1
00:00:02,334 --> 00:00:05,938
>> For generations we
have dreamed about a place

2
00:00:05,938 --> 00:00:08,641
to live and work in space.

3
00:00:08,641 --> 00:00:09,975
A space station.

4
00:00:09,975 --> 00:00:16,949
And right now 260 miles above
us that dream is reality.

5
00:00:16,949 --> 00:00:21,187
We dreamed that life up there
would benefit life down here.

6
00:00:21,187 --> 00:00:24,590
That dream has come true.

7
00:00:24,590 --> 00:00:27,460
Can research onboard
the space station lead

8
00:00:27,460 --> 00:00:29,795
to cleaner drinking
water on earth?

9
00:00:29,795 --> 00:00:33,132
Can it help farmers
produce better crops?

10
00:00:33,132 --> 00:00:35,501
Can it inspire a
generation of students?

11
00:00:35,501 --> 00:00:38,471
Can it even save a life?

12
00:00:38,471 --> 00:00:42,875
The answer to these
questions is yes.

13
00:00:42,875 --> 00:00:45,111
It already has.

14
00:00:45,111 --> 00:00:47,813
As the work aboard the
International Space Station

15
00:00:47,813 --> 00:00:50,749
begins to reach its
potential, the benefits

16
00:00:50,749 --> 00:00:53,686
to humanity are evident.

17
00:00:53,686 --> 00:00:56,388
These are just a few of
the stories from people

18
00:00:56,388 --> 00:01:00,693
who have realized those
benefits, in their own words.

19
00:01:02,495 --> 00:01:11,570
[Music]

20
00:01:17,042 --> 00:01:19,812
>> Is that 2?

21
00:01:19,812 --> 00:01:22,114
Can you say two?

22
00:01:22,114 --> 00:01:26,152
>> I found a big lump in the
side of my face and I kept going

23
00:01:26,152 --> 00:01:29,688
to doctor after doctor.

24
00:01:29,688 --> 00:01:34,493
And I was in so much pain

25
00:01:34,493 --> 00:01:39,265
at that time I was
like dying in bed.

26
00:01:39,265 --> 00:01:40,166
It hurt so bad.

27
00:01:40,166 --> 00:01:41,767
I've never been in so much pain.

28
00:01:41,767 --> 00:01:47,673
I went for my first MRI
and then it showed up with

29
00:01:47,673 --> 00:01:50,743
like hundreds of
tumors all over.

30
00:01:50,743 --> 00:01:55,481
And then they sent me to
-- Not Doctor Sutherland,

31
00:01:55,481 --> 00:01:57,116
but someone who works
in his office,

32
00:01:57,116 --> 00:02:04,023
and he thought it was
neurofibromatosis which I have.

33
00:02:04,023 --> 00:02:06,358
>> We didn't even

realize what that was.

34
00:02:06,358 --> 00:02:08,994
We'd always heard it called
the elephant man disease.

35
00:02:08,994 --> 00:02:13,799
There's different types
of neurofibromatosis.

36
00:02:13,799 --> 00:02:17,303
One of them the tumors go
on the outside of your skin.

37
00:02:17,303 --> 00:02:20,706
The other one the tumors
grow on the inside,

38
00:02:20,706 --> 00:02:25,511
and hers grow on the inside.

39
00:02:25,511 --> 00:02:27,079
>> A long time ago
when we were thinking

40
00:02:27,079 --> 00:02:29,648
about this we approached
MacDonald,

41
00:02:29,648 --> 00:02:31,383
Dettwiler and Associates.

42
00:02:31,383 --> 00:02:34,320
It's a company that happens
to be located in Canada

43
00:02:34,320 --> 00:02:37,323
that built robots for space.

44

00:02:37,323 --> 00:02:39,592
They built what Canadians
call a [inaudible]

45
00:02:39,592 --> 00:02:44,196
and then they constructed
the special purpose textures

46
00:02:44,196 --> 00:02:47,566
manipulator for the
International Space Station.

47
00:02:47,566 --> 00:02:50,736
And the idea was
if they could build

48
00:02:50,736 --> 00:02:54,206
such complex robots
perhaps in cooperation

49
00:02:54,206 --> 00:02:56,709
with medicine we
could build a robot

50
00:02:56,709 --> 00:02:59,712
that could operate
inside an MRI machine.

