

LIVING AND WORKING IN SPACE



LIVING AND WORKING IN SPACE

How do we live & work in space?



The Space Shuttle

the Workhorse of Space



"When I Grow Up

I Want to be

an Astronaut!"



1
00:00:05,739 --> 00:00:06,406
>> HI, I'M MARTY.

2
00:00:06,473 --> 00:00:08,308
WE ARE COMING TO YOU LIVE FROM

3
00:00:08,375 --> 00:00:10,944
THE SMITHSONIAN AIR AND SPACE

4
00:00:11,010 --> 00:00:11,978
MUSEUM IN WASHINGTON D.C.

5
00:00:12,045 --> 00:00:15,148
>> WE WANT TO WELCOME PROVIDENCE

6
00:00:15,215 --> 00:00:17,917
MIDDLE SCHOOL.

7
00:00:17,984 --> 00:00:22,489
[CHEERS AND APPLAUSE]

8
00:00:22,555 --> 00:00:32,332
>> RANDY BRESNIK AND PAOLO

9
00:00:32,399 --> 00:00:37,270
NESPOLI CONDUCTED MORE THAN 60

10
00:00:37,337 --> 00:00:37,670
EXPERIMENTS.

11
00:00:37,737 --> 00:00:40,840
>> WE'LL BE TALKING TO BOTH OF

12
00:00:40,907 --> 00:00:43,042
THEM TODAY.

13
00:00:43,109 --> 00:00:46,045

THIS IS SEVEN IN 30.

14

00:01:10,236 --> 00:00:52,719

15

00:01:10,303 --> 00:01:21,548

>> THIS IS STEM IN 30.

16

00:01:23,683 --> 00:01:26,019

>> WE ARE JOINED BY RANDY

17

00:01:26,085 --> 00:01:27,287

BRESNIK AND PAOLO NESPOLI.

18

00:01:27,353 --> 00:01:28,922

THANK YOU FOR JOINING US.

19

00:01:28,988 --> 00:01:30,089

>> HAPPY TO BE HERE.

20

00:01:30,156 --> 00:01:32,192

>> YOU ARE WATCHING ON-LINE ON

21

00:01:32,258 --> 00:01:34,060

Facebook, GO TO THE COMMENTS

22

00:01:34,127 --> 00:01:35,795

SECTION AND SUBMIT YOUR

23

00:01:35,862 --> 00:01:36,162

QUESTIONS.

24

00:01:36,229 --> 00:01:37,764

ANYTHING YOU WANTED TO KNOW

25

00:01:37,831 --> 00:01:40,533

ABOUT AN ASTRONAUT IS FAIR GAME.

26
00:01:40,600 --> 00:01:43,069
LIKE IF THEY LIKE CIRCUS PEANUTS

27
00:01:43,136 --> 00:01:44,270
OR NOT.

28
00:01:44,337 --> 00:01:45,672
IF YOU DON'T HAVE A QUESTION,

29
00:01:45,738 --> 00:01:48,141
TELL US WHERE YOU ARE WATCHING

30
00:01:48,208 --> 00:01:48,441
FROM.

31
00:01:48,508 --> 00:01:49,709
WE HAVE A FEW FRIENDS WHO ARE

32
00:01:49,776 --> 00:01:51,711
GOING TO ASK THE FIRST QUESTION.

33
00:01:51,778 --> 00:01:53,613
GO AHEAD.

34
00:01:53,680 --> 00:01:55,748
>> WHAT WAS MORE STRESSFUL,

35
00:01:55,815 --> 00:01:58,184
BEING ON EARTH, SPACE OR COMING

36
00:01:58,251 --> 00:01:58,485
BACK.

37
00:01:58,551 --> 00:02:00,887
>> WE HAD THE UNFORTUNATE

38
00:02:00,954 --> 00:02:02,288

OCCURRENCE OF WHILE WE WERE IN

39
00:02:02,355 --> 00:02:04,324
SPACE HAVING A HURRICANE GO

40
00:02:04,390 --> 00:02:05,391
THROUGH HOUSTON.

41
00:02:05,458 --> 00:02:09,429
EVEN THOUGH I WENT THROUGH SOME

42
00:02:09,496 --> 00:02:11,998
PHYSICAL STRESS OF GOING TO IRAQ

43
00:02:12,065 --> 00:02:15,335
OR COMING BACK FROM 17,500 MILES

44
00:02:15,401 --> 00:02:18,304
AN HOUR TO ZERO, TO ME WAS

45
00:02:18,371 --> 00:02:20,440
WATCHING HURRICANE HARVEY GO

46
00:02:20,507 --> 00:02:22,475
OVER HOUSTON WHILE MY WIFE AND

47
00:02:22,542 --> 00:02:23,877
TWO KIDS WERE UNDERNEATH IT.

48
00:02:23,943 --> 00:02:25,812
>> I WOULD AGREE ON THAT.

49
00:02:25,879 --> 00:02:29,115
WE DO A LOT OF THINGS IN SPACE

50
00:02:29,182 --> 00:02:30,817
THAT AREN'T STRESSFUL, BUT YOU

51
00:02:30,884 --> 00:02:33,152
NEED TO HAVE TO BE INVOLVED WITH

52
00:02:33,219 --> 00:02:33,453
IT.

53
00:02:33,520 --> 00:02:35,555
BUT THINKING OF WHAT THE PEOPLE

54
00:02:35,622 --> 00:02:36,623
ARE DOING.

55
00:02:36,689 --> 00:02:37,790
BECAUSE WE HAVE CONTROL.

56
00:02:37,857 --> 00:02:39,492
WE THINK WE HAVE CONTROL OF WHAT

57
00:02:39,559 --> 00:02:41,094
HAPPENS UP THERE.

58
00:02:41,160 --> 00:02:42,695
BUT YOU REALLY DON'T KNOW WHAT

59
00:02:42,762 --> 00:02:44,130
IS GOING ON DOWN THERE.

60
00:02:44,197 --> 00:02:46,099
I WOULD AGREE WITH RANDY.

61
00:02:46,165 --> 00:02:47,834
>> WHAT WAS THE HARDEST THING TO

62
00:02:47,901 --> 00:02:50,970
GET USED TO WHEN YOU CAME BACK

63
00:02:51,037 --> 00:02:51,938

FROM SPACE?

64

00:02:52,005 --> 00:02:54,140
>> HARDEST THING TO GET USED TO,

65

00:02:54,207 --> 00:02:58,211
WHEN YOU GET UP TO SPACE, RIGHT

66

00:02:58,278 --> 00:03:02,615
NOW WE HAVE THE HAIRS IN OUR

67

00:03:02,682 --> 00:03:04,584
EARS THAT GIVES US OUR BALANCE.

68

00:03:04,651 --> 00:03:07,320
WHEN YOU GET TO SPACE, THAT ALL

69

00:03:07,387 --> 00:03:07,620
STOPS.

70

00:03:07,687 --> 00:03:09,255
THERE IS NO GRAVITY TO MOVE THE

71

00:03:09,322 --> 00:03:10,323
FLUID IN YOUR EAR.

72

00:03:10,390 --> 00:03:12,258
WE MOVE AROUND BY WHAT WE SEE

73

00:03:12,325 --> 00:03:12,992
AND TOUCH.

74

00:03:13,059 --> 00:03:15,261
WHEN YOU COME BACK TO EARTH, ALL

75

00:03:15,328 --> 00:03:18,998
OF A SUDDEN THAT STARTS MOVING

76
00:03:19,065 --> 00:03:21,534
AGAIN, AND GIVING US THOSE

77
00:03:21,601 --> 00:03:21,935
SENSATIONS.

78
00:03:22,001 --> 00:03:26,205
WHEN WE HAD TO MOVE, I SAT ON

79
00:03:26,272 --> 00:03:30,310
THE LEFT AND WE HAD TO SIT ON

80
00:03:30,376 --> 00:03:31,811
THE CENTER HATCH WHEN WE WERE ON

81
00:03:31,878 --> 00:03:32,712
THE GROUND.

82
00:03:32,779 --> 00:03:35,815
WE HAD TO GO THIS WAY WHILE IT

83
00:03:35,882 --> 00:03:37,650
FELT WE WERE TUMBLING.

84
00:03:37,717 --> 00:03:39,953
AND SO GETTING THAT INNER EAR

85
00:03:40,019 --> 00:03:42,121
BACK UP TO SPEED TOOK SEVERAL

86
00:03:42,188 --> 00:03:42,422
DAYS.

87
00:03:42,488 --> 00:03:45,024
THAT WAS FOR ME THE MOST

88
00:03:45,091 --> 00:03:45,658

DIFFICULT PART.

89

00:03:45,725 --> 00:03:47,860

>> I WOULD SAY QUICKLY THAT I

90

00:03:47,927 --> 00:03:50,063

GOT TO SPACE AND I KIND OF

91

00:03:50,129 --> 00:03:52,165

THOUGHT I WAS SPIDER MAN AND

92

00:03:52,231 --> 00:03:53,132

SUPERMAN.

93

00:03:53,199 --> 00:03:54,934

FLYING ON THE CEILING, DOING

94

00:03:55,001 --> 00:03:56,436

THIS, PICKING UP STUFF.

