STATION LIFE

TRACY DYSON
Astronaut

1
00:00:17,990 --> 00:00:15,749
today we're going to talk about robotics

2
00:00:19,990 --> 00:00:18,000
on the international space station

3
00:00:22,390 --> 00:00:20,000
right now there are several types of

4
00:00:23,990 --> 00:00:22,400
robots in orbit there's a robotic arm

5
00:00:26,150 --> 00:00:24,000
that was used to construct the space

6
00:00:28,710 --> 00:00:26,160
station there's a dexterous robotic

7
00:00:30,710 --> 00:00:28,720
space handyman there's even robots that

8
00:00:31,750 --> 00:00:30,720
school children control by writing

9
00:00:33,510 --> 00:00:31,760
programs

10
00:00:35,670 --> 00:00:33,520
we'll learn about those and some pretty

11
00:00:37,670 --> 00:00:35,680
special robots here on earth

12
00:00:40,549 --> 00:00:37,680
join me as we go on board the iss to

13
00:00:43,270 --> 00:00:40,559

learn more about robotics hi i'm nasa

14
00:00:44,229 --> 00:00:43,280
astronaut tracy dyson welcome to station

15
00:00:48,790 --> 00:00:44,239
life

16
00:00:51,590 --> 00:00:50,389
we're moving out there

17
00:00:53,670 --> 00:00:51,600
right now

18
00:00:56,549 --> 00:00:53,680
thank you okay tracy we copy and that's

19
00:00:58,549 --> 00:00:56,559
good information we'll pass it along

20
00:01:00,709 --> 00:00:58,559
in this episode of station life we're

21
00:01:03,189 --> 00:01:00,719
going to talk about robotics on the

22
00:01:05,270 --> 00:01:03,199
international space station we'll hear

23
00:01:07,830 --> 00:01:05,280
from astronaut mike hopkins and what it

24
00:01:08,710 --> 00:01:07,840
takes to control the canadarm2 robotic

25
00:01:10,310 --> 00:01:08,720
arm

26
00:01:11,990 --> 00:01:10,320
we'll take a look at how robotic

27
00:01:14,550 --> 00:01:12,000
technologies from the international

28
00:01:15,830 --> 00:01:14,560
space station are helping lives right

29
00:01:17,429 --> 00:01:15,840
here on earth

30
00:01:19,510 --> 00:01:17,439
we'll have an interview with astronaut

31
00:01:21,749 --> 00:01:19,520
kara nyberg one of our most experienced

32
00:01:24,390 --> 00:01:21,759
robotic arm operators and the role

33
00:01:26,870 --> 00:01:24,400
robotics plays on the iss and hear

34
00:01:29,749 --> 00:01:26,880
stories of using cannon arm 2 to catch

35
00:01:31,670 --> 00:01:29,759
dragons among other things so don't go

36
00:01:39,749 --> 00:01:31,680
anywhere we've got a lot of robotic

37
00:01:41,749 --> 00:01:40,469
one of the things that's really

38
00:01:43,190 --> 00:01:41,759

interesting about the counter arm 2 on

39
00:01:44,950 --> 00:01:43,200
the space station is that it has the

40
00:01:47,429 --> 00:01:44,960
ability to inchworm around the space

41
00:01:49,190 --> 00:01:47,439
station it has seven joints and that

42
00:01:50,870 --> 00:01:49,200
makes it analogous to the human arm but

43
00:01:53,350 --> 00:01:50,880
it also has a symmetric design which

44
00:01:55,749 --> 00:01:53,360
means the base and the tip of the arm

45
00:01:57,270 --> 00:01:55,759
are symmetric and there's an elbow joint

46
00:01:59,990 --> 00:01:57,280
in the middle this means that what

47
00:02:01,510 --> 00:02:00,000
starts off as the base and can be then

48
00:02:03,749 --> 00:02:01,520
maneuvered and

49
00:02:05,910 --> 00:02:03,759
released once the tip has grabbed onto

50
00:02:08,070 --> 00:02:05,920
another location and then that base

51
00:02:10,150 --> 00:02:08,080
becomes the tip so imagine my arm as i

52
00:02:11,990 --> 00:02:10,160
go from here as i'm moving the arm here

53
00:02:13,910 --> 00:02:12,000
i can grab on this and release the scent

54
00:02:15,830 --> 00:02:13,920
and i can move around now this allows me

55
00:02:18,550 --> 00:02:15,840
to inch from around the space station

56
00:02:20,229 --> 00:02:18,560
and allow me to increase my range and in

57
00:02:22,550 --> 00:02:20,239
order to service things and also to do

58
00:02:23,830 --> 00:02:22,560
surveys and get the the arm around this

59
00:02:25,910 --> 00:02:23,840
