
PAO

1
00:00:01,300 --> 00:00:01,790
>> Kelly Humphries: Hi, guys.

2
00:00:01,790 --> 00:00:03,900
Welcome to Mission
Control Houston.

3
00:00:03,900 --> 00:00:07,910
I'm Kelly Humphries, and this is
veteran astronaut Mario Runco.

4
00:00:07,910 --> 00:00:10,470
We are ready for your questions.

5
00:00:10,470 --> 00:00:11,850
>> Ms. Sukumar: [Inaudible]
one of the students.

6
00:00:11,850 --> 00:00:15,760
Hi. This is Ms. Sukumar
from Deptford High School.

7
00:00:15,760 --> 00:00:18,490
Do you want me to ask the
questions one at a time

8
00:00:18,490 --> 00:00:21,320
or do you want the students
to be asking the questions?

9
00:00:21,320 --> 00:00:23,330
>> Kelly Humphries: We'd love to
hear directly from the students,

10
00:00:23,330 --> 00:00:25,900
but they do need to speak up
so we can hear their voices.

11
00:00:25,900 --> 00:00:27,410

And I want to make
sure they know

12
00:00:27,410 --> 00:00:29,230
that Mario knows New Jersey.

13
00:00:29,230 --> 00:00:32,990
He went to Rutgers University
and is originally from New York.

14
00:00:32,990 --> 00:00:35,070
So he knows your area.

15
00:00:35,070 --> 00:00:35,710
>> Ms. Sukumar: Very nice.

16
00:00:35,710 --> 00:00:38,200
So let's start with
Grant Wilson.

17
00:00:38,200 --> 00:00:39,780
He's a grade 11 student.

18
00:00:39,780 --> 00:00:41,380
He's a junior at our school.

19
00:00:41,380 --> 00:00:43,700
So Grant's question.

20
00:00:43,700 --> 00:00:44,420
Here he goes.

21
00:00:44,420 --> 00:00:45,950
Grant.

22
00:00:45,950 --> 00:00:49,500
>> Grant Wilson: How long have
you, in total, been in space?

23
00:00:49,500 --> 00:00:51,580
>> Mario Runco: How long
have I been in space?

24
00:00:51,580 --> 00:00:51,880
>> Grant Wilson: Yeah.

25
00:00:51,880 --> 00:00:53,960
>> Mario Runco: I had
done three missions.

26
00:00:53,960 --> 00:00:57,530
The first one was
in 1991 on STS 44.

27
00:00:57,530 --> 00:00:58,980
That was with the space shuttle.

28
00:00:58,980 --> 00:01:01,920
And then I did two more
space shuttle missions.

29
00:01:01,920 --> 00:01:04,870
In '93 and in '96.

30
00:01:04,870 --> 00:01:09,050
And the total time
among all missions is --

31
00:01:09,050 --> 00:01:14,310
was about 21 days total,
which now days compared

32
00:01:14,310 --> 00:01:15,220
to what the guys spend

33
00:01:15,220 --> 00:01:18,130
on the space station
is a very small number.

34
00:01:18,130 --> 00:01:21,010
>> Kelly Humphries: Okay,
that's a great question.

35
00:01:21,010 --> 00:01:24,230
And just a reminder, please
get to the microphone and speak

36
00:01:24,230 --> 00:01:25,520
up so we can hear you.

37
00:01:25,520 --> 00:01:27,780
It's a little hard.

38
00:01:27,780 --> 00:01:28,130
>> Ms. Sukumar: Sure.

39
00:01:28,130 --> 00:01:31,530
The next question is from Brian
McCachlan [assumed spelling].

40
00:01:31,530 --> 00:01:33,880
He's a grade nine student.

41
00:01:33,880 --> 00:01:36,180
He's a freshman.

42
00:01:36,180 --> 00:01:37,150
Brian, where are you?

43
00:01:37,150 --> 00:01:37,220
>> [Inaudible].

44
00:01:37,220 --> 00:01:38,750
>> Ms. Sukumar: All right.

45
00:01:38,750 --> 00:01:42,540

Brian's not here, but I'm
going to ask the question

46
00:01:42,540 --> 00:01:44,950
that Brian had asked
on his behalf.

47
00:01:44,950 --> 00:01:48,830
And the question is how
is space always expanding,

48
00:01:48,830 --> 00:01:52,980
and where does it expand into?

49
00:01:52,980 --> 00:01:55,570
>> Mario Runco: How and
why is space expanding

50
00:01:55,570 --> 00:01:57,030
and what is it expanding into?

51
00:01:57,030 --> 00:01:58,480
That is a great question,

52
00:01:58,480 --> 00:02:02,030
and I don't think we know
the answer to at this point.

