1
00:00:06,869 --> 00:00:04,150
the antarctic is is this absolutely

2
00:00:08,790 --> 00:00:06,879
incredible place it's a contradiction

3
00:00:11,350 --> 00:00:08,800
it's one of the driest places on earth

4
00:00:13,910 --> 00:00:11,360
and yet it holds 70 percent of the

5
00:00:15,509 --> 00:00:13,920
world's fresh water antarctic is big

6
00:00:17,990 --> 00:00:15,519
it's larger than the continental united

7
00:00:20,710 --> 00:00:18,000
states it's so incredibly cold it's the

8
00:00:23,509 --> 00:00:20,720
coldest place on earth at the surface at

9
00:00:26,550 --> 00:00:23,519
the base of the ice sheet it's melting

10
00:00:28,870 --> 00:00:26,560
we're talking about a big inaccessible

11
00:00:31,589 --> 00:00:28,880
chunk of ice that is probably some of

12
00:00:35,710 --> 00:00:31,599
the most unexplored territory on the

13
00:00:42,150 --> 00:00:38,709

[Music]

14
00:00:44,950 --> 00:00:42,160
today you know we have maps every single

15
00:00:46,389 --> 00:00:44,960
year complete coverage of the antarctic

16
00:00:48,790 --> 00:00:46,399
flowing into the ocean we're looking at

17
00:00:50,869 --> 00:00:48,800
all these changes we've got

18
00:00:53,350 --> 00:00:50,879
lasers in space measuring very subtle

19
00:00:54,470 --> 00:00:53,360
changes in the shape and the topography

20
00:00:56,630 --> 00:00:54,480
i mean what's it going to look like in

21
00:00:58,790 --> 00:00:56,640
10 years from now

22
00:01:02,069 --> 00:00:58,800
right i mean our understanding is going

23
00:01:03,830 --> 00:01:02,079
it's exponential it's amazing how much

24
00:01:05,750 --> 00:01:03,840
how little we knew and how much we know

25
00:01:07,510 --> 00:01:05,760
now uh and how much there still is to

26
00:01:09,350 --> 00:01:07,520
learn i i totally agree and i think

27
00:01:10,870 --> 00:01:09,360
what's wicked cool about that is both

28
00:01:12,550 --> 00:01:10,880
the remote sensing component and the

29
00:01:14,149 --> 00:01:12,560
glaciology component

30
00:01:16,550 --> 00:01:14,159
those have really

31
00:01:17,990 --> 00:01:16,560
accelerated and transformed inside units

32
00:01:20,149 --> 00:01:18,000
of time that are comparable to like the

33
00:01:21,990 --> 00:01:20,159
age of us you know it's that's pretty

34
00:01:23,190 --> 00:01:22,000
cool that that we're working in fields

35
00:01:25,590 --> 00:01:23,200
where

36
00:01:27,190 --> 00:01:25,600
this is we've seen that sort of that

37
00:01:28,789 --> 00:01:27,200
logarithmic

38
00:01:31,190 --> 00:01:28,799

just take off i

39
00:01:32,550 --> 00:01:31,200
totally agree i think

40
00:01:34,000 --> 00:01:32,560
some of the history stuff that's fun to

41
00:01:38,069 --> 00:01:34,010
look at

42
00:01:41,990 --> 00:01:38,079
[Music]