iss

60
00:02:27,750 --> 00:02:25,920
like many people in the world that have

61
00:02:29,670 --> 00:02:27,760
a space passion we all want to become

62
00:02:31,110 --> 00:02:29,680
astronauts and go into space

63
00:02:32,790 --> 00:02:31,120

what i realized as i was growing up was

64
00:02:34,710 --> 00:02:32,800
that there are other areas that one can

65
00:02:36,229 --> 00:02:34,720
perform in the space program and that

66
00:02:37,750 --> 00:02:36,239
was to become a flight controller once i

67
00:02:39,430 --> 00:02:37,760
became an active flight controller i

68
00:02:41,270 --> 00:02:39,440
remember being in the mission control

69
00:02:42,710 --> 00:02:41,280
center and sitting down and

70
00:02:45,509 --> 00:02:42,720
about to do an operation which i had

71
00:02:47,270 --> 00:02:45,519
written a procedure for as the operation

72
00:02:48,710 --> 00:02:47,280
was beginning i was looking at the

73
00:02:50,470 --> 00:02:48,720
numbers on my console i was looking at

74
00:02:52,070 --> 00:02:50,480
the details of the operation and i

75
00:02:53,350 --> 00:02:52,080
suddenly looked up at the monitor and i

76
00:02:55,910 --> 00:02:53,360
saw this beautiful view of the earth

77
00:02:57,830 --> 00:02:55,920
going by and i saw the canadarm2 moving

78
00:03:00,630 --> 00:02:57,840
across this view and it just sunk in

79
00:03:01,750 --> 00:03:00,640
that this is me i'm in space i didn't

80
00:03:03,509 --> 00:03:01,760
have to be an astronaut to get into

81
00:03:05,509 --> 00:03:03,519
space i'm a flight controller and part

82
00:03:07,589 --> 00:03:05,519
of this beautiful program and i could

83
00:03:09,910 --> 00:03:07,599
see my nation's arm moving and it just

84
00:03:12,149 --> 00:03:09,920
gave me this wave of energy and i just

85
00:03:13,430 --> 00:03:12,159
re-fell in love with my work

86
00:03:15,110 --> 00:03:13,440
then of course when that happened i had

87
00:03:16,470 --> 00:03:15,120
to relock onto my numbers and focus on

88
00:03:18,070 --> 00:03:16,480

the job at hand but it was a really

89
00:03:18,869 --> 00:03:18,080
fantastic moment and i'll never forget

90
00:03:20,790 --> 00:03:18,879
that

91
00:03:21,990 --> 00:03:20,800
my name is kam bahrami i'm a robotics

92
00:03:23,990 --> 00:03:22,000
flight controller for the canadian space

93
00:03:25,589 --> 00:03:24,000
agency i'm stationed here at nasa's

94
00:03:27,030 --> 00:03:25,599
johnson space center in the robotics

95
00:03:28,869 --> 00:03:27,040
flight control group

96
00:03:30,390 --> 00:03:28,879
my responsibilities here are to support

97
00:03:32,229 --> 00:03:30,400
and execute the robotic operations on

98
00:04:17,749 --> 00:03:32,239
the space station using canada's robotic

99
00:04:22,790 --> 00:04:19,670
did you know that we call operating the

100
00:04:24,310 --> 00:04:22,800
canada arm flying the robotic arm that's

101
00:04:26,469 --> 00:04:24,320
because it's a lot like flying an

102
00:04:28,629 --> 00:04:26,479
airplane i mean it's got hand controls

103
00:04:30,790 --> 00:04:28,639
you can pitch you can yaw you can roll

104
00:04:32,790 --> 00:04:30,800
and you have to be pretty precise

105
00:04:35,189 --> 00:04:32,800
watch astronaut mike hopkins describe

106
00:04:43,110 --> 00:04:35,199
how we use the canada arm to catch cargo

107
00:04:47,909 --> 00:04:45,270
okay hey everyone yesterday we had the

108
00:04:50,230 --> 00:04:47,919
opportunity to catch the orbital one

109
00:04:51,350 --> 00:04:50,240
cygnus vehicle also known as c gordon

110
00:04:52,790 --> 00:04:51,360
fullerton

111
00:04:55,350 --> 00:04:52,800
and i'm going to take the opportunity

112
00:04:57,590 --> 00:04:55,360
today to talk about the

113
00:04:59,350 --> 00:04:57,600

controls that we use for the robotic arm

114
00:05:00,390 --> 00:04:59,360
and so we're actually down in the cupola

115
00:05:02,870 --> 00:05:00,400
right now

116
00:05:04,710 --> 00:05:02,880
and this is where we control the robotic

117