51
00:02:59,712 --> 00:03:05,384
>> We did not realize
that it was built

52
00:03:05,384 --> 00:03:09,555
of the same material
as the space arm.

53
00:03:09,555 --> 00:03:14,693
And we're quite amazed that's
what he had made it out of.

54

00:03:14,693 --> 00:03:17,463
>> But it's the multidexterity
of the robot

55
00:03:17,463 --> 00:03:20,599
and that robot could
perform tasks

56
00:03:20,599 --> 00:03:24,136
that made us become
increasingly confident

57
00:03:24,136 --> 00:03:26,405
that we could overcome
the challenges related

58
00:03:26,405 --> 00:03:30,376
to building a robot that could
operate inside an MRI machine

59
00:03:30,376 --> 00:03:31,944
with the precision,
the accuracy,

60
00:03:31,944 --> 00:03:34,513
and the dexterity
of a neurosurgeon.

61
00:03:34,513 --> 00:03:38,851
It just so happened that the
first individual was a young

62
00:03:38,851 --> 00:03:44,123
woman and the young woman
harbored a fairly complex tumor

63
00:03:44,123 --> 00:03:47,793
underneath the front
part of her brain.

64

00:03:47,793 --> 00:03:51,897
A machine like NeuroArm
can manipulate tools

65
00:03:51,897 --> 00:03:54,633
at an accuracy of 50 microns.

66
00:03:54,633 --> 00:03:57,236
That is overwhelmingly superior

67
00:03:57,236 --> 00:03:59,138
to what the best surgeon
might be able to do.

68
00:03:59,138 --> 00:04:05,477
>> I think it's fabulous and to
me it's actually mind boggling

69
00:04:05,477 --> 00:04:10,849
that someone could take
that material and put it

70
00:04:10,849 --> 00:04:18,090
into a life saving device that
can help millions of people.

71
00:04:18,090 --> 00:04:23,562
>> I honestly think that
right now I'd be bed ridden.

72
00:04:23,562 --> 00:04:27,099
I would not be able
to get out of bed

73
00:04:27,099 --> 00:04:28,834
if it were not for my doctors.

74
00:04:28,834 --> 00:04:37,242
My parents would be taking
care of my kids right now.

75
00:04:37,242 --> 00:04:40,446
I guess like I'm glad that
it hopefully helped people

76
00:04:40,446 --> 00:04:41,847
who have my disease.

77
00:04:41,847 --> 00:04:47,152
And I hope that it helps people
who need surgery in the future.

78
00:04:47,152 --> 00:04:52,291
If they're ever propositioned
with a chance in the future

79
00:04:52,291 --> 00:04:56,528
to have something done like
this, I hope they take it.

80
00:04:56,528 --> 00:05:05,537
[Music]

81
00:05:14,046 --> 00:05:18,817
>> We're in the town
of Tres Picos.

82
00:05:18,817 --> 00:05:22,121
This is a water purifier that
uses technology developed

83
00:05:22,121 --> 00:05:26,425
by NASA and makes free
purified available to all

84
00:05:26,425 --> 00:05:31,296
of the people of the community.

85
00:05:31,296 --> 00:05:34,733

The technology was
developed by NASA

86
00:05:34,733 --> 00:05:40,339
for the International
Space Station.

87
00:05:40,339 --> 00:05:45,444
In this community the
water comes from the tower,

88
00:05:45,444 --> 00:05:48,247
but in other communities
where we are working

89
00:05:48,247 --> 00:05:51,950
on [inaudible] it comes
from the wells, from rivers,

90
00:05:51,950 --> 00:05:54,720
from streams, from springs.

91
00:05:54,720 --> 00:05:56,955
The water can come

92
00:05:56,955 --> 00:06:03,996
from practically any
source that you can imagine.

93
00:06:03,996 --> 00:06:08,066
People who drink contaminated
water alter their health.

94
00:06:08,066 --> 00:06:11,970
Their children's
development is diminished.

95
00:06:18,410 --> 00:06:20,679
>> My name is Raquel Perez
Perez [assumed spelling],

96
00:06:20,679 --> 00:06:24,616
and I am the campus
assistant of this school.