95

00:03:56,502 --> 00:03:58,638

THEN SUDDENLY I'M BACK ON EARTH

96

00:03:58,705 --> 00:04:00,773

AND GRAVITY GETS HOLD OF ME.

97

00:04:00,840 --> 00:04:02,275

AND THAT WAS REALLY, REALLY

98

00:04:02,342 --> 00:04:02,575

HARD.

99

00:04:02,642 --> 00:04:06,679

I FELT LIKE I WAS CHAINED TO THE

100

00:04:06,746 --> 00:04:08,881

SEAT, BARELY WALK.

101
00:04:08,948 --> 00:04:10,683
THAT WAS THE MOST STRONG.

102
00:04:10,750 --> 00:04:12,318
NOT ANY MORE BEING ABLE TO FLY

103
00:04:12,385 --> 00:04:15,288
UP TO THE CEILING AND DO THINGS.

104
00:04:15,355 --> 00:04:21,561
>> GREAT QUESTIONS GUYS.

105
00:04:21,628 --> 00:04:22,295
YOU SPENT 139 DAYS IN SPACE.

106
00:04:22,362 --> 00:04:23,730
CAN YOU TELL US ABOUT THAT

107
00:04:23,796 --> 00:04:24,063
MISSION.

108
00:04:24,130 --> 00:04:25,164
>> SURE.

109
00:04:25,231 --> 00:04:28,301
WE ENDED UP FLYING UP THERE.

110
00:04:28,368 --> 00:04:30,236
NATIONAL SPACE STATION HAS BEEN

111
00:04:30,303 --> 00:04:32,005
UP THERE 20 YEARS.

112
00:04:32,071 --> 00:04:34,574
ONE-THIRD OF NASA'S LIFETIME WE

113
00:04:34,641 --> 00:04:36,809

HAVE HAD THE SPACE STATION.

114

00:04:36,876 --> 00:04:39,012

HUMAN BEINGS HAVE BEEN MANNING

115

00:04:39,078 --> 00:04:40,513

THE SPACE STATION FOR 18 YEARS

116

00:04:40,580 --> 00:04:42,382

IS AMAZING.

117

00:04:42,448 --> 00:04:44,717

WE HAVE A CREW FROM THREE TO

118

00:04:44,784 --> 00:04:46,753

TWO, NOW A CREW OF SIX UP THERE.

119

00:04:46,819 --> 00:04:48,955

THAT IS OUR STANDARD CREW SIZE.

120

00:04:49,022 --> 00:04:51,157

WE WENT UP THERE AND JOINED THE

121

00:04:51,224 --> 00:04:53,559

CREW OF EXPEDITION 52.

122

00:04:53,626 --> 00:04:54,894

THEY HAD BEEN UP THERE FOR

123

00:04:54,961 --> 00:04:55,662

SEVERAL MONTHS.

124

00:04:55,728 --> 00:04:59,899

WE JOINED THEM, OUR CREW OF

125

00:04:59,966 --> 00:05:01,501

THREE, AND WE WERE UP THERE.

126

00:05:01,567 --> 00:05:04,637

WE HAD EXPEDITION 52 FOR FIVE

127

00:05:04,704 --> 00:05:05,905

WEEKS, THEY LEFT AND ANOTHER

128

00:05:05,972 --> 00:05:08,941

CREW CAME UP ON A DIFFERENT

129

00:05:09,008 --> 00:05:09,242

SOYUZ.

130

00:05:09,308 --> 00:05:11,978

THAT'S THE CREW YOU SEE ON THE

131

00:05:12,045 --> 00:05:14,847

SCREEN, EXPEDITION 53.

132

00:05:14,914 --> 00:05:18,885

WE WERE JOINED BY MARK VAN TODAY

133

00:05:18,951 --> 00:05:21,087

HIGH AND JOE ACABA.

134

00:05:21,154 --> 00:05:23,723

HE ACTUALLY HAD BEEN A TEACHER.

135

00:05:23,790 --> 00:05:25,692

WHEN HE WAS SELECTED TO BE AN

136

00:05:25,758 --> 00:05:26,559

ASTRONAUT, HE WAS TEACHING

137

00:05:26,626 --> 00:05:28,027

SCIENCE AND MATH IN SCHOOL AND

138

00:05:28,094 --> 00:05:29,295

BECAME AN ASTRONAUT.

139

00:05:29,362 --> 00:05:32,331

SO THEY JOINED US FOR EXPEDITION

140

00:05:32,398 --> 00:05:32,598

53.

141

00:05:32,665 --> 00:05:35,268

WE RIDE UP AND DOWN TO THE SPACE

142

00:05:35,334 --> 00:05:37,637

STATION IN THE SOYUZ SPACECRAFT.

143

00:05:37,704 --> 00:05:40,840

IT IS A VERY SMALL SPACECRAFT.

144

00:05:40,907 --> 00:05:43,576

IT'S DESIGNED TO GET US UP AND

145

00:05:43,643 --> 00:05:45,078

BACK AND THAT'S IT.

146

00:05:45,144 --> 00:05:47,914

IT'S ONLY THIS BIG.

147

00:05:47,980 --> 00:05:50,283

IMAGINE PAOLO AND I AND SOMEBODY

148

00:05:50,349 --> 00:05:53,953

ELSE IN A SPACE SUIT IN

149

00:05:54,020 --> 00:05:55,521

SOMETHING THIS BIG.

150

00:05:55,588 --> 00:06:00,593

WE GO FROM 0 MILES PER HOUR TO

151
00:06:00,660 --> 00:06:00,927
17,000.

152
00:06:00,993 --> 00:06:04,297
WE DOCK TO THE SPACE STATION.

153
00:06:04,363 --> 00:06:06,499
AND THAT SOYUZ WAITS FOR US AND

154
00:06:06,566 --> 00:06:10,636
THAT'S WHAT WE COME HOME IN AS

155
00:06:10,703 --> 00:06:10,937
WELL.

156
00:06:11,003 --> 00:06:14,674
>> WE DO, WHEN WE GO TO SPACE,

157
00:06:14,741 --> 00:06:16,509
THIS IS A HOUSE LABORATORY,

158
00:06:16,576 --> 00:06:18,711
WHERE YOU LIVE AND WORK, THAT'S

159
00:06:18,778 --> 00:06:20,546
THE REASON WHY WE GO TO SPACE.

160
00:06:20,613 --> 00:06:22,315
IN THIS ENVIRONMENT WE CAN DO

161
00:06:22,381 --> 00:06:23,916
INCREDIBLE THINGS YOU CANNOT DO

162
00:06:23,983 --> 00:06:24,650
HERE ON EARTH.

163
00:06:24,717 --> 00:06:26,753

WE DO SCIENCE, TECHNOLOGY.

164

00:06:26,819 --> 00:06:28,387

YOU WAKE UP IN THE MORNING AND

165

00:06:28,454 --> 00:06:30,556

YOU START WORKING ON EXPERIMENTS

166

00:06:30,623 --> 00:06:33,292

THAT HAVE TO DO WITH CRAZY

167

00:06:33,359 --> 00:06:35,628

STUFF, GENETICS, SPINNING

168

00:06:35,695 --> 00:06:36,496

MOTORS, FLUID.

169

00:06:36,562 --> 00:06:37,897

YOU WORK ON THE CEILING, YOU

170

00:06:37,964 --> 00:06:40,666

WORK ON THE WALL, YOU WORK

171

00:06:40,733 --> 00:06:41,400

EVERYWHERE.

172

00:06:41,467 --> 00:06:52,211

TURN AROUND.

173

00:06:52,278 --> 00:06:53,746

WHAT WERE YOU DOING HERE, FOR

174

00:06:53,813 --> 00:06:54,080

EXAMPLE?

175

00:06:54,147 --> 00:06:55,782

>> WE HAVE A GLOVE BOX WHERE WE

176

00:06:55,848 --> 00:06:57,483

CAN DO SCIENCE INSIDE OF IT.

177

00:06:57,550 --> 00:06:59,786

THIS EXPERIMENT, WE ARE GROWING

178

00:06:59,852 --> 00:07:01,487

LUNG TISSUE.

179

00:07:01,554 --> 00:07:04,690

LUNG TISSUE CAN GROW PERFECTLY

180

00:07:04,757 --> 00:07:06,926

IN SPACE BECAUSE THERE'S NO

181

00:07:06,993 --> 00:07:08,427

GRAVITY CRUSHING THE CELLS.

182

00:07:08,494 --> 00:07:10,963

THEY ARE LOOKING AT CURES FOR

183

00:07:11,030 --> 00:07:12,832

CANCER.

184

00:07:12,899 --> 00:07:15,668

OUR CREW MATE DUBBED THIS THE

185

00:07:15,735 --> 00:07:17,170

CANCER SEEKING MISSILES.

186

00:07:17,236 --> 00:07:19,772

NOW WE TRY TO KILL THE CANCER

187

00:07:19,839 --> 00:07:21,274

CELLS AND AFFECTS THE REST OF

188

00:07:21,340 --> 00:07:23,009

THE BODY.

189

00:07:23,075 --> 00:07:25,611

IF WE CAN SEND OUT MEDICINES TO

190

00:07:25,678 --> 00:07:27,547

TARGET ONLY THE CANCER CELLS,

191

00:07:27,613 --> 00:07:30,082

THAT'S GOING TO BE A HUGE, HUGE

192

00:07:30,149 --> 00:07:31,617

IMPROVEMENT FOR PEOPLE THAT END

193

00:07:31,684 --> 00:07:33,286

UP HAVING CANCER.

