



1
00:00:00,640 --> 00:00:03,560

[Music]

2
00:00:04,760 --> 00:00:07,280

[Volcano Rumbling]

3
00:00:14,000 --> 00:00:17,360

[Water flowing/bubbles]

4
00:00:17,360 --> 00:00:20,560

>>I've been curious about the natural world
since I was a very small child growing up

5
00:00:20,560 --> 00:00:25,040

along the shores of the Chesapeake Bay, where
I very quickly learned to study all the different

6
00:00:25,040 --> 00:00:30,610

animals and pick up trash, which led me to
study marine science and oceanography in school.

7
00:00:30,610 --> 00:00:34,250

And during my studies, I learned that the
ocean was in a great deal of trouble from

8
00:00:34,250 --> 00:00:38,629

human impacts- from overfishing, from pollution,
as well as climate change, and I wanted to

9
00:00:38,629 --> 00:00:42,999

do something about that, and for me, doing
something meant using science and technology

10
00:00:43,000 --> 00:00:48,120

to find novel ways to keep track of what was
happening in the ocean, and look for solutions.

11
00:00:48,560 --> 00:00:53,080

[Waves]

12

00:00:53,920 --> 00:00:58,280

Coral reefs are valued at billions of dollars across the world for fisheries, sustenance

13

00:00:58,309 --> 00:01:00,680

fisheries in island nations...

14

00:01:00,680 --> 00:01:03,850

>>...tourism, and new compounds for the pharmaceutical industry

15

00:01:03,850 --> 00:01:09,570

are two examples are how coral reefs have contributed a lot of money and generated wealth

16

00:01:09,570 --> 00:01:10,570

for a lot of people.

17

00:01:10,570 --> 00:01:15,030

We have this tremendous wealth of different types of ecosystems and species on this planet,

18

00:01:15,030 --> 00:01:21,330

and having these reefs around to maintain a sort of biological stock of genetic uniqueness

19

00:01:21,330 --> 00:01:27,670

is really important for genetic diversity, ecosystem health, and resilience of the ecosystem

20

00:01:27,670 --> 00:01:31,840

in the face of things like climate change and other sort of stressors they may encounter

21

00:01:31,840 --> 00:01:32,840

in the future.

22

00:01:32,840 --> 00:01:36,060

>>They've been called the canary in the coal mine, they're one of the first marine ecosystems

23
00:01:36,060 --> 00:01:41,890
to start to show very significant degradation from ocean temperatures increasing and ocean

24
00:01:41,890 --> 00:01:42,890
acidification.

25
00:01:42,890 --> 00:01:46,420
And they're simply aren't enough people that can be scuba diving in the water all the time

26
00:01:46,420 --> 00:01:50,360
to tell you how the coral reefs are doing, so we need new ways to monitor them using

27
00:01:50,360 --> 00:01:55,490
things like satellite imagery that can easily cover all parts of the world, even in places

28
00:01:55,490 --> 00:01:57,800
that you can't very readily get a person to.

29
00:01:57,800 --> 00:01:59,360
[Airplane taking off]

30
00:01:59,360 --> 00:02:04,040
What the ER-2 is doing is telling us what coral reefs would look like from space.

31
00:02:04,040 --> 00:02:07,000
[Airplane taking off]

32
00:02:07,000 --> 00:02:10,680
[Water flowing/bubbles]

33
00:02:12,280 --> 00:02:14,320

>>I'm an environmental scientist.

34

00:02:14,320 --> 00:02:15,490

I study ecosystems.

35

00:02:15,490 --> 00:02:22,130

I study how those ecosystems are impacted by external pressures such as climate and

36

00:02:22,130 --> 00:02:23,130

population.

37

00:02:23,130 --> 00:02:27,370

Our part in this project is to understand the color of coral reef signatures coming

38

00:02:27,370 --> 00:02:28,590

out of the water.

39

00:02:28,590 --> 00:02:32,230

What colors will the HypsIRI sensor see?

40

00:02:32,230 --> 00:02:36,900

Live corals look very different from dead, algae-encrusted corals, and they look very

41

00:02:36,900 --> 00:02:40,700

different from the surrounding un-colonized sand and coral rubble.

