1
00:00:11,560 --> 00:00:16,540
The National Aeronautics and Space Administration
strives to reach for new heights and reveal

2
00:00:16,540 --> 00:00:19,720
the unknown, to benefit all humankind.

3
00:00:19,720 --> 00:00:24,660
In this pursuit we explore places never before
seen by humans, reaching out into the vast

4
00:00:24,660 --> 00:00:26,150
unknown of space.

5
00:00:26,150 --> 00:00:30,360
While doing so, we learn more about ourselves
in the process.

6
00:00:30,360 --> 00:00:34,070
Part of that mission is the responsibility
of what is called “Planetary Protection”,

7
00:00:34,070 --> 00:00:38,340
both protecting our own precious home, and
protecting the undiscovered country we are

8
00:00:38,340 --> 00:00:43,060
now pioneering, from any harmful contamination
we could introduce.

9
00:00:43,060 --> 00:00:45,840
Whether it’s a rover landing on a distant
rocky world,

10
00:00:45,840 --> 00:00:50,110
robotic probes skimming the surface of a liquid
spewing moon,

11
00:00:50,110 --> 00:00:54,890

or returning samples back to our home planet
from a far away celestial object,

12
00:00:54,890 --> 00:00:58,980
the office of Planetary Protection strives
to protect all of the planets, all of the

13
00:00:58,980 --> 00:01:00,080
time.

14
00:01:00,080 --> 00:01:04,909
The importance of planetary protection is
not just an issue of international treaty

15
00:01:04,909 --> 00:01:11,420
and legality; it’s a simple scientific lesson
we’ve learned from Earth history.

16
00:01:11,420 --> 00:01:17,159
We all know the hard environmental lessons
learned from past mistakes of contamination

17
00:01:17,159 --> 00:01:19,820
here on Earth:

18
00:01:19,820 --> 00:01:24,420
From invasive flora and fauna tracked from
one continent to another/

19
00:01:24,420 --> 00:01:27,920
from sea-going natives that become lakefront
pestilence /

20
00:01:27,920 --> 00:01:34,070
from infestations of small vermin spreading
predator-free across vast landscapes.

21
00:01:34,070 --> 00:01:40,540
We must remain vigilant to not expose our
largely unexplored planetary neighbors to

22
00:01:40,540 --> 00:01:41,540
contamination.

23
00:01:41,540 --> 00:01:47,540
It’s our responsibility, and greatly to
our advantage, to prevent invasive species

24
00:01:47,540 --> 00:01:51,649
in interplanetary exploration as well as on
Earth.

25
00:01:51,649 --> 00:01:54,600
Obviously rabbits and iguanas aren’t the
type of contaminants that could stow away

26
00:01:54,600 --> 00:01:59,020
on a robotic planetary mission, but is it
possible to take microbial life accidentally

27
00:01:59,020 --> 00:02:01,420
to another world?

28
00:02:01,420 --> 00:02:05,020
What if we contaminate a planet with bacteria
from Earth before we have a chance to determine

29
00:02:05,020 --> 00:02:07,969
if life exist there naturally first?

30
00:02:07,969 --> 00:02:12,720
All the science we would do there would be
compromised forever; tainted or lost!

31
00:02:12,720 --> 00:02:19,030
We know from science that life adapts to extreme
environments in unexpected ways.

32
00:02:19,030 --> 00:02:25,349

Frigid polar caps once thought barren teem
with tiny enduring forms of life.

33
00:02:25,349 --> 00:02:31,790
Hot scorching deserts are often homes to hibernating
creatures that spring into life with the onset

34
00:02:31,790 --> 00:02:33,670
of rain.

35
00:02:33,670 --> 00:02:37,209
Take for example the Himalayan Tardigrade
(TAR-de-Grade) or “Water Bear”.

36
00:02:37,209 --> 00:02:44,280
A mere 1/16th of an inch long, they can survive
freezing in liquid nitrogen and boiling in

37
00:02:44,280 --> 00:02:48,180
water, and can stay dry and dormant for years.

38
00:02:48,180 --> 00:02:53,410
These little creatures have even survived
biological experiments aboard spacecraft,

39
00:02:53,410 --> 00:02:57,599
living through exposure to the vacuum of space.

40
00:02:57,599 --> 00:03:01,989
Planetary Protection is here to make sure
we don’t unknowingly take hitchhikers with

41
00:03:01,989 --> 00:03:04,280
us further into the galaxy.

42
00:03:04,280 --> 00:03:08,319
When we explore new landing zones and places
of interest, we want to confirm that native

43

00:03:08,319 --> 00:03:12,970
life isn’t already there, before we contaminate
or displace it with Earth life, riding aboard

44
00:03:12,970 --> 00:03:17,850
robotic explorers or the eventual first visit
from human explorers.

45
00:03:17,850 --> 00:03:24,640
We also need to know that the places astronauts
will eventually set foot are safe for exploration.

