1
00:00:06,490 --> 00:00:04,030
but this is this is one of the modules

2
00:00:09,520 --> 00:00:06,500
one of many modules on the space station

3
00:00:11,500 --> 00:00:09,530
this is the Kibo which is Japanese for

4
00:00:13,060 --> 00:00:11,510
hope it's the Japanese pressurized

5
00:00:16,029 --> 00:00:13,070
module this area that you're seeing

6
00:00:19,329 --> 00:00:16,039
right here around me and extending how

7
00:00:21,880 --> 00:00:19,339
about at least another 12 meters or 13

8
00:00:24,460 --> 00:00:21,890
meters behind me if I could turn that

9
00:00:27,249 --> 00:00:24,470
camera around and float it over to a

10
00:00:30,509 --> 00:00:27,259
window I could show you the exposed

11
00:00:32,889 --> 00:00:30,519
facility which is this spectacular

12
00:00:35,200 --> 00:00:32,899
location where we've got an airlock here

13
00:00:38,170 --> 00:00:35,210

and we can play scientific samples using

14
00:00:40,690 --> 00:00:38,180
a robotic arm out into the vacuum of

15
00:00:42,820 --> 00:00:40,700
space there's a number of pay roads out

16
00:00:45,130 --> 00:00:42,830
there right now but are doing science

17
00:00:47,350 --> 00:00:45,140
studying the Sun studying deep sky

18
00:00:50,440 --> 00:00:47,360
objects we've got materials payloads out

19
00:00:52,960 --> 00:00:50,450
there as well in the JPM there are many

20
00:00:55,720 --> 00:00:52,970
many racks that are here that do

21
00:00:57,760 --> 00:00:55,730
everything from from cell biology this

22
00:01:00,520 --> 00:00:57,770
one behind me for the right in your

23
00:01:02,740 --> 00:01:00,530
camera view we've got a gradient heating

24
00:01:05,499 --> 00:01:02,750
furnace we actually have a crop of

25
00:01:08,580 --> 00:01:05,509
cucumbers that's that's being studied

26
00:01:10,959 --> 00:01:08,590
over here and it's a it's a special

27
00:01:15,279 --> 00:01:10,969
biology experiment that also gives us

28
00:01:18,120 --> 00:01:15,289
the net facility capability of centrally

29
00:01:21,309 --> 00:01:18,130
accelerating and studying in this case

30
00:01:24,129 --> 00:01:21,319
gravitropism or the response to plants

31
00:01:25,569 --> 00:01:24,139
in the presence of a simulated gravity

32
00:01:28,830 --> 00:01:25,579
environment through the spinning of the

33
00:01:31,059 --> 00:01:28,840
centrifuge and there's an experiment

34
00:01:33,609 --> 00:01:31,069
back towards the left of your view very

35
00:01:36,340 --> 00:01:33,619
deep in this field of view which allows

36
00:01:39,160 --> 00:01:36,350
you to acoustically levitate materials

37
00:01:41,410 --> 00:01:39,170
to actually process do processing of

38
00:01:43,419 --> 00:01:41,420

materials absent to gravity induce

39
00:01:46,569 --> 00:01:43,429
convection you have on planet earth and

40
00:01:48,849 --> 00:01:46,579
you can do those that experiment

41
00:01:51,429 --> 00:01:48,859
actually is is it still got some work to

42
00:01:52,899 --> 00:01:51,439
go to get it running but that's one of

43
00:01:54,580 --> 00:01:52,909
many facilities that are in here is a

44
00:01:57,459 --> 00:01:54,590
number of racks one of I think a total

45
00:02:01,629 --> 00:01:57,469
of eight that allow you to in a modular

46
00:02:04,779 --> 00:02:01,639
fashion install the small payloads that

47
00:02:07,029 --> 00:02:04,789
will basically except power from the

48
00:02:09,730 --> 00:02:07,039
space station have be firmly controlled

49
00:02:11,980 --> 00:02:09,740
and regulated exchange data and

50
00:02:12,720 --> 00:02:11,990
telemetry commanding and so forth

51
00:02:14,449 --> 00:02:12,730
through the

52