53
00:02:02,030 --> 00:02:05,120
Space is, as far
as we have sensed

54
00:02:05,120 --> 00:02:09,680
with our Hubble space telescope
and other orbiting observatories

55
00:02:09,680 --> 00:02:13,710
like the Gamma Ray Observatory,
we know that there are objects

56
00:02:13,710 --> 00:02:16,730
that we can see and sense

57
00:02:16,730 --> 00:02:20,450
out 13,000,000,000
light years from Earth.

58
00:02:20,450 --> 00:02:24,920
And that's really the extent
of the known Universe.

59
00:02:24,920 --> 00:02:28,890
The objects within that
space, the known Universe,

60
00:02:28,890 --> 00:02:34,230
are expanding away from each
other into distances farther

61
00:02:34,230 --> 00:02:36,510
than the 13,000,000,000
light years.

62
00:02:36,510 --> 00:02:40,400
Now, remember, a light year is
about 6,000,000,000,000 miles.

63
00:02:40,400 --> 00:02:43,620
So I said 13,000,000,000
times 6,000,000,000,000.

64
00:02:43,620 --> 00:02:46,900
So that's the distance to
the farthest known extent

65
00:02:46,900 --> 00:02:49,610
of the Universe, at least today.

66
00:02:49,610 --> 00:02:51,750

And that's a darn good question.

67
00:02:51,750 --> 00:02:56,230
And maybe Brian will be
able to become the scientist

68
00:02:56,230 --> 00:02:57,710
that figures that out.

69
00:02:57,710 --> 00:02:58,530
>> Kelly Humphries: You
know, the other part

70
00:02:58,530 --> 00:03:01,940
of that is what exactly
is in all of that space?

71
00:03:01,940 --> 00:03:04,780
And one of the experiments on
the International Space Station,

72
00:03:04,780 --> 00:03:07,940
the alpha-magnetic
spectrometer, is doing --

73
00:03:07,940 --> 00:03:11,390
sifting through the various
cosmic rays and particles

74
00:03:11,390 --> 00:03:15,370
that come to Earth to try to
identify a little bit more

75
00:03:15,370 --> 00:03:17,750
about things like
matter, antimatter,

76
00:03:17,750 --> 00:03:21,920
and this theoretical dark
matter that we believe exists

77
00:03:21,920 --> 00:03:25,240
because we can indirectly
sense that.

78
00:03:25,240 --> 00:03:27,340
But we don't have any
direct measurements of that.

79
00:03:27,340 --> 00:03:30,260
And so that's a really
interesting experiment.

80
00:03:30,260 --> 00:03:33,550
And having the space station
orbiting the Earth provides us

81
00:03:33,550 --> 00:03:36,240
the power to operate that
outside the Earth's atmosphere.

82
00:03:36,240 --> 00:03:39,130
And look more at what
is in between the matter

83
00:03:39,130 --> 00:03:41,400
that we can see and sense.

84
00:03:41,400 --> 00:03:47,300
And we're ready for
your next question.

85
00:03:47,300 --> 00:03:47,870
>> Ms. Sukumar: [Inaudible].

86
00:03:47,870 --> 00:03:49,420
>> Kelly Humphries: I'm sorry.

87
00:03:49,420 --> 00:03:58,780

We're not able to
hear that at all.

88
00:03:58,780 --> 00:03:58,850
>> Ms. Sukumar: [Inaudible].

89
00:03:58,850 --> 00:04:08,360
>> Kelly Humphries:
Something must have happened

90
00:04:08,360 --> 00:04:12,610
to the microphone.

91
00:04:12,610 --> 00:04:13,040
I'm sorry.

92
00:04:13,040 --> 00:04:15,390
You may want to check
your microphone.

93
00:04:15,390 --> 00:04:20,490
And verify that it's in a
good location and plugged in.

94
00:04:20,490 --> 00:04:23,870
>> Mario Runco: And while
you're doing that -- oop.

95
00:04:23,870 --> 00:04:25,470
And while you're doing
that, let me comment

96
00:04:25,470 --> 00:04:27,570
about what Kelly had just said.

97
00:04:27,570 --> 00:04:29,940
And that is with
the dark matter.

98

00:04:29,940 --> 00:04:35,350
Scientists believe that
there is a construct,

99
00:04:35,350 --> 00:04:36,640
a thing called dark matter.

100
00:04:36,640 --> 00:04:40,110
And that's because, for
example, the Milky Way Galaxy,

101
00:04:40,110 --> 00:04:42,930
our own galaxy, has matter
in it, and it is spinning

102
00:04:42,930 --> 00:04:45,380
around in a disk-like fashion.