97
00:06:24,616 --> 00:06:28,020
There were lots of
children with parasites

98
00:06:28,020 --> 00:06:31,857
and stomach bugs before
the purified water came.

99
00:06:31,857 --> 00:06:33,358
Now the kids are healthier

100
00:06:33,358 --> 00:06:37,496
because they now drink
purified water from the plant.

101
00:06:37,496 --> 00:06:42,267
The energy that is being used
is solar, and the children come

102
00:06:42,267 --> 00:06:45,437
to recess with their cups and
they get the water themselves.

103
00:06:45,437 --> 00:06:50,342
They are happy now
and they want to come

104
00:06:50,342 --> 00:06:51,944
and drink water all the time.

105
00:06:51,944 --> 00:06:58,250
>> When you get involved
with a plant of this kind

106

00:06:58,250 --> 00:07:02,521
that gives people access to pure
water for human consumption,

107
00:07:02,521 --> 00:07:05,057
that is going to prevent
people from getting sick,

108
00:07:05,057 --> 00:07:08,527
what you're really doing is
improving people's health,

109
00:07:08,527 --> 00:07:11,530
but also you're improving
the economy for these people.

110
00:07:11,530 --> 00:07:19,505
>> If we could put one of
these plants in every community

111
00:07:19,505 --> 00:07:22,407
and have people use it you
would have resolved one

112
00:07:22,407 --> 00:07:25,744
of the most important
sources of health problems.

113
00:07:25,744 --> 00:07:32,851
At least in the rural
areas of Mexico.

114
00:07:32,851 --> 00:07:35,220
That's the truth.

115
00:07:35,220 --> 00:07:38,323
If it is well used, you
can change the lives

116
00:07:38,323 --> 00:07:39,825

of an entire community.

117
00:07:39,825 --> 00:07:43,395
It gives you children
that learn more.

118
00:07:43,395 --> 00:07:46,698
It gives you parents who
spend less money on medicine.

119
00:07:46,698 --> 00:07:49,067
It changes the future.

120
00:07:50,502 --> 00:07:59,578
[Music]

121
00:08:01,513 --> 00:08:03,081
>> Our farm is called AWG Farms.

122
00:08:03,081 --> 00:08:05,617
It started back in 1975.

123
00:08:05,617 --> 00:08:07,819
It's a family run farm.

124
00:08:07,819 --> 00:08:11,623
I have two brothers now, and
my son [inaudible] operation.

125
00:08:11,623 --> 00:08:13,191
This will be the
third generation farm

126
00:08:13,191 --> 00:08:17,729
in this particular area.

127
00:08:17,729 --> 00:08:20,499
The main crop is sugar beets.

128
00:08:20,499 --> 00:08:22,935
Then we have spring wheat.

129
00:08:22,935 --> 00:08:24,803
Sunflowers.

130
00:08:24,803 --> 00:08:26,138
Soy beans.

131
00:08:26,138 --> 00:08:30,475
Corn. And once in a while
we'll raise some edible beans.

132
00:08:30,475 --> 00:08:36,415
[Music]

133
00:08:36,415 --> 00:08:38,617
>> Remote sensing
is a way to look

134
00:08:38,617 --> 00:08:42,020
at our crops during the growing
season to be able to determine

135
00:08:42,020 --> 00:08:45,057
if we need to do any
monitoring of diseases and

136
00:08:45,057 --> 00:08:47,492
or fertility differences.

137
00:08:47,492 --> 00:08:53,165
We have an organization in Grand
Forks, North Dakota called UMAC.

138
00:08:53,165 --> 00:08:55,000
Well, that organization
put a camera

139
00:08:55,000 --> 00:08:57,669
on the space station
called Issac.

140
00:08:57,669 --> 00:09:02,708
Well, the biggest problem with
satellite imagery is the fact

141
00:09:02,708 --> 00:09:05,277
that [inaudible] we
get every 16 days.

142
00:09:05,277 --> 00:09:09,247
And on that 16th day in this
region if we have cloud cover

143
00:09:09,247 --> 00:09:11,383
that image is virtually
useless for us.