00:02:17,369 --> 00:02:14,459
base station assets allow payload

53
00:02:18,750 --> 00:02:17,379
developers on the ground to work those

54
00:02:20,210 --> 00:02:18,760
we've got like I see a number of those

55
00:02:24,780 --> 00:02:20,220
racks scattered throughout the entire

56
00:02:28,020 --> 00:02:24,790
u.s. segment on Space Station I'd like

57
00:02:30,089 --> 00:02:28,030
to do i think is try to give you a

58
00:02:32,070 --> 00:02:30,099
little bit of a virtual tour albeit

59
00:02:34,320 --> 00:02:32,080
using some of the fixed cameras that we

60
00:02:36,000 --> 00:02:34,330
have on Space Station and show you some

61
00:02:38,400 --> 00:02:36,010
of the other modules we don't have a lot

62
00:02:40,350 --> 00:02:38,410
of time and I can't show you into the

63
00:02:41,729 --> 00:02:40,360

Russian segment I can talk a little bit

64
00:02:43,350 --> 00:02:41,739
about the science that's going on there

65
00:02:44,850 --> 00:02:43,360
but unfortunately the video system that

66
00:02:47,759 --> 00:02:44,860
we have set up for today doesn't allow

67
00:02:50,309 --> 00:02:47,769
me to go far enough half to show you the

68
00:02:51,809 --> 00:02:50,319
equipment there but if you're ready I'll

69
00:02:53,550 --> 00:02:51,819
go ahead and take you over to the

70
00:02:57,449 --> 00:02:53,560
European experiment module the European

71
00:02:59,970 --> 00:02:57,459
module Columbus okay so this is the

72
00:03:01,650 --> 00:02:59,980
Columbus European module we do a lot of

73
00:03:04,259 --> 00:03:01,660
life sciences experiments here and

74
00:03:05,699 --> 00:03:04,269
there's also some fluid physics

75
00:03:09,000 --> 00:03:05,709
experiments there's a laboratory

76
00:03:11,309 --> 00:03:09,010
directly above my head and up in your

77
00:03:13,140 --> 00:03:11,319
field of view which is a few it fluid

78
00:03:15,119 --> 00:03:13,150
science laboratory and in there we

79
00:03:18,599 --> 00:03:15,129
essentially have an earth simulator in

80
00:03:20,879 --> 00:03:18,609
it it basically represents the Earth's

81
00:03:22,890 --> 00:03:20,889
core then the mantle and allows you to

82
00:03:24,960 --> 00:03:22,900
do experiments in a simulated

83
00:03:27,210 --> 00:03:24,970
environment to better understand the the

84
00:03:30,089 --> 00:03:27,220
internal workings of planet Earth from a

85
00:03:32,190 --> 00:03:30,099
geologic standpoint we've got a number

86
00:03:34,020 --> 00:03:32,200
of cell biology type experiments here

87
00:03:37,949 --> 00:03:34,030
we've got a culture of the capability to

88
00:03:41,460 --> 00:03:37,959

do culturing of of cells and and also

89
00:03:43,140 --> 00:03:41,470
this intricately accelerate those this

90
00:03:45,930 --> 00:03:43,150
bio laboratory that's off to my left

91
00:03:47,940 --> 00:03:45,940
your right in the field of view we do a

92
00:03:49,710 --> 00:03:47,950
lot of our experiments on station

93
00:03:52,500 --> 00:03:49,720
directed towards understanding how to

94
00:03:54,870 --> 00:03:52,510
keep humans healthy and safe and snakes

95
00:03:57,629 --> 00:03:54,880
long enough to go beyond low-earth orbit

96
00:04:02,009 --> 00:03:57,639
and a lot of those involves studying in

97
00:04:04,530 --> 00:04:02,019
a semi non-invasive way how our bodies

98
00:04:08,809 --> 00:04:04,540
change so we are both experimenters and

99
00:04:11,069 --> 00:04:08,819
subjects on a lot of that science a big

100
00:04:12,960 --> 00:04:11,079
contribution towards that or we call the

101
00:04:15,869 --> 00:04:12,970
human research facility racks and we've

102
00:04:18,990 --> 00:04:15,879
