
Google+
NASA

1
00:00:02,810 --> 00:00:01,010
Ryan's not look like from the outside

2
00:00:04,579 --> 00:00:02,820
but we've got a couple of astronauts in

3
00:00:06,380 --> 00:00:04,589
the inside who are ready to answer some

4
00:00:07,760 --> 00:00:06,390
questions for us Leland Melvin who is

5
00:00:10,610 --> 00:00:07,770
also the associate administrator for

6
00:00:16,580 --> 00:00:10,620
education for NASA and Rex Walheim can

7
00:00:17,810 --> 00:00:16,590
y'all wave and say hi hello okay I'm

8
00:00:19,130 --> 00:00:17,820
gonna let y'all kind of introduce

9
00:00:20,769 --> 00:00:19,140
yourself then tell a little bit about

10
00:00:23,029 --> 00:00:20,779
Orion and then we'll take some questions

11
00:00:25,370 --> 00:00:23,039
sure I'll start out my name is Rex

12
00:00:26,839 --> 00:00:25,380
Walheim I'm NASA astronaut I flown three

13
00:00:29,570 --> 00:00:26,849

times in the space shuttle over the last

14
00:00:31,519 --> 00:00:29,580
10 11 years and I we're sitting here in

15
00:00:32,810 --> 00:00:31,529
the Orion spacecraft which is really

16
00:00:35,479 --> 00:00:32,820
exciting because after the Space Shuttle

17
00:00:36,920 --> 00:00:35,489
retired this is vehicle it's going to

18
00:00:39,290 --> 00:00:36,930
take us even farther than we've ever

19
00:00:41,330 --> 00:00:39,300
been in space before and we really

20
00:00:43,160 --> 00:00:41,340
excited about the program Orion we're

21
00:00:44,810 --> 00:00:43,170
going to fly the first test mission next

22
00:00:46,279 --> 00:00:44,820
year it's an unmanned mission but is

23
00:00:47,600 --> 00:00:46,289
going to send us 15 times farther than

24
00:00:49,100 --> 00:00:47,610
the out through the space station so

25
00:00:51,889 --> 00:00:49,110
it's an exciting time in the space

26
00:00:54,619 --> 00:00:51,899
program Leon hey thanks Rex and I Rex

27
00:00:56,660 --> 00:00:54,629
and I flew together an SES 122 and 2008

28
00:00:58,340 --> 00:00:56,670
when they're fantastic yes yeah but I've

29
00:01:00,770 --> 00:00:58,350
hung up my space boots and I phone a

30
00:01:02,569 --> 00:01:00,780
couple times in space on SCS 122 and 129

31
00:01:04,820 --> 00:01:02,579
and i'm in charge of all of NASA's

32
00:01:06,800 --> 00:01:04,830
education program so we just kicked off

33
00:01:08,300 --> 00:01:06,810
the exploration design challenge today

34
00:01:11,300 --> 00:01:08,310
so all of you out there students out

35
00:01:14,990 --> 00:01:11,310
there K through 12 go to nasa gov /

36
00:01:16,730 --> 00:01:15,000
education / EDC and help us build a

37
00:01:19,310 --> 00:01:16,740
radiation shield so we can send

38
00:01:21,350 --> 00:01:19,320

astronauts to space safely as well as

39
00:01:24,560 --> 00:01:21,360
maybe you guys one day so bring on your

40
00:01:27,230 --> 00:01:24,570
questions all right our first question

41
00:01:29,390 --> 00:01:27,240
to be from Twitter and that is a will do

42
00:01:32,510 --> 00:01:29,400
Ryan or the NPC V and eventually have

43
00:01:35,359 --> 00:01:32,520
the ability to land or even travel for

44
00:01:37,310 --> 00:01:35,369
periods longer than six months that's a

45
00:01:39,920 --> 00:01:37,320
that's what we want to now the MPCV by

46
00:01:41,600 --> 00:01:39,930
itself is a 21-day mission vehicle so it

47
00:01:42,679 --> 00:01:41,610
can get us to the vicinity of the moon

48
00:01:44,330 --> 00:01:42,689
we can stay there for a little while but

49
00:01:45,980 --> 00:01:44,340
then we have to come home now we want to

50
00:01:47,870 --> 00:01:45,990
go the longer duration we have to

51
00:01:49,609 --> 00:01:47,880
develop a vehicle I can that can help us

52
00:01:51,050 --> 00:01:49,619
transit the big distance between you

53
00:01:53,120 --> 00:01:51,060
know Earth and Mars or something like

54
00:01:55,190 --> 00:01:53,130
that so we'll have to have a you know a

55
00:01:56,690 --> 00:01:55,200
habitation module of some sort to go the

56
00:02:01,730 --> 00:01:56,700
longer longer durations and longer

57
00:02:02,719 --> 00:02:01,740
distances and that's one of the reasons

58
00:02:05,780 --> 00:02:02,729
I guess that we need that radiation

59
00:02:07,789 --> 00:02:05,790
shield right exactly the radiation

60
00:02:09,680 --> 00:02:07,799
shield is going to help us protect our

61
00:02:11,930 --> 00:02:09,690
astronauts from these high-energy

62
00:02:13,400 --> 00:02:11,940
radiation blast and sometimes like when

63
00:02:16,130 --> 00:02:13,410

you walk around on the plan

64
00:02:18,320 --> 00:02:16,140
for a year you receive about 360 Miller

65
00:02:21,290 --> 00:02:18,330
Miller REM of radiation so that's about

66
00:02:24,410 --> 00:02:21,300
four to five chest x-rays but when you

67
00:02:26,720 --> 00:02:24,420
go to space you can receive a radiation

68
00:02:29,930 --> 00:02:26,730
blast from a solar flare that it sees

69
00:02:32,270 --> 00:02:29,940
about 7,000 rim so that's orders of

70
00:02:34,180 --> 00:02:32,280
magnitude more so we have to be shielded

71
00:02:40,220 --> 00:02:34,190
to ensure their astronauts remain safe

72
00:02:41,840 --> 00:02:40,230
maybe you Rex yeah okay our next

73
00:02:43,280 --> 00:02:41,850
question um I guess I people are

74
00:02:44,570 --> 00:02:43,290
probably looking and seeing you inside

75
00:02:46,460 --> 00:02:44,580
of it and looks a little small so they

76
00:02:50,900 --> 00:02:46,470
asked is the Orion spacecraft too little

77
00:02:53,300 --> 00:02:50,910
for long it's too little for lunch 24

78
