
NASA
SPACESTATION
LIVE

1
00:00:09,750 --> 00:00:08,070
so 15 years of humans living on board

2
00:00:12,150 --> 00:00:09,760
the international space station a lot

3
00:00:13,749 --> 00:00:12,160
has happened not only just building the

4
00:00:16,390 --> 00:00:13,759
station but of course to its true

5
00:00:18,310 --> 00:00:16,400
purpose scientific research i'm joined

6
00:00:19,990 --> 00:00:18,320
here today by dr tara rudley an

7
00:00:22,070 --> 00:00:20,000
associate program scientist with the

8
00:00:24,070 --> 00:00:22,080
international space station program to

9
00:00:25,429 --> 00:00:24,080
talk about it a little bit more now tara

10
00:00:26,790 --> 00:00:25,439
just first off thanks so much for

11
00:00:29,429 --> 00:00:26,800
joining me here today i really

12
00:00:31,189 --> 00:00:29,439
appreciate it and i mean 15 years that's

13
00:00:32,709 --> 00:00:31,199

that seems like such a long time but i

14
00:00:34,549 --> 00:00:32,719
mean even in the scientific world it's

15
00:00:36,389 --> 00:00:34,559
not always necessarily that long is it

16
00:00:38,950 --> 00:00:36,399
no it's not you know i was a baby when i

17
00:00:40,389 --> 00:00:38,960
came to work here in 2001 at nasa so we

18
00:00:42,310 --> 00:00:40,399
were just getting started with the space

19
00:00:44,630 --> 00:00:42,320
station and it's been really fun to see

20
00:00:46,389 --> 00:00:44,640
all the types of science come across

21
00:00:48,950 --> 00:00:46,399
over these 15 years and it is standard

22
00:00:51,350 --> 00:00:48,960
for science yeah so back in the year

23
00:00:53,750 --> 00:00:51,360
2000 the first crew got on board three

24
00:00:55,670 --> 00:00:53,760
crew members a much smaller station back

25
00:00:57,670 --> 00:00:55,680
then but it was already equipped to

26
00:00:59,110 --> 00:00:57,680
start doing research what were some of

27
00:01:01,110 --> 00:00:59,120
the things they were doing you know 15

28
00:01:02,630 --> 00:01:01,120
years ago yeah the most important things

29
00:01:04,229 --> 00:01:02,640
are the things that we care about most

30
00:01:06,149 --> 00:01:04,239
and that is really observing the earth

31
00:01:07,910 --> 00:01:06,159
they got started right away with that

32
00:01:09,510 --> 00:01:07,920
and doing lots of studies on the human

33
00:01:11,190 --> 00:01:09,520
body how the body responds to space

34
00:01:13,429 --> 00:01:11,200
flight and those are the two things that

35
00:01:15,109 --> 00:01:13,439
are most close to us in fact a lot of

36
00:01:17,429 --> 00:01:15,119
people don't know the first publication

37
00:01:19,190 --> 00:01:17,439
research publication result came from

38
00:01:21,830 --> 00:01:19,200

crew earth observation on the space

39
00:01:23,590 --> 00:01:21,840
station so there you go trivia cool and

40
00:01:26,310 --> 00:01:23,600
so i mean there

41
00:01:29,030 --> 00:01:26,320
we've had over 1700 experiments you know

42
00:01:30,870 --> 00:01:29,040
and counting in the 15 years since give

43
00:01:32,950 --> 00:01:30,880
give everybody down here just kind of a

44
00:01:34,789 --> 00:01:32,960
sense of how much can actually be going

45
00:01:37,429 --> 00:01:34,799
on on board the station just on any

46
00:01:39,190 --> 00:01:37,439
given day on any given day they'll have

47
00:01:40,789 --> 00:01:39,200
a full day's worth of science it's i

48
00:01:42,230 --> 00:01:40,799
mean it's their job they're doing this

49
00:01:44,310 --> 00:01:42,240
all the time when they're not sleeping

50
00:01:46,069 --> 00:01:44,320
or or maintaining the vehicle but a lot

51
00:01:48,149 --> 00:01:46,079
of people don't know that in a six month

52
00:01:51,429 --> 00:01:48,159
period of time our crew members can be

53
00:01:52,950 --> 00:01:51,439
doing about 200 to 250 investigations

54
00:01:55,350 --> 00:01:52,960
representing hundreds of scientists

55
00:01:57,190 --> 00:01:55,360
around the world so those those crew up