43
00:01:44,469 --> 00:01:42,000
it wasn't long ago in the 1960s and 70s

44
00:01:46,630 --> 00:01:44,479
that satellites were only able to catch

45
00:01:49,190 --> 00:01:46,640
snapshots of antarctica

46
00:01:51,429 --> 00:01:49,200
they were single moments in time few and

47
00:01:53,670 --> 00:01:51,439
far between

48
00:01:56,310 --> 00:01:53,680
it wasn't until decades later when

49
00:01:58,789 --> 00:01:56,320
landsat 7 started to reveal detailed

50
00:02:01,109 --> 00:01:58,799
features of antarctica that signs of

51
00:02:03,749 --> 00:02:01,119
change could start to be seen

52
00:02:06,469 --> 00:02:03,759
at the ground level nasa first stepped

53
00:02:08,550 --> 00:02:06,479
foot on the ice sheet in 1983

54
00:02:10,790 --> 00:02:08,560
when robert binchadler began studying

55
00:02:13,750 --> 00:02:10,800
the behavior of ice streams along the

56
00:02:15,750 --> 00:02:13,760
coast of the ross ice shelf

57
00:02:17,589 --> 00:02:15,760
over the decades the combination of

58
00:02:20,390 --> 00:02:17,599
efforts on the ground

59
00:02:22,390 --> 00:02:20,400
air and space helped nasa develop

60
00:02:25,910 --> 00:02:22,400
game-changing ways of mapping the

61
00:02:28,309 --> 00:02:25,920
unexplored places on the continent

62
00:02:30,309 --> 00:02:28,319
we don't have a high-resolution map of

63
00:02:32,070 --> 00:02:30,319

antarctica to date but this will be the

64
00:02:33,990 --> 00:02:32,080
first high-resolution map that's

65
00:02:36,309 --> 00:02:34,000
available to the science community 25

66
00:02:39,350 --> 00:02:36,319
meters in resolution lima takes us from

67
00:02:41,350 --> 00:02:39,360
the world of black and white tv lima is

68
00:02:44,070 --> 00:02:41,360
true color high resolution

69
00:02:45,830 --> 00:02:44,080
representation of antarctica it's a step

70
00:02:48,949 --> 00:02:45,840
change

71
00:02:51,990 --> 00:02:48,959
and then it wasn't until 2011 that we

72
00:02:53,110 --> 00:02:52,000
had our very first map of

73
00:02:54,869 --> 00:02:53,120
how the

74
00:02:57,030 --> 00:02:54,879
surface of the ice sheet moves right

75
00:02:58,390 --> 00:02:57,040
because the the ice sheet is ice that is

76
00:02:59,430 --> 00:02:58,400
flowing into the ocean it's moving

77
00:03:00,790 --> 00:02:59,440
everywhere

78
00:03:02,790 --> 00:03:00,800
i think you know what alex was getting

79
00:03:04,470 --> 00:03:02,800
at what is our our

80
00:03:05,910 --> 00:03:04,480
look and our mapping and our view of

81
00:03:07,990 --> 00:03:05,920
antarctica going to look like in 10

82
00:03:09,430 --> 00:03:08,000
years and i i hope we have a better

83
00:03:11,350 --> 00:03:09,440
three-dimensional sense of the ice sheet

84
00:03:13,190 --> 00:03:11,360
that we have a very good sense of the

85
00:03:15,270 --> 00:03:13,200
bottom

86
00:03:17,030 --> 00:03:15,280
we're getting at the resolution of

87
00:03:18,550 --> 00:03:17,040
different things that come down to base

88
00:03:21,030 --> 00:03:18,560

and scale things that we didn't really

89
00:03:23,750 --> 00:03:21,040
have before so we're looking at things

90
00:03:24,869 --> 00:03:23,760
at dynamics and systems at a much

91
00:03:27,990 --> 00:03:24,879
smaller

92
00:03:30,630 --> 00:03:28,000
a traversable is that a word type scale