00:05:06,390 --> 00:05:04,720
arm when we go out and we grapple one of

118
00:05:07,909 --> 00:05:06,400
these vehicles like the cygnus vehicle

119
00:05:10,310 --> 00:05:07,919
that we did yesterday

120
00:05:12,710 --> 00:05:10,320
and so this is the control station and

121
00:05:14,629 --> 00:05:12,720
what you see over here on my left this

122
00:05:15,830 --> 00:05:14,639
controls the translation of the robotic

123
00:05:17,909 --> 00:05:15,840
arm

124
00:05:18,870 --> 00:05:17,919
and then over here we have rotational

125
00:05:21,350 --> 00:05:18,880
control

126
00:05:22,790 --> 00:05:21,360
and this middle computer is where we

127
00:05:24,629 --> 00:05:22,800
actually take the

128
00:05:27,430 --> 00:05:24,639
robotic arm into the different modes

129
00:05:29,909 --> 00:05:27,440
that we do have and then on our left

130
00:05:31,830 --> 00:05:29,919
over here we have a control panel for

131
00:05:34,310 --> 00:05:31,840
the various monitors so what we're doing

132
00:05:37,270 --> 00:05:34,320
when we're grappling is i'm watching on

133
00:05:39,909 --> 00:05:37,280
this monitor a basically a target on the

134
00:05:41,909 --> 00:05:39,919
vehicle and i've got an overlay on it

135
00:05:44,710 --> 00:05:41,919
that allows me to line up the robotic

136
00:05:46,870 --> 00:05:44,720
arm with that vehicle and i just drive

137
00:05:48,469 --> 00:05:46,880
right in i wanted to take advantage

138
00:05:50,390 --> 00:05:48,479

today though because we have a pretty

139
00:05:53,590 --> 00:05:50,400
special opportunity here

140
00:05:55,670 --> 00:05:53,600
to show you a unique view of the robotic

141
00:05:58,390 --> 00:05:55,680
arm and so if we look out one of the

142
00:06:01,350 --> 00:05:58,400
cupola windows here

143
00:06:03,270 --> 00:06:01,360
you can actually see the end effector of

144
00:06:05,749 --> 00:06:03,280
the robotic arm and we don't get a

145
00:06:07,110 --> 00:06:05,759
chance to look at this view very often

146
00:06:10,390 --> 00:06:07,120
in fact today we were doing an

147
00:06:11,909 --> 00:06:10,400
inspection on on the end effector and so

148
00:06:13,590 --> 00:06:11,919
if you look in the middle you can see

149
00:06:15,510 --> 00:06:13,600
those cables those are what we call the

150
00:06:17,110 --> 00:06:15,520
snares and when we go over the pin

151
00:06:18,790 --> 00:06:17,120
that's on the vehicle

152
00:06:21,110 --> 00:06:18,800
and i pull a trigger

153
00:06:23,189 --> 00:06:21,120
it causes those those uh cables those

154
00:06:25,270 --> 00:06:23,199
snares to close around that pin and

155
00:06:27,909 --> 00:06:25,280
that's how we grapple onto

156
00:06:29,909 --> 00:06:27,919
a vehicle and actually you can see up

157
00:06:32,150 --> 00:06:29,919
above as well there's that's the camera

158
00:06:34,309 --> 00:06:32,160
that is giving us that view

159
00:06:35,670 --> 00:06:34,319
and that's a pretty unique view for us

160
00:09:47,910 --> 00:06:35,680
and so just wanted to share that with

161
00:09:52,550 --> 00:09:50,150
clearly the canadian space agency's

162
00:09:54,949 --> 00:09:52,560
robotic arms are technological marvels

163
00:09:57,509 --> 00:09:54,959

in space you'll be happy to know that

164
00:10:02,630 --> 00:09:57,519
the same technologies are saving lives

165
00:10:07,590 --> 00:10:05,430
1981 marked the debut in space of one of

166
00:10:09,030 --> 00:10:07,600
canada's most iconic symbols

167
00:10:11,030 --> 00:10:09,040
canadarm

168
00:10:13,430 --> 00:10:11,040
developed for canada by macdonald

169
00:10:15,829 --> 00:10:13,440
detwiler and associates formerly spa

170
00:10:19,350 --> 00:10:15,839
aerospace the first canadarm and its

171
00:10:20,710 --> 00:10:19,360
descendants canadarm2 and dexter are in

172
00:10:23,110 --> 00:10:20,720
great part responsible for the

173
00:10:25,190 --> 00:10:23,120
successful assembly and operating of the

174
00:10:26,949 --> 00:10:25,200
international space station

175
00:10:29,269 --> 00:10:26,959