56
00:01:59,510 --> 00:01:57,200
there are doing lots and lots of good

57
00:02:01,910 --> 00:01:59,520
things for us okay and one of the things

58
00:02:03,990 --> 00:02:01,920
so one of our favorite phrases is off

59
00:02:06,550 --> 00:02:04,000
the earth for the earth and

60
00:02:08,389 --> 00:02:06,560
that kind of came from one of the big

61
00:02:09,830 --> 00:02:08,399
reasons that we're doing all the science

62
00:02:11,990 --> 00:02:09,840
and one of the big benefits that we're

63
00:02:13,830 --> 00:02:12,000

getting out of all this science explain

64
00:02:15,190 --> 00:02:13,840
that for me yeah i mean

65
00:02:17,030 --> 00:02:15,200
there are things you know if you think

66
00:02:19,350 --> 00:02:17,040
about science and space there's lots

67
00:02:22,630 --> 00:02:19,360
that happen physically that allows

68
00:02:24,630 --> 00:02:22,640
microgravity to uh to unmask some of the

69
00:02:26,949 --> 00:02:24,640
effects that we see in normal processes

70
00:02:29,830 --> 00:02:26,959
here on earth so it's really a unique

71
00:02:31,670 --> 00:02:29,840
opportunity to study fluid behavior

72
00:02:34,070 --> 00:02:31,680
changes in the human body

73
00:02:36,390 --> 00:02:34,080
the way fire behaves combustion

74
00:02:38,070 --> 00:02:36,400
lots of lots of different things and so

75
00:02:39,430 --> 00:02:38,080
that we take advantage of that unique

76
00:02:41,990 --> 00:02:39,440
laboratory that you can't get here on

77
00:02:44,070 --> 00:02:42,000
earth and we do those experiments and we

78
00:02:45,589 --> 00:02:44,080
do them not just to benefit those who of

79
00:02:48,710 --> 00:02:45,599
us who want to go further and explore

80
00:02:50,630 --> 00:02:48,720
space but really we get a lot back here

81
00:02:52,790 --> 00:02:50,640
that we can use on earth a lot of new

82
00:02:54,630 --> 00:02:52,800
knowledge that we can use to apply

83
00:02:56,869 --> 00:02:54,640
changes to the way we maybe design

84
00:02:59,190 --> 00:02:56,879
medicines or or materials and things

85
00:03:00,949 --> 00:02:59,200
that affect our everyday lives okay you

86
00:03:02,710 --> 00:03:00,959
touched on some of them so let's you

87
00:03:05,190 --> 00:03:02,720
know let's dive right in let's kind of

88
00:03:06,949 --> 00:03:05,200

go through the list so 15 years what are

89
00:03:08,710 --> 00:03:06,959
what are some of the areas that we've

90
00:03:10,309 --> 00:03:08,720
really been exploring some of the things

91
00:03:12,710 --> 00:03:10,319
that have come out of that i think one

92
00:03:15,350 --> 00:03:12,720
of the neatest new areas uh to come out

93
00:03:17,990 --> 00:03:15,360
of space station use that benefits earth

94
00:03:20,710 --> 00:03:18,000
are enabling the the commercial industry

95
00:03:23,350 --> 00:03:20,720
to access space so we're looking at now

96
00:03:25,910 --> 00:03:23,360
entire companies whose business is space

97
00:03:27,990 --> 00:03:25,920
they send investigations to the to the

98
00:03:30,149 --> 00:03:28,000
space station they provide access for

99
00:03:31,830 --> 00:03:30,159
other companies and they just um you

100
00:03:33,589 --> 00:03:31,840
know enable the commercialization of the

101
00:03:35,270 --> 00:03:33,599
space station which opens up research to

102
00:03:37,350 --> 00:03:35,280
everyone and that's through the national

103
00:03:40,149 --> 00:03:37,360
laboratory effort okay and what else

104
00:03:42,470 --> 00:03:40,159
going on another one um that we really

105
00:03:44,149 --> 00:03:42,480
like is the uh the water purification

106
00:03:46,149 --> 00:03:44,159
efforts space station you know you've

107
00:03:48,149 --> 00:03:46,159
got to keep your astronauts fed and give

108
00:03:50,309 --> 00:03:48,159
them water clean water to drink and some

109
00:03:52,390 --> 00:03:50,319
of the efforts that came from building

110
00:03:54,070 --> 00:03:52,400
the system for space station clean water