194

00:07:33,352 --> 00:07:35,421

BECAUSE WE CAN KILL THE CANCER

195

00:07:35,488 --> 00:07:37,590

BUT NOT HARM THEIR BODY.

196

00:07:37,657 --> 00:07:39,158

IT HAS REAL APPLICATION UP THERE

197

00:07:39,225 --> 00:07:40,660

FOR WHAT WE ARE LOOKING TO DO

198

00:07:40,726 --> 00:07:42,161

DOWN HERE ON EARTH.

199

00:07:42,228 --> 00:07:44,931

>> THIS WAS ONE OF THE 300 PLUS

200

00:07:44,997 --> 00:07:46,899

EXPERIMENTS WE DID IN SPACE.

201
00:07:46,966 --> 00:07:48,301
YOU NEED MAKE SURE YOU ARE ABLE

202
00:07:48,367 --> 00:07:49,302
TO DO THINGS.

203
00:07:49,368 --> 00:07:51,003
YOU HAVE TO HANDLE STUFF, MAKE

204
00:07:51,070 --> 00:07:53,372
SURE THAT THINGS DON'T FLOAT

205
00:07:53,439 --> 00:07:53,673
AWAY.

206
00:07:53,739 --> 00:07:55,341
YOU NEED TO BE CAREFUL WHAT YOU

207
00:07:55,408 --> 00:07:56,042
ARE DOING.

208
00:07:56,108 --> 00:07:58,077
YOU DO EXPERIMENTS IN THE

209
00:07:58,144 --> 00:07:59,879
JAPANESE LABORATORY, THE

210
00:07:59,946 --> 00:08:01,380
EUROPEAN LABORATORY, THE

211
00:08:01,447 --> 00:08:02,849
AMERICAN LABORATORY, SOMETIMES

212
00:08:02,915 --> 00:08:04,350
YOU GO TO THE RUSSIAN PART OF

213
00:08:04,417 --> 00:08:04,951

THE STATION.

214

00:08:05,017 --> 00:08:08,788

SO IT'S VERY, VERY INCREDIBLE,

215

00:08:08,855 --> 00:08:10,690

QUICK STUFF THAT YOU ARE DOING.

216

00:08:10,756 --> 00:08:13,125

YOU PLAY WITH REFRIGERATORS,

217

00:08:13,192 --> 00:08:15,228

THOSE ARE COOL REFRIGERATORS,

218

00:08:15,294 --> 00:08:17,530

YOU BETTER HAVE GLOVES.

219

00:08:17,597 --> 00:08:18,798

>> MINUS 80.

220

00:08:18,865 --> 00:08:21,934

>> OTHERWISE YOUR HANDS WILL BE

221

00:08:22,001 --> 00:08:25,371

STUCK TO THE PIECES OF METAL YOU

222

00:08:25,438 --> 00:08:26,572

TAKE OUT FROM THERE.

223

00:08:26,639 --> 00:08:30,109

A LOT OF TIMES WE ARE THE GUINEA

224

00:08:30,176 --> 00:08:30,910

PIGS IN SPACE.

225

00:08:30,977 --> 00:08:32,845

YOU ARE THE SUBJECT OF THE

226

00:08:32,912 --> 00:08:33,312

INVESTIGATIONS.

227

00:08:33,379 --> 00:08:35,147

WE TAKE BLOOD, MEASURE THINGS

228

00:08:35,214 --> 00:08:37,917

AND WE PLAY DOCTOR, WE PLAY

229

00:08:37,984 --> 00:08:39,085

GUINEA PIG.

230

00:08:39,151 --> 00:08:42,355

AND THIS IS IN A RAPID

231

00:08:42,421 --> 00:08:42,755

SUCCESSION.

232

00:08:42,822 --> 00:08:45,491

WE DO SOME CRAZY EXPERIMENTS.

233

00:08:45,558 --> 00:08:49,428

THIS ONE HAD TO DO WITH FLUIDS

234

00:08:49,495 --> 00:08:50,663

IN SPACE THAT WEIGH, THE HEAT

235

00:08:50,730 --> 00:08:55,334

AND FLUIDS, VERY COMPLEX THINGS.

236

00:08:55,401 --> 00:08:57,637

WE SET IT UP SO THE SCIENTISTS

237

00:08:57,703 --> 00:09:00,973

CAN LOOK AT THIS TINY, MINUTE

238

00:09:01,040 --> 00:09:02,508

DETAIL THAT YOU CANNOT REALLY

239

00:09:02,575 --> 00:09:04,343

SEE HERE ON EARTH.

240

00:09:04,410 --> 00:09:05,611

THAT'S WHY WE GO UP THERE.

241

00:09:05,678 --> 00:09:07,813

>> SOMETIMES THE EXPERIMENTS

242

00:09:07,880 --> 00:09:09,615

WHERE WE ARE MAKING THINGS

243

00:09:09,682 --> 00:09:11,617

HAPPEN AND OTHER TIMES WE'LL SET

244

00:09:11,684 --> 00:09:13,786

UP THE EXPERIMENT AND THEY WILL

245

00:09:13,853 --> 00:09:15,855

RUN IT REMOTELY FROM THE GROUND.

246

00:09:15,922 --> 00:09:19,325

THEY CAN RUN AN EXPERIMENT FROM

247

00:09:19,392 --> 00:09:21,727

THEIR COMPUTER FROM DOWN HERE

248

00:09:21,794 --> 00:09:25,665

AND BE HAPPENING UP ON THE SPACE

249

00:09:25,731 --> 00:09:26,399

STATION.

250

00:09:26,465 --> 00:09:28,567

PAOLO IS WORKING ON THIS, WE ARE

251
00:09:28,634 --> 00:09:29,702
BURNING FLAMES.

252
00:09:29,769 --> 00:09:31,904
WE HAD ONE CALLED COOL FLAMES,

253
00:09:31,971 --> 00:09:35,574
IT TAKES FLAMES AND WE ARE ABLE

254
00:09:35,641 --> 00:09:39,645
TO BURN THINGS AT 800° INSTEAD

255
00:09:39,712 --> 00:09:40,579
OF 1200.

256
00:09:40,646 --> 00:09:45,351
IF WE CAN DO THAT, WE CAN MAKE

257
00:09:45,418 --> 00:09:48,020
AIRPLANES SAFER OR LIGHTER.

258
00:09:48,087 --> 00:09:52,692
WE CAN BURN THINGS MORE

259
00:09:52,758 --> 00:09:53,125
EFFICIENTLY.

260
00:09:53,192 --> 00:09:56,329
>> AND SO WHAT I WAS SAYING

261
00:09:56,395 --> 00:09:58,664
BEFORE THAT YOU CAN BE A GUINEA

262
00:09:58,731 --> 00:09:59,398
PIG.

263
00:09:59,465 --> 00:10:00,933

HERE'S A COMPLEX EXPERIMENT WE

264

00:10:01,000 --> 00:10:02,501

WERE RUNNING ON THE EUROPEAN

265

00:10:02,568 --> 00:10:04,904

SPACE AGENCY LABORATORY THERE.

266

00:10:04,971 --> 00:10:06,806

IT'S AN EXPERIMENT WHERE YOU

267

00:10:06,872 --> 00:10:09,508

TAKE YOUR LEG AND HOOK IT UP TO

268

00:10:09,575 --> 00:10:11,744

A MACHINE AND THEN THE MACHINE

269

00:10:11,811 --> 00:10:13,346

MAKES YOUR LEG MOVE, YOU TRY TO

270

00:10:13,412 --> 00:10:14,313

MOVE THE MACHINE.

271

00:10:14,380 --> 00:10:19,018

IT'S A VERY LONG, STRESSFUL

272

00:10:19,085 --> 00:10:19,418

EXPERIMENT.

273

00:10:19,485 --> 00:10:22,188

WE USE ELECTRIC SHOCK TO SHOCKER

274

00:10:22,254 --> 00:10:25,791

THE MUSCLES SO THEY CONTRACT,

275

00:10:25,858 --> 00:10:29,695

AND THE MACHINE MEASURES THE

276

00:10:29,762 --> 00:10:29,996

FORCE.

277

00:10:30,062 --> 00:10:33,666

>> THE HUMAN BEING, THE BODIES

278

00:10:33,733 --> 00:10:38,270

ARE AFFECTED BY NO GRAVITY.

279

00:10:38,337 --> 00:10:39,305

WE ARE MOVING AROUND WITH OUR

280

00:10:39,372 --> 00:10:39,605

HANDS.

281

00:10:39,672 --> 00:10:42,375

IF THE MUSCLES AREN'T WORKING,

282

00:10:42,441 --> 00:10:44,310

THEY ARE STARTING TO ATROPHY,

283

00:10:44,377 --> 00:10:48,247

LIKE IF YOU STAYED IN BED FOR A

284

00:10:48,314 --> 00:10:50,016

MONTH OR TWO MONTHS.

285

00:10:50,082 --> 00:10:55,788

IF THAT HAPPENS, YOUR BONES LOSE

286

00:10:55,855 --> 00:10:56,122

DENSITY.