144
00:09:11,383 --> 00:09:14,786
So then we have to
wait another 16 days.

145
00:09:14,786 --> 00:09:17,489
The biggest thing with Issac,
we would get it much more often.

146
00:09:17,489 --> 00:09:20,525
When we wanted to get that
particular image, Issac gave it

147
00:09:20,525 --> 00:09:26,031
to us when we wanted it versus a
more rotational type satellite.

148
00:09:26,031 --> 00:09:29,635
They were able to get imagery to
us with a couple bands of light,

149
00:09:29,635 --> 00:09:32,571
more necessary ones we needed
which is near infrared and red.

150
00:09:32,571 --> 00:09:36,008
Near infrared band is
something to do with biomass,

151
00:09:36,008 --> 00:09:37,242
how the crop is growing.

152
00:09:37,242 --> 00:09:40,779
More biomass, you get more
[inaudible] potential.

153
00:09:40,779 --> 00:09:43,115
We're able to obtain a piece
of software that's written

154
00:09:43,115 --> 00:09:45,717
by a local programmer of
this region that allows us

155
00:09:45,717 --> 00:09:49,154
to take these images and
manipulate them into zones

156
00:09:49,154 --> 00:09:50,555
within the field itself.

157
00:09:50,555 --> 00:09:53,892
And by doing that we can see
different patterns in the field,

158
00:09:53,892 --> 00:09:57,162
and within those patterns we
can manage the field differently

159
00:09:57,162 --> 00:10:00,198

based off of biomass or
[inaudible] field itself.

160
00:10:00,198 --> 00:10:04,903
It's just a tool that we can
use as a reference to be able

161
00:10:04,903 --> 00:10:06,538
to make better decisions.

162
00:10:06,538 --> 00:10:10,275
And by doing that our
farm is more profitable.

163
00:10:10,275 --> 00:10:15,514
And that, to me,
is very important.

164
00:10:15,514 --> 00:10:24,589
[Music]

165
00:10:27,693 --> 00:10:30,462
>> I grew up out in
the country in Indiana.

166
00:10:30,462 --> 00:10:32,731
Corn and soy beans
were the main crops.

167
00:10:32,731 --> 00:10:38,704
I had always been interested
in technology and in science.

168
00:10:38,704 --> 00:10:40,939
Being out in the rural setting
there wasn't a whole lot

169
00:10:40,939 --> 00:10:43,508
of support for this.

170
00:10:43,508 --> 00:10:48,180
Space Jam is an annual
weekend boy scout event

171
00:10:48,180 --> 00:10:51,516
and we do all kinds of
technology based things.

172
00:10:52,784 --> 00:10:55,554
We have about 1,000 people
that come every year.

173
00:10:55,554 --> 00:10:57,389
This is our seventh
year of doing it.

174
00:10:57,389 --> 00:11:00,625
And it's a blast every year.

175
00:11:00,625 --> 00:11:02,794
The contact with the
International Space Station was

176
00:11:02,794 --> 00:11:06,798
one of the driving forces that
helped to create Space Jam.

177
00:11:06,798 --> 00:11:10,535
In fact, the first Space Jam
was really basically only

178
00:11:10,535 --> 00:11:12,037
about the contact.

179
00:11:12,037 --> 00:11:16,641
It was a dream of the ham
operator to say, "Hey, let's --

180
00:11:16,641 --> 00:11:19,678

I want to talk to astronauts
on the space station.

181
00:11:19,678 --> 00:11:21,213
How cool could that be?"

182
00:11:21,213 --> 00:11:25,183
That's the top of the game.

183
00:11:25,183 --> 00:11:27,552
Each year we call up to the
International Space Station

184
00:11:27,552 --> 00:11:29,955
and we give these young
kids the opportunity

185
00:11:29,955 --> 00:11:32,124
to ask questions
to the astronaut.

186
00:11:32,124 --> 00:11:35,260
>> Is it true that it
will take over a year

187
00:11:35,260 --> 00:11:36,862
to get to Mars and back?

188
00:11:36,862 --> 00:11:37,629
Over.

189
00:11:37,629 --> 00:11:39,364
>> It absolutely is true.