00:02:55,070 --> 00:02:53,310
long bodega for long missions well you

79
00:02:57,050 --> 00:02:55,080
know it for a 21-day mission this would

80
00:02:59,150 --> 00:02:57,060
be big enough you know Leo and I've have

81
00:03:00,920 --> 00:02:59,160
been on space missions for about 14 days

82
00:03:02,570 --> 00:03:00,930
with as in the space shuttle which is a

83
00:03:04,430 --> 00:03:02,580
little bit bigger than this but this

84
00:03:05,600 --> 00:03:04,440
volume would be fine for 21 days but if

85
00:03:07,160 --> 00:03:05,610
you want to go too long missions that's

86
00:03:08,600 --> 00:03:07,170
where you do have to have a habitation

87
00:03:10,430 --> 00:03:08,610
module and so that's gonna be a little

88
00:03:13,100 --> 00:03:10,440

bigger give you a little bit room to to

89
00:03:14,930 --> 00:03:13,110
have the facilities you need to extend

90
00:03:17,750 --> 00:03:14,940
have an extended voyage out to Mars or

91
00:03:19,730 --> 00:03:17,760
other destination like an asteroid in

92
00:03:21,199 --> 00:03:19,740
this remember you can use all the volume

93
00:03:23,000 --> 00:03:21,209
in here so remember the first time we

94
00:03:24,800 --> 00:03:23,010
trained around the galley on the space

95
00:03:26,060 --> 00:03:24,810
shuttle we're all trying to fight around

96
00:03:28,580 --> 00:03:26,070
the galley trying to get in there to

97
00:03:30,530 --> 00:03:28,590
prepare our meals but in space people

98
00:03:32,390 --> 00:03:30,540
can be upside down right side up you

99
00:03:35,270 --> 00:03:32,400
know all in different orientations to

100
00:03:37,430 --> 00:03:35,280
use that same area so the volume you can

101
00:03:38,600 --> 00:03:37,440
expand out and use more the volume but

102
00:03:41,449 --> 00:03:38,610
still as rich said you need more of a

103
00:03:43,910 --> 00:03:41,459
habitation module to keep us from

104
00:03:45,260 --> 00:03:43,920
getting too claustrophobic and the only

105
00:03:47,900 --> 00:03:45,270
problem is when you're launching yeah I

106
00:03:49,880 --> 00:03:47,910
launch sitting next to leland on sds 122

107
00:03:51,560 --> 00:03:49,890
and he's kind of a big guy you know he's

108
00:03:52,970 --> 00:03:51,570
a former professional athlete and so

109
00:03:54,770 --> 00:03:52,980
we're in our spacesuits and we're

110
00:03:56,390 --> 00:03:54,780
sitting like this and so finally one day

111
00:03:57,530 --> 00:03:56,400
I said to Steve my commander said hey

112
00:03:58,729 --> 00:03:57,540
Steve next time we watch with a

113
00:04:00,530 --> 00:03:58,739

professional athlete can we pick a

114
00:04:06,020 --> 00:04:00,540
jockey no make it a little bit easier

115
00:04:08,120 --> 00:04:06,030
for a launch phase funny man all right

116
00:04:10,670 --> 00:04:08,130
and the next question I they asked will

117
00:04:17,420 --> 00:04:10,680
spacecraft of the future be built out of

118
00:04:19,670 --> 00:04:17,430
the atmosphere I can sure Whittle

119
00:04:22,880 --> 00:04:19,680
spacecraft of the future be built out of

120
00:04:24,409 --> 00:04:22,890
the Earth's atmosphere I guess like

121
00:04:26,060 --> 00:04:24,419
we're doing that work like we did the

122
00:04:28,430 --> 00:04:26,070
International Space Station

123
00:04:31,850 --> 00:04:28,440
are you talking about the distances the

124
00:04:33,680 --> 00:04:31,860
vehicles go and where we'll build it

125
00:04:35,000 --> 00:04:33,690
with a build it here on earth or out and

126
00:04:36,440 --> 00:04:35,010
how does a good question yeah when we

127
00:04:37,520 --> 00:04:36,450
build them here on earth well for the

128
00:04:38,960 --> 00:04:37,530
Orion program we're going to build them

129
00:04:40,340 --> 00:04:38,970
here on earth now the components will be

130
00:04:41,930 --> 00:04:40,350
built here we've made juice minor

131
00:04:43,580 --> 00:04:41,940
assembly when we go to the long missions

132
00:04:45,380 --> 00:04:43,590
to an asteroid er to Mars we may have to

133
00:04:46,910 --> 00:04:45,390
assemble them in low-earth orbit but the

134
00:04:48,770 --> 00:04:46,920
vast majority we want a symbol here on

135
00:04:50,510 --> 00:04:48,780
earth and the reason is is really tough

136
00:04:51,650 --> 00:04:50,520
to make things in space you know we

137
00:04:53,420 --> 00:04:51,660
learned a tremendous amount from the

138
00:04:55,160 --> 00:04:53,430

International Space Station but it takes

139
00:04:56,810 --> 00:04:55,170
a long time you know it took us 10 years

140
00:04:58,280 --> 00:04:56,820
or more to build the space station and

141
00:05:00,260 --> 00:04:58,290
so we don't want to have that long

142
00:05:03,410 --> 00:05:00,270
assembly process when we go to Mars or

143
00:05:05,720 --> 00:05:03,420
an asteroid so we will most likely have

144
00:05:06,890 --> 00:05:05,730
the basic crew vehicle will be here or

145
00:05:08,480 --> 00:05:06,900
in Orion and then we'll have a

146
00:05:09,740 --> 00:05:08,490
habitation module and maybe a land or

147
00:05:16,430 --> 00:05:09,750
whatever else we need for our various

148
00:05:18,620 --> 00:05:16,440
missions okay and our next question is

149
00:05:21,020 --> 00:05:18,630
from Michael kimmage from on Twitter he

150
00:05:22,480 --> 00:05:21,030
asked what right will the spacecraft

151
00:05:25,340 --> 00:05:22,490
travel and how will you prevent

152
00:05:29,210 --> 00:05:25,350
devastating collisions from space debris

153
00:05:31,970 --> 00:05:29,220
or asteroids how do we avoid collisions

154
00:05:35,210 --> 00:05:31,980