now the technology behind these robots

176
00:10:33,509 --> 00:10:29,279
is finding its way back to earth

177
00:10:35,590 --> 00:10:33,519
by the end of 2014 an estimated 24 400

178
00:10:37,590 --> 00:10:35,600
canadian women will have been diagnosed

179
00:10:39,269 --> 00:10:37,600
with breast cancer

180
00:10:42,230 --> 00:10:39,279
early detection and treatment make a

181
00:10:44,069 --> 00:10:42,240
difference and help save lives

182
00:10:46,069 --> 00:10:44,079
researchers at the center for surgical

183
00:10:49,910 --> 00:10:46,079
invention and innovation turned to

184
00:10:51,750 --> 00:10:49,920
canadarm technology to develop igar

185
00:10:53,990 --> 00:10:51,760
it is a promising platform offering

186
00:10:55,670 --> 00:10:54,000
one-stop diagnosis and treatment for

187
00:10:57,829 --> 00:10:55,680
patients with a high risk of breast

188
00:10:59,910 --> 00:10:57,839

cancer

189
00:11:02,069 --> 00:10:59,920
currently undergoing clinical trials

190
00:11:04,150 --> 00:11:02,079
igar is one of the first robots of its

191
00:11:06,069 --> 00:11:04,160
kind designed to work inside an mri

192
00:11:08,310 --> 00:11:06,079
scanner that can show the size and

193
00:11:11,990 --> 00:11:08,320
location of tumors more accurately than

194
00:11:14,310 --> 00:11:12,000
a mammogram or ultrasound scan

195
00:11:15,910 --> 00:11:14,320
thanks to its delicate and precise touch

196
00:11:18,870 --> 00:11:15,920
the robot will be able to perform

197
00:11:21,350 --> 00:11:18,880
biopsies with pinpoint accuracy analyze

198
00:11:23,990 --> 00:11:21,360
them and treat early tumors without open

199
00:11:28,870 --> 00:11:26,150
the platform will also help in detection

200
00:11:31,350 --> 00:11:28,880
and treatment of lung liver kidney and

201
00:11:35,670 --> 00:11:31,360
prostate cancers and might also be used

202
00:11:40,150 --> 00:11:37,990
thanks to canadian space robotics this

203
00:11:42,069 --> 00:11:40,160
technology is a step towards a future

204
00:11:44,389 --> 00:11:42,079
where surgeons can rely on robots to

205
00:11:47,269 --> 00:11:44,399
perform intricate medical procedures

206
00:11:49,030 --> 00:11:47,279
that will be less invasive less painful

207
00:11:53,110 --> 00:11:49,040
and will allow patients to recover

208
00:12:05,670 --> 00:11:55,350
canadian space agency

209
00:12:09,350 --> 00:12:07,750
my name is terry fong i run the human

210
00:12:11,590 --> 00:12:09,360
exploration tele robotics project of

211
00:12:13,910 --> 00:12:11,600
nasa and what we're doing is developing

212
00:12:24,069 --> 00:12:13,920
robots to improve the way that humans

213
00:12:27,910 --> 00:12:26,069

humans go further and further into space

214
00:12:29,509 --> 00:12:27,920
as they go to mars one of the big things

215
00:12:31,590 --> 00:12:29,519
that we're going to need are robots to

216
00:12:33,350 --> 00:12:31,600
help humans uh live and work when

217
00:12:34,470 --> 00:12:33,360
they're very very far away from earth

218
00:12:36,550 --> 00:12:34,480
you know if you think about being on

219
00:12:38,710 --> 00:12:36,560
mars one of the big challenges how do

220
00:12:40,550 --> 00:12:38,720
you carry out work on a surface how do

221
00:12:41,910 --> 00:12:40,560
you work outside of a habitat and so one

222
00:12:43,430 --> 00:12:41,920
of the things we're trying to do is

223
00:12:45,430 --> 00:12:43,440
create robots that can work ahead of

224
00:12:47,110 --> 00:12:45,440
humans uh robots that can work in

225
00:12:49,269 --> 00:12:47,120
support of humans and robots to follow

226
00:12:51,350 --> 00:12:49,279
up doing those things that humans need

227
00:12:52,870 --> 00:12:51,360
robots to do to finish up work i'm just

228
00:12:54,389 --> 00:12:52,880
really excited about the idea of humans

229
00:13:39,829 --> 00:12:54,399
and robots working together well frankly

230
00:13:43,910 --> 00:13:42,230
well guess who we have with us today we

231
00:13:46,629 --> 00:13:43,920
