00:03:50,870
Now, the companies working with NASA are incorporating technological advances

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00:03:50,870 --> 00:03:52,720
into their own designs.

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00:03:52,720 --> 00:03:57,040
GERACE: The Apollo rocket, as you know, incorporated what we call a tractor puller,

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00:03:57,040 --> 00:04:04,030
which had the smaller rocket on a tower above the spacecraft, and that's really advantageous

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00:04:04,030 --> 00:04:05,290
for a couple of areas.

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00:04:05,290 --> 00:04:10,670
Which, from a control standpoint, it's much easier to design a control system to control that

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00:04:10,670 --> 00:04:16,620
during an abort. Also, you can put more powerful rockets, solid rocket motors up there away

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00:04:16,620 --> 00:04:23,060
from the actual capsule. Now, a pusher motor is the other type of abort system that is being

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00:04:23,060 --> 00:04:27,960
developed and that has some advantages as well. It tends to be more synergistic with the

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00:04:27,960 --> 00:04:34,080
overall architecture because if you don't have an abort, which most of the time you wouldn't, you

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00:04:34,080 --> 00:04:39,740
can use those propellants for other parts of your mission design. And that enables your overall

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00:04:39,740 --> 00:04:43,160
design to be more effective and efficient.

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00:04:43,160 --> 00:04:48,110
NARRATOR: This work is a unique challenge to NASA engineers who have not designed a new

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00:04:48,110 --> 00:04:52,710

spacecraft since the space shuttle, which began flying in 1981.

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00:04:52,710 --> 00:04:57,800
GERACE: My background is the Launch Services Program. We've launched missions to Mars,

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00:04:57,800 --> 00:05:02,920
to Pluto and that has been enormously exciting as well. But this is manned spaceflight.

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00:05:02,920 --> 00:05:09,820
And this is an opportunity for us as a country to be able to bring back the capability that we lost

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00:05:09,820 --> 00:05:14,990
when we retired the shuttle to take our astronauts to low Earth orbit and be able to be part of