in space it's a very good question

155
00:05:37,280 --> 00:05:35,220
Michael um right now we are tracking a

156
00:05:39,110 --> 00:05:37,290
number of particles that are floating

157
00:05:41,180 --> 00:05:39,120
around in space above and around space

158
00:05:43,670 --> 00:05:41,190
station so if there's a there's a I

159
00:05:45,320 --> 00:05:43,680
think a two-centimeter and I guess to

160
00:05:46,910 --> 00:05:45,330
similar size particle if it's going to

161
00:05:50,120 --> 00:05:46,920
be on a collision path with space

162
00:05:52,070 --> 00:05:50,130
station we will actually do a burn to do

163
00:05:54,340 --> 00:05:52,080

an orbital just burn to move out of the

164
00:05:57,410 --> 00:05:54,350
way because those particles traveling

165
00:05:59,690 --> 00:05:57,420
seven kilometers per second can do

166
00:06:02,300 --> 00:05:59,700
considerable damage to the shell to the

167
00:06:04,430 --> 00:06:02,310
the vehicle itself and you could have a

168
00:06:05,570 --> 00:06:04,440
puncture in the in the module itself so

169
00:06:07,510 --> 00:06:05,580
that would you know make us have to come

170
00:06:10,210 --> 00:06:07,520
home so we have to definitely detect

171
00:06:12,890 --> 00:06:10,220
debris out there and be able to do

172
00:06:17,680 --> 00:06:12,900
collision avoidance maneuvers to ensure

173
00:06:20,120 --> 00:06:17,690
that we don't bump into it good question

174
00:06:21,740 --> 00:06:20,130
okay and then we also got asked how do

175
00:06:26,500 --> 00:06:21,750
you protect astronauts from space

176
00:06:28,420 --> 00:06:26,510
radiation must've space radiation

177
00:06:29,830 --> 00:06:28,430
okay well there that you know that's a

178
00:06:31,630 --> 00:06:29,840
critical question and that's kind of why

179
00:06:33,400 --> 00:06:31,640
we have this design challenge is you

180
00:06:35,410 --> 00:06:33,410
know you say well we've been going to

181
00:06:37,030 --> 00:06:35,420
space for 450 years now how can we

182
00:06:38,770 --> 00:06:37,040
haven't solved this problem well the

183
00:06:40,060 --> 00:06:38,780
main reasons we haven't needed to yet

184
00:06:41,620 --> 00:06:40,070
except for on the Apollo missions we

185
00:06:43,600 --> 00:06:41,630
haven't gone beyond low-earth orbit

186
00:06:45,100 --> 00:06:43,610
because the the Earth's environment the

187
00:06:46,180 --> 00:06:45,110
magnetosphere protects you when you're a

188
00:06:47,950 --> 00:06:46,190

low-earth orbit so when we're at the

189
00:06:49,390 --> 00:06:47,960
space station we have to be careful

190
00:06:51,520 --> 00:06:49,400
about radiation but not anywhere near

191
00:06:52,750 --> 00:06:51,530
the magnitude of the radiation outside

192
00:06:54,100 --> 00:06:52,760
farther away from the earth because the

193
00:06:56,290 --> 00:06:54,110
space station altitude is about you know

194
00:06:57,370 --> 00:06:56,300
between 202 and 50 miles up when you go

195
00:06:59,170 --> 00:06:57,380
farther than that you lose the

196
00:07:01,300 --> 00:06:59,180
protection of the Earth from radiation

197
00:07:02,770 --> 00:07:01,310
and then you really need this protection

198
00:07:04,090 --> 00:07:02,780
so there's very people are looking at

199
00:07:05,950 --> 00:07:04,100
various ways and we're trying to figure

200
00:07:07,450 --> 00:07:05,960
out what the best way is whether use

201
00:07:09,130 --> 00:07:07,460
water for shielding or whether use

202
00:07:10,480 --> 00:07:09,140
different materials for shielding you

203
00:07:11,710 --> 00:07:10,490
know you might want to use let hey let's

204
00:07:13,360 --> 00:07:11,720
use lead shielding well there's a little

205
00:07:15,010 --> 00:07:13,370
problem with that when it cost 10,000

206
00:07:16,930 --> 00:07:15,020
pounds to just get ten thousand dollars

207
00:07:18,340 --> 00:07:16,940
to get a pound of material to orbit you

208
00:07:20,050 --> 00:07:18,350
realize it'd be very expensive to have

209
00:07:21,220 --> 00:07:20,060
lead shielding so we're looking at

210
00:07:22,480 --> 00:07:21,230
different things but there are options

211
00:07:23,770 --> 00:07:22,490
and we're gonna try to study those and

212
00:07:27,790 --> 00:07:23,780
figure out what the best one is and

213
00:07:29,530 --> 00:07:27,800

another option that people are at people

214
00:07:31,690 --> 00:07:29,540
are actually looking at how could you

215
00:07:33,640 --> 00:07:31,700
radiation hardened the body because we

216
00:07:35,050 --> 00:07:33,650
right now we radiation hard micro

217
00:07:36,730 --> 00:07:35,060
electronics are there ways that you

218
00:07:38,440 --> 00:07:36,740
could do some countermeasures to

219
00:07:40,870 --> 00:07:38,450
actually do something to your body to

220
00:07:42,430 --> 00:07:40,880
where your your body is rat hardened and

221
00:07:44,170 --> 00:07:42,440
so those are other ways you can do

222
00:07:45,840 --> 00:07:44,180
something from a biological standpoint

223
00:07:48,070 --> 00:07:45,850
so maybe it's a combination of

224
00:07:50,080 --> 00:07:48,080
biological and shielding but you know we

225
00:07:52,000 --> 00:07:50,090
look at the rocket equation mass is in

226
00:07:53,470 --> 00:07:52,010
the Iraqi equation so is Rick said if

227
00:07:55,090 --> 00:07:53,480
you use lead you're going to have a

228
00:07:57,190 --> 00:07:55,100
problem with your propulsion system

229
00:07:59,680 --> 00:07:57,200
getting yourself up to Mars or two or

230
00:08:02,620 --> 00:07:59,690
asteroid so you want a lighted vehicle