have with us none other than one of our

232
00:13:48,470 --> 00:13:46,639
most experienced robotic operators and

233
00:13:52,069 --> 00:13:48,480
leaders in the astronaut core in that

234
00:13:53,990 --> 00:13:52,079
category doctor astronaut karen nyberg

235
00:13:55,990 --> 00:13:54,000
welcome to station live thank you very

236
00:13:57,910 --> 00:13:56,000
much i don't get enough of karen we

237
00:13:59,670 --> 00:13:57,920
actually sit right next to each other

238
00:14:01,030 --> 00:13:59,680

our office desks are right next to each

239
00:14:03,350 --> 00:14:01,040
other but

240
00:14:05,829 --> 00:14:03,360
she is someone that i greatly admire for

241
00:14:07,509 --> 00:14:05,839
all of the experience that she brings to

242
00:14:10,509 --> 00:14:07,519
the international space station she has

243
00:14:13,269 --> 00:14:10,519
been part of the construction work on

244
00:14:15,110 --> 00:14:13,279
sts-124 that's correct she helped to

245
00:14:17,750 --> 00:14:15,120
bring a module let her talk about that

246
00:14:19,590 --> 00:14:17,760
in a second to and attached it to the

247
00:14:21,030 --> 00:14:19,600
space station and then she lived on

248
00:14:24,949 --> 00:14:21,040
board the space station during

249
00:14:25,990 --> 00:14:24,959
expedition 36 and 37 and did a number of

250
00:14:28,310 --> 00:14:26,000
uh

251
00:14:29,189 --> 00:14:28,320
tasks with the robotic arm at that point

252
00:14:30,629 --> 00:14:29,199
and so

253
00:14:32,949 --> 00:14:30,639
there has been

254
00:14:36,230 --> 00:14:32,959
rarely anyone else that has touched that

255
00:14:37,590 --> 00:14:36,240
robotic arm control than karen nyberg so

256
00:14:38,949 --> 00:14:37,600
please karen tell us a little bit more

257
00:14:40,870 --> 00:14:38,959
about the experience that you've had

258
00:14:42,870 --> 00:14:40,880
operating robotic arms on board the

259
00:14:44,389 --> 00:14:42,880
space station i've been very lucky i've

260
00:14:46,389 --> 00:14:44,399
gotten to do pretty much

261
00:14:48,870 --> 00:14:46,399
everything that it was designed to do

262
00:14:50,790 --> 00:14:48,880
with it um as you as you mentioned

263
00:14:52,710 --> 00:14:50,800

264
00:14:53,910 --> 00:14:52,720
we brought up the japanese laboratory in

265
00:14:57,350 --> 00:14:53,920
the payload bay of space shuttle

266
00:15:01,110 --> 00:14:57,360
discovery and we used the canada arm

267
00:15:02,790 --> 00:15:01,120
to take it out of the payload bay

268
00:15:05,430 --> 00:15:02,800
move it around attach it to space

269
00:15:06,870 --> 00:15:05,440
station so that is one of the big tasks

270
00:15:11,189 --> 00:15:06,880
that the arm was designed to do

271
00:15:11,670 --> 00:15:11,199
originally is carry heavy or big

272
00:15:13,910 --> 00:15:11,680
and then masses

273
00:15:15,990 --> 00:15:13,920
the and kibo was one of the or we called

274
00:15:17,990 --> 00:15:16,000
kebo's the whole complex but the the

275
00:15:19,350 --> 00:15:18,000
pressurized module was is the largest

276
00:15:21,189 --> 00:15:19,360
right

277
00:15:23,269 --> 00:15:21,199
it is and talk about because you didn't

278
00:15:26,710 --> 00:15:23,279
you also on your shuttle flight operate

279
00:15:28,310 --> 00:15:26,720
the pdrs the the shuttle arm i did okay

280
00:15:30,550 --> 00:15:28,320
talk a little bit about because this is

281
00:15:32,470 --> 00:15:30,560
exciting the difference between that arm

282
00:15:35,269 --> 00:15:32,480
and the station arm in terms of the

283
00:15:37,590 --> 00:15:35,279
joints right well the the shuttle arm

284
00:15:40,470 --> 00:15:37,600
was pretty much fixed at the shoulder

285
00:15:42,710 --> 00:15:40,480
where you could have some pitch and yaw

286
00:15:44,310 --> 00:15:42,720
the station arm also has roll at the

287
00:15:45,990 --> 00:15:44,320
shoulder which adds another degree of

288
00:15:48,310 --> 00:15:46,000

freedom so you have a lot more motion

289
00:15:50,870 --> 00:15:48,320
with the arm and also you can move the