103
00:04:45,380 --> 00:04:47,720
But the rate of spin is

104
00:04:47,720 --> 00:04:50,480
such that the centrifugal
acceleration outward

105
00:04:50,480 --> 00:04:56,090
that would throw the objects
within the galaxy like the ball

106
00:04:56,090 --> 00:04:57,940
at the end of a string when
you let go of the string,

107
00:04:57,940 --> 00:05:01,360
they would flight outward and
not stay as part of the galaxy.

108
00:05:01,360 --> 00:05:05,000
But there's enough
gravity within that galaxy

109
00:05:05,000 --> 00:05:06,260
to hold everything together.

110
00:05:06,260 --> 00:05:10,590
But the matter and the mass
that we know of in the objects

111
00:05:10,590 --> 00:05:12,900
that we can see is
not enough to do that.

112
00:05:12,900 --> 00:05:15,740
So they've invented
dark matter to try

113
00:05:15,740 --> 00:05:18,590
and solve the equation
so it makes sense.

114
00:05:18,590 --> 00:05:19,840
So there's something there.

115
00:05:19,840 --> 00:05:20,850
We just can't sense it.

116
00:05:20,850 --> 00:05:23,850
And we don't know what it is.

117
00:05:23,850 --> 00:05:26,160
Now, there is some
-- there are things

118
00:05:26,160 --> 00:05:29,940
out there called robe planets
that are like the Earth

119
00:05:29,940 --> 00:05:33,630
or Jupiter that do not

revolve around the stars.

120
00:05:33,630 --> 00:05:36,330
So they would be dark
planets that we can't see.

121
00:05:36,330 --> 00:05:37,660
So maybe there's
-- that's one --

122
00:05:37,660 --> 00:05:40,820
maybe that's one possibility
that's not so exotic

123
00:05:40,820 --> 00:05:43,640
that would account
for that extra mass.

124
00:05:43,640 --> 00:05:44,220
>> Kelly Humphries: Okay.

125
00:05:44,220 --> 00:05:46,180
I'm hearing that we may
have gotten the audio

126
00:05:46,180 --> 00:05:46,950
connection fixed.

127
00:05:46,950 --> 00:05:48,750
You want to try another
question, guys?

128
00:05:48,750 --> 00:05:49,450
>> Ms. Sukumar: Yes, we do.

129
00:05:49,450 --> 00:05:50,740
>> Mario Runco: Now
that's better.

130

00:05:50,740 --> 00:05:52,110
>> Kelly Humphries:
We can hear you now.

131
00:05:52,110 --> 00:05:54,020
>> Yeah. How do you
feel in space?

132
00:05:54,020 --> 00:05:56,180
Do you feel more
inspired and at ease?

133
00:05:56,180 --> 00:05:58,150
Or do you become
cynical [phonetic]?

134
00:05:58,150 --> 00:05:59,630
>> Mario Runco: Ah,
good question.

135
00:05:59,630 --> 00:06:02,100
I actually -- it's the former.

136
00:06:02,100 --> 00:06:05,410
I feel very inspired
and uplifted.

137
00:06:05,410 --> 00:06:09,090
And the reason for that
is when you're in orbit

138
00:06:09,090 --> 00:06:11,650
around the Earth, you can
see most of the Earth.

139
00:06:11,650 --> 00:06:14,040
And, indeed, some of
the earlier astronauts

140
00:06:14,040 --> 00:06:16,400

that traveled farther away from
the Earth like those that went

141
00:06:16,400 --> 00:06:19,240
to the moon, could see the
entire Earth at one time.

142
00:06:19,240 --> 00:06:23,350
And it is so spectacularly
beautiful and majestic.

143
00:06:23,350 --> 00:06:25,680
And likewise, when you
look out into the Universe,

144
00:06:25,680 --> 00:06:29,910
you see the stars
and the celestial sky

145
00:06:29,910 --> 00:06:32,730
in a much more vivid fashion.

146
00:06:32,730 --> 00:06:35,910
And your being among them

147
00:06:35,910 --> 00:06:40,240
in that setting just is very
exhilarating and inspirational.

148
00:06:40,240 --> 00:06:43,380
And actually, we had
talked earlier, Kelly and I,

149
00:06:43,380 --> 00:06:47,280
about some of the work we
were doing here at NASA

150
00:06:47,280 --> 00:06:53,630
that is related to that in terms
of taking images of the Earth.

151
00:06:53,630 --> 00:06:55,300
>> Kelly Humphries: All right.

152
00:06:55,300 --> 00:06:56,630
Next question.

153
00:06:56,630 --> 00:06:58,360
>> Ms. Sukumar: Next question is

154
00:06:58,360 --> 00:06:59,960
from Michael Holmes
[assumed spelling].

155
00:06:59,960 --> 00:07:00,860
He's a freshman.