93
00:03:33,509 --> 00:03:30,640
yeah so there's rima reference elevation

94
00:03:35,350 --> 00:03:33,519
model of antarctica it's incredibly high

95
00:03:36,949 --> 00:03:35,360
resolution incredible detail and gives

96
00:03:38,550 --> 00:03:36,959
us some of the most precise knowledge we

97
00:03:40,390 --> 00:03:38,560
have of the ice sheet elevation you know

98
00:03:43,110 --> 00:03:40,400
and we're able to use the data for

99
00:03:45,350 --> 00:03:43,120
practical things like initializing a

100
00:03:47,990 --> 00:03:45,360
model a numerical model of ice sheet

101
00:03:51,030 --> 00:03:48,000
flow and so having these types of data

102
00:03:52,949 --> 00:03:51,040
sets just lets crowspheric scientists

103
00:03:55,110 --> 00:03:52,959
get to work that much faster and

104
00:04:00,070 --> 00:03:55,120
generate conclusions from the data that

105
00:04:03,910 --> 00:04:01,750
spent a total of about you know a little

106
00:04:04,869 --> 00:04:03,920
over two years in antarctica on the

107
00:04:06,710 --> 00:04:04,879
ground

108
00:04:08,229 --> 00:04:06,720
and some of that was with research that

109
00:04:09,910 --> 00:04:08,239
i've been doing recently with nasa and

110
00:04:11,990 --> 00:04:09,920
some it goes back to

111
00:04:14,550 --> 00:04:12,000
kind of you know your first jobs out of

112
00:04:16,550 --> 00:04:14,560
out of school and whatnot doing doing um

113
00:04:17,430 --> 00:04:16,560

gis and remote sensing

114
00:04:19,749 --> 00:04:17,440
for

115
00:04:21,349 --> 00:04:19,759
the science support contractor that's

116
00:04:23,430 --> 00:04:21,359
that's in antarctica

117
00:04:25,749 --> 00:04:23,440
the u.s national science foundation

118
00:04:28,310 --> 00:04:25,759
operates three permanent stations in

119
00:04:30,469 --> 00:04:28,320
antarctica which provide the facilities

120
00:04:32,950 --> 00:04:30,479
for scientists like kelly to do some

121
00:04:35,030 --> 00:04:32,960
pretty remote research and then more

122
00:04:37,749 --> 00:04:35,040
recently you know i've been working on

123
00:04:39,430 --> 00:04:37,759
the 88 stock project which is going down

124
00:04:41,030 --> 00:04:39,440
just after thanksgiving missing

125
00:04:43,590 --> 00:04:41,040
christmas coming back kind of in late

126
00:04:45,990 --> 00:04:43,600
january doing a big science first base

127
00:04:47,909 --> 00:04:46,000
out of this uh south pole station in

128
00:04:50,390 --> 00:04:47,919
support of icesat-2 we come

129
00:04:52,230 --> 00:04:50,400
out of the base drive a 300 kilometer

130
00:04:54,710 --> 00:04:52,240
stretch along 88 south and then go home

131
00:04:57,909 --> 00:04:54,720
at 750 kilometers total

132
00:04:59,270 --> 00:04:57,919
work and life at the pole is harsh

133
00:05:00,550 --> 00:04:59,280
it's cold

134
00:05:03,990 --> 00:05:00,560
very cold

135
00:05:05,189 --> 00:05:04,000
and it's very dry antarctica is a desert

136
00:05:07,749 --> 00:05:05,199
after all

137
00:05:13,270 --> 00:05:07,759
and there's wind relentless wind with

138
00:05:18,230 --> 00:05:15,510

the other environmental issue that i

139
00:05:25,270 --> 00:05:18,240
that i see is this is huge too is

140
00:05:28,469 --> 00:05:26,120
trying to breathe

141
00:05:29,990 --> 00:05:28,479
[Laughter]