287

00:10:56,188 --> 00:10:57,857

SO WE GET TO MARS, WE ARE ABLE

288

00:10:57,923 --> 00:10:58,958

TO WORK.

289

00:10:59,025 --> 00:11:03,095

THIS PARTICULAR EXPERIMENT,

290

00:11:03,162 --> 00:11:04,797

PAOLO MENTIONED ABOUT ZAPPING IT

291

00:11:04,864 --> 00:11:06,098

WITH ELECTRICITY.

292

00:11:06,165 --> 00:11:08,934

WE CAN TELL OUR MIND TO MOVE OUR

293

00:11:09,001 --> 00:11:09,268

MUSCLES.

294

00:11:09,335 --> 00:11:12,371

YOUR MUSCLES HAVE A LOT MORE

295

00:11:12,438 --> 00:11:14,540

CAPABILITY THAN WHAT YOUR MIND

296

00:11:14,607 --> 00:11:16,542

TELLS YOU.

297

00:11:16,609 --> 00:11:17,943

THEN THEY ZAP IT TO SEE HOW MUCH

298

00:11:18,010 --> 00:11:19,445

MORE ABILITY YOUR MUSCLE HAS

299

00:11:19,512 --> 00:11:21,047

MORE THAN WHAT YOU ARE THINKING.

300

00:11:21,113 --> 00:11:23,682

WE DO THAT TESTING ON THE GROUND

301
00:11:23,749 --> 00:11:25,651
AND IN SPACE TO SEE IF THERE IS

302
00:11:25,718 --> 00:11:26,619
A DIFFERENCE.

303
00:11:26,685 --> 00:11:27,553
>> IT WAS FUN.

304
00:11:27,620 --> 00:11:30,056
>> IT WAS FUN WHEN IT WAS OVER.

305
00:11:30,122 --> 00:11:32,958
>> THAT'S WHY WE HAVE THAT

306
00:11:33,025 --> 00:11:34,560
PICTURE, IT'S DONE, NO MORE

307
00:11:34,627 --> 00:11:35,528
SHOCKING FOR TODAY.

308
00:11:35,594 --> 00:11:37,630
>> WHEN YOU LOOK UP, WHAT YOU

309
00:11:37,696 --> 00:11:39,031
ARE SEEING RIGHT NOW.

310
00:11:39,098 --> 00:11:41,167
THAT IS PAOLO AND I WORKING.

311
00:11:41,233 --> 00:11:42,835
YOU CAN SEE A TABLET.

312
00:11:42,902 --> 00:11:44,236
THE SAME TECHNOLOGY YOU HAVE AT

313
00:11:44,303 --> 00:11:46,072

HOME OR SCHOOL, USING A TABLET

314

00:11:46,138 --> 00:11:49,275

TO BE ABLE TO DO YOUR HOMEWORK

315

00:11:49,341 --> 00:11:51,610

OR LOOK ON-LINE, WE USE ON THE

316

00:11:51,677 --> 00:11:54,346

SPACE STATION TO GO THROUGH OUR

317

00:11:54,413 --> 00:11:54,747

PROCEDURES.

318

00:11:54,814 --> 00:11:57,049

WE ACTUALLY DO MORE STUFF FOR

319

00:11:57,116 --> 00:11:58,584

EXPLORATION GOING LONG

320

00:11:58,651 --> 00:11:58,951

DISTANCES.

321

00:11:59,018 --> 00:12:02,555

HERE'S JOE ACABA LOOKING AT OUR

322

00:12:02,621 --> 00:12:04,690

SPECIAL EXPERIMENT CALLED

323

00:12:04,757 --> 00:12:05,057

VEGGIE.

324

00:12:05,124 --> 00:12:07,760

WE GREW THREE TYPES OF LETTUCE.

325

00:12:07,827 --> 00:12:09,562

YOU GO TO A GROCERY STORE AND

326

00:12:09,628 --> 00:12:11,564

YOU GO INTO THE PRODUCE SECTION,

327

00:12:11,630 --> 00:12:14,567

THE LETTUCE, YOU DON'T SMELL

328

00:12:14,633 --> 00:12:17,036

LETTUCE, YOU SMELL LEMONS AND

329

00:12:17,103 --> 00:12:17,369

ORANGES.

330

00:12:17,436 --> 00:12:19,738

BUT WHEN YOU ARE IN A SPACE

331

00:12:19,805 --> 00:12:21,607

CAPSULE AND ALL YOU SMELL IS

332

00:12:21,674 --> 00:12:23,943

EACH OTHER, GUESS WHAT, LETTUCE

333

00:12:24,009 --> 00:12:25,711

HAS A REALLY GOOD SMELL.

334

00:12:25,778 --> 00:12:31,484

>> ACTUALLY, HOUSTON TOLD US WE

335

00:12:31,550 --> 00:12:32,651

COULD TAKE A LITTLE LEAVE AND

336

00:12:32,718 --> 00:12:33,385

TEST IT.

337

00:12:33,452 --> 00:12:36,021

I THOUGHT IT'S A PIECE OF GRASS,

338

00:12:36,088 --> 00:12:38,524

LETTUCE, IT DOESN'T TASTE LIKE

339

00:12:38,591 --> 00:12:39,258

NOTHING.

340

00:12:39,325 --> 00:12:41,427

INSTEAD, IT WAS AN AMAZING

341

00:12:41,494 --> 00:12:41,727

TASTE.

342

00:12:41,794 --> 00:12:44,864

WHEN YOU DON'T TASTE LETTUCE

343

00:12:44,930 --> 00:12:46,632

WHEN, YOUR SENSES ARE DUMBED

344

00:12:46,699 --> 00:12:49,902

DOWN BECAUSE OF THE CLOSED

345

00:12:49,969 --> 00:12:51,270

ENVIRONMENT, YOU TASTE LETTUCE,

346

00:12:51,337 --> 00:12:53,372

YOU UNDERSTAND WHAT HUMANS CAN

347

00:12:53,439 --> 00:12:55,307

DO AND WHAT IT MEANS TO HAVE

348

00:12:55,374 --> 00:12:56,709

THESE SENSES.

349

00:12:56,775 --> 00:12:58,110

IT'S INCREDIBLE.

350

00:12:58,177 --> 00:13:00,212

>> WE DO A LOT OF OTHER THINGS

351
00:13:00,279 --> 00:13:01,447
ON THE SPACE STATION.

352
00:13:01,514 --> 00:13:03,149
WE GET TO GO AND LOOK AT THE

353
00:13:03,215 --> 00:13:03,449
EARTH.

354
00:13:03,516 --> 00:13:04,783
THAT'S ONE OF OUR FAVORITE

355
00:13:04,850 --> 00:13:06,886
THINGS TO DO, TO TAKE PICTURES

356
00:13:06,952 --> 00:13:08,921
OF THE EARTH AND TRY TO SHARE

357
00:13:08,988 --> 00:13:10,923
THE INCREDIBLE BEAUTY WITH YOU

358
00:13:10,990 --> 00:13:11,223
GUYS.

359
00:13:11,290 --> 00:13:13,826
WE HAVE DONE THAT VIA OUR SOCIAL

360
00:13:13,893 --> 00:13:15,928
MEDIA, THE NASA WEB PAGES.

361
00:13:15,995 --> 00:13:21,467
ALL YOU HAVE TO DO IS GOOGLE THE

362
00:13:21,534 --> 00:13:22,735
NASA SPACE PICTURES, YOU CAN SEE

363
00:13:22,801 --> 00:13:23,836

THESE THINGS.

364

00:13:23,903 --> 00:13:26,105

WE HAD TO DO REPAIRS ON THE

365

00:13:26,172 --> 00:13:27,173

INSIDE AND OUTSIDE.

366

00:13:27,239 --> 00:13:29,275

WE GET INTO OUR SPACE SUITS, TWO

367

00:13:29,341 --> 00:13:32,378

AT A TIME, AND WE BUTTON THEM

368

00:13:32,444 --> 00:13:35,314

UP, DO LEAK CHECKS AND HEAD

369

00:13:35,381 --> 00:13:35,915

OUTSIDE.

370

00:13:35,981 --> 00:13:39,919

YOU GOT 300 POUNDS, BUT YOU ARE

371

00:13:39,985 --> 00:13:43,856

IN YOUR OWN SPACECRAFT.

372

00:13:43,923 --> 00:13:47,693

WE HAVE PEOPLE INSIDE FLYING THE

373

00:13:47,760 --> 00:13:49,461

ROBOTIC ARM AND FLYING THEM

374

00:13:49,528 --> 00:13:51,564

AROUND THE DIFFERENT WORK SITES.

375

00:13:51,630 --> 00:13:53,265

IT'S A BIG TEAM EFFORT TO GET

376

00:13:53,332 --> 00:13:54,066

THAT DONE.

377

00:13:54,133 --> 00:13:57,403

WE ALSO DO A LOT OF OUTREACH.

378

00:13:57,469 --> 00:13:59,505

>> PART OF THE ACTIVITY WE DO

379

00:13:59,572 --> 00:14:02,208

THERE IS TALKING TO SCHOOL KIDS

380

00:14:02,274 --> 00:14:02,675

LIKE YOU.