156
00:07:00,860 --> 00:07:02,740
And his question is --

157
00:07:02,740 --> 00:07:06,130
>> Michael Holmes: What do
you use to work out in space?

158
00:07:06,130 --> 00:07:07,400
>> Kelly Humphries:
Oh, good question.

159
00:07:07,400 --> 00:07:10,130
And you really need
to work out in space.

160
00:07:10,130 --> 00:07:14,590
I'll answer the question,
but let me just say, firstly,

161
00:07:14,590 --> 00:07:18,370
that on Earth, gravity is
working on us all the time.

162
00:07:18,370 --> 00:07:22,080
And for example, like my heart
is pumping blood right now

163
00:07:22,080 --> 00:07:25,060
up against gravity to my
head to keep me conscious

164
00:07:25,060 --> 00:07:27,070
so I don't keel over
in the chair.

165
00:07:27,070 --> 00:07:29,620
And when gravity is removed,

166
00:07:29,620 --> 00:07:31,670
the heart doesn't
have to work so hard.

167
00:07:31,670 --> 00:07:34,240
Yet, when I come return to
Earth, it has to go back

168
00:07:34,240 --> 00:07:35,430
into that environment.

169
00:07:35,430 --> 00:07:37,640
So we need to stay
conditioned because muscles

170
00:07:37,640 --> 00:07:40,820
that you don't use, as everyone
knows, tend to grow weaker.

171
00:07:40,820 --> 00:07:43,400
So we need to maintain at
least the level of strength

172

00:07:43,400 --> 00:07:45,430
that we had when
we left the Earth.

173
00:07:45,430 --> 00:07:51,410
And we use devices such as
ergometers and treadmills

174
00:07:51,410 --> 00:07:56,160
and cycling machines
and bungees in a fashion

175
00:07:56,160 --> 00:08:00,880
that are all designed
using springs and the

176
00:08:00,880 --> 00:08:03,320
like to mimic gravity.

177
00:08:03,320 --> 00:08:05,590
For example, if I'm
running on a treadmill,

178
00:08:05,590 --> 00:08:08,570
there are bungee cords
holding me to the treadmill

179
00:08:08,570 --> 00:08:12,850
such that I can actually run
on the treadmill and it works.

180
00:08:12,850 --> 00:08:18,440
And then we use bungees
and spring-like things

181
00:08:18,440 --> 00:08:20,390
to mimic weightlifting
and the like.

182
00:08:20,390 --> 00:08:22,630

So we try to do -- and
there are many devices

183
00:08:22,630 --> 00:08:26,160
that have been developed
to help and facilitate

184
00:08:26,160 --> 00:08:28,730
that exercise protocol.

185
00:08:28,730 --> 00:08:32,350
>> Kelly Humphries: And just
to add onto that, there are --

186
00:08:32,350 --> 00:08:35,050
bone density loss is
another important thing

187
00:08:35,050 --> 00:08:37,610
when you do the long
duration stays in space.

188
00:08:37,610 --> 00:08:40,720
And so doing this kind
of exercise puts force

189
00:08:40,720 --> 00:08:44,810
onto your bones in the same
way that you would put force

190
00:08:44,810 --> 00:08:46,820
on your heels when you walk.

191
00:08:46,820 --> 00:08:48,900
And that helps keep
the bones strong,

192
00:08:48,900 --> 00:08:50,370
which is a really
important thing.

193
00:08:50,370 --> 00:08:53,350
And research into that is
also helping us solve problems

194
00:08:53,350 --> 00:08:55,690
that people have on
Earth like osteoporosis.

195
00:08:55,690 --> 00:08:59,310
Some of your grandparents
may have experienced that

196
00:08:59,310 --> 00:09:01,340
and have -- it's too
easy to break a hip

197
00:09:01,340 --> 00:09:02,770
or whatnot because of that.

198
00:09:02,770 --> 00:09:03,950
And some of the research

199
00:09:03,950 --> 00:09:07,570
in space is helping us apply
what we're learning there

200
00:09:07,570 --> 00:09:09,800
to diseases we have
here on Earth.

201
00:09:09,800 --> 00:09:12,080
And so that's another
part of exercise on orbit

202
00:09:12,080 --> 00:09:13,350
because these folks all come --

203
00:09:13,350 --> 00:09:15,660

stay up there for about six
months, and then they've got

204
00:09:15,660 --> 00:09:18,100
to readapt to being on
gravity when they get home.

205
00:09:18,100 --> 00:09:20,780
>> Mario Runco: And in the case
of osteoporosis, it happens --

206
00:09:20,780 --> 00:09:24,080
if we don't exercise, we tend
to develop those symptoms

207
00:09:24,080 --> 00:09:25,830
in the very short
period of time,

208
00:09:25,830 --> 00:09:27,130
in a matter of weeks and months.

