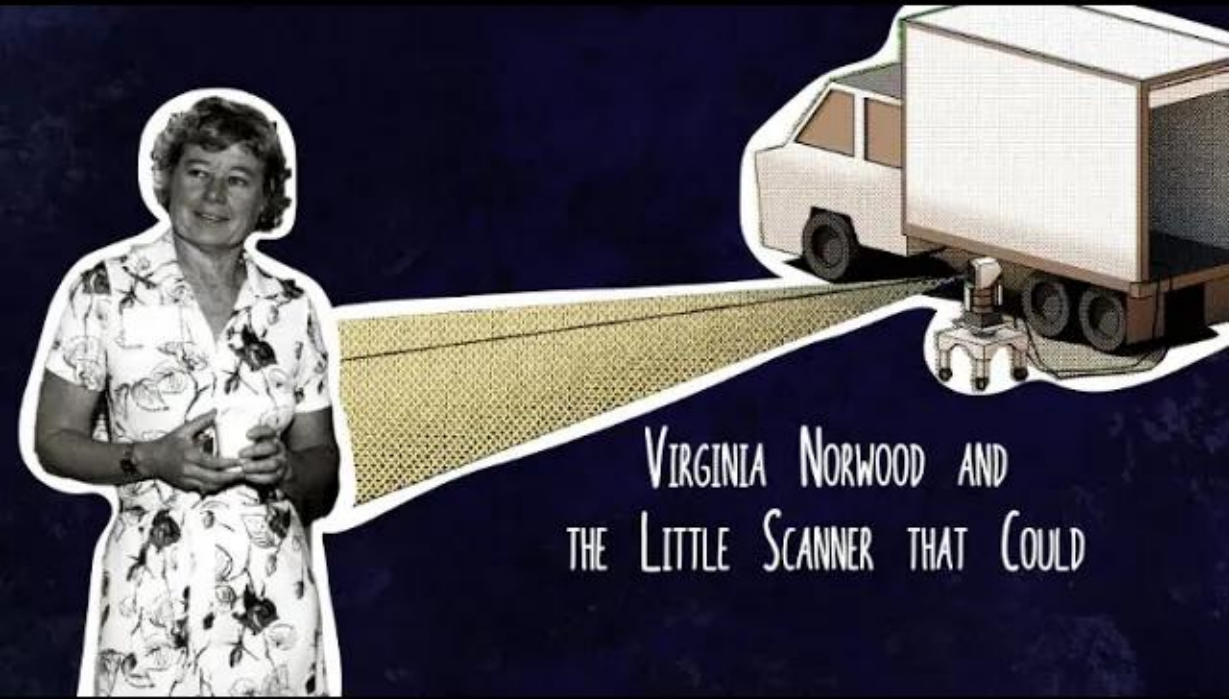
Virginia Norwood and
the Little Scanner that Could

1
00:00:12,310 --> 00:00:09,750
[Music]

2
00:00:14,950 --> 00:00:12,320
in the 1960s the united states decided

3
00:00:16,870 --> 00:00:14,960
to venture forth to the moon's surface

4
00:00:18,870 --> 00:00:16,880
this new vantage point of space allowed

5
00:00:20,230 --> 00:00:18,880
us to look back at earth's surface in

6
00:00:21,990 --> 00:00:20,240
wonder

7
00:00:23,990 --> 00:00:22,000
photographs taken by astronauts on the

8
00:00:26,630 --> 00:00:24,000
apollo and gemini missions fascinated

9
00:00:27,750 --> 00:00:26,640
the world and inspired a few to ask the

10
00:00:29,910 --> 00:00:27,760
question

11
00:00:32,229 --> 00:00:29,920
could space be the solution for regular

12
00:00:35,270 --> 00:00:32,239
earth observations

13
00:00:37,350 --> 00:00:35,280

one piece of technology dating to 1968

14
00:00:38,910 --> 00:00:37,360
has since defined earth remote sensing

15
00:00:40,229 --> 00:00:38,920
from space

16
00:00:42,389 --> 00:00:40,239
[Music]

