



ICESat-2
LASER
FOCUS

1

00:00:08,100 --> 00:00:12,130

VO: The ATLAS instrument on ICESat-2 will measure heights

2

00:00:12,150 --> 00:00:16,170

on Earth by transmitting a pattern of six laser beams,

3

00:00:16,190 --> 00:00:20,210

receiving the laser photons that Earth reflects back up to the

4

00:00:20,230 --> 00:00:24,240

satellite, and recording the travel time of those photons.

5

00:00:24,260 --> 00:00:28,270

First up: Transmitting the laser.

6

00:00:28,290 --> 00:00:32,280

Tyler: Hey there, I'm Tyler Evans, an optical mechanical engineer working on the ATLAS

7

00:00:32,300 --> 00:00:36,300

project for the ICESat-2 mission. So what we have here is the optical bench, which

8

00:00:36,320 --> 00:00:40,380

has a lot of the transmitter components on it, which is where the laser starts before

9

00:00:40,400 --> 00:00:44,440

it bounces off a bunch of mirrors and goes out towards Earth to measure ice.

10

00:00:44,460 --> 00:00:48,510

So the laser comes out of the box off of the fold mirror, and the fold mirror folds it

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00:00:48,530 --> 00:00:52,570

90 degrees. So it comes out towards the rest of the bench. Then it encounters this

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00:00:52,590 --> 00:00:56,620

optic, which is the polarizing beam combiner, or the PBC,

13

00:00:56,640 --> 00:01:00,660

which sends the light in two different directions. So it picks off a small

14

00:01:00,680 --> 00:01:04,690

percentage of light to go through the periscope and into the laser sampling assembly.

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00:01:04,710 --> 00:01:08,720

So one of the channels in the LSA is the start pulse detector,

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00:01:08,740 --> 00:01:12,750

which is basically the stopwatch of starting and stopping that timer for how

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00:01:12,770 --> 00:01:16,820

long it's going to take the photons to get back down to measure the ice and back. And that's

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00:01:16,840 --> 00:01:20,900

really how the scientists are able to calculate what the elevation of ice is, is by knowing that

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00:01:20,920 --> 00:01:24,960

time that each of the photons travels. The rest of the beam comes out through the PBC

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00:01:24,980 --> 00:01:29,020

out toward the beam expander. It hits the small mirror first

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00:01:29,040 --> 00:01:33,060

and it's ten millimeters at this point. But when it hits this

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00:01:33,080 --> 00:01:37,110

small mirror, the mirror has curvature to it, so what it does is it takes that ten millimeter beam

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00:01:37,130 --> 00:01:41,140

and it starts to expand it, all the way out to 44 millimeters by

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00:01:41,160 --> 00:01:45,160

the time it hits the second mirror. Once it hits the second mirror, it has curvature in it,

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00:01:45,180 --> 00:01:49,200

which recollimates it. So now, instead of expanding, it's now staying at a constant

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00:01:49,220 --> 00:01:53,210

size of 44 millimeters all the way out to the rest of the bench.

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00:01:53,230 --> 00:01:57,280

It then goes through the beam steering mirror, which is here. ATLAS has

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00:01:57,300 --> 00:02:01,350

a mechanism to be able to actually steer the beam and compensate for changes

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00:02:01,370 --> 00:02:05,410

that might happen on the bench. So as the spacecraft goes in and out of the Sun, thermal

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00:02:05,430 --> 00:02:09,470

changes will happen to actually make the bench bend, and to compensate for those bends,

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00:02:09,490 --> 00:02:13,510

you don't want to have the light bend as well, so we have a motorized mirror

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00:02:13,530 --> 00:02:17,550

to be able to steer that beam so it's always pointing in the same direction no

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00:02:17,570 --> 00:02:21,580

matter what happens to the bench. So the beam goes through the beam steering mirror,

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00:02:21,600 --> 00:02:25,660

and then it actually goes through the DOE, which is the diffractive optical element,

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00:02:25,680 --> 00:02:29,670

which sits right here under the bench. And it's a circular piece of glass, and it has

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00:02:29,690 --> 00:02:33,690

an etched pattern in it, and that etched pattern basically takes that