381

00:14:02,741 --> 00:14:04,944

WE HAD THE OPPORTUNITY TO TALK

382

00:14:05,010 --> 00:14:07,146

TO SCHOOLS ALL OVER THE WORLD,

383

00:14:07,213 --> 00:14:10,583

IN EUROPE, IN JAPAN, IN UNITED

384

00:14:10,649 --> 00:14:10,950

STATES.

385

00:14:11,016 --> 00:14:12,284

AND IT'S ALL INTERESTING, ALL

386

00:14:12,351 --> 00:14:14,687

THE QUESTIONS WE GET AND THE WAY

387

00:14:14,753 --> 00:14:16,989

THAT THINGS ARE FRAMED.

388

00:14:17,056 --> 00:14:19,225

>> FUN TO BE ABLE TO SHOW YOU

389

00:14:19,291 --> 00:14:23,462

GUYS WHAT IT'S LIKE TO BE UP

390

00:14:23,529 --> 00:14:23,862

THERE.

391

00:14:23,929 --> 00:14:24,530

GUESS WHAT?

392

00:14:24,597 --> 00:14:25,664

>> WE HAD THE OPPORTUNITY OF

393

00:14:25,731 --> 00:14:27,666

BEING UP THERE ON HALLOWEEN.

394

00:14:27,733 --> 00:14:32,438

I DECIDED, I WANT TO BE A REAL

395

00:14:32,504 --> 00:14:33,272

SPIDER MAN.

396

00:14:33,339 --> 00:14:35,407

I BROUGHT UP SOME COSTUMES AND

397

00:14:35,474 --> 00:14:37,376

WE PLAYED AROUND A LITTLE BIT.

398

00:14:37,443 --> 00:14:40,446

I WAS ACTUALLY ABLE TO FLY IN

399

00:14:40,512 --> 00:14:42,581

SPACE GRABS LIKE SPIDER MAN.

400

00:14:42,648 --> 00:14:47,319

>> AND MY KIDS PICKED OUT MY

401
00:14:47,386 --> 00:14:53,459
COSTUME, I WAS THE MINION.

402
00:14:53,525 --> 00:14:56,662
I HAD A BIRTHDAY WHILE I WAS UP

403
00:14:56,729 --> 00:14:56,962
THERE.

404
00:14:57,029 --> 00:15:00,666
WE CELEBRATED THE BIRTHDAY.

405
00:15:00,733 --> 00:15:06,672
WE DON'T HAVE TO HAVE CANDLES.

406
00:15:06,739 --> 00:15:10,509
WE GOT TO PUT ON OUR SPACE

407
00:15:10,576 --> 00:15:12,611
HAWAIIAN SHIRTS AND HAD ALOHA

408
00:15:12,678 --> 00:15:14,780
FRIDAYS AND THEY JOINED US ON

409
00:15:14,847 --> 00:15:16,682
THE MISSION AND WEAR THEIR

410
00:15:16,749 --> 00:15:17,816
HAWAIIAN SHIRTS ON FRIDAY.

411
00:15:17,883 --> 00:15:19,718
>> WE WERE SURFING IN SPACE.

412
00:15:19,785 --> 00:15:21,387
WE WERE SHOWING OFF.

413
00:15:21,453 --> 00:15:22,788

THEN AT A CERTAIN POINT IT WAS A

414

00:15:22,855 --> 00:15:25,457

MOMENT WHERE I KIND OF

415

00:15:25,524 --> 00:15:26,859

COMPLAINED WITH THE MANAGER WE

416

00:15:26,925 --> 00:15:31,463

DON'T GET TO DO PIZZA IN SPACE.

417

00:15:31,530 --> 00:15:33,532

SURE ENOUGH, THEY SEND US A FEW

418

00:15:33,599 --> 00:15:36,468

THINGS WE COULD MAKE PIZZA.

419

00:15:36,535 --> 00:15:38,470

I THOUGHT, NOTHING CAN COMPARE

420

00:15:38,537 --> 00:15:40,773

TO A REALLY GOOD ITALIAN PIZZA.

421

00:15:40,839 --> 00:15:42,975

BUT ACTUALLY, IN SPACE, EVEN

422

00:15:43,042 --> 00:15:45,878

THOUGH WITH ALL THE LITTLE

423

00:15:45,944 --> 00:15:47,079

PROBLEMS THAT WE HAVE, YOU CAN

424

00:15:47,146 --> 00:15:48,347

REALLY NOT COOK PIZZA.

425

00:15:48,414 --> 00:15:51,684

WE WERE ABLE TO HAVE OUR OWN

426
00:15:51,750 --> 00:15:54,086
SPECIAL PIZZA, YOU DID

427
00:15:54,153 --> 00:15:54,453
PEPPERONI.

428
00:15:54,520 --> 00:15:57,022
>> I DID THE MEAT LOVERS,

429
00:15:57,089 --> 00:15:59,591
COVERED IN PEPPERONI.

430
00:15:59,658 --> 00:16:02,027
AND IT STUCK TO IT BECAUSE OF

431
00:16:02,094 --> 00:16:04,830
THE SURFACE TENSION, IT HOLDS IT

432
00:16:04,897 --> 00:16:06,765
ON TO THE PIZZA DOUGH.

433
00:16:06,832 --> 00:16:08,267
>> I DID OLIVES.

434
00:16:08,334 --> 00:16:10,269
I HAD TO SHARE IT.

435
00:16:10,336 --> 00:16:13,205
SO I TOOK A PAIR OF SCISSORS.

436
00:16:13,272 --> 00:16:15,240
IT'S REALLY INCREDIBLE BECAUSE

437
00:16:15,307 --> 00:16:17,609
EVERYTHING FLOATS AWAY.

438
00:16:17,676 --> 00:16:22,881

IT'S NICE WHEN YOUR PIZZA IS

439

00:16:22,948 --> 00:16:24,917

FLOATING AWAY AND COME BACK

440

00:16:24,983 --> 00:16:25,217

HERE.

441

00:16:25,284 --> 00:16:27,853

>> THEY ARE FLOATABLE SAUCERS OF

442

00:16:27,920 --> 00:16:29,788

THE EDIBLE KIND.

443

00:16:29,855 --> 00:16:33,459

THEN IT WAS TIME TO COME HOME.

444

00:16:33,525 --> 00:16:34,526

ANOTHER THREE CREW MEMBERS WERE

445

00:16:34,593 --> 00:16:38,197

GOING TO COME UP.

446

00:16:38,263 --> 00:16:42,434

AFTER 2,224 ORBITS OF THE EARTH

447

00:16:42,501 --> 00:16:44,737

OR 58,835,000 MILES, IT WAS TIME

448

00:16:44,803 --> 00:16:48,407

FOR US TO GO AHEAD AND COME ON

449

00:16:48,474 --> 00:16:48,907

HOME.

450

00:16:48,974 --> 00:16:51,610

AND WE ENDED UP COMING BACK,

451
00:16:51,677 --> 00:16:59,785
LANDING IN MINUS 15° WEATHER IN

452
00:16:59,852 --> 00:17:00,185
KAZAKHSTAN.

453
00:17:00,252 --> 00:17:04,857
WE WERE GLAD TO BE HOME DECEMBES

454
00:17:04,923 --> 00:17:05,791
FOR CHRISTMAS.

455
00:17:05,858 --> 00:17:10,496
>> THAT LOOKS LIKE AN INCREDIBLE

456
00:17:10,562 --> 00:17:10,796
TRIP.

457
00:17:10,863 --> 00:17:11,964
THANKS FOR SHARING US.

458
00:17:12,030 --> 00:17:15,501
>> DID BEING A MARINE HELP TO

459
00:17:15,567 --> 00:17:17,302
BECOME AN ASTRONAUT?

460
00:17:17,369 --> 00:17:20,873
>> I WAS FORTUNATE TO GET A

461
00:17:20,939 --> 00:17:22,908
SCHOLARSHIP TO GO TO COLLEGE AND

462
00:17:22,975 --> 00:17:24,109
THEN BECOME A PILOT.

463
00:17:24,176 --> 00:17:27,379

I LEARNED ABOUT TEAM WORK,

464

00:17:27,446 --> 00:17:29,882

DEPENDING ON YOUR CREW MATE AND

465

00:17:29,948 --> 00:17:31,450

WORKING HARD AND MAKE SURE YOU

466

00:17:31,517 --> 00:17:32,651

DIDN'T LET THEM DOWN.

467

00:17:32,718 --> 00:17:34,286

PLUS, THE THINGS I WAS ABLE TO

468

00:17:34,353 --> 00:17:38,090

LEARN IN THE MARINE CORPS WITH

469

00:17:38,157 --> 00:17:39,691

TRAINING AS FAR AS BEING A

470

00:17:39,758 --> 00:17:42,494

PILOT, TRAIN TO DO THE MISSION

471

00:17:42,561 --> 00:17:43,996

WITH THE AIRPLANE I WAS ASSIGNED

472

00:17:44,062 --> 00:17:44,663

TO FLY.

473

00:17:44,730 --> 00:17:47,666

IT WAS EXCITING TO REPRESENT THE

474

00:17:47,733 --> 00:17:48,834

MARINE CORPS IN SPACE AND SHARE

475

00:17:48,901 --> 00:17:51,537

GREAT PICTURES OF MARINE CORPS

476
00:17:51,603 --> 00:17:53,138
FLAGS ALL OVER THE EARTH.

