
70514-003
EPISODE THREE
MORE THAN JUST A PRETTY PICTURE

1
00:00:02,540 --> 00:00:03,970
(on-screen text) Landsat 9: Continuing the Legacy

2
00:00:05,100 --> 00:00:08,650
Mike O'Brien: It was a Friday night even, and it was about 10:00 PM.

3
00:00:08,670 --> 00:00:11,250
And I got a phone call cause I'm on call.

4
00:00:11,270 --> 00:00:16,430
Basically, had the operator explain that the antenna stopped moving during setup.

5
00:00:16,450 --> 00:00:21,710
Narrator: This is Mike O'Brien recounting a call that every ground station engineer dreads:

6
00:00:21,730 --> 00:00:24,830
The antenna is down and you have less than two hours to fix it

7
00:00:24,850 --> 00:00:27,530
before the satellite needs to make contact with it.

8
00:00:27,550 --> 00:00:28,740
Mike O'Brien: Um, I drove to site.

9
00:00:28,760 --> 00:00:31,030
It was exactly what I thought it was at the time.

10
00:00:31,050 --> 00:00:35,280
It was a software problem and the antenna drove itself into a limit.

11
00:00:35,300 --> 00:00:37,890
When it does that, it kills power to the antenna

12
00:00:37,910 --> 00:00:41,310
and it has to be manually manipulated to move out of that area.

13
00:00:41,330 --> 00:00:43,510

So I, you know, put the harness on,

14
00:00:43,530 --> 00:00:46,680
you know, got into the lift, went up to the axis.

15
00:00:46,700 --> 00:00:50,940
Um, you have to open that, uh, housing doors, which is no big deal.

16
00:00:50,960 --> 00:00:52,740
And then you crank the hand crank,

17
00:00:52,760 --> 00:00:54,740
which physically moves the antenna

18
00:00:54,760 --> 00:00:56,670
and it moved in out of that limit area.

19
00:00:56,690 --> 00:01:00,750
I had about 12 minutes left before the next pass started.
(on-screen text) Episode 3: More Than Just a Pretty Picture

20
00:01:01,620 --> 00:01:03,770
Narrator: Let's take a step back to explain why,

21
00:01:03,790 --> 00:01:06,550
apart from strapping yourself to a lift 30 feet in the air,

22
00:01:06,570 --> 00:01:08,570
this is a stressful situation.

23
00:01:08,590 --> 00:01:12,510
A Landsat satellite orbits the earth every 99 minutes,

24
00:01:12,530 --> 00:01:16,120
furiously collecting images of everything below it with each pass.

25
00:01:16,140 --> 00:01:18,730
Much like the storage on your phone quickly decreases

26
00:01:18,750 --> 00:01:20,990
as your pictures of cute dogs increase,

27
00:01:21,010 --> 00:01:23,200
Landsat's storage is also limited.

28
00:01:23,220 --> 00:01:26,000
Which is why the satellite makes contact with a ground station

29
00:01:26,020 --> 00:01:28,370
every few hours to offload its data.

30
00:01:28,390 --> 00:01:30,890
But what if the ground station is down?

31
00:01:30,910 --> 00:01:33,880
Well, in that case, Landsat's internal harddrive fills up

32
00:01:33,900 --> 00:01:36,300
and doesn't capture the next round of images.

33
00:01:36,320 --> 00:01:38,110
Critical data is lost.

34
00:01:38,130 --> 00:01:42,590
Luckily, that is extremely rare and data is hardly ever lost...

35
00:01:42,610 --> 00:01:44,980
especially with a workflow like this:

36
00:01:45,000 --> 00:01:47,330
Mike O'Brien: So every time a Landsat 8 image comes in,

37
00:01:47,350 --> 00:01:50,980
I record on four independent different pieces of equipment.

38

00:01:51,000 --> 00:01:55,780
That way, if there's a failure, I still have three other great copies.

39
00:01:55,800 --> 00:01:57,410
Narrator: We couldn't really tell the story of data

40
00:01:57,430 --> 00:01:59,930
without mentioning Landsat's data renaissance

41
00:01:59,950 --> 00:02:03,240
when a landmark decision changed earth science forever.\h

42
00:02:03,260 --> 00:02:08,220
In 1990, Landsat data cost as much as $4,000 per "scene".

43
00:02:08,240 --> 00:02:11,990
Usually scientists require several of these "scenes" to do their research.

44
00:02:12,010 --> 00:02:15,280
As you can imagine, the cost was a major obstacle.

45
00:02:15,300 --> 00:02:19,160
In 2008, Landsat took down its paywall.\h

46
00:02:19,180 --> 00:02:22,710
Kristi Kline: I recall having one of our international cooperator meetings

47
00:02:22,730 --> 00:02:24,480
and a woman from Russia was there

48
00:02:24,500 --> 00:02:32,160
and she gave a briefing that really highlighted the importance of free data

49
00:02:32,180 --> 00:02:37,310
basically saying how it was democratizing for countries like hers,

50
00:02:37,330 --> 00:02:43,990
where suddenly you had an open source of information where,

51
00:02:44,010 --> 00:02:49,060
anybody could get access and see what was going on on the face of the earth.\h

52
00:02:49,080 --> 00:02:52,480
Narrator: Kristi Kline manages the entire Landsat data archive,

53
00:02:52,500 --> 00:02:54,190
nearly 50 years of it.