190
00:11:39,364 --> 00:11:40,766
>> The first time

191
00:11:40,766 --> 00:11:43,368
that I remember really having

this real impression was I think

192
00:11:43,368 --> 00:11:45,604
the third year we did this.

193
00:11:45,604 --> 00:11:49,274
I was in charge of actually
calling up the space station

194
00:11:49,274 --> 00:11:51,209
and establishing the contact.

195
00:11:51,209 --> 00:11:53,512
We were out in the middle of
the night in a field and I said,

196
00:11:53,512 --> 00:11:56,848
"Anyone SS, Anyone SS,
this is WB9SA calling

197
00:11:56,848 --> 00:11:57,949
for a scheduled contact.

198
00:11:57,949 --> 00:11:58,750
Do you copy?

199
00:11:58,750 --> 00:12:00,085
Over." And I sent it again.

200
00:12:00,085 --> 00:12:03,321
And then all of a sudden real
crisp comes back, "WB9SA,

201
00:12:03,321 --> 00:12:04,923
this is the International
Space Station.

202
00:12:04,923 --> 00:12:06,258
How are you doing tonight?"

203
00:12:06,258 --> 00:12:09,027
It's amazing.

204
00:12:09,027 --> 00:12:12,531
I graduated as valedictorian
and I was lucky enough

205
00:12:12,531 --> 00:12:15,667
to be admitted to Princeton
with a complete scholarship.

206
00:12:15,667 --> 00:12:17,536
And I then moved
to San Francisco

207
00:12:17,536 --> 00:12:19,771
where I'm a software engineer.

208
00:12:19,771 --> 00:12:22,641
So I went from living on
a farm to living downtown

209
00:12:22,641 --> 00:12:25,710
in San Francisco writing
software for people.

210
00:12:25,710 --> 00:12:28,814
It was a really amazing
experience to do all that.

211
00:12:30,515 --> 00:12:39,591
[Music]

212
00:12:40,425 --> 00:12:42,627
>> [Inaudible] is a large state.

213
00:12:42,627 --> 00:12:46,264
Our territory is about the

size of France and we consist

214
00:12:46,264 --> 00:12:50,268
of 853 units and municipalities.

215
00:12:50,268 --> 00:12:53,438
There are large distances
between our communities

216
00:12:53,438 --> 00:12:58,009
and many very isolated
rural communities.

217
00:13:01,213 --> 00:13:03,982
We are using new technology
that impacts the quality

218
00:13:03,982 --> 00:13:06,751
of prenatal care the
diagnostic capacity

219
00:13:06,751 --> 00:13:08,119
of the primary care doctor

220
00:13:08,119 --> 00:13:12,490
in the situations involving
distant, isolated communities.

221
00:13:12,490 --> 00:13:17,028
[Music]

222
00:13:17,028 --> 00:13:21,733
Providing medical care for
people in remote locations

223
00:13:21,733 --> 00:13:23,869
like these rural communities

224
00:13:23,869 --> 00:13:27,172

or the International Space
Station can be difficult

225
00:13:27,172 --> 00:13:29,241
because trained medical
personnel are not

226
00:13:29,241 --> 00:13:30,308
always available.

227
00:13:30,308 --> 00:13:34,746
NASA research teams
developed techniques

228
00:13:34,746 --> 00:13:37,749
that enabled astronauts
aboard the space station

229
00:13:37,749 --> 00:13:41,653
with minimal training to operate
an ultrasound device using

230
00:13:41,653 --> 00:13:45,257
simple printed guides.

231
00:13:45,257 --> 00:13:48,627
The ultrasound images are
transmitted in real time

232
00:13:48,627 --> 00:13:52,063
to a doctor back on Earth who
can make medical decisions

233
00:13:52,063 --> 00:13:54,065
without actually being
aboard the station.

234
00:13:54,065 --> 00:13:57,802
These same techniques
have been adapted for use

235
00:13:57,802 --> 00:14:01,473
with portable ultrasound
devices in communities

236
00:14:01,473 --> 00:14:05,477
where expert medical care
is not always available.

237
00:14:05,477 --> 00:14:10,849
[Music]

238
00:14:10,849 --> 00:14:12,550
>> My name is [inaudible].