231
00:08:04,330 --> 00:08:02,630
as possible with as much shielding as

232
00:08:08,040 --> 00:08:04,340
possible but the shielding should be

233
00:08:10,180 --> 00:08:08,050
lightweight good question all right um

234
00:08:11,530 --> 00:08:10,190
our next question you'll not be able to

235
00:08:12,810 --> 00:08:11,540
answer this especially well since you've

236
00:08:15,370 --> 00:08:12,820
been in space together but are there any

237
00:08:18,220 --> 00:08:15,380
psychological side effects of a human on

238
00:08:20,020 --> 00:08:18,230

a human being in space are there any

239
00:08:21,460 --> 00:08:20,030
psychological effects on human being in

240
00:08:23,110 --> 00:08:21,470
space that's a very good question and

241
00:08:24,580 --> 00:08:23,120
there are and there's going to be you

242
00:08:26,560 --> 00:08:24,590
know it's not easy staying in space for

243
00:08:27,730 --> 00:08:26,570
six months up on the space station but

244
00:08:29,560 --> 00:08:27,740
the neat thing about that is we have a

245
00:08:30,690 --> 00:08:29,570
great ability to communicate back with

246
00:08:32,650 --> 00:08:30,700
home you know we have a

247
00:08:34,900 --> 00:08:32,660
computer-generated phone where we can

248
00:08:38,200 --> 00:08:34,910
call our families in and talk to them so

249
00:08:39,610 --> 00:08:38,210
it you have a little close connection to

250
00:08:40,180 --> 00:08:39,620
to earth and you also have this

251
00:08:41,529 --> 00:08:40,190
beautiful view

252
00:08:43,450 --> 00:08:41,539
outside you look outside underneath is

253
00:08:45,880 --> 00:08:43,460
this incredible beautiful planet you can

254
00:08:47,050 --> 00:08:45,890
look at it never gets old now we go to

255
00:08:49,630 --> 00:08:47,060
for instance let's say we're going to

256
00:08:51,040 --> 00:08:49,640
Mars it's going to redefine how we do

257
00:08:52,600 --> 00:08:51,050
space flight because it's not going to

258
00:08:54,490 --> 00:08:52,610
be the same as we're doing right now for

259
00:08:56,770 --> 00:08:54,500
one thing after a few days when you're

260
00:08:58,270 --> 00:08:56,780
when you are we are going away from

261
00:08:59,740 --> 00:08:58,280
Earth all of a sudden the earth's going

262
00:09:01,810 --> 00:08:59,750
to recede has become a just a little

263
00:09:03,370 --> 00:09:01,820

star just like all the other stars and

264
00:09:04,690 --> 00:09:03,380
I've heard people say it's going to

265
00:09:06,730 --> 00:09:04,700
redefine the meaning of the word

266
00:09:08,920 --> 00:09:06,740
loneliness you know so because all your

267
00:09:10,990 --> 00:09:08,930
entire your entire being is that this

268
00:09:12,340 --> 00:09:11,000
little tiny blink of light in the in the

269
00:09:13,770 --> 00:09:12,350
horizon and that's all you see all

270
00:09:15,220 --> 00:09:13,780
around you and so you do have to

271
00:09:17,140 --> 00:09:15,230
psychological that you have to make sure

272
00:09:18,520 --> 00:09:17,150
your crews are prepared for that you

273
00:09:20,010 --> 00:09:18,530
know but it like I say it will be a

274
00:09:22,030 --> 00:09:20,020
whole new ballgame then once you get to

275
00:09:23,920 --> 00:09:22,040
Mars and on the way as you're getting

276
00:09:25,600 --> 00:09:23,930
farther away from Earth the

277
00:09:27,100 --> 00:09:25,610
communication delays start to play in

278
00:09:29,860 --> 00:09:27,110
effect it could take 20 minutes for

279
00:09:31,330 --> 00:09:29,870
conversations to reach you so you can't

280
00:09:33,160 --> 00:09:31,340
have a normal conversation once you say

281
00:09:35,320 --> 00:09:33,170
something that may take up to 20 minutes

282
00:09:37,240 --> 00:09:35,330
or so to get to earth and then maybe 20

283
00:09:38,380 --> 00:09:37,250
minutes to get back so you can't

284
00:09:39,640 --> 00:09:38,390
communicate that way so you have to

285
00:09:41,770 --> 00:09:39,650
figure out new ways of talking to people

286
00:09:42,790 --> 00:09:41,780
so it's going to be very different you

287
00:09:44,770 --> 00:09:42,800
know but people say well who would want

288
00:09:46,180 --> 00:09:44,780

to do that well true explorers you know

289
00:09:48,850 --> 00:09:46,190
the people who left their countries in

290
00:09:50,500 --> 00:09:48,860
the in the olden days and and sailed

291
00:09:52,300 --> 00:09:50,510
away to a new world those are the kind

292
00:09:53,560 --> 00:09:52,310
of people that that can do these kind of

293
00:09:54,970 --> 00:09:53,570
mission is not going to be easy but

294
00:09:56,170 --> 00:09:54,980
there's explorers out there maybe some

295
00:09:57,910 --> 00:09:56,180
of you listening out there that kind of

296
00:09:59,620 --> 00:09:57,920
people could do that someday it'll be

297
00:10:01,450 --> 00:09:59,630
tough but with a lot of psychological

298
00:10:02,380 --> 00:10:01,460
support and really thinking about how

299
00:10:04,870 --> 00:10:02,390
you going to handle things I think we

300
00:10:06,340 --> 00:10:04,880
could do it that's great you know cuz I

301
00:10:08,290 --> 00:10:06,350
know when I flew with Rex we had

302
00:10:09,520 --> 00:10:08,300
psychological support for each other we

303
00:10:11,650 --> 00:10:09,530
had some problems that happen on our

304
00:10:13,720 --> 00:10:11,660
flight and we all banded together to

305
00:10:15,550 --> 00:10:13,730
make those problems go away and I think

306
00:10:17,710 --> 00:10:15,560
that's the same thing that any crew

307
00:10:19,570 --> 00:10:17,720