209
00:09:27,130 --> 00:09:30,760
So we can study that, whereas
normally, on a person on Earth,

210
00:09:30,760 --> 00:09:33,530
it would take a lifetime before
they had developed any symptoms.

211
00:09:33,530 --> 00:09:36,400
So we have a very
accelerated laboratory in which

212
00:09:36,400 --> 00:09:39,840
to develop drugs and protocols
to maybe address that.

213
00:09:39,840 --> 00:09:41,530
And that's what Kelly

was talking about.

214
00:09:41,530 --> 00:09:42,540
>> Kelly Humphries:
And nutrition too

215
00:09:42,540 --> 00:09:44,920
because they're learning
that nutrition and exercise

216
00:09:44,920 --> 00:09:47,410
in combination have a
really important effect

217
00:09:47,410 --> 00:09:50,390
on how well you're able to keep
fit aboard the space station.

218
00:09:50,390 --> 00:09:52,760
>> Mario Runco: I'm sure you've
heard that one before too.

219
00:09:52,760 --> 00:09:53,790
>> Kelly Humphries:
Next question.

220
00:09:53,790 --> 00:09:53,880
>> Ms. Sukumar: [Inaudible].

221
00:09:53,880 --> 00:09:56,510
>> John Gilbert [assumed
spelling]: I'm John Gilbert.

222
00:09:56,510 --> 00:09:57,590
I'm a senior.

223
00:09:57,590 --> 00:10:03,740
I want to know how did your
navy career prepare you

224
00:10:03,740 --> 00:10:05,040
to be an astronaut.

225
00:10:05,040 --> 00:10:06,970
>> Mario Runco: Ah,
good question.

226
00:10:06,970 --> 00:10:10,720
My navy career, I was a
meteorologist, oceanographer,

227
00:10:10,720 --> 00:10:17,760
and I was also a surface ship
watch officer in the navy.

228
00:10:17,760 --> 00:10:21,190
And the scientific part of my
background, the meteorology,

229
00:10:21,190 --> 00:10:25,680
oceanography, helped with
my ability to understand all

230
00:10:25,680 --> 00:10:30,780
of the technical parts of what
is needed to operate in space,

231
00:10:30,780 --> 00:10:32,130
orbital mechanics and the like.

232
00:10:32,130 --> 00:10:35,130
So I had a very rigorous
engineering,

233
00:10:35,130 --> 00:10:37,140
scientific background.

234
00:10:37,140 --> 00:10:40,580
The navy portion of it

is the crew of a ship,

235
00:10:40,580 --> 00:10:44,160
much like the crew
of a spaceship,

236
00:10:44,160 --> 00:10:46,560
is based in operations.

237
00:10:46,560 --> 00:10:50,590
And it's very similar when
you're operating on board a ship

238
00:10:50,590 --> 00:10:52,920
or a submarine to
when you're operating

239
00:10:52,920 --> 00:10:54,870
in a spacecraft as a crew.

240
00:10:54,870 --> 00:10:56,970
You learn to operate as a team,

241
00:10:56,970 --> 00:10:58,920
you learn your systems
on the ship.

242
00:10:58,920 --> 00:11:03,230
And indeed, many of them --
actually, they're all the same.

243
00:11:03,230 --> 00:11:05,960
Say that, for example,
there's environmental systems

244
00:11:05,960 --> 00:11:07,870
on the ship, as there
are on a spacecraft.

245

00:11:07,870 --> 00:11:10,850
So some of the hardware's
different and how it is --

246
00:11:10,850 --> 00:11:13,150
it functions is different,
but the principle

247
00:11:13,150 --> 00:11:16,450
and why it's there is
basically the same.

248
00:11:16,450 --> 00:11:20,690
So it's a very close one-to-one
relationship between operating

249
00:11:20,690 --> 00:11:23,540
in the naval environment
as a space environment.

250
00:11:23,540 --> 00:11:24,830
>> Kelly Humphries: And
interestingly enough,

251
00:11:24,830 --> 00:11:25,560
one of the crew members

252
00:11:25,560 --> 00:11:28,070
on the space station right
now also is a navy veteran.

253
00:11:28,070 --> 00:11:34,190
Chris Cassidy was a navy seal.

254
00:11:34,190 --> 00:11:35,060
Next question.

255
00:11:35,060 --> 00:11:37,710
>> Solomon [assumed spelling]:
I'm Solomon, ninth grade.

256
00:11:37,710 --> 00:11:41,890
And my question is what made
you want to be an astronaut?

257
00:11:41,890 --> 00:11:44,990
>> Mario Runco: Well,
I've always had a desire

258
00:11:44,990 --> 00:11:46,770
to learn new things

259
00:11:46,770 --> 00:11:50,660
and to understand the
Universe, what's out there.