111
00:03:55,830 --> 00:03:54,080
have been now applied commercially and

112
00:03:57,350 --> 00:03:55,840
used all around the world in areas that

113
00:03:59,270 --> 00:03:57,360

can take

114
00:04:01,350 --> 00:03:59,280
water that's from rivers and lakes and

115
00:04:04,149 --> 00:04:01,360
pass it through this system that is now

116
00:04:06,550 --> 00:04:04,159
gravity fed ironically requires no power

117
00:04:09,589 --> 00:04:06,560
and these guys can get clean water it's

118
00:04:14,070 --> 00:04:11,830
protein crystal growth is another really

119
00:04:16,310 --> 00:04:14,080
interesting use of microgravity because

120
00:04:18,069 --> 00:04:16,320
in space you can allow

121
00:04:19,830 --> 00:04:18,079
these crystals these delicate crystals

122
00:04:21,749 --> 00:04:19,840
to grow nice and large and why do we

123
00:04:23,830 --> 00:04:21,759
care about growing crystals because lots

124
00:04:25,670 --> 00:04:23,840
of proteins in your body

125
00:04:27,110 --> 00:04:25,680
we don't understand how they work and if

126
00:04:29,990 --> 00:04:27,120
we can grow them up in crystal

127
00:04:31,189 --> 00:04:30,000
structures really nice unique shape we

128
00:04:32,790 --> 00:04:31,199
can get

129
00:04:34,629 --> 00:04:32,800
better benefits about you know how to

130
00:04:37,030 --> 00:04:34,639
make better medicines and how to attach

131
00:04:38,870 --> 00:04:37,040
these proteins and so our japanese

132
00:04:40,870 --> 00:04:38,880
colleagues actually were successful at

133
00:04:42,870 --> 00:04:40,880
sending protein crystals up into space

134
00:04:44,310 --> 00:04:42,880
growing up a particular protein that's

135
00:04:46,150 --> 00:04:44,320
involved in the progression of duchenne

136
00:04:47,909 --> 00:04:46,160
muscular dystrophy finding out things

137
00:04:50,469 --> 00:04:47,919
they hadn't seen before here on earth

138
00:04:51,909 --> 00:04:50,479

and were able to make more potent forms

139
00:04:53,590 --> 00:04:51,919
of the treatment of

140
00:04:55,670 --> 00:04:53,600
muscular dystrophy it's in trials right

141
00:04:58,230 --> 00:04:55,680
now yeah

142
00:05:00,070 --> 00:04:58,240
the um ultrasound you know not not a lot

143
00:05:01,830 --> 00:05:00,080
of astronauts that go to space station

144
00:05:02,870 --> 00:05:01,840
are actually medical doctors so there's

145
00:05:04,070 --> 00:05:02,880
they're going to need to know how to

146
00:05:06,310 --> 00:05:04,080
treat themselves in the case of

147
00:05:08,230 --> 00:05:06,320
emergency so we've had ultrasound

148
00:05:10,390 --> 00:05:08,240
techniques that have been designed to

149
00:05:11,590 --> 00:05:10,400
train our astronauts and telecommunicate

150
00:05:14,230 --> 00:05:11,600
with them

151
00:05:17,110 --> 00:05:14,240
in medicine in space that have now been

152
00:05:18,710 --> 00:05:17,120
actually applied to here on earth and

153
00:05:21,110 --> 00:05:18,720
it's it's new techniques software

154
00:05:23,670 --> 00:05:21,120
programs that allow doctors maybe here

155
00:05:27,189 --> 00:05:23,680
in the u.s to treat patients across the

156
00:05:29,670 --> 00:05:27,199
globe in areas that don't have access to

157
00:05:31,749 --> 00:05:29,680
highly sophisticated imagery

158
00:05:33,909 --> 00:05:31,759
studios

159
00:05:36,150 --> 00:05:33,919
improved eye surgery with spaceflight

160
00:05:38,629 --> 00:05:36,160
hardware there was investigation that

161
00:05:40,230 --> 00:05:38,639
was looking at eye tracking in space

162
00:05:41,749 --> 00:05:40,240
what about this for space flight what's

163
00:05:43,510 --> 00:05:41,759

different with our bodies in space

164
00:05:45,270 --> 00:05:43,520
flight and so new hardware that was

165
00:05:47,430 --> 00:05:45,280
designed to really watch how the eyes

166
00:05:49,270 --> 00:05:47,440
move and that affects balances and

167
00:05:50,950 --> 00:05:49,280
frames of references

168