290
00:15:53,430 --> 00:15:50,880
location of the station arm yes on

291
00:15:55,350 --> 00:15:53,440
station so you can go along the truss

292
00:15:56,470 --> 00:15:55,360
and move it to different places and move

293
00:15:58,150 --> 00:15:56,480
it to the lab and they do this little

294
00:16:01,189 --> 00:15:58,160
inch worm maneuver they call it where

295
00:16:03,030 --> 00:16:01,199
they attach one side release the other

296
00:16:05,030 --> 00:16:03,040
and inch it along the station to

297
00:16:07,670 --> 00:16:05,040
different spots that's creepy but also

298
00:16:09,189 --> 00:16:07,680
kind of exciting at the same time and so

299
00:16:11,030 --> 00:16:09,199
you did this motion which what do we

300
00:16:13,749 --> 00:16:11,040
call this one the the pitch plane pitch

301
00:16:15,910 --> 00:16:13,759
plane um we can only do that with the um

302
00:16:18,870 --> 00:16:15,920
with the station arm right and that's

303
00:16:21,350 --> 00:16:18,880
also what kind of makes it exciting and

304
00:16:23,829 --> 00:16:21,360
versatile and uh dangerous at the same

305
00:16:25,910 --> 00:16:23,839
time right because you can be moving

306
00:16:28,230 --> 00:16:25,920
like this part of the arm can stay still

307
00:16:30,310 --> 00:16:28,240
and this part can be moving around right

308
00:16:32,389 --> 00:16:30,320
and uh there's just a ton of stuff you

309
00:16:34,310 --> 00:16:32,399
got to be looking out for when you i

310
00:16:36,790 --> 00:16:34,320
mean your mind is going constantly as

311
00:16:38,470 --> 00:16:36,800
you're operating that robotic arm so

312
00:16:39,670 --> 00:16:38,480
talk a little bit about your space

313
00:16:42,550 --> 00:16:39,680

station experience i know we had a

314
00:16:44,790 --> 00:16:42,560
number of cargo ships come up and they

315
00:16:47,670 --> 00:16:44,800
all require at this point a grappling of

316
00:16:50,310 --> 00:16:47,680
the arm and an operator at the other end

317
00:16:53,670 --> 00:16:50,320
which vehicles did you grapple we had uh

318
00:16:56,389 --> 00:16:53,680
htv4 arrive again japanese do big things

319
00:16:58,069 --> 00:16:56,399
big that's our biggest cargo ship

320
00:17:01,030 --> 00:16:58,079
so i was at the controls to capture that

321
00:17:02,470 --> 00:17:01,040
and we also had um orbital demo arrive

322
00:17:05,110 --> 00:17:02,480
so it was the first

323
00:17:07,189 --> 00:17:05,120
orbital sciences vehicle luca captured

324
00:17:09,909 --> 00:17:07,199
that and i was working with him um

325
00:17:11,990 --> 00:17:09,919
during that and i have to say

326
00:17:13,510 --> 00:17:12,000
of all the things i've done in my space

327
00:17:15,829 --> 00:17:13,520
flight career

328
00:17:18,390 --> 00:17:15,839
when i was at the controls of the arm

329
00:17:20,309 --> 00:17:18,400
and it was just the realization that

330
00:17:22,309 --> 00:17:20,319
that vehicle is coming in there are

331
00:17:24,710 --> 00:17:22,319
thousands of people around the world who

332
00:17:25,750 --> 00:17:24,720
are counting on nobody but you at the

333
00:17:28,390 --> 00:17:25,760
time

334
00:17:30,150 --> 00:17:28,400
to successfully capture that vehicle and

335
00:17:32,070 --> 00:17:30,160
i didn't think about it much as i was

336
00:17:33,909 --> 00:17:32,080
doing the flying but as soon as i

337
00:17:36,549 --> 00:17:33,919
finished and we confirmed that we had it

338
00:17:38,310 --> 00:17:36,559

captured i could tell my heart was about

339
00:17:40,789 --> 00:17:38,320
to come out of my chest

340
00:17:42,789 --> 00:17:40,799
it was it and it just really shows i

341
00:17:43,909 --> 00:17:42,799
mean a lot of the things you do

342
00:17:45,590 --> 00:17:43,919
you're working

343
00:17:47,590 --> 00:17:45,600
more as a team and you're always working

344
00:17:49,110 --> 00:17:47,600
as a team but for that moment when

345
00:17:50,870 --> 00:17:49,120
you're at the controls of that robotic

346
00:17:52,630 --> 00:17:50,880