training for a two-year really about a

308
00:10:21,490 --> 00:10:19,580
two and a half year mission gonna have

309
00:10:23,440 --> 00:10:21,500
to really be close and really depend on

310
00:10:25,000 --> 00:10:23,450
each other because the model that we use

311
00:10:27,190 --> 00:10:25,010
now where we constantly talk to the

312
00:10:29,350 --> 00:10:27,200
ground for support and for getting

313
00:10:31,810 --> 00:10:29,360

questions and questions answered on a

314
00:10:33,370 --> 00:10:31,820
fairly quick time frame it's not going

315
00:10:35,230 --> 00:10:33,380
to happen on Mars and so you have to be

316
00:10:37,660 --> 00:10:35,240
a lot more self-sufficient maybe use

317
00:10:39,160 --> 00:10:37,670
more robotic analogs and things that can

318
00:10:41,110 --> 00:10:39,170
help you with getting your missions in

319
00:10:42,820 --> 00:10:41,120
your task done but again that

320
00:10:44,530 --> 00:10:42,830
psychological you know that

321
00:10:46,510 --> 00:10:44,540
psychological element would have to

322
00:10:48,310 --> 00:10:46,520
really get people that can handle being

323
00:10:50,890 --> 00:10:48,320
alone in that environment for much

324
00:10:52,240 --> 00:10:50,900
longer period yeah you handle it be able

325
00:10:53,829 --> 00:10:52,250
to handle being alone and you really

326
00:10:54,110 --> 00:10:53,839
have to to bring out the teamwork in

327
00:10:56,420 --> 00:10:54,120
each

328
00:10:57,769 --> 00:10:56,430
and find a group that can get along with

329
00:10:59,510 --> 00:10:57,779
each other and then then train him a

330
00:11:01,400 --> 00:10:59,520
team working you know like when yeah

331
00:11:03,290 --> 00:11:01,410
that's right when when Leland and I were

332
00:11:04,430 --> 00:11:03,300
assigned a mission st s 120 to one of

333
00:11:05,870 --> 00:11:04,440
the first things we did when we got a

334
00:11:07,430 --> 00:11:05,880
sign was we went out to a National

335
00:11:09,650 --> 00:11:07,440
Outdoor Leadership School you know

336
00:11:11,000 --> 00:11:09,660
basically an outdoor camping trip for 10

337
00:11:13,340 --> 00:11:11,010
days where they stress you make you

338
00:11:15,110 --> 00:11:13,350

climb down canyons and back up and you

339
00:11:16,880 --> 00:11:15,120
know make your own food try to find

340
00:11:18,470 --> 00:11:16,890
water sources it was very stressful but

341
00:11:20,470 --> 00:11:18,480
it was great because it made us learn to

342
00:11:22,700 --> 00:11:20,480
communicate with each other and it also

343
00:11:24,350 --> 00:11:22,710
helped us learn about each other like I

344
00:11:26,090 --> 00:11:24,360
knew it if Leland got grumpy just bring

345
00:11:27,829 --> 00:11:26,100
out some food if we'll give him that you

346
00:11:29,090 --> 00:11:27,839
feel ill he gets a lot happier and

347
00:11:30,350 --> 00:11:29,100
that's an important key i need to know

348
00:11:31,550 --> 00:11:30,360
you know when i'm in space hey Leland

349
00:11:33,800 --> 00:11:31,560
looks a little down here you know throw

350
00:11:35,720 --> 00:11:33,810
a shrimp cocktail you know me hey I got

351
00:11:37,040 --> 00:11:35,730
some chocolate pudding cake here leyland

352
00:11:38,600 --> 00:11:37,050
and then the lead once back in the game

353
00:11:39,680 --> 00:11:38,610
so you learn those things the training

354
00:11:43,640 --> 00:11:39,690
program that will help you in a long

355
00:11:45,650 --> 00:11:43,650
long mission to Mars so I have a

356
00:11:47,600 --> 00:11:45,660
question maybe I can answer this for

357
00:11:50,600 --> 00:11:47,610
each other Rex is would Leyland be up to

358
00:11:52,250 --> 00:11:50,610
that challenge and Leland would Rex you

359
00:11:54,829 --> 00:11:52,260
know I think Lee would we be at would

360
00:11:56,000 --> 00:11:54,839
ask what I'm gonna answer weatherly want

361
00:11:57,350 --> 00:11:56,010
to be up to the challenge and I think he

362
00:11:59,480 --> 00:11:57,360
would be he has one of the perfect

363
00:12:01,430 --> 00:11:59,490

personalities to to fly in space he's

364
00:12:03,350 --> 00:12:01,440
he's very easy to get along with he's it

365
00:12:05,000 --> 00:12:03,360
good-natured and got a great sense humor

366
00:12:07,550 --> 00:12:05,010
so I think he would be one of the ideal

367
00:12:08,930 --> 00:12:07,560
candidates for a long mission and i

368
00:12:10,340 --> 00:12:08,940
think i would love to fly with Rex when

369
00:12:12,949 --> 00:12:10,350
long-duration mission because he's not

370
00:12:15,500 --> 00:12:12,959
only brilliant but he cracks he makes

371
00:12:17,690 --> 00:12:15,510
these funny one liner jokes that is keep

372
00:12:18,949 --> 00:12:17,700
everyone in stitches like you know how

373
00:12:21,110 --> 00:12:18,959
did the what was I want to have the

374
00:12:23,780 --> 00:12:21,120
chicken cost of why why didn't the

375
00:12:26,750 --> 00:12:23,790
skeleton cross the road because he had

376
00:12:28,760 --> 00:12:26,760
no guts see see what I mean so we would

377
00:12:32,630 --> 00:12:28,770
laugh all day long this was we were in

378
00:12:34,010 --> 00:12:32,640
our t CDT countdown training in Rex's

379
00:12:35,900 --> 00:12:34,020
they're cracking jokes so you need

380
00:12:38,000 --> 00:12:35,910
people they can work well together they

381
00:12:39,290 --> 00:12:38,010
can play well together they can they can

382
00:12:41,030 --> 00:12:39,300
laugh at each other and laugh at

383
00:12:43,460 --> 00:12:41,040
themselves yeah and I have that

384