260
00:11:50,660 --> 00:11:54,040
But very specifically,
when I was very young

261
00:11:54,040 --> 00:11:57,630
at age five years old,
the first satellite went

262
00:11:57,630 --> 00:11:58,690
into orbit, Sputnik.

263
00:11:58,690 --> 00:12:01,710
And then shortly
thereafter, a few years later,

264
00:12:01,710 --> 00:12:04,940
the first human beings, Yuri
Gagarin and Alan Shepard,

265
00:12:04,940 --> 00:12:06,540
went into orbit around Earth.

266
00:12:06,540 --> 00:12:10,910

And I knew then that's
exactly what I wanted to do.

267
00:12:10,910 --> 00:12:13,700
And I feel very, very
fortunate and privileged

268
00:12:13,700 --> 00:12:16,050
to have had the opportunity
to do so.

269
00:12:16,050 --> 00:12:21,360
And I'm very lucky to be here
sitting talking to you about it.

270
00:12:23,090 --> 00:12:23,890
>> Go ahead?

271
00:12:23,890 --> 00:12:24,400
>> Ms. Sukumar: Yeah.

272
00:12:24,400 --> 00:12:26,930
>> What do you think is your
most significant accomplishment

273
00:12:26,930 --> 00:12:30,070
in all your space
missions as an astronaut?

274
00:12:30,070 --> 00:12:32,430
>> Mario Runco: Ah, my most
significant accomplishment?

275
00:12:32,430 --> 00:12:36,330
The most memorable one was
the one on my second mission,

276
00:12:36,330 --> 00:12:39,300
was when I did a spacewalk.

277
00:12:39,300 --> 00:12:45,400
And honestly, I guess the most
significant accomplishment is

278
00:12:45,400 --> 00:12:48,470
on my last mission,
we had a number

279
00:12:48,470 --> 00:12:51,480
of technology development
experiments on board

280
00:12:51,480 --> 00:12:55,130
that spacecraft, both on
the shuttle and others

281
00:12:55,130 --> 00:12:57,920
that we put overboard
and we tested

282
00:12:57,920 --> 00:13:00,810
in orbit alongside
the space shuttle.

283
00:13:00,810 --> 00:13:05,740
And in that sense, is those
technology development

284
00:13:05,740 --> 00:13:07,600
experiments were
pushing the boundaries

285
00:13:07,600 --> 00:13:10,150
of what are capabilities
are to explore space.

286
00:13:10,150 --> 00:13:13,470
So I guess that, in my
mind, would be something

287
00:13:13,470 --> 00:13:16,630
that if we can move to an area

288
00:13:16,630 --> 00:13:20,790
where we can explore it more
efficiently and go farther

289
00:13:20,790 --> 00:13:26,000
out into space is something
that I hope continues.

290
00:13:26,000 --> 00:13:26,740
>> Kelly Humphries:
and I think some

291
00:13:26,740 --> 00:13:28,120
of those were directly
applicable

292
00:13:28,120 --> 00:13:30,240
to the space station
development, weren't they?

293
00:13:30,240 --> 00:13:31,800
>> Mario Runco: Actually, yes.

294
00:13:31,800 --> 00:13:35,580
We had attitude control
satellite.

295
00:13:35,580 --> 00:13:37,050
It's called the satellite
test unit.

296
00:13:37,050 --> 00:13:42,240
It was a device that we tried to
use the forces in Earth's orbit

297
00:13:42,240 --> 00:13:46,140

to control the attitude
of this spacecraft.

298
00:13:46,140 --> 00:13:49,250
And in a sense, they do a little
bit with the space station.

299
00:13:49,250 --> 00:13:53,860
We've got gyros that move
through angular momentum

300
00:13:53,860 --> 00:13:56,140
that can torque the
space station around.

301
00:13:56,140 --> 00:13:59,230
We also have thrusters, but
we don't use those that often.

302
00:13:59,230 --> 00:14:02,340
And we try to keep the space
station in an equilibrium point

303
00:14:02,340 --> 00:14:05,650
where we don't have
to use the gyros even.

304
00:14:05,650 --> 00:14:11,510
But all three together hold the
spacecraft where it needs to be.

305
00:14:11,510 --> 00:14:12,870
>> Kelly Humphries: Great.

306
00:14:12,870 --> 00:14:13,610
Another question?

307
00:14:13,610 --> 00:14:18,850
>> How does your body shift
from gravy to no gravity?

308
00:14:18,850 --> 00:14:21,130
And how do you feel?

309
00:14:21,130 --> 00:14:24,040
>> Mario Runco: Well, the body
does a number of reactions

310
00:14:24,040 --> 00:14:27,630
when you get into space
and you're in orbit

311
00:14:27,630 --> 00:14:29,830
and the gravity vector
is removed.

