1
00:00:00,000 --> 00:00:02,753
NARRATOR: Asteroid Bennu
is a fascinating object.

2
00:00:02,753 --> 00:00:05,506
It records our solar system's
earliest history,

3
00:00:05,506 --> 00:00:08,091
contains information about the
origins of life,

4
00:00:08,091 --> 00:00:09,760
and has uncertainties in
its orbit

5
00:00:09,760 --> 00:00:12,513
that leaves a small possibility
of impacting Earth

6
00:00:12,513 --> 00:00:14,348
late in the twenty-second
century.

7
00:00:14,348 --> 00:00:17,367
These properties make Bennu
the perfect target for NASA's

8
00:00:17,367 --> 00:00:20,354
OSIRIS-REx asteroid
sample return mission.

9
00:00:20,354 --> 00:00:23,440
LAURETTA: It's a great adventure
to explore an unknown world.

10
00:00:23,440 --> 00:00:25,609
We're going to reach out and
touch it, and then we're going

11
00:00:25,609 --> 00:00:29,196
to bring treasure back to
Earth for scientific analysis.

12
00:00:29,196 --> 00:00:31,114
To me it doesn't get any
more exciting than that.

13
00:00:31,114 --> 00:00:38,472
[logo music]

14
00:00:38,472 --> 00:00:40,591
NARRATOR: There is a huge
scientific payoff of delivering

15
00:00:40,591 --> 00:00:44,678
a sample of asteroid Bennu
directly into the hands of
scientists.

16
00:00:44,678 --> 00:00:46,797
LAURETTA: We want to understand
the origin of the Earth,

17
00:00:46,797 --> 00:00:49,466
the origin of the Moon, the
other terrestrial planets,

18
00:00:49,466 --> 00:00:52,502
but the earliest histories of
those bodies is wiped out.

19
00:00:52,502 --> 00:00:55,889
The asteroids record the
earliest stages of the solar
system.

20
00:00:55,889 --> 00:00:58,642
So it really is a time capsule
from the very dawn

21
00:00:58,642 --> 00:01:00,377
of the history of our solar
system.

22
00:01:00,377 --> 00:01:02,896
My dream is that we find
something that's unique, that's

23
00:01:02,896 --> 00:01:05,882
not represented in our meteorite
collections, and is really

24
00:01:05,882 --> 00:01:08,368
organic-rich material on the
surface of this asteroid

25
00:01:08,368 --> 00:01:11,655
that holds all kinds of
scientific treasures about the
origin of life

26
00:01:11,655 --> 00:01:16,076
and organic molecular
evolution in the solar system.

27
00:01:16,076 --> 00:01:18,078
NARRATOR: In addition to the
planetary science, sending a

28
00:01:18,078 --> 00:01:20,664
spacecraft to asteroid
Bennu will let us better

29
00:01:20,664 --> 00:01:23,450
understand the orbit of
this near-Earth object.

30
00:01:23,450 --> 00:01:26,887
Bennu is four to five thousand

times more massive than the
meteor

31
00:01:26,887 --> 00:01:30,190
that exploded above Chelyabinsk,
Russia in 2013,

32
00:01:30,190 --> 00:01:34,127
and there's a small chance that
Bennu could hit us late in the
next century,

33
00:01:34,127 --> 00:01:36,229
depending on how
its orbit evolves.

34
00:01:36,229 --> 00:01:39,316
LAURETTA: In order to accurately
predict its future orbital
evolution,

35
00:01:39,316 --> 00:01:41,735
we have to not only understand
the force of gravity,

36
00:01:41,735 --> 00:01:46,440
but thermal forces on the
asteroid can significantly alter
its future path.

37
00:01:46,440 --> 00:01:50,143
So we're going to study not only
the thermal emission coming off
of Bennu,

38
00:01:50,143 --> 00:01:52,829
but we're also going to build up
a global model to make sure

39
00:01:52,829 --> 00:01:55,449
we understand the theory

that underlies this, so that we

40
00:01:55,449 --> 00:01:58,268
can use it to accurately predict
where Bennu's going to be in the
future

41
00:01:58,268 --> 00:02:00,871
and apply it to other
potentially hazardous asteroids

42
00:02:00,871 --> 00:02:03,724
to really help us
understand the impact hazard.

43
00:02:03,724 --> 00:02:09,212
NARRATOR: OSIRIS-REx will launch
in September 2016 and arrive at
asteroid Bennu in 2018.

44
00:02:09,212 --> 00:02:11,548
Once the team is ready, they
will use the Touch-and-Go

45
00:02:11,548 --> 00:02:15,569
Sample Acquisition Mechanism,
TAG-SAM, to grab a sample off
the surface.

46
00:02:15,569 --> 00:02:18,188
LAURETTA: We have a unique
design where we put this TAG-SAM

47
00:02:18,188 --> 00:02:21,141
device onto the surface of the
asteroid, and then we blow down

48
00:02:21,141 --> 00:02:24,811
high-pressure nitrogen gas to
kind of agitate the soil

49
00:02:24,811 --> 00:02:27,514
and then basically scoop it
up in a giant air filter.

50
00:02:27,514 --> 00:02:30,567
That whole process takes five
seconds, so it's kind of get in,

51
00:02:30,567 --> 00:02:32,219
get the sample, and
get out of there.

52
00:02:32,219 --> 00:02:34,788
NARRATOR: There's good reason to
think this approach will work.

53
00:02:34,788 --> 00:02:36,990
One of the challenges of
sampling an asteroid

54
00:02:36,990 --> 00:02:39,326
is navigating in a
low-gravity environment.

55
00:02:39,326 --> 00:02:43,246
And with so little gravity,
objects have a tendency to
bounce.

56
00:02:43,246 --> 00:02:45,982
LAURETTA: Our design is to
bounce off the surface of the
asteroid.

57
00:02:45,982 --> 00:02:49,669
In fact we've got a spring
in the forearm of our TAG-SAM
device

58
00:02:49,669 --> 00:02:52,255

which is acting literally like a
pogo stick to push us off

59
00:02:52,255 --> 00:02:54,991
the surface of the asteroid
after we make that initial
contact.

60
00:02:54,991 --> 00:02:57,828
So from everything that I've
seen, trying to bounce off the

61
00:02:57,828 --> 00:03:02,599
surface of the asteroid is the
easiest way to get that
material.

62
00:03:02,599 --> 00:03:04,918
NARRATOR: Once OSIRIS-REx
delivers the asteroid sample

63
00:03:04,918 --> 00:03:08,405
to Earth in 2023, it will have
brought back the largest sample

64
00:03:08,405 --> 00:03:11,525
of an extraterrestrial body
since the Apollo missions,

65
00:03:11,525 --> 00:03:13,794
and like the moon rocks from
Apollo, the sample will be

66
00:03:13,794 --> 00:03:17,631
studied for decades to come
with ever increasing technology.

67
00:03:17,631 --> 00:03:19,833
LAURETTA: This is really a
treasure of information about

68
00:03:19,833 --> 00:03:22,452
the history of our solar
system, and will not only solve

69
00:03:22,452 --> 00:03:25,088
the scientific questions
that we're asking today, but
those that

70
00:03:25,088 --> 00:03:29,576
people will be asking for many
generations into the future.