00:12:45,199 --> 00:12:43,470
psychological edge so well yeah I would

385
00:12:47,300 --> 00:12:45,209
love to fly with Rex again corny jokes

386
00:12:48,650 --> 00:12:47,310
but when you're sit on your back on tons

387
00:12:50,090 --> 00:12:48,660
of high explosives you gotta have a

388
00:12:53,630 --> 00:12:50,100

little bit of a sense of humor about us

389
00:12:56,540 --> 00:12:53,640
really okay we've got some technical

390
00:12:59,210 --> 00:12:56,550
questions now on Orion and we're at via

391
00:13:03,079 --> 00:12:59,220
nesto when will we see it launched and

392
00:13:04,250 --> 00:13:03,089
what's its source of energy ok the

393
00:13:05,870 --> 00:13:04,260
question was when are we going to see a

394
00:13:07,370 --> 00:13:05,880
launch and Orion and our first test

395
00:13:07,879 --> 00:13:07,380
flight is going to be next year so

396
00:13:09,699 --> 00:13:07,889
really excite

397
00:13:13,039 --> 00:13:09,709
about that we're going to launch a a

398
00:13:14,210 --> 00:13:13,049
Ryan vehicle on a delta for heavy launch

399
00:13:15,979 --> 00:13:14,220
vehicle so it's an expendable launch

400
00:13:17,090 --> 00:13:15,989
vehicle it's not going to be man it's

401
00:13:19,999 --> 00:13:17,100
going to be a test mission so we're

402
00:13:21,919 --> 00:13:20,009
going to send a a Ryan capsule up about

403
00:13:25,309 --> 00:13:21,929
15 times the L to the space station so

404
00:13:26,989 --> 00:13:25,319
about 3,700 miles and we're going to be

405
00:13:29,059 --> 00:13:26,999
able to test its reentry systems its

406
00:13:30,739 --> 00:13:29,069
orientation systems and and basically

407
00:13:32,809 --> 00:13:30,749
get a first look at how the Orion

408
00:13:34,429 --> 00:13:32,819
vehicle performs that's the that's next

409
00:13:35,749 --> 00:13:34,439
year and then we're going to we're going

410
00:13:37,669 --> 00:13:35,759
to be hopefully flying our first mission

411
00:13:40,460 --> 00:13:37,679
on top of this the Space Launch System

412
00:13:41,479 --> 00:13:40,470
in about 20 17 so it's all coming up

413
00:13:43,669 --> 00:13:41,489

it's going to take a while cuz it's a

414
00:13:45,079 --> 00:13:43,679
big program to build but there's some

415
00:13:46,699 --> 00:13:45,089
exciting things coming up and what is

416
00:13:48,229 --> 00:13:46,709
powered by for the launch system is

417
00:13:50,059 --> 00:13:48,239
liquid hydrogen liquid oxygen for the

418
00:13:51,739 --> 00:13:50,069
for the salt for the liquid liquid

419
00:13:58,309 --> 00:13:51,749
boosters and then maybe solid rocket

420
00:14:00,769 --> 00:13:58,319
boosters for the strap ons okay and then

421
00:14:03,109 --> 00:14:00,779
we also got asked them how will I Ryan

422
00:14:06,199 --> 00:14:03,119
return to earth and will it visit the

423
00:14:09,229 --> 00:14:06,209
space station okay you want to ask them

424
00:14:11,030 --> 00:14:09,239
ok the the how will return to earth it's

425
00:14:13,009 --> 00:14:11,040
a it's going to be very similar the way

426
00:14:13,879 --> 00:14:13,019
Apollo capsules return to the earthy the

427
00:14:15,439 --> 00:14:13,889
interesting thing about the Apollo

428
00:14:17,030 --> 00:14:15,449
program is those guys were really smart

429
00:14:19,069 --> 00:14:17,040
and we're learning the more we do things

430
00:14:21,319 --> 00:14:19,079
in space how smart those guys who who

431
00:14:23,030 --> 00:14:21,329
did things back the Apollo era back with

432
00:14:24,919 --> 00:14:23,040
very little calculation power they knew

433
00:14:26,840 --> 00:14:24,929
what made sense and they built a system

434
00:14:29,210 --> 00:14:26,850
that worked you know remarkably well and

435
00:14:31,220 --> 00:14:29,220
so the Orion spacecraft will come home

436
00:14:32,960 --> 00:14:31,230
on parachutes and so it'll land in the

437
00:14:34,609 --> 00:14:32,970
ocean and we'll be able to retrieve our

438
00:14:37,369 --> 00:14:34,619

crew members that way so it's very

439
00:14:37,999 --> 00:14:37,379
similar to the Apollo program and let's

440
00:14:40,340 --> 00:14:38,009
see what else was the other question

441
00:14:41,749 --> 00:14:40,350
well go to the space station first it

442
00:14:43,009 --> 00:14:41,759
will not go to the space station on the

443
00:14:45,019 --> 00:14:43,019
missions that we have planned right now

444
00:14:46,400 --> 00:14:45,029
it potentially could but it's going to

445
00:14:47,809 --> 00:14:46,410
be going to a different inclination and

446
00:14:53,689 --> 00:14:47,819
so won't be visiting the space station

447
00:14:56,600 --> 00:14:53,699
on the missions that we have planned ok

448
00:14:59,119 --> 00:14:56,610
and then one more of Arthur's spacewalks

449
00:15:03,289 --> 00:14:59,129
for repairs and that could be done on a

450
00:15:05,210 --> 00:15:03,299
deep-space journey it well there's a

451
00:15:08,389 --> 00:15:05,220
possibility of doing space walks in in

452
00:15:09,889 --> 00:15:08,399
in any in any mission because when you

453
00:15:11,059 --> 00:15:09,899
get to Mars you're going to have to you

454
00:15:12,799 --> 00:15:11,069
know get out and make sure that your

455
00:15:14,749 --> 00:15:12,809
vehicle when you land your vehicle say

456
00:15:16,669 --> 00:15:14,759
if your habitat you know when you think

457
00:15:19,279 --> 00:15:16,679
about shielding on Mars you know I think

458
00:15:21,920 --> 00:15:19,289
if you use five meters of Martian soil

459
00:15:24,500 --> 00:15:21,930
helps I think it helps

460