17
00:00:44,630 --> 00:00:42,399
it was initially doubted but the little

18
00:00:46,229 --> 00:00:44,640
scanner that could divide all cynics to

19
00:00:48,790 --> 00:00:46,239
give us what we know today as the

20
00:00:50,069 --> 00:00:48,800
landsat program

21
00:00:52,869 --> 00:00:50,079
this instrument called the

22
00:00:54,630 --> 00:00:52,879
multi-spectral scanner or mss

23
00:00:57,270 --> 00:00:54,640
was designed and championed by virginia

24
00:00:58,950 --> 00:00:57,280
t norwood earning her the moniker the

25
00:01:01,270 --> 00:00:58,960
mother of landsat

26
00:01:03,349 --> 00:01:01,280
the landsat system is an amazing one it

27
00:01:05,670 --> 00:01:03,359
makes you wonder if the mss system

28
00:01:08,469 --> 00:01:05,680
hadn't been on board and operating what

29
00:01:10,630 --> 00:01:08,479
would have happened to landsat

30
00:01:13,190 --> 00:01:10,640
virginia norwood graduated from mit with

31
00:01:15,030 --> 00:01:13,200
a degree in mathematical physics

32
00:01:17,109 --> 00:01:15,040
soon after she developed a radar

33
00:01:19,030 --> 00:01:17,119
reflector that discovered previously

34
00:01:20,870 --> 00:01:19,040
untrackable winds

35
00:01:23,670 --> 00:01:20,880
her continuous successes got her a

36
00:01:25,429 --> 00:01:23,680
position at hughes aircraft company

37
00:01:27,350 --> 00:01:25,439
she was amongst the first women to join

38
00:01:29,429 --> 00:01:27,360

their technical staff where she

39
00:01:32,069 --> 00:01:29,439
pioneered the first space-based

40
00:01:35,270 --> 00:01:32,079
multi-spectral scanner

41
00:01:37,670 --> 00:01:35,280
she said i was kind of known as the

42
00:01:40,310 --> 00:01:37,680
person who could solve impossible

43
00:01:45,350 --> 00:01:40,320
problems so people would bring things to

44
00:01:49,670 --> 00:01:47,510
norwood was working at hughes when nasa

45
00:01:53,270 --> 00:01:49,680
initiated the earth resources technology

46
00:01:54,870 --> 00:01:53,280
satellite mission in 1967.

47
00:01:57,109 --> 00:01:54,880
as scientists at the university of

48
00:01:58,709 --> 00:01:57,119
michigan and purdue demonstrated the

49
00:02:01,190 --> 00:01:58,719
future of land imaging was

50
00:02:03,109 --> 00:02:01,200
multi-spectral

51
00:02:05,030 --> 00:02:03,119
they used this developing technology to

52
00:02:06,360 --> 00:02:05,040
assess the planet's surface on a more

53
00:02:09,589 --> 00:02:06,370
local scale

54
00:02:12,309 --> 00:02:09,599
[Music]