477
00:17:53,205 --> 00:17:54,940
THEY SERVE OTHER PEOPLE JUST

478
00:17:55,007 --> 00:17:57,276
LIKE ASTRONAUTS SERVE HUMANKIND.

479
00:17:57,342 --> 00:17:58,877
WE ARE WORKING TOGETHER TO

480
00:17:58,944 --> 00:18:02,381
FURTHER THE HUMAN EXPLORATION OF

481
00:18:02,448 --> 00:18:02,681
SPACE.

482
00:18:02,748 --> 00:18:05,350
>> YOU WERE IN THE MILITARY,

483
00:18:05,417 --> 00:18:05,617
TOO.

484
00:18:05,684 --> 00:18:07,886
>> MY PREVIOUS LIFE, I LIKE TO

485
00:18:07,953 --> 00:18:10,155
CALL IT BEFORE I BECAME AN

486
00:18:10,222 --> 00:18:11,723
ENGINEER, I WAS IN THE ARMY.

487
00:18:11,790 --> 00:18:14,359
I ENDED UP WORKING FOR THE

488
00:18:14,426 --> 00:18:18,063

SPECIAL FORCES THAT REQUIRE ME

489

00:18:18,130 --> 00:18:21,099

TO REALLY PUSH MYSELF IN EVERY

490

00:18:21,166 --> 00:18:21,567

DIRECTION.

491

00:18:21,633 --> 00:18:25,003

IT REALLY TAUGHT ME THAT WITH

492

00:18:25,070 --> 00:18:27,539

THE RIGHT EQUIPMENT, THE RIGHT

493

00:18:27,606 --> 00:18:29,374

EDUCATION, YOU NEED TO STUDY AND

494

00:18:29,441 --> 00:18:30,809

KNOW WHAT'S GOING ON.

495

00:18:30,876 --> 00:18:32,110

WITH THE RIGHT TRAINING AND

496

00:18:32,177 --> 00:18:34,179

ABOVE ALL, WITH THE RIGHT TEAM,

497

00:18:34,246 --> 00:18:37,149

YOU CAN REALLY GO WHERE YOU

498

00:18:37,216 --> 00:18:40,786

THINK IT'S IMPOSSIBLE TO GO.

499

00:18:40,853 --> 00:18:43,889

>> WHAT WAS ONE OF THE COOLEST

500

00:18:43,956 --> 00:18:46,458

SCIENCE EXPERIMENTS YOU DID IN

501
00:18:46,525 --> 00:18:46,758
SPACE?

502
00:18:46,825 --> 00:18:52,464
>> AS A CREW, WE DID 300 PLUS

503
00:18:52,531 --> 00:18:52,865
EXPERIMENTS.

504
00:18:52,931 --> 00:18:54,967
I WOULD HAVE DIFFICULTIES IN

505
00:18:55,033 --> 00:18:56,668
SAYING WHICH ONE WAS THE COOLEST

506
00:18:56,735 --> 00:18:56,935
ONE.

507
00:18:57,002 --> 00:18:59,171
A LOT OF EXPERIMENTS WE SHOWED

508
00:18:59,238 --> 00:19:01,373
BEFORE A PICTURE OF THIS, THIS

509
00:19:01,440 --> 00:19:03,275
IS A FLUID EXPERIMENT.

510
00:19:03,342 --> 00:19:05,777
HAS TO DO WITH FLUIDS AND HEAT

511
00:19:05,844 --> 00:19:07,813
AND HOW THINGS CHANGE.

512
00:19:07,880 --> 00:19:11,016
IT'S AN INCREDIBLE EXPERIMENT.

513
00:19:11,083 --> 00:19:13,986

I HAVE DIFFICULTY UNDERSTANDING.

514

00:19:14,052 --> 00:19:17,256

I'M THERE TOUCHING THE BOTTOMS.

515

00:19:17,322 --> 00:19:19,157

THE ONE WE COULD TOUCH WHEN WE

516

00:19:19,224 --> 00:19:21,627

SAW THE LETTUCE GROW AND WE

517

00:19:21,693 --> 00:19:24,229

TASTED IT, THAT WAS ALSO VERY

518

00:19:24,296 --> 00:19:25,297

NICE.

519

00:19:25,364 --> 00:19:27,633

WE HAD MANY TO DO WITH MEASURING

520

00:19:27,699 --> 00:19:30,536

OUR BODY, TAKING BLOOD.

521

00:19:30,602 --> 00:19:32,437

WE HAD SOME ANIMALS ON BOARD

522

00:19:32,504 --> 00:19:35,007

THAT WE HAD TO TAKE CARE OF.

523

00:19:35,073 --> 00:19:37,142

IT WAS, ALL OF THAT WAS

524

00:19:37,209 --> 00:19:37,543

INTERESTING.

525

00:19:37,609 --> 00:19:38,877

I WOULD HAVE A HARD TIME TO

526

00:19:38,944 --> 00:19:39,778

MENTION ONE.

527

00:19:39,845 --> 00:19:44,716

EVERY DAY YOU HAVE FUN IN AN

528

00:19:44,783 --> 00:19:46,251

INCREDIBLE NUMBER OF DIFFERENT

529

00:19:46,318 --> 00:19:46,585

FIELDS.

530

00:19:46,652 --> 00:19:47,352

>> WHAT ABOUT YOU?

531

00:19:47,419 --> 00:19:50,656

>> THE ANIMALS WE HAD, WE HAD AN

532

00:19:50,722 --> 00:19:52,824

EXPERIMENT OF MICE FROM JAPAN.

533

00:19:52,891 --> 00:19:55,260

HALF WE LET STAY IN ZERO

534

00:19:55,327 --> 00:19:55,594

GRAVITY.

535

00:19:55,661 --> 00:19:57,029

THEY FLOATED AROUND.

536

00:19:57,095 --> 00:20:02,301

THE OTHER ONES, WE SPUN THEM IN

537

00:20:02,367 --> 00:20:02,701

CENTRIFUGE.

538

00:20:02,768 --> 00:20:04,670

ONLY TIME THEY HAD ZERO GRAVITY

539

00:20:04,736 --> 00:20:08,507
WAS A FEW MINUTES.

540

00:20:08,574 --> 00:20:11,376
WE WERE TAKING SAMPLES AND

541

00:20:11,443 --> 00:20:12,411
OBSERVING THEM.

542

00:20:12,477 --> 00:20:15,614
IT WAS FUNNY TO SEE A MOUSE IN

543

00:20:15,681 --> 00:20:17,649
ZERO GRAVITY, THEY ARE FREAKING

544

00:20:17,716 --> 00:20:19,818
OUT TRYING TO GET AHOLD OF

545

00:20:19,885 --> 00:20:20,185
SOMETHING.

546

00:20:20,252 --> 00:20:22,387
I WONDER IF THAT'S WHAT I LOOK

547

00:20:22,454 --> 00:20:24,189
LIKE WHEN I GOT ZERO GRAVITY FOR

548

00:20:24,256 --> 00:20:25,290
THE FIRST TIME.

549

00:20:25,357 --> 00:20:31,763
WITH THOSE MICE, WE STUDY HOW

550

00:20:31,830 --> 00:20:34,933
THEIR BODIES AND BONES CHANGED.

551
00:20:35,000 --> 00:20:38,203
THAT HELPS US UNDERSTAND OUR

552
00:20:38,270 --> 00:20:38,570
BODIES.

553
00:20:38,637 --> 00:20:40,839
AND THAT WILL GIVE US COUNTER

554
00:20:40,906 --> 00:20:42,874
MEASURES WHEN WE GO TO MARS TO

555
00:20:42,941 --> 00:20:45,611
MAKE SURE OUR BODIES STAY IN THE

556
00:20:45,677 --> 00:20:47,779
BEST SHAPE THEY CAN.

557
00:20:47,846 --> 00:20:51,683
>> PAOLO AND RANDY RAN A LOT OF

558
00:20:51,750 --> 00:20:52,084
EXPERIMENTS.

559
00:20:52,150 --> 00:20:54,886
BEFORE THEY LAUNCHED, COMRADE

560
00:20:54,953 --> 00:20:57,756
WORKED WITH US TO RUN LESSONS

561
00:20:57,823 --> 00:21:00,192
YOU CAN RUN IN YOUR CLASSROOM.

562
00:21:00,258 --> 00:21:02,594
LET'S CHECK OUT ISS SCIENCE.

563
00:21:02,661 --> 00:21:09,234

■
564
00:21:09,301 --> 00:21:12,738
>> HELLO, RANDY BRESNIK.

565
00:21:12,804 --> 00:21:15,273
I'M HERE TO TALK ABOUT PUFFY

566
00:21:15,340 --> 00:21:16,642
HEAD, BIRD LEGS, THAT'S WHAT

567
00:21:16,708 --> 00:21:17,409
HAPPENS TO US.

568
00:21:17,476 --> 00:21:19,678
ALL THE FLUID IN OUR BODY CAN

569
00:21:19,745 --> 00:21:21,680
NOW GO WHERE IT NEEDS TO AND

570
00:21:21,747 --> 00:21:23,115
IT'S THE SAME PRESSURE.

571
00:21:23,181 --> 00:21:25,083
RIGHT NOW I GOT ALL THIS WATER

572
00:21:25,150 --> 00:21:27,486
IN MY LEGS, I HAVE ENOUGH WATER

573
00:21:27,552 --> 00:21:30,222
IN MY HEAD SO I DON'T PASS OUT.