142
00:05:32,230 --> 00:05:30,000
trying to breathe what's the problem

143
00:05:35,029 --> 00:05:32,240
with your breathing

144
00:05:37,430 --> 00:05:35,039
we're ten thousand feet above sea level

145
00:05:38,550 --> 00:05:37,440
getting higher every day

146
00:05:39,909 --> 00:05:38,560
you know you can get out of the

147
00:05:42,550 --> 00:05:39,919
temperature you can get out of the wind

148
00:05:47,749 --> 00:05:42,560
but you're at 10 000 feet period and

149
00:05:52,390 --> 00:05:50,230
the crazy thing is is i can look at a

150
00:05:54,390 --> 00:05:52,400
satellite image of the antarctic

151
00:05:56,390 --> 00:05:54,400
and even with a fairly small postage

152
00:05:59,350 --> 00:05:56,400
stamp i can tell you where it is and i

153
00:06:01,270 --> 00:05:59,360
have never been to the antarctic i feel

154
00:06:04,150 --> 00:06:01,280
like the fanboy that just can't afford

155
00:06:06,230 --> 00:06:04,160
the ticket to the concert

156
00:06:08,070 --> 00:06:06,240
is it strange knowing so much sort of

157
00:06:10,070 --> 00:06:08,080
geography about a place having not been

158
00:06:13,590 --> 00:06:10,080
there or how many other people just

159
00:06:15,749 --> 00:06:13,600
stare at imagery of places they've never

160
00:06:17,990 --> 00:06:15,759
been and understand it and

161
00:06:19,590 --> 00:06:18,000
you know deep ways that maybe people

162
00:06:21,670 --> 00:06:19,600
that have set foot on the con that never

163
00:06:23,909 --> 00:06:21,680

even thought about it

164
00:06:25,990 --> 00:06:23,919
it actually takes quite a while to

165
00:06:27,110 --> 00:06:26,000
build trust between those communities

166
00:06:28,550 --> 00:06:27,120
because they do they have these

167
00:06:29,749 --> 00:06:28,560
different kind of world views of how

168
00:06:31,189 --> 00:06:29,759
things are

169
00:06:32,550 --> 00:06:31,199
when you talk to somebody on the ground

170
00:06:34,469 --> 00:06:32,560
especially in the past when remote

171
00:06:36,390 --> 00:06:34,479
sensing was was just starting to become

172
00:06:39,270 --> 00:06:36,400
more prominent is that there's an

173
00:06:41,110 --> 00:06:39,280
inherent skepticism that that you can't

174
00:06:43,670 --> 00:06:41,120
you can't see what i'm seeing

175
00:06:46,469 --> 00:06:43,680
because it's so detailed and it's so

176
00:06:48,870 --> 00:06:46,479
nuanced and the people that are looking

177
00:06:52,070 --> 00:06:48,880
from the satellites down

178
00:06:54,070 --> 00:06:52,080
often feel that the world is so big and

179
00:06:55,270 --> 00:06:54,080
so massive and moving in so many

180
00:06:56,950 --> 00:06:55,280
different ways that how could you

181
00:06:58,710 --> 00:06:56,960
possibly understand it from putting your

182
00:07:00,309 --> 00:06:58,720