46
00:03:24,640 --> 00:03:28,290
Therefore NASA scientists and engineers are
working hard at overcoming every obstacle

47
00:03:28,290 --> 00:03:31,530
that could get in the way of humans going
to our next destination;

48
00:03:31,530 --> 00:03:36,189
with robotics, rockets, suits and more…
and planetary protection is part of that Journey

49
00:03:36,189 --> 00:03:40,540
to Mars; in development, clean rooms, launches
and landings.

50
00:03:40,540 --> 00:03:43,920
So what does The Office of Planetary Protection
do?

51
00:03:43,920 --> 00:03:49,189
The first step is to identify how the mission
will interact with the planetary target.

52
00:03:49,189 --> 00:03:53,090
Most objects in the solar system don't provide
habitats for Earth life, so protection of

53

00:03:53,090 --> 00:03:57,709
these objects is easy: we just keep records
of what our spacecraft do, and where they

54
00:03:57,709 --> 00:03:59,060
end up.

55
00:03:59,060 --> 00:04:03,590
Today, there are only three solar system objects
that are known to provide possible habitats

56
00:04:03,590 --> 00:04:08,040
for Earth life, so these objects have the
most stringent restrictions.

57
00:04:08,040 --> 00:04:12,329
Each one is unique, studied in different ways,
and with different instruments.

58
00:04:12,329 --> 00:04:18,239
Flybys of Jupiter's icy moon, Europa, with
its sub-surface global ocean, or of Enceladus

59
00:04:18,239 --> 00:04:23,210
[en-SELL-ah-dus], Saturn's tiny ice-ejecting
moon, are much different from the exploration

60
00:04:23,210 --> 00:04:29,190
being done today on and around the planet
Mars with robotic orbiters and landers.

61
00:04:29,190 --> 00:04:34,310
From the Viking project's historic firsts
in Mars exploration to today's Curiosity

62
00:04:34,310 --> 00:04:40,310
Rover and Mars Reconnaissance Orbiter, to
the future Mars 2020 rover, these missions

63
00:04:40,310 --> 00:04:44,819

were carefully treated to avoid accidentally
releasing Earth life.

64
00:04:44,819 --> 00:04:53,230
Fly-by, orbit, land, rove or even sample return;
with each future mission comes it’s own

65
00:04:53,230 --> 00:04:58,040
set of planetary protection guidelines and
monitoring systems.

66
00:04:58,040 --> 00:05:03,690
After the mission is identified, the next
step is to figure out how to keep Earth microbes

67
00:05:03,690 --> 00:05:09,440
away from the hardware that will interact
with the target surface.

68
00:05:09,440 --> 00:05:11,889
Clean it.

69
00:05:11,889 --> 00:05:16,520
Wrap it.

70
00:05:16,520 --> 00:05:21,150
Bake it.

71
00:05:21,150 --> 00:05:25,300
Planetary Protection monitors NASA clean rooms,
rooms that have specially designed, controlled

72
00:05:25,300 --> 00:05:29,800
environments where scientists and engineers
prepare payloads and delivery systems for

73
00:05:29,800 --> 00:05:30,800
mission.

74

00:05:30,800 --> 00:05:33,930
The clean room “Bunny Suit” as it’s
called keeps human contaminants contained,

75
00:05:33,930 --> 00:05:39,000
making sure the clean room stays a “clean
room”, down to the microscopic level.

76
00:05:39,000 --> 00:05:44,180
From ground processing to launch, flight,
landing and beyond, Planetary Protection remains

77
00:05:44,180 --> 00:05:45,610
vigilant.

78
00:05:45,610 --> 00:05:51,230
We have the responsibility to keep Mars and
other planets pristine for scientific investigation,

79
00:05:51,230 --> 00:05:54,070
without influence of Earth borne contaminants.

80
00:05:54,070 --> 00:05:58,479
We want to know if there is life on other
planets, and to find that out, the data must

81
00:05:58,479 --> 00:05:59,919
be unspoiled.

82
00:05:59,919 --> 00:06:04,910
For example, if your roommate sees your nice
new contaminant-free carton of milk sitting

83
00:06:04,910 --> 00:06:09,960
in the cold environment of the fridge, do
you want them to use a clean glass to get

84
00:06:09,960 --> 00:06:11,930
their milk sample?

85
00:06:11,930 --> 00:06:16,110
Or should they just drink directly from your
carton and expose the rest of the milk and

86
00:06:16,110 --> 00:06:19,460
eventually you to their biological hitchhikers?

87
00:06:19,460 --> 00:06:25,639
We also have the responsibility to make sure
that future astronaut crews will be safe when

88
00:06:25,639 --> 00:06:33,460
observing the red planet in person, and protect
planetary resources for possible future use.

89
00:06:33,460 --> 00:06:38,650
Most importantly, we have the responsibility
to protect our planet Earth from exposure

90
00:06:38,650 --> 00:06:44,849
to possible alien microbial life, that could
be present in samples returned by robotic

91
00:06:44,849 --> 00:06:47,030
or crewed missions.

92
00:06:47,030 --> 00:06:51,479
The Office of Planetary Protection is here
to protect all of the planets, all of the