got two of those in here and one of the

103
00:04:21,509 --> 00:04:19,000
experiments that we do actually a number

104
00:04:23,490 --> 00:04:21,519
of them use a specific piece of

105
00:04:25,170 --> 00:04:23,500
equipment in there an ultrasonic an

106
00:04:28,920 --> 00:04:25,180
ultrasound equipment basically and it's

107
00:04:32,700 --> 00:04:28,930
and we all get training pre-flight and

108
00:04:35,580 --> 00:04:32,710
and we all learn how to be pretty decent

109
00:04:38,430 --> 00:04:35,590
ultrasound technicians and we're

110
00:04:40,170 --> 00:04:38,440
essentially doing studies albeit under

111
00:04:41,640 --> 00:04:40,180
the guidance of some very smart

112
00:04:43,830 --> 00:04:41,650
intelligent folks on the ground to

113
00:04:45,000 --> 00:04:43,840

understand how the heart muscle changes

114
00:04:46,980 --> 00:04:45,010
for example in the weightless

115
00:04:48,839 --> 00:04:46,990
environment of space there's not a lot

116
00:04:50,219 --> 00:04:48,849
of force the force of gravity that we

117
00:04:51,810 --> 00:04:50,229
have to interact with all the time in

118
00:04:54,270 --> 00:04:51,820
your body is just as strong as it needs

119
00:04:57,300 --> 00:04:54,280
to be for the environment it's in so

120
00:04:58,830 --> 00:04:57,310
there is some atrophy and some changes

121
00:05:00,450 --> 00:04:58,840
that occur in the heart muscle there's

122
00:05:02,399 --> 00:05:00,460
also some changes occur in the entire

123
00:05:04,140 --> 00:05:02,409
vascular system and so with the

124
00:05:06,510 --> 00:05:04,150
ultrasound we can study the heart muscle

125
00:05:08,310 --> 00:05:06,520
we can stand we can do it immediately

126
00:05:08,970 --> 00:05:08,320
following exercise we can do it

127
00:05:11,010 --> 00:05:08,980
interesting

128
00:05:14,660 --> 00:05:11,020
stay we can study how blood vessels

129
00:05:18,030 --> 00:05:14,670
change how the volume of the sort of the

130
00:05:19,860 --> 00:05:18,040
the area essentially for the blood

131
00:05:22,500 --> 00:05:19,870
vessels how those will change and adapt

132
00:05:25,410 --> 00:05:22,510
over the period of time you have here on

133
00:05:28,500 --> 00:05:25,420
orbit and it helps scientists better

134
00:05:30,510 --> 00:05:28,510
understand again how to mitigate some of

135
00:05:33,600 --> 00:05:30,520
the detrimental issues that you'd have

136
00:05:35,550 --> 00:05:33,610
do the weightlessness of space we have a

137
00:05:37,530 --> 00:05:35,560
body mass measurement a piece of

138
00:05:39,540 --> 00:05:37,540

equipment over there that's also met

139
00:05:41,400 --> 00:05:39,550
same rack and it's kind of a unique

140
00:05:43,350 --> 00:05:41,410
problem trying to measure somebody's

141
00:05:44,760 --> 00:05:43,360
mass in a weightless environment so we

142
00:05:47,700 --> 00:05:44,770
don't have any weight but we still of

143
00:05:49,230 --> 00:05:47,710
course retain the mass and there's two

144
00:05:51,420 --> 00:05:49,240
different ways to do it one is to do it

145
00:05:52,980 --> 00:05:51,430
the way a piece of equipment in the

146
00:05:56,610 --> 00:05:52,990
Russian segment works and that is to

147
00:05:58,050 --> 00:05:56,620
accelerate and oscillate the mass

148
00:06:01,200 --> 00:05:58,060
whether it's ourselves or our

149
00:06:03,300 --> 00:06:01,210
experimental hardware and basically the

150
00:06:04,890 --> 00:06:03,310
light or something is the the higher the

151
00:06:08,070 --> 00:06:04,900
frequency of the oscillations will be

152
00:06:09,660 --> 00:06:08,080
given a fixed spring constant so that's

153