574
00:21:30,288 --> 00:21:33,125
WHEN YOU GET TO SPACE, A GALLON

575
00:21:33,191 --> 00:21:36,061
AND A HALF OF WATER TO COUNTER

576
00:21:36,128 --> 00:21:38,997
ACT GRAVITY MAKES YOUR HEAD

577
00:21:39,064 --> 00:21:39,297
PUFFY.

578
00:21:39,364 --> 00:21:41,900
YOU HUNG UPSIDE DOWN FOR HALF AN

579
00:21:41,967 --> 00:21:43,902
HOUR, THAT WOULD BE HOW YOUR

580
00:21:43,969 --> 00:21:45,203
HEAD FEELS.

581
00:21:45,270 --> 00:21:48,240
UNTIL YOU GET PAST THE DAY, DAY

582
00:21:48,306 --> 00:21:51,643
AND A HALF MARK, WHERE YOU CAN

583
00:21:51,710 --> 00:21:54,479
URINATE THAT, IT'S A PRETTY

584
00:21:54,546 --> 00:21:56,081
STUFFY AND PUFFY HEAD.

585
00:21:56,148 --> 00:21:58,083
NOW OVER TO MARTY AND BETH TO

586
00:21:58,150 --> 00:21:58,750
LEARN MORE.

587
00:21:58,817 --> 00:22:00,218
>> THANKS.

588
00:22:00,285 --> 00:22:02,521

LET'S TALK ABOUT PUFFY HEAD,

589

00:22:02,587 --> 00:22:04,356

BIRD LEGS.

590

00:22:04,423 --> 00:22:06,892

>> THIS IS ASTRONAUT.

591

00:22:06,958 --> 00:22:08,627

HE'S FILLED WITH FLUID.

592

00:22:08,694 --> 00:22:10,595

AND IT'S DOWN HERE IN HIS FEET.

593

00:22:10,662 --> 00:22:12,964

>> IF YOU HAVE STOOD ON YOUR

594

00:22:13,031 --> 00:22:14,566

FEET FOR A LONG TIME, YOU NOTICE

595

00:22:14,633 --> 00:22:15,467

THEY SWELL UP.

596

00:22:15,534 --> 00:22:17,269

THE FLUID IS MAKING ITS WAY DOWN

597

00:22:17,335 --> 00:22:18,470

TO YOUR FEET.

598

00:22:18,537 --> 00:22:21,106

>> LET'S SEE WHAT HAPPENS WHEN

599

00:22:21,173 --> 00:22:24,309

WE FLIP HIM UPSIDE DOWN.

600

00:22:24,376 --> 00:22:25,844

THAT FLUID RUSHES TO HIS HEAD

601
00:22:25,911 --> 00:22:29,247
AND LEAVES THE FOOT REGION.

602
00:22:29,314 --> 00:22:30,849
>> THIS HAPPENS TO ASTRONAUTS

603
00:22:30,916 --> 00:22:33,151
WHEN THEY GO INTO SPACE.

604
00:22:33,218 --> 00:22:35,620
THIS FLUID IS NOT PULLED DOWN BY

605
00:22:35,687 --> 00:22:35,987
GRAVITY.

606
00:22:36,054 --> 00:22:39,658
IT GETS UP INTO YOUR HEAD

607
00:22:39,725 --> 00:22:42,160
UNDERSTAND GET A PUFFY HEAD AND

608
00:22:42,227 --> 00:22:43,195
LITTLE BIRD LEGS.

609
00:22:43,261 --> 00:22:45,330
>> IF YOU WANT TO TRY THIS IN

610
00:22:45,397 --> 00:22:47,733
YOUR CLASSROOM, HEAD TO THE

611
00:22:47,799 --> 00:22:50,368
WEBSITE AND CHECK OUT THE LESSON

612
00:22:50,435 --> 00:22:50,669
PLAN.

613
00:22:50,736 --> 00:22:52,070

>> TELL ME ABOUT WHAT YOU TOOK

614

00:22:52,137 --> 00:22:53,038

UP INTO SPACE.

615

00:22:53,105 --> 00:22:55,907

>> I HAD THE HELP OF MY CHILDREN

616

00:22:55,974 --> 00:22:57,709

TO PICK THIS ONE OUT.

617

00:22:57,776 --> 00:23:00,746

AND THEY FOUND THIS, THEY SAID

618

00:23:00,812 --> 00:23:03,148

TAKE THIS IN SPACE, THIS IS FUN.

619

00:23:03,215 --> 00:23:06,718

HAVE ANY OF YOU TOUCHED ONE OF

620

00:23:06,785 --> 00:23:07,018

THESE?

621

00:23:07,085 --> 00:23:08,587

THIS IS THE ONE THAT YOU WILL

622

00:23:08,653 --> 00:23:12,023

SEE IN THE VIDEO THAT FLEW IN

623

00:23:12,090 --> 00:23:14,025

SPACE.

624

00:23:14,092 --> 00:23:16,394

>> WHAT I THINK IS COOL ABOUT

625

00:23:16,461 --> 00:23:18,430

THIS, IT'S A GREAT DEMONSTRATION

626

00:23:18,497 --> 00:23:21,199

OF NEWTON'S LAWS USING SOMETHING

627

00:23:21,266 --> 00:23:21,967

YOU ARE FAMILIAR WITH.

628

00:23:22,033 --> 00:23:23,535

WAS IT A LOT OF FUN?

629

00:23:23,602 --> 00:23:24,870

>> IT WAS.

630

00:23:24,936 --> 00:23:27,906

IF YOU SEE ME TOUCH IT AND LET

631

00:23:27,973 --> 00:23:31,076

GO OF IT, IT WOULD STILL BE

632

00:23:31,143 --> 00:23:31,443

SPINNING.

633

00:23:31,510 --> 00:23:33,011

>> ARE YOU READY TO TAKE

634

00:23:33,078 --> 00:23:33,378

QUESTION?

635

00:23:33,445 --> 00:23:34,012

>> ABSOLUTELY.

636

00:23:34,079 --> 00:23:36,915

>> LET'S GO TO AUDIENCE

637

00:23:36,982 --> 00:23:37,282

QUESTION.

638

00:23:37,349 --> 00:23:38,750

>> I'M LESLIE.

639

00:23:38,817 --> 00:23:41,019

WHAT KIND OF THINGS DO

640

00:23:41,086 --> 00:23:42,888

ASTRONAUTS DO ON THE SPACE

641

00:23:42,954 --> 00:23:43,221

STATION?

642

00:23:43,288 --> 00:23:46,424

>> WE CAN DO A LOT OF FUN

643

00:23:46,491 --> 00:23:47,159

THINGS.

644

00:23:47,225 --> 00:23:49,361

ONE OF THE NICEST THINGS IS TO

645

00:23:49,427 --> 00:23:50,929

LOOK AT THE EARTH.

646

00:23:50,996 --> 00:23:54,533

JUST PUT YOUR NOSE ON THIS

647

00:23:54,599 --> 00:23:55,667

WINDOW, YOU CAN LOOK AT THE

648

00:23:55,734 --> 00:23:56,001

EARTH.

649

00:23:56,067 --> 00:23:58,770

YOU SEE THE PLANET PASSING BY

650

00:23:58,837 --> 00:24:02,908

AND IT'S PASSING AT 4 MILES PER

651
00:24:02,974 --> 00:24:03,241
SECOND.

652
00:24:03,308 --> 00:24:05,010
IN AN HOUR AND A HALF, YOU SEE

653
00:24:05,076 --> 00:24:06,711
THE WHOLE EARTH PASSING UNDER

654
00:24:06,778 --> 00:24:07,879
YOU.

655
00:24:07,946 --> 00:24:09,447
SEASONS, DAY, NIGHT, EVERYTHING

656
00:24:09,514 --> 00:24:10,849
LIKE THIS.

657
00:24:10,916 --> 00:24:13,985
BUT THEN WE CAN PLAY AROUND,

658
00:24:14,052 --> 00:24:18,390
RANDY, THE SPINNER, THE FIDGET.

659
00:24:18,456 --> 00:24:21,226
>> WE DID ONE DEMONSTRATION

660
00:24:21,293 --> 00:24:25,030
WHERE WE HAD A BUNGEE CORD AND

661
00:24:25,096 --> 00:24:26,565
WE PULLED IT BACK.

662
00:24:26,631 --> 00:24:28,733
WE WERE PULLING BACK WITH THE

663
00:24:28,800 --> 00:24:30,135

SAME AMOUNT OF FORCE.

664

00:24:30,202 --> 00:24:33,171

WE SHOT THINGS OF DIFFERENT SIZE

665

00:24:33,238 --> 00:24:34,372

AND WEIGHT.

666

00:24:34,439 --> 00:24:37,142

WE STARTED OFF WITH A THING OF

667

00:24:37,209 --> 00:24:38,777

CHAP STICK.

668

00:24:38,844 --> 00:24:41,413

THEN WE TRY SOMETHING BIGGER, A

669

00:24:41,479 --> 00:24:44,850

LITTLE MODEL OF ORION

670

00:24:44,916 --> 00:24:45,483

SPACECRAFT.