55
00:02:14,229 --> 00:02:12,319
multi-spectral devices like the mss

56
00:02:16,869 --> 00:02:14,239
measure energy from the electromagnetic

57
00:02:19,110 --> 00:02:16,879
spectrum including both visible and

58
00:02:21,350 --> 00:02:19,120
infrared light

59
00:02:22,949 --> 00:02:21,360
the sensor acts passively recording

60
00:02:24,630 --> 00:02:22,959
certain wavelengths of light reflected

61
00:02:26,470 --> 00:02:24,640
off the earth's surface these

62
00:02:28,150 --> 00:02:26,480
measurements are recorded digitally and

63
00:02:30,309 --> 00:02:28,160

transmitted to ground stations to be

64
00:02:33,509 --> 00:02:30,319
analyzed pixel by pixel something that

65
00:02:39,509 --> 00:02:36,229
however nasa and usgs both had

66
00:02:41,589 --> 00:02:39,519
reservations the mss was new technology

67
00:02:43,030 --> 00:02:41,599
and they favored the return beam viticon

68
00:02:45,270 --> 00:02:43,040
the rbv

69
00:02:47,430 --> 00:02:45,280
designed by rca to map the moon for the

70
00:02:50,070 --> 00:02:47,440
apollo missions

71
00:02:51,990 --> 00:02:50,080
the rbv used television tube technology

72
00:02:53,430 --> 00:02:52,000
to create a system of cameras each

73
00:02:55,509 --> 00:02:53,440
filtered to a specific set of

74
00:02:57,670 --> 00:02:55,519
wavelengths or bands

75
00:03:02,390 --> 00:02:57,680
they were limited to the blue green

76
00:03:07,670 --> 00:03:05,350
the system was analog limited and soon

77
00:03:10,229 --> 00:03:07,680
to be dated so how to convince them to

78
00:03:12,550 --> 00:03:10,239
try multi-spectral technology

79
00:03:16,830 --> 00:03:12,560
people felt much more comfortable with

80
00:03:19,190 --> 00:03:16,840
that even if they didn't understand the

81
00:03:22,229 --> 00:03:19,200
ramifications and so we felt that there

82
00:03:23,990 --> 00:03:22,239
was a real bias because of that

83
00:03:26,630 --> 00:03:24,000
with the help of other innovators like

84
00:03:28,390 --> 00:03:26,640
jack lansing and web howe the prototype

85
00:03:30,390 --> 00:03:28,400
designed by virginia norwood was created

86
00:03:32,789 --> 00:03:30,400
for only a hundred thousand dollars less

87
00:03:34,789 --> 00:03:32,799
than a million dollars today

88
00:03:36,390 --> 00:03:34,799

her original designs included a scanner

89
00:03:38,390 --> 00:03:36,400
that looked at six bands of the

90
00:03:41,270 --> 00:03:38,400
electromagnetic spectrum

91
00:03:43,589 --> 00:03:41,280
however because the more trusted rbv

92
00:03:45,430 --> 00:03:43,599
system was heavier and larger taking up

93
00:03:49,670 --> 00:03:45,440
more of the satellite she had to cut

94
00:03:54,550 --> 00:03:52,229
and really only a tiny corner of the

95
00:03:57,270 --> 00:03:54,560
spacecraft was allotted to the tiny

96
00:03:59,990 --> 00:03:57,280
little multi-spectral scanner and no one

97
00:04:02,149 --> 00:04:00,000
knew precisely how it was going to

98
00:04:04,149 --> 00:04:02,159
perform whether it would even work

99
00:04:07,270 --> 00:04:04,159
whether the mirror would work whether

100
00:04:11,190 --> 00:04:07,280
the digitized data would work from the

101
00:04:11,990 --> 00:04:11,200
get-go her superiors were saying

102
00:04:13,830 --> 00:04:12,000
oh

103
00:04:15,350 --> 00:04:13,840
you know hand-wringing that this was

104
00:04:17,509 --> 00:04:15,360
going to be a problem

105
00:04:21,509 --> 00:04:17,519
there was so much about it that was

106
00:04:24,310 --> 00:04:21,519
novel and there was so much skepticism

107
00:04:26,629 --> 00:04:24,320
to allay nasa and usgs jitters about the

108
00:04:28,629 --> 00:04:26,639
much-doubted scanner the prototype was

109
00:04:30,870 --> 00:04:28,639
stuck onto the back of a truck and taken

110
00:04:32,870 --> 00:04:30,880
on a california road trip

111
00:04:36,070 --> 00:04:32,880
this was because

112
00:04:38,070 --> 00:04:36,080
george olaska said

113
00:04:39,670 --> 00:04:38,080

nobody believes that scandal will work i

114
00:04:42,469 --> 00:04:39,680
think you better

115
00:04:44,469 --> 00:04:42,479
you better give us some assurance and so

116
00:04:46,230 --> 00:04:44,479
jack lansing and a couple of people took

117
00:04:47,350 --> 00:04:46,240
it out on the truck

118
00:04:49,830 --> 00:04:47,360
and uh

119
00:04:51,670 --> 00:04:49,840
he was an outdoors type anyway so he

120
00:04:56,469 --> 00:04:51,680
just thought it was great to get tahoe

121
00:05:01,029 --> 00:04:58,790
the images were spectacular

122
00:05:03,670 --> 00:05:01,039
the half dome image still hangs on

123
00:05:07,029 --> 00:05:03,680
norwood's wall today

124
00:05:09,029 --> 00:05:07,039
on july 23 1972 the earth resources

125
00:05:12,950 --> 00:05:09,039
technology satellite launched into orbit

126
00:05:17,909 --> 00:05:15,590
just 14 days after launch a power surge

127
00:05:20,310 --> 00:05:17,919
caused by the rbv electronics physically

128
00:05:22,629 --> 00:05:20,320
rocked the spacecraft and the rbv was

129
00:05:25,270 --> 00:05:22,639
immediately shut off

130
00:05:27,189 --> 00:05:25,280
the first cloud-free image from the mss

131
00:05:29,990 --> 00:05:27,199
was the washita mountains in

132
00:05:32,230 --> 00:05:30,000
southeastern oklahoma

133
00:05:34,950 --> 00:05:32,240
i looked at those images and tears came

134
00:05:37,430 --> 00:05:34,960
to my eyes and i said

135
00:05:41,029 --> 00:05:37,440
it's everything we hoped for

136
00:05:42,790 --> 00:05:41,039
and more than we expected it was one of

137
00:05:44,790 --> 00:05:42,800
it was i could say

138
00:05:47,430 --> 00:05:44,800

a highlight of my career and one of the

139
00:05:49,990 --> 00:05:47,440
major highlights of my life was to see

140
00:05:52,469 --> 00:05:50,000
that and to see that it worked and to

141
00:05:54,790 --> 00:05:52,479
think about what we could do with it

142
00:05:56,469 --> 00:05:54,800
virginia norway incredibly innovative

143
00:05:57,510 --> 00:05:56,479
pulled off something that nobody thought

144
00:05:59,590 --> 00:05:57,520
would occur

145
00:06:01,749 --> 00:05:59,600
virginia norwood's mss became the

146
00:06:04,230 --> 00:06:01,759
standard for the landsat satellites

147
00:06:06,469 --> 00:06:04,240
a 7-bin sensor a refinement of her

148
00:06:09,189 --> 00:06:06,479
original six-band design flew on

149
00:06:11,909 --> 00:06:09,199
landsats 4 and 5 and went on to shape

150
00:06:15,270 --> 00:06:11,919
much of space-based land remote sensing

151
00:06:17,749 --> 00:06:15,280
a field that has only grown since then

152
00:06:20,070 --> 00:06:17,759
50 years later using technology that has

153
00:06:21,909 --> 00:06:20,080
evolved from norwood's original concepts

154
00:06:26,710 --> 00:06:21,919
landsat satellites are still showing us

155
00:06:32,230 --> 00:06:30,309
in 2021 landsat 9 launched into orbit

156
00:06:34,550 --> 00:06:32,240
the data now freely available to

157
00:06:37,189 --> 00:06:34,560
everyone will bring about new scientific