00:05:53,029 --> 00:05:50,960
was actually as it turns out could be

169
00:05:54,629 --> 00:05:53,039
applied to here on the ground and it was

170
00:05:57,029 --> 00:05:54,639
it was taken and applied to commercial

171
00:05:58,629 --> 00:05:57,039
use and it helps surgeons now

172
00:06:00,710 --> 00:05:58,639
who are treating who are performing eye

173
00:06:02,629 --> 00:06:00,720
surgery track the eye movements track

174
00:06:05,350 --> 00:06:02,639
the laser of the surgery during

175
00:06:07,990 --> 00:06:05,360
during the surgery

176
00:06:09,670 --> 00:06:08,000
the robotic arms um that you know the

177
00:06:12,629 --> 00:06:09,680
the space flight arms the canada arm

178
00:06:15,350 --> 00:06:12,639
that we see on station and and and um

179
00:06:17,749 --> 00:06:15,360
the dexter were developed by canada and

180
00:06:19,270 --> 00:06:17,759
um the makers of that that device have

181
00:06:22,390 --> 00:06:19,280
actually applied it commercially to a

182
00:06:24,790 --> 00:06:22,400
brain assist brain surgery assist device

183
00:06:27,270 --> 00:06:24,800
now these guys can do doctors can do

184
00:06:29,590 --> 00:06:27,280
surgery on the brain in areas that you

185
00:06:32,150 --> 00:06:29,600
can't access otherwise you've got to get

186
00:06:33,830 --> 00:06:32,160
through an mri device some tumors are so

187
00:06:37,029 --> 00:06:33,840
hidden you can't see it unless it's in

188
00:06:39,029 --> 00:06:37,039

an mri the materials the decks the

189
00:06:41,350 --> 00:06:39,039
dexterity the textile function of this

190
00:06:43,590 --> 00:06:41,360
robotic brain surgery device allows

191
00:06:46,629 --> 00:06:43,600
surgery surgery to happen from across

192
00:06:48,550 --> 00:06:46,639
the room in an mri and patients dozens

193
00:06:51,189 --> 00:06:48,560
of patients have already been treated uh

194
00:06:53,670 --> 00:06:51,199
using this device

195
00:06:55,110 --> 00:06:53,680
bone loss bone loss has been a problem

196
00:06:56,469 --> 00:06:55,120
in space you know you either use it or

197
00:06:58,710 --> 00:06:56,479
lose it

198
00:07:00,150 --> 00:06:58,720
and in space there's not a lot of use

199
00:07:02,390 --> 00:07:00,160
because they're not walking around so we

200
00:07:03,990 --> 00:07:02,400
see a lot of bone mass loss

201
00:07:06,309 --> 00:07:04,000
but what we found over the years of

202
00:07:08,390 --> 00:07:06,319
space station research is trying out new

203
00:07:11,350 --> 00:07:08,400
techniques and we found that if we

204
00:07:13,189 --> 00:07:11,360
increase the astronauts vitamin d intake

205
00:07:15,189 --> 00:07:13,199
we increase and make sure they take all

206
00:07:17,510 --> 00:07:15,199
their calories and they use the new what

207
00:07:19,350 --> 00:07:17,520
you see here innovative resistive um

208
00:07:22,390 --> 00:07:19,360
advanced resistive exercise device or

209
00:07:23,909 --> 00:07:22,400
arid high load high impact then we've

210
00:07:25,749 --> 00:07:23,919
been able to maintain bone mineral

211
00:07:27,830 --> 00:07:25,759
density and that is a huge breakthrough

212
00:07:30,070 --> 00:07:27,840
for not just our astronauts but for

213
00:07:31,990 --> 00:07:30,080

those on the ground who

214
00:07:34,070 --> 00:07:32,000
are aging and are looking at facing

215
00:07:35,589 --> 00:07:34,080
potential osteoporosis take these things

216
00:07:37,749 --> 00:07:35,599
into consideration

217
00:07:39,909 --> 00:07:37,759
high load take your vitamin d increase

218
00:07:43,430 --> 00:07:39,919
vitamin d and eat all your calories we

219
00:07:45,029 --> 00:07:43,440
also see we also are able to use other

220
00:07:47,749 --> 00:07:45,039
what we call model organisms such as

221
00:07:50,629 --> 00:07:47,759
mice to look at changes in the bone

222
00:07:52,869 --> 00:07:50,639
density losses and maybe apply new

223
00:07:55,189 --> 00:07:52,879
medicines and treatments such as the

224