42

00:02:40,700 --> 00:02:45,450

So by looking at the detailed spectrum of light coming out of the water in the visible and

43

00:02:45,450 --> 00:02:49,570

near-infrared portion of the spectrum, we believe we'll be able to say something about

44

00:02:49,570 --> 00:02:54,800

where the coral resides and how healthy it is.

45

00:02:56,730 --> 00:03:00,830

In order to interpret the data that's being collected by the ER-2, you have to know something

46

00:03:00,830 --> 00:03:05,930

about the inherent reflectance of the features on the ocean floor that we're interested in-

47

00:03:05,930 --> 00:03:09,690

healthy coral, not healthy coral, bare sand, and rubble.

48

00:03:09,690 --> 00:03:11,950

So what we're doing is we're measuring, in water,

49

00:03:11,950 --> 00:03:15,250

the reflectance of the ocean floor, very close to the ocean floor.

50

00:03:15,250 --> 00:03:21,540

But also we're deploying radiometers at the ocean surface, so that we can understand the

51

00:03:21,540 --> 00:03:26,599

change in that color as it propagates through water column to the surface.

52

00:03:26,599 --> 00:03:30,900

That's the information that needs to be taken into consideration when we try to interpret

53

00:03:30,900 --> 00:03:32,740

the data in terms of coral health.

54

00:03:32,740 --> 00:03:35,270

We have to essentially remove the effects

of water.

55

00:03:35,270 --> 00:03:40,860

>>This is something relatively new, using satellite imagery, using hyper-spectral imagery to categorize

56

00:03:40,860 --> 00:03:42,600

coral reefs.

57

00:03:44,050 --> 00:03:49,520

We're collecting bottom spectra underwater of coral, algae, and sand, so that we can

58

00:03:49,520 --> 00:03:54,631

better use the hyper-spectral imagery to figure out how much coral or algae or sand there

59

00:03:54,631 --> 00:03:56,900

are in each specific shot.

60

00:03:56,900 --> 00:04:01,670

It's not immediately obvious in a satellite image whether a pixel is coral or algae and

61

00:04:01,670 --> 00:04:03,130

how much coral is in it.

62

00:04:03,130 --> 00:04:06,810

And to do that really well, we need to collect both pieces of information at the same time.

63

00:04:06,810 --> 00:04:11,080

We need an airborne image, and we also need to know exactly what's going on in the

64

00:04:11,080 --> 00:04:12,080

water.

65

00:04:12,080 --> 00:04:17,930

We can be collecting in water data to match up with those specific images and so we know

66

00:04:17,930 --> 00:04:22,199

that in a particular pixel there's a certain amount of coral, a certain amount of algae,

67

00:04:22,199 --> 00:04:26,620

it better informs us how, in the future, we can remove the atmosphere and the water effects

68

00:04:26,620 --> 00:04:28,700

from the satellite data.

69

00:04:28,700 --> 00:04:33,760

[Background sound/chatter]

70

00:04:48,880 --> 00:04:56,080

>>Our autonomous kayak system is a fully autonomous platform that's customizable, configureable,

71

00:04:56,080 --> 00:04:59,210

and made entirely with off-the-shelf components.

72

00:04:59,210 --> 00:05:03,210

It'll be towing an optical sled from the US Naval Research Laboratory, and we'll also

73

00:05:03,210 --> 00:05:09,060

have it towing a YSI XO2 water quality parameter monitoring sonde, which gives us the ability

74

00:05:09,060 --> 00:05:15,560

to measure chlorophyll A, fluorescent dissolved organic matter, pH, temperature, and salinity.

75

00:05:15,880 --> 00:05:18,680

[Music]

76

00:05:19,080 --> 00:05:25,440

>>These sensors are providing timely, and volume of data necessary to understand not only coral

77

00:05:25,470 --> 00:05:29,330

reef ecosystems, but all the other kinds of ecosystems around the world, in the ocean

78

00:05:29,330 --> 00:05:30,330

and on land.

79

00:05:30,330 --> 00:05:34,300

And the only way we can save these ecosystems is to understand how they respond and then

80

00:05:34,300 --> 00:05:39,280

develop mitigation methods so that we can help them out.