00:15:26,450 --> 00:15:24,510
keep about a thousand Miller Miller

461
00:15:28,850 --> 00:15:26,460
heads of radiation from coming in your

462
00:15:30,530 --> 00:15:28,860
in Europe in your habitat so you'll have

463
00:15:33,050 --> 00:15:30,540

to put on a spacesuit to go actually and

464
00:15:34,519 --> 00:15:33,060
do those types of EVs but actually doing

465
00:15:36,470 --> 00:15:34,529
the mission itself Rick's would it be

466
00:15:38,329 --> 00:15:36,480
spacewalks potentially on the first

467
00:15:40,340 --> 00:15:38,339
we're still looking at what our

468
00:15:41,870 --> 00:15:40,350
capabilities will be the the the Orion

469
00:15:42,889 --> 00:15:41,880
has a capability being depressed so you

470
00:15:45,110 --> 00:15:42,899
can open the hatch and you could

471
00:15:46,370 --> 00:15:45,120
potentially do a short space walk if we

472
00:15:47,780 --> 00:15:46,380
have all the right equipment on that so

473
00:15:49,220 --> 00:15:47,790
we're so we're looking at that now when

474
00:15:50,449 --> 00:15:49,230
we go deeper and do the more advanced

475
00:15:52,070 --> 00:15:50,459
machines then we really do want to make

476
00:15:54,050 --> 00:15:52,080
sure all our space walking capabilities

477
00:15:55,100 --> 00:15:54,060
are in place for instance you went to an

478
00:15:57,500 --> 00:15:55,110
asteroid you really want to be able to

479
00:15:58,820 --> 00:15:57,510
go out and sample the asteroid and and

480
00:16:00,920 --> 00:15:58,830
those type of things so we wouldn't have

481
00:16:02,180 --> 00:16:00,930
a spacewalk capability there the tricky

482
00:16:03,949 --> 00:16:02,190
part gets when you go to a surface where

483
00:16:05,060 --> 00:16:03,959
they go to the moon or to Mars or

484
00:16:06,650 --> 00:16:05,070
something like that then you need a new

485
00:16:07,639 --> 00:16:06,660
space suit a walking space suit because

486
00:16:09,740 --> 00:16:07,649
it's basically have on the space station

487
00:16:11,600 --> 00:16:09,750
right now is a zero-g suit so it's a

488
00:16:13,070 --> 00:16:11,610

microgravity suit so it's not built for

489
00:16:14,900 --> 00:16:13,080
walking so we need some boots that are

490
00:16:16,639 --> 00:16:14,910
built for walking and so we're going to

491
00:16:18,680 --> 00:16:16,649
work on that before we do any lunar op

492
00:16:20,600 --> 00:16:18,690
lunar up activities space walking and

493
00:16:22,490 --> 00:16:20,610
for the deep space flights how many

494
00:16:24,380 --> 00:16:22,500
people but right now we're going for

495
00:16:26,510 --> 00:16:24,390
where I have a crew of four for the

496
00:16:28,940 --> 00:16:26,520
first missions but we can flexibly that

497
00:16:30,500 --> 00:16:28,950
can flex depending on what kind of crew

498
00:16:32,120 --> 00:16:30,510
complement we need we need a but we can

499
00:16:33,920 --> 00:16:32,130
carry up to 44 people on a mission the

500
00:16:35,570 --> 00:16:33,930
bestest and mobiles for the deep space

501
00:16:36,860 --> 00:16:35,580
for deep-space mission admit it'll maybe

502
00:16:38,300 --> 00:16:36,870
a little bit different depending on what

503
00:16:39,530 --> 00:16:38,310
your habitation module is like though

504
00:16:40,519 --> 00:16:39,540
but you'd probably want at least a crew

505
00:16:41,660 --> 00:16:40,529
of four especially on the deep-space

506
00:16:43,010 --> 00:16:41,670
mission because that you need some

507
00:16:44,810 --> 00:16:43,020
redundancy and when you only have proved

508
00:16:46,220 --> 00:16:44,820
to which you could potentially fly you

509
00:16:47,750 --> 00:16:46,230
know if somebody gets sick it really

510
00:16:49,699 --> 00:16:47,760
does affect how you can do the mission

511
00:16:51,230 --> 00:16:49,709
whereas with the with a crew of four you

512
00:16:53,329 --> 00:16:51,240
can really back each other up and have

513
00:16:54,890 --> 00:16:53,339

enough people to get the job done like

514
00:16:59,860 --> 00:16:54,900
with the back each other up on 122

515
00:17:02,660 --> 00:16:59,870
that's right okay next question is

516
00:17:04,250 --> 00:17:02,670
regarding human exploration plans what

517
00:17:06,470 --> 00:17:04,260
are some of the major reasons for

518
00:17:09,949 --> 00:17:06,480
funding missions to making human life

519
00:17:13,549 --> 00:17:09,959
multi planets multiplanetary can you a

520
00:17:15,679 --> 00:17:13,559
set first stars are so so many of you I

521
00:17:17,569 --> 00:17:15,689
guess it was maybe three Fridays ago for

522
00:17:21,679 --> 00:17:17,579
five years ago there was an asteroid

523
00:17:25,270 --> 00:17:21,689
called 2012 da14 that came about 17,000

524
00:17:28,280 --> 00:17:25,280
miles from our planet now what if that

525
00:17:32,030 --> 00:17:28,290
50-yard diameter asteroid hit our planet

526
00:17:34,880 --> 00:17:32,040
in 1908 one hit I think it leveled about

527
00:17:35,780 --> 00:17:34,890
800 square miles in Siberia and it did

528
00:17:38,240 --> 00:17:35,790
even hit the

529
00:17:41,000 --> 00:17:38,250
it exploded before it hit the ground so

530
00:17:42,950 --> 00:17:41,010
what if there was some type of you know

531
00:17:45,140 --> 00:17:42,960
huge ass for coming to our planet that

532
00:17:47,510 --> 00:17:45,150
could actually be the dinosaur killers

533
00:17:50,480 --> 00:17:47,520
or the end of our civilization as we

534
00:17:52,210 --> 00:17:50,490
know it so as explorers we have to make

535
00:17:54,350 --> 00:17:52,220
sure that we keep pushing ourselves

536