312
00:14:29,830 --> 00:14:33,970
Primarily -- and we had
already discussed some of that

313
00:14:33,970 --> 00:14:39,010
with the bone density loss,
the muscle toning loss.

314
00:14:39,010 --> 00:14:43,940
But the most immediate reaction
that one feels is a fluid shift.

315
00:14:43,940 --> 00:14:47,630
And again, I'm sitting
here, or if I'm standing up,

316
00:14:47,630 --> 00:14:50,210
gravity is working to
hold my bodily fluids,

317
00:14:50,210 --> 00:14:57,000
the bloods in my legs and arms
if I have my arms at my side.

318
00:14:57,000 --> 00:14:58,650
When you remove the
gravity, that --

319
00:14:58,650 --> 00:15:00,850
there tends to be a fluid
shift out of the legs,

320
00:15:00,850 --> 00:15:02,970
into the chest cavity
and the head.

321
00:15:02,970 --> 00:15:04,910
And if you look very carefully
at some of the pictures

322
00:15:04,910 --> 00:15:07,560
of the astronauts in space,
they do look a little puffy,

323
00:15:07,560 --> 00:15:10,940
a little more full than
they do on the ground.

324
00:15:10,940 --> 00:15:12,640
And that is because
of that fluid shift.

325
00:15:12,640 --> 00:15:16,420
Now, a consequence of that fluid
shift is what we call space

326
00:15:16,420 --> 00:15:19,110
adaptation syndrome.

327
00:15:19,110 --> 00:15:23,660
It's not the same as, but it's
not very much different as,

328

00:15:23,660 --> 00:15:27,430
it's hard to describe, as when
you -- if you go aboard a ship

329
00:15:27,430 --> 00:15:30,560
and you have a tendency
to be seasick.

330
00:15:30,560 --> 00:15:34,780
It is a similar reaction,
but not exactly.

331
00:15:34,780 --> 00:15:36,610
And you tend not to
feel very comfortable.

332
00:15:36,610 --> 00:15:38,930
You got this -- maybe
a headache.

333
00:15:38,930 --> 00:15:40,530
You might have some nausea.

334
00:15:40,530 --> 00:15:42,710
It depends on the individual.

335
00:15:42,710 --> 00:15:47,620
And what's the good news is, is
that goes away after a few days.

336
00:15:47,620 --> 00:15:48,970
The body adapts.

337
00:15:48,970 --> 00:15:52,450
You tend to, you know,
not notice it anymore.

338
00:15:52,450 --> 00:15:55,770
An analogy I would draw is if
you ever had a tooth filled,

339
00:15:55,770 --> 00:15:58,220
you know, with a cavity
and you had a filling done

340
00:15:58,220 --> 00:16:01,580
or you had work done on your
teeth, you know, the first day

341
00:16:01,580 --> 00:16:04,240
or two that you had that
filling, you tend to notice it.

342
00:16:04,240 --> 00:16:06,530
But then after a few
days or three days,

343
00:16:06,530 --> 00:16:08,260
you don't notice it anymore.

344
00:16:08,260 --> 00:16:09,810
You get used to that feeling.

345
00:16:09,810 --> 00:16:14,110
And it's sort of the same with
space adaptation syndrome.

346
00:16:14,110 --> 00:16:16,130
>> Kelly Humphries: Okay.

347
00:16:16,130 --> 00:16:17,570
Another question?

348
00:16:17,570 --> 00:16:20,740
>> Brian Brookes
[assumed spelling]:

349
00:16:20,740 --> 00:16:23,350
My name is Brian Brookes,

I'm in ninth grade.

350
00:16:23,350 --> 00:16:24,140
I'm a freshman.

351
00:16:24,140 --> 00:16:28,810
And I wanted to know what
does up in space smell like?

352
00:16:28,810 --> 00:16:30,200
>> Mario Runco: Did
I get that right?

353
00:16:30,200 --> 00:16:31,290
>> Kelly Humphries:
What does space --

354
00:16:31,290 --> 00:16:33,290
>> Mario Runco: Smell --
what does space smell like?

355
00:16:33,290 --> 00:16:34,880
That's a darn good question.

356
00:16:34,880 --> 00:16:39,910
Actually, the direct
answer is nobody knows

357
00:16:39,910 --> 00:16:43,400
because space would not
have smell if you're outside

358
00:16:43,400 --> 00:16:46,430
because it's basically a vacuum.

359
00:16:46,430 --> 00:16:50,010
And there's no way to sense
odors 'cause we need atmosphere

360

00:16:50,010 --> 00:16:52,090
and air for -- to
pass over our nostrils

361
00:16:52,090 --> 00:16:54,220
to have a sense of smell.