arm it was it was me or nobody that's

347
00:17:54,789 --> 00:17:52,640
all yeah

348
00:17:56,549 --> 00:17:54,799
and that's that's pretty cool i mean you

349
00:17:58,150 --> 00:17:56,559
you can focus through that heart

350
00:17:59,510 --> 00:17:58,160
pounding and you're probably like

351
00:18:02,710 --> 00:17:59,520
pushing that aside i have no idea what

352
00:18:04,950 --> 00:18:02,720
that is but when it's over the flush of

353
00:18:07,590 --> 00:18:04,960
wow i just did that is

354
00:18:08,710 --> 00:18:07,600
pretty rewarding yes absolutely

355
00:18:13,909 --> 00:18:08,720
so

356
00:18:16,070 --> 00:18:13,919
four different arms we include the opss

357
00:18:17,110 --> 00:18:16,080
you have grappled

358
00:18:19,110 --> 00:18:17,120
two

359
00:18:21,590 --> 00:18:19,120
cargo ships

360
00:18:24,789 --> 00:18:21,600
you have grappled

361
00:18:27,430 --> 00:18:24,799
a robotic arm the largest element a

362
00:18:29,430 --> 00:18:27,440
pressurized element on the space station

363
00:18:31,909 --> 00:18:29,440

karen with all of this experience and

364
00:18:33,830 --> 00:18:31,919
you've worked with so many different

365
00:18:35,190 --> 00:18:33,840
other individuals other astronauts

366
00:18:36,230 --> 00:18:35,200
coordinating

367
00:18:37,750 --> 00:18:36,240
these

368
00:18:39,270 --> 00:18:37,760
tasks

369
00:18:41,510 --> 00:18:39,280
what would you say was the most

370
00:18:43,029 --> 00:18:41,520
rewarding part about your robotics

371
00:18:46,470 --> 00:18:43,039
experience

372
00:18:47,590 --> 00:18:46,480
both in space and and in training for it

373
00:18:49,430 --> 00:18:47,600
i think

374
00:18:51,430 --> 00:18:49,440
it's the most rewarding thing in all of

375
00:18:53,430 --> 00:18:51,440
these robotics activities is similar to

376
00:18:54,710 --> 00:18:53,440
the most rewarding thing in everything

377
00:18:57,430 --> 00:18:54,720
we're doing when we're traveling in

378
00:18:59,590 --> 00:18:57,440
space is getting the job done and

379
00:19:02,870 --> 00:18:59,600
getting a job done well

380
00:19:05,510 --> 00:19:02,880
um and working as the team to do that

381
00:19:07,270 --> 00:19:05,520
you know during the spacewalks

382
00:19:09,029 --> 00:19:07,280
we wouldn't have been able to do the

383
00:19:11,350 --> 00:19:09,039
spacewalk activity without the

384
00:19:12,470 --> 00:19:11,360
robotic arm help so i was an important

385
00:19:14,070 --> 00:19:12,480
part of the team

386
00:19:16,390 --> 00:19:14,080
capturing a vehicle we could not capture

387
00:19:18,230 --> 00:19:16,400
the vehicle without the robotic arm so a

388
00:19:19,990 --> 00:19:18,240

very important part of the team

389
00:19:21,430 --> 00:19:20,000
well i'd say that there's uh there's

390
00:19:23,669 --> 00:19:21,440
very little space station that would

391
00:19:25,830 --> 00:19:23,679
exist today if it were not for

392
00:19:28,470 --> 00:19:25,840
robotic arms and especially that big

393
00:19:29,350 --> 00:19:28,480
canon arm 2 that we have used to move so

394
00:19:33,510 --> 00:19:29,360
many

395
00:19:37,190 --> 00:19:35,029
i just want to thank you so much for

396
00:19:39,909 --> 00:19:37,200
coming on the show today karen because

397
00:19:42,070 --> 00:19:39,919
uh this whole episode is about robotics

398
00:19:44,390 --> 00:19:42,080
and when i heard that that's what our

399
00:19:46,710 --> 00:19:44,400
topic was the first person i thought of

400
00:19:47,909 --> 00:19:46,720
was karen nyberg so thank you for being

401
00:19:49,430 --> 00:19:47,919
here it's been a real pleasure and we

402
00:20:25,750 --> 00:19:49,440
hope to have you back thanks for having

403
00:20:30,149 --> 00:20:28,310
the canada arm and japanese robotic arms

404
00:20:33,110 --> 00:20:30,159
aren't the only robots we have on the

405
00:20:34,710 --> 00:20:33,120
space station meet robonaut it not only

406
00:20:37,270 --> 00:20:34,720
looks like a human but it's also

407
00:20:39,190 --> 00:20:37,280