feet on the ground and looking at a

183
00:07:02,150 --> 00:07:00,319
single spot

184
00:07:04,469 --> 00:07:02,160
one of alex's current projects is

185
00:07:07,189 --> 00:07:04,479
comparing the antarctica of today with

186
00:07:09,589 --> 00:07:07,199
the antarctica of the past the problem

187
00:07:12,870 --> 00:07:09,599
is nasa's satellite imagery only takes

188
00:07:16,150 --> 00:07:12,880

us so far back to go back further alex

189
00:07:18,550 --> 00:07:16,160
needed another agency's satellites the

190
00:07:20,230 --> 00:07:18,560
first satellites were not for scientific

191
00:07:22,550 --> 00:07:20,240
applications they were for military

192
00:07:24,550 --> 00:07:22,560
applications there was a series of

193
00:07:26,710 --> 00:07:24,560
satellites still some of the most

194
00:07:27,749 --> 00:07:26,720
expensive ones that we know about its

195
00:07:30,550 --> 00:07:27,759
name

196
00:07:33,029 --> 00:07:30,560
hexagon

197
00:07:35,110 --> 00:07:33,039
and they were these short-lived

198
00:07:37,430 --> 00:07:35,120
satellites you know this was during the

199
00:07:39,830 --> 00:07:37,440
cold war and they were really designed

200
00:07:41,830 --> 00:07:39,840
to keep tabs on the russians and and

201
00:07:43,670 --> 00:07:41,840
where the missile silos were but they

202
00:07:45,990 --> 00:07:43,680
were collecting imagery other places

203
00:07:47,830 --> 00:07:46,000
they were using analog cameras so that

204
00:07:50,629 --> 00:07:47,840
means they had film and they'd have

205
00:07:52,869 --> 00:07:50,639
these these gold canisters full of film

206
00:07:54,950 --> 00:07:52,879
like miles of film and they would

207
00:07:57,510 --> 00:07:54,960
deorbit these canisters when they would

208
00:07:59,909 --> 00:07:57,520
get over the us these canisters would

209
00:08:02,070 --> 00:07:59,919
re-enter through the atmosphere

210
00:08:04,230 --> 00:08:02,080
and they would deploy a parachute and

211
00:08:07,189 --> 00:08:04,240
then a plane and would actually go and

212
00:08:09,029 --> 00:08:07,199
grab these canisters mid-air

213
00:08:12,230 --> 00:08:09,039

and then bring them down develop the

214
00:08:13,990 --> 00:08:12,240
film and then analyze them for all the

215
00:08:15,830 --> 00:08:14,000
different targets

216
00:08:18,150 --> 00:08:15,840
we've had a big project where we've

217
00:08:19,990 --> 00:08:18,160
tried to scan a lot of that imagery

218
00:08:21,830 --> 00:08:20,000
through the usgs

219
00:08:23,670 --> 00:08:21,840
so that we can analyze that imagery to

220
00:08:25,029 --> 00:08:23,680
see what the antarctic looked like back

221
00:08:27,300 --> 00:08:25,039
in the 70s

222
00:08:31,749 --> 00:08:27,310
and and how it's changed up until now

223
00:08:33,269 --> 00:08:31,759
[Music]