00:06:12,480 --> 00:06:09,670
one way we do it we also have another

154
00:06:14,820 --> 00:06:12,490
way just using F equals MA and we

155
00:06:17,100 --> 00:06:14,830
essentially apply a fixed force and we

156
00:06:20,130 --> 00:06:17,110
look at the time it takes to accelerate

157
00:06:21,750 --> 00:06:20,140
or time to cover a specific distance and

158
00:06:23,520 --> 00:06:21,760
integrate that to get the acceleration

159
00:06:26,250 --> 00:06:23,530
and we can find what the masses that way

160
00:06:27,810 --> 00:06:26,260
so we have another piece of equipment

161
00:06:30,030 --> 00:06:27,820
here off to your left which is called

162
00:06:33,480 --> 00:06:30,040
marez and that is specifically designed

163
00:06:36,630 --> 00:06:33,490

understand how how much force how much

164
00:06:38,220 --> 00:06:36,640
output our muscles can generate here in

165
00:06:40,110 --> 00:06:38,230
space it's still in this check out phase

166
00:06:43,080 --> 00:06:40,120
right now and it's very big and very

167
00:06:45,840 --> 00:06:43,090
impressive and let's see there's a

168
00:06:48,990 --> 00:06:45,850
number of other kinds of facilities here

169
00:06:51,770 --> 00:06:49,000
that allow us to do blood work and to

170
00:06:55,500 --> 00:06:51,780
analyze samples of blood and urine and

171
00:06:57,660 --> 00:06:55,510
help understand the biochemistry changes

172
00:06:59,220 --> 00:06:57,670
that occur due to weightlessness and

173
00:07:03,650 --> 00:06:59,230
being in the space environment for half

174
00:07:10,190 --> 00:07:06,440
this is the u.s. laboratory destiny that

175
00:07:11,210 --> 00:07:10,200
I'm in right now and it is full of all

176
00:07:12,800 --> 00:07:11,220
different kinds of equipment to do

177
00:07:13,850 --> 00:07:12,810
everything from combustion experiments

178
00:07:16,070 --> 00:07:13,860
which we do in this combustion

179
00:07:18,410 --> 00:07:16,080
integrated rack to fluid physics which

180
00:07:20,930 --> 00:07:18,420
we do in this rack over here we've got a

181
00:07:23,470 --> 00:07:20,940
microgravity science glovebox here which

182
00:07:25,370 --> 00:07:23,480
allows you to have experiments or

183
00:07:28,370 --> 00:07:25,380
materials that might be a little bit

184
00:07:30,380 --> 00:07:28,380
hazardous and two to do to basically

185
00:07:33,200 --> 00:07:30,390
operate and interact with those

186
00:07:37,460 --> 00:07:33,210
experiments isolated from the habitable

187
00:07:40,610 --> 00:07:37,470
volume of the space station off to your

188
00:07:43,310 --> 00:07:40,620

right in this in your view right now and

189
00:07:44,840 --> 00:07:43,320
i'll see if i can give you it well I'll

190
00:07:46,970 --> 00:07:44,850
just hand it off here a little bit to

191
00:07:48,590 --> 00:07:46,980
the right just to your right I can't get

192
00:07:50,860 --> 00:07:48,600
all the way around to it but Robonaut

193
00:07:53,330 --> 00:07:50,870
which is a technology demonstrated

194
00:07:57,110 --> 00:07:53,340
demonstration piece of hardware and it's

195
00:08:00,740 --> 00:07:57,120
a humanoid dexterous robot that allows

196
00:08:05,510 --> 00:08:00,750
us essentially to understand how to

197
00:08:09,230 --> 00:08:05,520
create robotic equipment to assist and

198
00:08:11,240 --> 00:08:09,240
and operate with the crew on board space

199
00:08:13,700 --> 00:08:11,250
station and so robonaut's going through

200
00:08:16,220 --> 00:08:13,710
some checkouts right now it's it's a

201
00:08:17,840 --> 00:08:16,230
phenomenally capable robot with

202
00:08:19,550 --> 00:08:17,850
something on the order of 40 or so