54
00:02:54,210 --> 00:02:56,320
She knows first hand how hungry the

55
00:02:56,340 --> 00:02:58,690
science community is for Landsat products.

56
00:02:58,710 --> 00:03:01,200
The first year scenes were available for free,

57
00:03:01,220 --> 00:03:03,530
downloads jumped exponentially.\h

58
00:03:03,550 --> 00:03:06,400
Kristi Kline: In 2008, we had over a million downloads.

59
00:03:06,420 --> 00:03:11,870
And today, we typically get 15 to 20 million each year.

60
00:03:11,890 --> 00:03:14,320
Narrator: Which brings us to our next segment…

61
00:03:14,340 --> 00:03:16,450
Look at these. Stunning, right?

62
00:03:16,470 --> 00:03:17,410
WRONG

63

00:03:17,430 --> 00:03:19,390
I mean, well yes, they are gorgeous,

64
00:03:19,410 --> 00:03:22,780
but they are also a consistent record of change over time.\h

65
00:03:22,800 --> 00:03:24,480
At its most basic level,

66
00:03:24,500 --> 00:03:28,550
it's easy to see how Earth has changed since Landsat 1 launched in 1972.

67
00:03:28,570 --> 00:03:31,830
Just look at an early image and then compare it to a current one.

68
00:03:31,850 --> 00:03:34,200
Maybe it's changed a lot, maybe a little,

69
00:03:34,220 --> 00:03:35,660
but that's about all you can say.

70
00:03:35,680 --> 00:03:38,700
Landsat provides more than just pictures, though

71
00:03:38,720 --> 00:03:42,920
From space, it sends back verified scientific data in multiple wavelengths.

72
00:03:42,940 --> 00:03:48,810
With Landsat, we can quantify exactly how much each 30-meter by 30-meter pixel has changed.

73
00:03:48,830 --> 00:03:51,990
And with the full Landsat archive available at no cost,

74
00:03:52,010 --> 00:03:55,520
you can track the complete progression of each pixel throughout the season.

75
00:03:55,540 --> 00:03:58,480
And you can do that for millions of pixels at a time.

76
00:03:59,010 --> 00:04:02,120
Has a piece of land changed from wetlands to suburban housing?

77
00:04:02,140 --> 00:04:04,270
Did forests become farmland?

78
00:04:04,290 --> 00:04:07,890
Or, looking closer, have *these* pixels of forest become stressed

79
00:04:07,910 --> 00:04:09,300
due to insect damage?

80
00:04:09,320 --> 00:04:12,330
Are *those* pixels of farm fields suffering from drought?

81
00:04:12,350 --> 00:04:14,460
With carefully calibrated Landsat data,

82
00:04:14,480 --> 00:04:18,100
it is possible to answer these questions for the whole globe.

83
00:04:18,120 --> 00:04:20,370
Jeff Masek: It's you know, it's a slice of human history.

84
00:04:20,390 --> 00:04:26,910
It's amazing how well for this 50 years we're documenting every change on the planet.\h

85
00:04:26,930 --> 00:04:30,680
Narrator: This is Jeff Masek, Landsat 9 Project Scientist.

86
00:04:30,700 --> 00:04:33,130
Jeff Masek: My thing has always been history.

87
00:04:33,150 --> 00:04:35,780
My academic training is actually in geology,

88

00:04:35,800 --> 00:04:39,980
but the thing that I sort of loved about geology was still that kind of long time, right.

89
00:04:40,000 --> 00:04:44,340
It's just being able to, like, stand in a spot and say that,

90
00:04:44,360 --> 00:04:48,270
you know, there was an ocean here 50 million years ago,

91
00:04:48,290 --> 00:04:51,110
and I can look at the fossils that are indicated for that.\h

92
00:04:51,130 --> 00:04:55,540
The thing that got me into the Landsat record was still that historical perspective

93
00:04:55,560 --> 00:04:57,820
It's not 50 million years, it's 50 years,

94
00:04:57,840 --> 00:05:00,350
but still you're seeing before your eyes,

95
00:05:00,370 --> 00:05:06,460
how the environment of forest change, how agriculture changes, urban expansion,

96
00:05:06,480 --> 00:05:10,380
the whole, the whole thing, how the planet has changed over 50 years.

97
00:05:10,400 --> 00:05:13,850
Not only can you not conserve what you cannot measure,

98
00:05:13,870 --> 00:05:18,660
you can't measure the effectiveness of conservation approaches if you can't measure the change.\h

99
00:05:18,680 --> 00:05:22,300
We have limited resources, we have environmental pressures,

100
00:05:22,320 --> 00:05:26,840
we can do something about them if we have the right information.

101
00:05:28,300 --> 00:05:30,400
(on-screen text) Coming Next...
(off-screen voice) Quatre, trois, deux,

102
00:05:30,420 --> 00:05:32,970
Jeff Masek: You know, there's almost been an explosion in

103
00:05:32,990 --> 00:05:35,450
the number of Earth resources satellites,

104
00:05:35,470 --> 00:05:39,320
Earth observation satellites that are out there in the international community