224
00:08:35,350 --> 00:08:33,279
i get asked a lot like how did you get

225
00:08:37,029 --> 00:08:35,360
into this and i think it was because

226
00:08:38,870 --> 00:08:37,039
my family what we did for family

227
00:08:41,110 --> 00:08:38,880
vacations was load in the car go up

228
00:08:43,589 --> 00:08:41,120
north and go skiing and so what i

229
00:08:45,590 --> 00:08:43,599
remember as a kid is snow and it

230
00:08:47,430 --> 00:08:45,600
frustrates me when you know i see

231
00:08:49,829 --> 00:08:47,440
short winters and whatnot or you know

232
00:08:52,949 --> 00:08:49,839
not a lot of snow it's it bums me out so

233
00:08:54,710 --> 00:08:52,959
i think that's how it started

234
00:08:56,230 --> 00:08:54,720
i did two years of engineering and then

235
00:08:58,790 --> 00:08:56,240
i kind of got restless and so i went and

236
00:09:00,870 --> 00:08:58,800
traveled south america with my wife to

237
00:09:02,710 --> 00:09:00,880
be and found myself sitting in front of

238
00:09:04,790 --> 00:09:02,720

the moreno glacier at one point

239
00:09:06,550 --> 00:09:04,800
wondering if this was something that

240
00:09:08,550 --> 00:09:06,560
anybody had ever thought about studying

241
00:09:09,910 --> 00:09:08,560
and also starting to realize that these

242
00:09:11,509 --> 00:09:09,920
things would probably change a lot in

243
00:09:13,269 --> 00:09:11,519
the future

244
00:09:14,389 --> 00:09:13,279
and i remember i was just in awe i mean

245
00:09:16,949 --> 00:09:14,399
i was just

246
00:09:19,430 --> 00:09:16,959
it was you know these these ten-story

247
00:09:22,230 --> 00:09:19,440
buildings of ice crashing off into a

248
00:09:24,230 --> 00:09:22,240
lake and i had never seen anything like

249
00:09:27,030 --> 00:09:24,240
that with with that much power that i

250
00:09:29,110 --> 00:09:27,040
could witness in real time

251
00:09:31,829 --> 00:09:29,120
i i just sat there and watched it until

252
00:09:33,269 --> 00:09:31,839
my wife dragged me away because she was

253
00:09:34,790 --> 00:09:33,279
ready to go

254
00:09:37,190 --> 00:09:34,800
that was kind of occurring at the same

255
00:09:40,710 --> 00:09:37,200
time that i wanted to contribute to

256
00:09:42,870 --> 00:09:40,720
something big societally

257
00:09:45,670 --> 00:09:42,880
there's an amazing photo taken by apollo

258
00:09:49,030 --> 00:09:45,680
on its last mission that everyone's seen

259
00:09:51,110 --> 00:09:49,040
it it's the base of earth as a disc and

260
00:09:52,389 --> 00:09:51,120
in the center of the frame is africa

261
00:09:53,990 --> 00:09:52,399
and what

262
00:09:55,509 --> 00:09:54,000
you fail to really realize is if you

263
00:09:57,430 --> 00:09:55,519

look down at the bottom of that the bulk

264
00:09:59,750 --> 00:09:57,440
of antarctica is in that photo too and

265
00:10:03,269 --> 00:09:59,760
it's kind of the first time you get

266
00:10:04,510 --> 00:10:03,279
a really big remote sensing full look

267
00:10:05,990 --> 00:10:04,520
at the continent

268
00:10:08,310 --> 00:10:06,000
[Music]

269
00:10:09,670 --> 00:10:08,320
we need to

270
00:10:12,150 --> 00:10:09,680
do this again

271
00:10:13,590 --> 00:10:12,160
get people back on the moon to

272
00:10:15,430 --> 00:10:13,600
respark

273
00:10:17,910 --> 00:10:15,440
that interest in

274
00:10:19,670 --> 00:10:17,920
in sciences and engineering when i talk

275
00:10:21,190 --> 00:10:19,680
to my colleagues that are a bit older

276
00:10:23,750 --> 00:10:21,200
than than i am

277
00:10:26,310 --> 00:10:23,760
a lot of them say that the mercury

278
00:10:28,150 --> 00:10:26,320
gemini apollo that type of activity got

279
00:10:29,910 --> 00:10:28,160
them into engineering

280
00:10:31,670 --> 00:10:29,920
we need that again

281
00:10:33,350 --> 00:10:31,680
so i think this is fundamentally

282
00:10:35,110 --> 00:10:33,360
important to kind of

283
00:10:38,790 --> 00:10:35,120
keep nasa and that exploration and

284
00:10:40,870 --> 00:10:38,800
engineering that getting kids and adults

285
00:10:42,870 --> 00:10:40,880
interested in science

286
00:10:44,870 --> 00:10:42,880
i get frustrated that we've likely

287
00:10:47,190 --> 00:10:44,880
already crossed certain tipping points

288
00:10:48,949 --> 00:10:47,200

and i get apathetic that we're not

289
00:10:50,710 --> 00:10:48,959
taking more action and that i'm not

290
00:10:54,310 --> 00:10:50,720
having enough of an impact and that

291
00:10:56,389 --> 00:10:54,320
really frustrates me um and and kind of

292
00:10:58,230 --> 00:10:56,399
makes me feel down but

293
00:11:00,069 --> 00:10:58,240
then i thought you know

294
00:11:02,630 --> 00:11:00,079
where i started on this journey which

295
00:11:05,750 --> 00:11:02,640
was staring at a glacier in south

296
00:11:08,150 --> 00:11:05,760
america in 2007 or eight

297
00:11:10,630 --> 00:11:08,160
where i am now in kind of the influence

298
00:11:13,110 --> 00:11:10,640
that i'm able to have you know to do my

299
00:11:14,550 --> 00:11:13,120
small part in this big picture

300
00:11:18,230 --> 00:11:14,560
it it's kind of one of the like don't

301
00:11:20,949 --> 00:11:18,240
give up stories right like we're we are

302
00:11:23,430 --> 00:11:20,959
making progress we are getting through

303
00:11:26,389 --> 00:11:23,440
um our voices are starting to resonate

304
00:11:27,910 --> 00:11:26,399
and we just can't give up because