671

00:24:45,550 --> 00:24:50,522

AND IT WENT THROUGH A HUGE TRASH

672

00:24:50,589 --> 00:24:50,822

BAG.

673

00:24:50,889 --> 00:24:53,859

WE THREAT GO AND IT FLOATED OFF

674

00:24:53,925 --> 00:24:54,159

SLOW.

675

00:24:54,226 --> 00:24:56,795

TO SHOW YOU GUYS, LIKE MARTY

676
00:24:56,862 --> 00:24:59,564
SAID, PHYSICS IN ACTION IN ZERO

677
00:24:59,631 --> 00:25:01,867
GRAVITY, THAT WAS ONE OF THE FUN

678
00:25:01,933 --> 00:25:02,200
THINGS.

679
00:25:02,267 --> 00:25:07,205
>> WE WERE PLAYING WITH FOOD.

680
00:25:07,272 --> 00:25:09,140
CAN YOU IMAGINE WHAT YOU CAN DO

681
00:25:09,207 --> 00:25:11,142
WITH FLOOD FLOATING AROUND ON

682
00:25:11,209 --> 00:25:12,210
THE SPACE STATION?

683
00:25:12,277 --> 00:25:13,111
THAT'S WHAT WE DID.

684
00:25:13,178 --> 00:25:16,681
>> WE HAVE AN ON-LINE QUESTION

685
00:25:16,748 --> 00:25:21,720
NEXT FROM AN ASTRONAUT WANNA-BE.

686
00:25:21,786 --> 00:25:23,655
WHAT IS EXPECTED FOR A PERSON

687
00:25:23,722 --> 00:25:24,723
COULD BE EXPECTED?

688
00:25:24,789 --> 00:25:27,525

>> RIGHT NOW, IN ANY COUNTRY,

689

00:25:27,592 --> 00:25:29,561

YOU GOT TO BE ABLE TO HAVE A

690

00:25:29,628 --> 00:25:32,364

BASIC EDUCATION AND MOST REQUIRE

691

00:25:32,430 --> 00:25:34,900

A BACHELOR'S DEGREE IN SCIENCE,

692

00:25:34,966 --> 00:25:38,103

MATH, ENGINEERING OR THOSE TYPES

693

00:25:38,169 --> 00:25:39,237

OF FIELDS.

694

00:25:39,304 --> 00:25:40,705

THAT'S THE BASIS FOR THE WORK WE

695

00:25:40,772 --> 00:25:42,140

ARE DOING.

696

00:25:42,207 --> 00:25:45,644

MANY PEOPLE HAVE ADVANCED

697

00:25:45,710 --> 00:25:46,678

DEGREES AS WELL AS GRADUATE

698

00:25:46,745 --> 00:25:46,978

WORK.

699

00:25:47,045 --> 00:25:48,780

THE BIGGEST THING IS ONCE YOU

700

00:25:48,847 --> 00:25:51,116

GET AN EDUCATION, BECOMING

701
00:25:51,182 --> 00:25:52,484
EXCELLENT IN THAT FIELD IS THE

702
00:25:52,550 --> 00:25:52,751
KEY.

703
00:25:52,817 --> 00:25:57,055
IF YOU LOOK AT ANY OF THE

704
00:25:57,122 --> 00:25:58,790
ASTRONAUT BIOGRAPHIES, ANYBODY

705
00:25:58,857 --> 00:26:00,825
THAT'S BEEN IN SPACE FROM ANY

706
00:26:00,892 --> 00:26:01,159
COUNTRY.

707
00:26:01,226 --> 00:26:02,394
THEY ARE ALL SIMILAR.

708
00:26:02,460 --> 00:26:03,895
SOMEONE HAS WORKED HARD TO GET

709
00:26:03,962 --> 00:26:05,864
THEIR EDUCATION, BUT THEN GONE

710
00:26:05,931 --> 00:26:07,966
ON TO BE GOOD IN THEIR FIELD AND

711
00:26:08,033 --> 00:26:10,735
A WIDE VARIETY OF INTEREST.

712
00:26:10,802 --> 00:26:14,406
PEOPLE THAT ARE CONCERT PIANISTS

713
00:26:14,472 --> 00:26:17,442

THAT ARE AN ENGINEER.

714

00:26:17,509 --> 00:26:19,511

ONE GENTLEMAN PLAYED

715

00:26:19,577 --> 00:26:21,780

PROFESSIONAL SOCCER TO PUT

716

00:26:21,846 --> 00:26:24,182

HIMSELF TO BECOME A DOCTOR AND

717

00:26:24,249 --> 00:26:25,483

THEN AN ASTRONAUT.

718

00:26:25,550 --> 00:26:29,220

AND GUYS LIKE PAOLO, AN ENGINEER

719

00:26:29,287 --> 00:26:35,126

AND FLOWN IN SPACE 300 TIMES.

720

00:26:35,193 --> 00:26:36,695

>> 300 DAYS.

721

00:26:36,761 --> 00:26:39,130

>> WIDE VARIETY AND BEING

722

00:26:39,197 --> 00:26:40,932

EXCELLENCE ARE THE PATH.

723

00:26:40,999 --> 00:26:42,968

>> YOU NEED TO SPEAK ENGLISH, BY

724

00:26:43,034 --> 00:26:44,269

THE WAY.

725

00:26:44,336 --> 00:26:45,303

MINIMUM, WHICH IS OBVIOUS FOR

726

00:26:45,370 --> 00:26:49,374

YOU GUYS, BUT NOT SO MUCH FOR US

727

00:26:49,441 --> 00:26:49,774

FOREIGNERS.

728

00:26:49,841 --> 00:26:52,210

THAT'S A REQUIREMENT, TOO.

729

00:26:52,277 --> 00:26:53,311

>> THANK YOU SO MUCH.

730

00:26:53,378 --> 00:26:55,447

WE ARE JUST ABOUT OUT OF TIME.

731

00:26:55,513 --> 00:26:57,749

WE WANT YOU TO TUNE IN NEXT WEEK

732

00:26:57,816 --> 00:27:00,318

AS WE LOOK AT OBSERVATORIES AND

733

00:27:00,385 --> 00:27:01,987

HOW WE KNOW WHAT'S OUT THERE.

734

00:27:02,053 --> 00:27:06,925

>> DID YOU KNOW YOU DO NOT NEED

735

00:27:06,992 --> 00:27:09,027

THE HUBBLE SPACE TELESCOPE TO

736

00:27:09,094 --> 00:27:11,062

VIEW DIFFERENT GALAXIES.

737

00:27:11,129 --> 00:27:17,736

YOU CAN USE A PAIR OF

738

00:27:17,802 --> 00:27:18,136

BINOCULARS.

739

00:27:18,203 --> 00:27:19,738

IS IT SAFE TO LOOK AT THE SUN,

740

00:27:19,804 --> 00:27:22,240

HOW DO YOU FIND A BLACK HOLE.

741

00:27:22,307 --> 00:27:27,379

IF YOU WANT TO KNOW WHAT WE

742

00:27:27,445 --> 00:27:30,315

KNOW, BE SURE TO CHECK OUT STEM

743

00:27:30,382 --> 00:27:31,516

IN 30.

744

00:27:31,583 --> 00:27:33,685

>> WHILE COMRADE WAS IN SPACE,

745

00:27:33,752 --> 00:27:35,387

WE HAD AN OPPORTUNITY TO TALK TO

746

00:27:35,453 --> 00:27:37,422

HIM AND HE HAD A LITTLE SURPRISE

747

00:27:37,489 --> 00:27:38,056

FOR US.

748

00:27:38,123 --> 00:27:39,958

IF YOU CHECK OUT THE VIDEO, YOU

749

00:27:40,025 --> 00:27:42,560

WILL SEE WE WERE EXCITED ABOUT

750

00:27:42,627 --> 00:27:42,861

THIS.

751
00:27:42,927 --> 00:27:45,764
TOOK ONE OF OUR BOOK MARKS INTO

752
00:27:45,830 --> 00:27:46,064
SPACE.

753
00:27:46,131 --> 00:27:49,167
THAT WAS ABSOLUTELY INCREDIBLE.

754
00:27:49,234 --> 00:27:49,934
COMRADE, THANK YOU FOR DOING

755
00:27:50,001 --> 00:27:51,336
THAT FOR US.

756
00:27:51,403 --> 00:27:57,409
>> WE WERE VERY, VERY --

757
00:27:57,475 --> 00:27:57,776
[LAUGHTER]

758
00:27:57,842 --> 00:28:02,447
>> BACK FROM SPACE WITH

759
00:28:02,514 --> 00:28:04,182
58 MILLION-MILES ON IT.

760
00:28:04,249 --> 00:28:05,617
HERE'S YOUR BOOK MARK.

761
00:28:05,683 --> 00:28:06,851
>> THANK YOU.

762
00:28:06,918 --> 00:28:08,219
THANK YOU SO MUCH FOR DOING

763
00:28:08,286 --> 00:28:08,520

THAT.

764

00:28:08,586 --> 00:28:11,423

WE WANT TO THANK PAOLO AND RANDY

765

00:28:11,489 --> 00:28:14,192

FOR COMING OUT TODAY AND

766

00:28:14,259 --> 00:28:15,427

PROVIDENCE MIDDLE SCHOOL.

767

00:28:15,493 --> 00:28:17,295

>> AND THANK BOEING FOR