362
00:16:54,220 --> 00:16:58,400
Having said that, there is
a sense of odor in space.

363
00:16:58,400 --> 00:17:03,400
And that tends to be
like a new car smell.

364
00:17:03,400 --> 00:17:04,500
If you get into a new car.

365
00:17:04,500 --> 00:17:06,590
Everybody -- most
people like the smell.

366
00:17:06,590 --> 00:17:07,610
You take it in.

367
00:17:07,610 --> 00:17:10,970
And that is from the
outgassing of the materials

368
00:17:10,970 --> 00:17:13,000
of which the car is made.

369
00:17:13,000 --> 00:17:14,970
And depending upon
the spacecraft,

370
00:17:14,970 --> 00:17:17,150
in the case of the
space shuttle,

371
00:17:17,150 --> 00:17:18,300
I was not aware of that.

372
00:17:18,300 --> 00:17:20,700
And you kind of get used
to it because you operate

373
00:17:20,700 --> 00:17:22,980
in a similar environment
in simulators.

374
00:17:22,980 --> 00:17:26,820
You actually train in the space
shuttle at times before launch.

375
00:17:26,820 --> 00:17:28,520
So you're in the real vehicle.

376
00:17:28,520 --> 00:17:32,680
And you're also inside
your suits at times.

377
00:17:32,680 --> 00:17:36,120
And what I noticed one
time after being removed

378
00:17:36,120 --> 00:17:40,350
from the space shuttle after
several years, I got back inside

379
00:17:40,350 --> 00:17:44,900
of one, and what
struck me was the odor.

380
00:17:44,900 --> 00:17:50,000
The smell of the space
shuttle itself is

381
00:17:50,000 --> 00:17:54,200

that combined collective of
outgassing from the materials

382
00:17:54,200 --> 00:17:56,190
in the space shuttle, at least

383
00:17:56,190 --> 00:17:57,720
in the case of the
space shuttle.

384
00:17:57,720 --> 00:18:02,700
And it hit me that
that's the smell of space.

385
00:18:02,700 --> 00:18:06,580
So it's not really the
space outside that smells.

386
00:18:06,580 --> 00:18:08,580
It's the things that
we bring with us

387
00:18:08,580 --> 00:18:12,780
that actually give us
a sense of orientation

388
00:18:12,780 --> 00:18:15,470
from a sense of smell
perspective.

389
00:18:15,470 --> 00:18:17,190
>> Kelly Humphries: Now,
you're a veteran spacewalker.

390
00:18:17,190 --> 00:18:19,540
I understand there is a
special smell that comes

391
00:18:19,540 --> 00:18:20,960
with coming back in the airlock

392
00:18:20,960 --> 00:18:22,950
after a spacewalk,
for some folks.

393
00:18:22,950 --> 00:18:23,460
>> Mario Runco: Yes.

394
00:18:23,460 --> 00:18:27,010
When you come back in and
pop your helmet off, again,

395
00:18:27,010 --> 00:18:32,470
it's that odor of the
spacecraft that hits you,

396
00:18:32,470 --> 00:18:35,810
that it's like a sense of home.

397
00:18:35,810 --> 00:18:40,030
I mean, if you walk into
various retail stores

398
00:18:40,030 --> 00:18:42,870
or somebody's home,
there's a slightly different

399
00:18:42,870 --> 00:18:44,240
characteristic odor.

400
00:18:44,240 --> 00:18:47,420
And that's -- you know, if
it's your home and that's --

401
00:18:47,420 --> 00:18:48,970
and if it's something
wrong or different,

402
00:18:48,970 --> 00:18:50,490

then you'll notice it.

403
00:18:50,490 --> 00:18:50,820
>> Kelly Humphries: Okay.

404
00:18:50,820 --> 00:18:51,330
>> Mario Runco: Yeah.

405
00:18:51,330 --> 00:18:51,560
>> Kelly Humphries: Well,

406
00:18:51,560 --> 00:18:53,950
I understand that's all
the time we have for today.

407
00:18:53,950 --> 00:18:56,770
We want to thank you folks
for being with us today.

408
00:18:56,770 --> 00:18:58,210
And thank you, Mario --

409
00:18:58,210 --> 00:18:58,490
>> Mario Runco: My pleasure.

410
00:18:58,490 --> 00:18:59,040
>> Kelly Humphries:
For joining us

411
00:18:59,040 --> 00:19:00,440
and answering the
students' questions.

412
00:19:00,440 --> 00:19:08,160
We hope you have a great rest
of your day and a great weekend.

413
00:19:08,160 --> 00:19:09,580
>> Mario Runco: Take care, guys.

414
00:19:09,580 --> 00:19:09,810
>> Thank you.