00:07:58,070 --> 00:07:55,199
company that produced the form of

225
00:08:00,390 --> 00:07:58,080
medicine called prolia it's used now in

226
00:08:01,909 --> 00:08:00,400
osteoporosis in treatment on the ground

227
00:08:03,990 --> 00:08:01,919
some of their work was done on space

228
00:08:06,950 --> 00:08:04,000
station to lead them to that kind of use

229
00:08:12,710 --> 00:08:07,830
so

230
00:08:13,830 --> 00:08:12,720
seeing from the bacteria that are on the

231
00:08:16,790 --> 00:08:13,840
space station that we send to

232
00:08:18,629 --> 00:08:16,800
microgravity some of these bacteria tend

233
00:08:21,029 --> 00:08:18,639
to become more virulent or more

234
00:08:22,629 --> 00:08:21,039
aggressive and then some you know some

235
00:08:25,510 --> 00:08:22,639
don't do anything but what we've seen in

236
00:08:27,270 --> 00:08:25,520
some cases such as salmonella is

237
00:08:29,350 --> 00:08:27,280
a model now that we can send these

238
00:08:31,270 --> 00:08:29,360

bacteria up to space expose them get

239
00:08:32,550 --> 00:08:31,280
them home and look at you know look at

240
00:08:34,149 --> 00:08:32,560
the genes that have made them more

241
00:08:35,990 --> 00:08:34,159
virulent in space what is it about the

242
00:08:37,909 --> 00:08:36,000
microgravity environment that could make

243
00:08:40,389 --> 00:08:37,919
them more aggressive and when we

244
00:08:42,070 --> 00:08:40,399
understand that we can apply it to

245
00:08:43,350 --> 00:08:42,080
vaccine development here on earth and

246
00:08:45,910 --> 00:08:43,360
that's just what we're doing we've

247
00:08:49,269 --> 00:08:45,920
discovered new ways to develop potential

248
00:08:51,590 --> 00:08:49,279
vaccines for those of us here on earth

249
00:08:53,350 --> 00:08:51,600
so we've also been able to through the

250
00:08:56,070 --> 00:08:53,360
15 years of space station research

251
00:08:57,750 --> 00:08:56,080
impact over 43 million students across

252
00:09:00,070 --> 00:08:57,760
the globe through programs such as

253
00:09:02,630 --> 00:09:00,080
youtube space lab and sphere xero

254
00:09:04,389 --> 00:09:02,640
robotics they're usually inquiry-based

255
00:09:06,470 --> 00:09:04,399
projects that allow students to be

256
00:09:08,470 --> 00:09:06,480
involved in human exploration

257
00:09:10,870 --> 00:09:08,480
through science technology engineering

258
00:09:12,870 --> 00:09:10,880
and math so you know this is our future

259
00:09:14,230 --> 00:09:12,880
and and there's something always ongoing

260
00:09:17,269 --> 00:09:14,240
with space station and students

261
00:09:21,350 --> 00:09:19,509
breast cancer treatment much like the um

262
00:09:24,150 --> 00:09:21,360
the brain surgery device now there's a

263
00:09:26,949 --> 00:09:24,160

breast tumor treatment device that is

264
00:09:29,750 --> 00:09:26,959
stems from the same craters of the

265
00:09:31,190 --> 00:09:29,760
canada robotic arm and now we can

266
00:09:34,230 --> 00:09:31,200
surgeons have been able to perform

267
00:09:36,790 --> 00:09:34,240
clinical trials of breast cancer remover

268
00:09:39,269 --> 00:09:36,800
within an mri environment so again just

269
00:09:41,750 --> 00:09:39,279
imagine doing surgery while the patient

270
00:09:43,430 --> 00:09:41,760
is actually inside an mri you can't do

271
00:09:45,110 --> 00:09:43,440
it with people you can do it with

272
00:09:46,470 --> 00:09:45,120
robotics that have the right dexterity

273
00:09:48,949 --> 00:09:46,480
and the right type of materials and

274
00:09:50,949 --> 00:09:48,959
that's what they're doing

275
00:09:53,269 --> 00:09:50,959
monitoring water quality from space this

276
00:09:55,829 --> 00:09:53,279
is a big one the hyperspectral imager

277
00:09:57,750 --> 00:09:55,839
for the coastal ocean or the hico was an

278
00:09:59,750 --> 00:09:57,760
imaging sensor on the space station that

279
00:10:01,590 --> 00:09:59,760