designed to work like one too with hands

408
00:20:41,510 --> 00:20:39,200
and arms robonaut is able to use the

409
00:20:44,070 --> 00:20:41,520
same tools that astronauts use in the

410
00:20:46,230 --> 00:20:44,080
future robonaut may be used to perform

411
00:20:49,430 --> 00:20:46,240
hazardous maintenance tasks or even

412
00:21:04,070 --> 00:20:51,590
robonaut a robot meant to work with

413
00:21:07,909 --> 00:21:06,470

r2's head houses not its brain but its

414
00:21:10,470 --> 00:21:07,919
vision equipment

415
00:21:11,590 --> 00:21:10,480
behind r2's visor are four visible light

416
00:21:13,510 --> 00:21:11,600
cameras

417
00:21:15,909 --> 00:21:13,520
two to provide stereo vision for the

418
00:21:17,590 --> 00:21:15,919
robot and its operators and two

419
00:21:19,590 --> 00:21:17,600
auxiliary cameras

420
00:21:22,390 --> 00:21:19,600
a fifth infrared camera is housed in the

421
00:21:24,630 --> 00:21:22,400
mouth area for depth perception

422
00:21:26,549 --> 00:21:24,640
each arm boasts seven degrees of freedom

423
00:21:28,950 --> 00:21:26,559
and the strength to hold 20 pounds in

424
00:21:31,350 --> 00:21:28,960
any pose in earth's gravity

425
00:21:33,830 --> 00:21:31,360
each arm is approximately two feet eight

426
00:21:35,350 --> 00:21:33,840
inches long giving r2 a total wingspan

427
00:21:37,510 --> 00:21:35,360
of eight feet

428
00:21:39,750 --> 00:21:37,520
instead of feet the robot has clamps

429
00:21:41,190 --> 00:21:39,760
that allow it to latch onto and climb up

430
00:21:43,750 --> 00:21:41,200
on objects

431
00:21:47,350 --> 00:21:43,760
the legs are also longer than human legs

432
00:21:49,990 --> 00:21:47,360
a span of nine feet 2.7 meters and are

433
00:21:52,470 --> 00:21:50,000
more flexible giving the robot more ways

434
00:21:53,590 --> 00:21:52,480
to cling to things inside or outside the

435
00:21:55,430 --> 00:21:53,600
station

436
00:21:57,510 --> 00:21:55,440
the advantage of a humanoid design is

437
00:22:00,390 --> 00:21:57,520
that robonaut can take over simple

438
00:22:02,230 --> 00:22:00,400

repetitive or especially dangerous tasks

439
00:22:03,750 --> 00:22:02,240
on places such as the international

440
00:22:05,750 --> 00:22:03,760
space station

441
00:22:07,029 --> 00:22:05,760
our experience with r2 on the station

442
00:22:09,029 --> 00:22:07,039
will help them understand its

443
00:22:17,909 --> 00:22:09,039
capabilities for possible deep space

444
00:23:19,430 --> 00:22:47,430
so

445
00:23:24,070 --> 00:23:21,510
welcome back and thanks for watching

446
00:23:26,710 --> 00:23:24,080
this episode of station life

447
00:23:28,070 --> 00:23:26,720
today we learned about robots we

448
00:23:29,990 --> 00:23:28,080
wouldn't have been able to build our

449
00:23:31,270 --> 00:23:30,000
international space station without the

450
00:23:33,669 --> 00:23:31,280
canada arm

451
00:23:35,990 --> 00:23:33,679
good thing for us spin-offs developed

452
00:23:37,909 --> 00:23:36,000
from the technology are helping patients

453
00:23:39,350 --> 00:23:37,919
with neurosurgery and is now being

454
00:23:40,549 --> 00:23:39,360
developed to help those with breast

455
00:23:42,789 --> 00:23:40,559
cancer

456
00:23:45,990 --> 00:23:42,799
we're also developing new technologies

457
00:23:47,830 --> 00:23:46,000
for robotics in space and on earth

458
00:23:50,470 --> 00:23:47,840
if we're to succeed with future missions

459
00:23:51,830 --> 00:23:50,480
to mars we need humans and robots

460
00:23:53,830 --> 00:23:51,840
working together

461
00:23:56,470 --> 00:23:53,840
and that's a wrap for this episode of

462
00:23:58,230 --> 00:23:56,480
station life so be sure to stay in touch

463
00:24:00,549 --> 00:23:58,240

and follow us on facebook and twitter

464
00:24:04,470 --> 00:24:00,559
for the latest research news and don't

465
00:24:06,950 --> 00:24:04,480
forget to download our

466
00:24:09,430 --> 00:24:06,960
kick a new app for your mobile device