239
00:14:12,550 --> 00:14:16,087
I'm a doctor in the
town of Munga.

240
00:14:16,087 --> 00:14:19,357
>> In Munga people live
with a particularity

241
00:14:19,357 --> 00:14:22,894
and that is isolation.

242
00:14:22,894 --> 00:14:26,765
We have a geographical barrier
that is the [inaudible] river

243
00:14:26,765 --> 00:14:33,338
which is both a blessing for the
region, but it also isolates us.

244
00:14:33,338 --> 00:14:40,679
We live in a region where
financial resources are few.

245
00:14:40,679 --> 00:14:44,049

People do not have a lot of
work, but they are honest,

246
00:14:44,049 --> 00:14:47,719
good people who do not
have much opportunity.

247
00:14:47,719 --> 00:14:50,622
So there are many needy people
who need these resources

248
00:14:50,622 --> 00:14:52,524
and rely only on
this institution

249
00:14:52,524 --> 00:14:54,960
to provide assistance.

250
00:14:54,960 --> 00:15:02,467
This is a technology that
helps us solve many problems.

251
00:15:02,467 --> 00:15:09,007
[Music]

252
00:15:09,007 --> 00:15:12,711
There was a case of a patient
who came to the hospital

253
00:15:12,711 --> 00:15:14,779
with severe respiratory failure

254
00:15:14,779 --> 00:15:16,614
and the people realized
she would die

255
00:15:16,614 --> 00:15:19,985
in just 20 to 30 minutes.

256

00:15:19,985 --> 00:15:23,188
We ran. We talked with Doctor
[inaudible] who was training us

257
00:15:23,188 --> 00:15:24,723
to use the ultrasound.

258
00:15:24,723 --> 00:15:26,591
He came and applied
the ultrasound

259
00:15:26,591 --> 00:15:29,027
and discovered large
amounts of fluid

260
00:15:29,027 --> 00:15:31,196
around her lungs and heart.

261
00:15:31,196 --> 00:15:34,432
We performed a procedure
and drained a lot of fluids.

262
00:15:34,432 --> 00:15:37,135
In 20 minutes, 10 minutes,

263
00:15:37,135 --> 00:15:39,337
the woman immediately
experienced an improvement.

264
00:15:39,337 --> 00:15:41,840
And in half an hour
was already walking.

265
00:15:41,840 --> 00:15:44,342
It was like a miracle.

266
00:15:44,342 --> 00:15:45,844
Arise and walk.

267

00:15:45,844 --> 00:15:48,213
She was dying in front of us

268
00:15:48,213 --> 00:15:52,951
without people knowing
what was happening.

269
00:15:52,951 --> 00:15:55,420
This ultrasound was instrumental

270
00:15:55,420 --> 00:15:58,523
in saving the life
of that patient.

271
00:15:58,523 --> 00:16:04,796
[Music]

272
00:16:04,796 --> 00:16:08,099
>> We've only begun to see the
International Space Station's

273
00:16:08,099 --> 00:16:10,935
benefits to humanity.

274
00:16:10,935 --> 00:16:13,705
These are just a few of
the ways that the science

275
00:16:13,705 --> 00:16:16,908
and research conducted
aboard the ISS is improving

276
00:16:16,908 --> 00:16:18,009
lives today.

277
00:16:18,009 --> 00:16:22,847
There are countless
more benefits to come.

278

00:16:22,847 --> 00:16:26,518
Sometimes in ways that
we have never predicted.

279
00:16:26,518 --> 00:16:31,423
Every day hundreds of scientists
around the world are working

280
00:16:31,423 --> 00:16:34,359
with the crews on board the
International Space Station

281
00:16:34,359 --> 00:16:37,762
to perform life changing
research.

282
00:16:37,762 --> 00:16:41,599
Every day they use the
weightless environment of space

283
00:16:41,599 --> 00:16:43,735
to conduct experiments in ways

284
00:16:43,735 --> 00:16:45,336
that can't be done
here on Earth.

285
00:16:45,336 --> 00:16:50,575
And every day those
experiments improve life

286
00:16:50,575 --> 00:16:53,878
for people all over the world.

287
00:16:53,878 --> 00:16:55,280
This will be the legacy