203
00:08:21,740 --> 00:08:19,560
degrees of freedom so it's got a hand

204
00:08:25,610 --> 00:08:21,750
that operates just like our hands do and

205
00:08:28,760 --> 00:08:25,620
it's got you know full it's got a broad

206
00:08:30,830 --> 00:08:28,770
wingspan from a from a human standpoint

207
00:08:32,150 --> 00:08:30,840
but basically it's designed to interact

208
00:08:34,820 --> 00:08:32,160
with all the things that we interact

209
00:08:37,370 --> 00:08:34,830
with and actually last month woven alt

210
00:08:39,230 --> 00:08:37,380
was here where I'm standing taking air

211
00:08:41,860 --> 00:08:39,240
flow measurements from our ventilation

212
00:08:44,510 --> 00:08:41,870
system right nearby with one hand

213
00:08:46,420 --> 00:08:44,520

holding the probe near the the

214
00:08:50,060 --> 00:08:46,430
ventilation ducts and another hand

215
00:08:52,040 --> 00:08:50,070
holding the instrument and with his eyes

216
00:08:54,200 --> 00:08:52,050
if you will which are camera cameras are

217
00:08:57,110 --> 00:08:54,210
located just where humanized would be

218
00:08:59,570 --> 00:08:57,120
reading the display and operating that

219
00:09:01,730 --> 00:08:59,580
that piece of equipment down the down

220
00:09:03,470 --> 00:09:01,740
the road I think the goal would be to

221
00:09:05,240 --> 00:09:03,480
have that kind of technology to be able

222
00:09:07,400 --> 00:09:05,250
to take outside with you when you do

223
00:09:11,000 --> 00:09:07,410
spacewalks for example and all the tools

224
00:09:12,890 --> 00:09:11,010
we would use outside during EVs or

225
00:09:14,390 --> 00:09:12,900
extracurricular activities prova not

226
00:09:16,710 --> 00:09:14,400
would be able to operate as well so

227
00:09:18,600 --> 00:09:16,720
great technology there

228
00:09:21,480 --> 00:09:18,610
we've got lots of equipment keep us

229
00:09:25,019 --> 00:09:21,490
healthy and safe one of our key piece of

230
00:09:28,740 --> 00:09:25,029
equipment to exercise is a vibration

231
00:09:31,619 --> 00:09:28,750
isolated bicycle essentially and it's a

232
00:09:33,300 --> 00:09:31,629
nerve ometer and it's isolated from the

233
00:09:35,129 --> 00:09:33,310
structure of space station so as you

234
00:09:37,100 --> 00:09:35,139
pedal it you're not putting vibrations

235
00:09:40,439 --> 00:09:37,110
into the structure that would disturb

236
00:09:43,019 --> 00:09:40,449
microgravity sensitive kinds of payloads

237
00:09:45,650 --> 00:09:43,029
like material science payloads and we

238
00:09:48,240 --> 00:09:45,660

similarly do a vibration isolation

239
00:09:50,340 --> 00:09:48,250
through vibration isolation have a

240
00:09:53,400 --> 00:09:50,350
treadmill that will allow you to run as

241
00:09:58,050 --> 00:09:53,410
fast is 12 or more than 12 miles an hour

242
00:09:59,759 --> 00:09:58,060
and essentially keep all of the

243
00:10:03,179 --> 00:09:59,769
vibration of the impacts of your feet

244
00:10:04,650 --> 00:10:03,189
your foot falls on the tread isolated

245
00:10:06,329 --> 00:10:04,660
from the structure as well and it's

246
00:10:07,800 --> 00:10:06,339
critical for us to be exercising like

247
00:10:12,059 --> 00:10:07,810
this on the order of 200 two or so hours

248
00:10:13,889 --> 00:10:12,069
a day to keep from getting to

249
00:10:18,210 --> 00:10:13,899
decondition to get low safely returned

250
00:10:19,470 --> 00:10:18,220
home a captain Burbank really again on

251
00:10:21,509 --> 00:10:19,480
behalf of the crew here at Air Station

252
00:10:24,660 --> 00:10:21,519
Houston appreciate you taking the time