helped detect water quality parameters

280
00:10:04,069 --> 00:10:01,600
things like clarity water clarity

281
00:10:07,350 --> 00:10:04,079
phytoplankton concentration distribution

282
00:10:09,910 --> 00:10:07,360
of germs cyanobacteria in the water it

283
00:10:12,230 --> 00:10:09,920
was built by the the u.s naval research

284
00:10:13,590 --> 00:10:12,240
laboratory and put on station but then

285
00:10:15,350 --> 00:10:13,600
there was a partnership with the

286
00:10:17,829 --> 00:10:15,360
environmental protection agency that was

287
00:10:19,509 --> 00:10:17,839
able to take data from that instrument

288
00:10:21,829 --> 00:10:19,519

and apply it to now a smartphone

289
00:10:24,069 --> 00:10:21,839
application where now users can help

290
00:10:25,509 --> 00:10:24,079
determine places in where water's

291
00:10:28,150 --> 00:10:25,519
contaminated places you wouldn't want to

292
00:10:30,550 --> 00:10:28,160
go swimming in and now that we've got

293
00:10:32,949 --> 00:10:30,560
that kind of information it it's it's

294
00:10:35,990 --> 00:10:32,959
allows you know more access for people

295
00:10:38,230 --> 00:10:36,000
to get to clean places of clean water

296
00:10:40,470 --> 00:10:38,240
finally don't forget space station is an

297
00:10:42,470 --> 00:10:40,480
earth observation platform it can pop it

298
00:10:44,470 --> 00:10:42,480
can cover up to 90 percent of the

299
00:10:46,710 --> 00:10:44,480
earth's populations where we can monitor

300
00:10:49,670 --> 00:10:46,720
things like disasters such as floods and

301
00:10:51,750 --> 00:10:49,680
fires volcanic eruption deforestation

302
00:10:53,509 --> 00:10:51,760
the iserv project

303
00:10:55,430 --> 00:10:53,519
allowed us to do that in partnership

304
00:10:57,190 --> 00:10:55,440
with the u.s agency for international

305
00:10:59,190 --> 00:10:57,200
development so

306
00:11:01,509 --> 00:10:59,200
what what happens is we can get images

307
00:11:03,350 --> 00:11:01,519
from space station and we have and been

308
00:11:04,790 --> 00:11:03,360
able to disseminate them around from

309
00:11:06,949 --> 00:11:04,800
around the world not just automatic

310
00:11:08,069 --> 00:11:06,959
autonomously but with crew

311
00:11:09,670 --> 00:11:08,079
astronaut

312
00:11:11,990 --> 00:11:09,680
interference as well and allows us to do

313
00:11:13,430 --> 00:11:12,000

that so i mean that's just a tiny

314
00:11:15,750 --> 00:11:13,440
picture of everything that's been going

315
00:11:17,829 --> 00:11:15,760
on and just real quick in closing i mean

316
00:11:20,470 --> 00:11:17,839
15 years in the books what's what's the

317
00:11:21,990 --> 00:11:20,480
next 15 years of human research and

318
00:11:24,470 --> 00:11:22,000
human space flight research going to

319
00:11:26,870 --> 00:11:24,480
look like yeah i think the next 15 years

320
00:11:29,509 --> 00:11:26,880
of space station utilization is going to

321
00:11:31,350 --> 00:11:29,519
cover both you know more applications on

322
00:11:33,110 --> 00:11:31,360
earth and of course it's going to do

323
00:11:35,430 --> 00:11:33,120
what we need to do to advance us to

324
00:11:37,750 --> 00:11:35,440
explore beyond low earth orbit but the

325
00:11:39,750 --> 00:11:37,760
thing is it's going to take time science

326
00:11:41,190 --> 00:11:39,760
allows for science to be repeated and

327
00:11:42,870 --> 00:11:41,200
publications come through so we'll be

328
00:11:44,630 --> 00:11:42,880
seeing publications and results from

329
00:11:46,790 --> 00:11:44,640
space station come through over 15 years

330
00:11:48,550 --> 00:11:46,800
and beyond all right well very exciting

331
00:11:49,990 --> 00:11:48,560
again dr tara rutley one of the

332
00:11:51,670 --> 00:11:50,000
associate program scientists for the

333
00:11:53,430 --> 00:11:51,680
international space station thanks so

334
00:11:54,949 --> 00:11:53,440
much for joining me today it's a big day