253
00:10:26,429 --> 00:10:24,670
to give us the tour give us a give us an

254
00:10:29,819 --> 00:10:26,439
opportunity to understand kind of what

255
00:10:31,769 --> 00:10:29,829
it is you all do up there add that into

256
00:10:34,350 --> 00:10:31,779
what we did earlier today the getting to

257
00:10:37,619 --> 00:10:34,360
see the mock-up gave us a really great I

258
00:10:38,730 --> 00:10:37,629
don't think as you watch on TV or any

259
00:10:41,069 --> 00:10:38,740
other thing when you get to see the

260
00:10:43,350 --> 00:10:41,079
mock-up can really get an idea of the

261
00:10:44,999 --> 00:10:43,360
size the actual size of the space

262
00:10:46,350 --> 00:10:45,009
station up there i think a lot bigger

263
00:10:49,230 --> 00:10:46,360

than a lot of us had originally thought

264
00:10:51,420 --> 00:10:49,240
and to me one of the most amazing parts

265
00:10:54,299 --> 00:10:51,430
is as we watch the moving map you're

266
00:10:55,860 --> 00:10:54,309
talking to you realizing that you the

267
00:10:57,449 --> 00:10:55,870
distance you've covered over the short

268
00:11:00,119 --> 00:10:57,459
time we've been speaking you made it

269
00:11:03,840 --> 00:11:00,129
from about that you know midway from

270
00:11:06,540 --> 00:11:03,850
Midway other Pacific to halfway between

271
00:11:08,129 --> 00:11:06,550
South America and Africa is really kind

272
00:11:13,139 --> 00:11:08,139
of an amazing thing to think about as

273
00:11:15,210 --> 00:11:13,149
well Rick have you aboard today and and

274
00:11:16,439 --> 00:11:15,220
it's real hard to tell you in such a

275
00:11:18,990 --> 00:11:16,449
short period of time just what a

276
00:11:20,160 --> 00:11:19,000
spectacular place this is but you

277
00:11:22,290 --> 00:11:20,170
certainly got a sense forward in the

278
00:11:23,579 --> 00:11:22,300
mock-ups and a little bit that I was

279
00:11:25,139 --> 00:11:23,589
able to show you today hopefully you

280
00:11:26,730 --> 00:11:25,149
showed you you know told you a little

281
00:11:29,880 --> 00:11:26,740
bit more of the story but

282
00:11:32,639 --> 00:11:29,890
but it's a it's a phenomenal place and

283
00:11:34,380 --> 00:11:32,649
and it is hard for me to believe right

284
00:11:36,900 --> 00:11:34,390
now that they're just a very few weeks

285
00:11:38,579 --> 00:11:36,910
left before before i'll return the best

286
00:11:40,170 --> 00:11:38,589
part of course is to get to see family

287
00:11:41,639 --> 00:11:40,180
and friends again that's one thing you

288
00:11:43,050 --> 00:11:41,649

don't do nearly enough of during the

289
00:11:46,530 --> 00:11:43,060
training leading up to this and

290
00:11:49,380 --> 00:11:46,540
certainly you feel very remote sometimes

291
00:11:51,269 --> 00:11:49,390
from family while you're up here but but

292
00:11:52,860 --> 00:11:51,279
there'll be a lot of time to catch you

293
00:11:53,730 --> 00:11:52,870
up very shortly for me but there's

294
00:11:55,620 --> 00:11:53,740
always gonna be a part of me that's

295
00:11:57,720 --> 00:11:55,630
going to very much miss this mrs.

296
00:11:59,400 --> 00:11:57,730
environment miss working with these

297
00:12:02,040 --> 00:11:59,410
wonderful teams on the ground this in

298
00:12:03,570 --> 00:12:02,050
the science that we do up here but we'll

299
00:12:05,519 --> 00:12:03,580
be handing the baton off to some

300
00:12:07,500 --> 00:12:05,529
incredibly capable people down the road

301
00:12:09,990 --> 00:12:07,510
to is filled all the best to you it was

302
00:12:11,220 --> 00:12:10,000
great having you on board and hopefully