00:17:57,170 --> 00:17:54,360
going off and looking at where we can

537
00:18:00,830 --> 00:17:57,180
have have a habitable place for for our

538
00:18:03,440 --> 00:18:00,840

civilization to to to flourish moon Mars

539
00:18:06,410 --> 00:18:03,450
asteroid you know wherever but I think

540
00:18:08,780 --> 00:18:06,420
we as as a civilization once we stop

541
00:18:11,270 --> 00:18:08,790
exploring and looking to go to other

542
00:18:13,070 --> 00:18:11,280
destinations who will perish as a

543
00:18:14,840 --> 00:18:13,080
civilization yeah I kind of echo that

544
00:18:16,370 --> 00:18:14,850
obviously there's you know planetary

545
00:18:17,570 --> 00:18:16,380
protection arguments about you know

546
00:18:20,380 --> 00:18:17,580
asteroids and things like that but

547
00:18:23,150 --> 00:18:20,390
there's also just the basic exploration

548
00:18:24,680 --> 00:18:23,160
aspect of that and we as humans are born

549
00:18:26,930 --> 00:18:24,690
to explore we've always wanted to know

550
00:18:28,580 --> 00:18:26,940
what's beyond the next hill and you look

551
00:18:30,350 --> 00:18:28,590
back on early in our country when

552
00:18:32,090 --> 00:18:30,360
President Jefferson sent Lewis and Clark

553
00:18:33,530 --> 00:18:32,100
on their expedition you know we didn't

554
00:18:35,780 --> 00:18:33,540
know what we didn't know he sent those

555
00:18:37,670 --> 00:18:35,790
people up to find a passage to Oregon

556
00:18:39,170 --> 00:18:37,680
and you know we didn't know the kinds of

557
00:18:40,700 --> 00:18:39,180
things we discovered we found new kinds

558
00:18:42,590 --> 00:18:40,710
of animals new kind of plants and we

559
00:18:44,240 --> 00:18:42,600
didn't know what we didn't know but the

560
00:18:45,680 --> 00:18:44,250
fact is we were better for it once we

561
00:18:47,030 --> 00:18:45,690
did know these things and we learned

562
00:18:48,260 --> 00:18:47,040
these things and people say well why

563
00:18:49,370 --> 00:18:48,270

don't you just make it a business and

564
00:18:51,230 --> 00:18:49,380
have the businesses go do space

565
00:18:52,520 --> 00:18:51,240
exploration well some of the low Earth

566
00:18:54,110 --> 00:18:52,530
orbit stuff is getting to the point

567
00:18:56,120 --> 00:18:54,120
where there's a business case for it but

568
00:18:57,560 --> 00:18:56,130
true exploration going to Mars that's

569
00:18:59,300 --> 00:18:57,570
the stuff governments do you know

570
00:19:00,860 --> 00:18:59,310
president Jefferson's in stata Lewis and

571
00:19:02,600 --> 00:19:00,870
Clark I want you to go to Oregon I want

572
00:19:04,850 --> 00:19:02,610
you to set up a 7-eleven and sell some

573
00:19:05,810 --> 00:19:04,860
goods and and make some money you know

574
00:19:06,980 --> 00:19:05,820
what he said is you know you're going to

575
00:19:08,780 --> 00:19:06,990
go out explore and that's what the

576
00:19:10,880 --> 00:19:08,790
government can do it can allow you to do

577
00:19:12,860 --> 00:19:10,890
just true exploration eventually you

578
00:19:14,210 --> 00:19:12,870
know enough people explore that country

579
00:19:15,620 --> 00:19:14,220
that there's plenty of 7-elevens and

580
00:19:17,660 --> 00:19:15,630
businesses going on in Oregon nowadays

581
00:19:18,980 --> 00:19:17,670
that is right so maybe eventually there

582
00:19:20,480 --> 00:19:18,990
will be you know business cases for

583
00:19:22,520 --> 00:19:20,490
going to deep space but right now its

584
00:19:23,810 --> 00:19:22,530
exploration and and we don't know what

585
00:19:27,860 --> 00:19:23,820
we don't know and we're gonna learn some

586
00:19:30,080 --> 00:19:27,870
exciting things from it both speaking of

587
00:19:31,520 --> 00:19:30,090
things we don't know um next question

588
00:19:35,300 --> 00:19:31,530

was have you solved the problem of

589
00:19:36,680 --> 00:19:35,310
osteoporosis effects hmm osteoporosis

590
00:19:38,720 --> 00:19:36,690
effects we're looking at a number of

591
00:19:40,550 --> 00:19:38,730
different things and well that's one of

592
00:19:42,170 --> 00:19:40,560
the things we really learned from this

593
00:19:44,060 --> 00:19:42,180
International Space Station you know we

594
00:19:45,770 --> 00:19:44,070
spent you know many years building the

595
00:19:47,289 --> 00:19:45,780
space station and now since we finished

596
00:19:49,210 --> 00:19:47,299
building it we're entering the

597
00:19:51,489 --> 00:19:49,220
of utilization we're really using the

598
00:19:52,509 --> 00:19:51,499
space station to to investigate all

599
00:19:54,039 --> 00:19:52,519
these different things we need to learn

600
00:19:56,409 --> 00:19:54,049
about because it astronauts in space

601
00:19:58,629 --> 00:19:56,419
they do suffer bone loss very similar to

602
00:20:00,399 --> 00:19:58,639
osteoporosis people who have

603
00:20:01,899 --> 00:20:00,409
osteoporosis here on earth and so we're

604
00:20:04,330 --> 00:20:01,909
finding ways whether it's through

605
00:20:06,430 --> 00:20:04,340
through medicines or exercise and

606
00:20:07,600 --> 00:20:06,440
various ways to combat osteoporosis I'm

607
00:20:10,090 --> 00:20:07,610
a my last space shuttle flight we

608
00:20:12,669 --> 00:20:10,100
actually had a test where we had some

609
00:20:14,409 --> 00:20:12,679
mice that we studied that some of them

610
00:20:15,340 --> 00:20:14,419
were given osteoporosis drugs and some

611
00:20:17,019 --> 00:20:15,350
of them weren't we're trying to figure

612
00:20:19,659 --> 00:20:17,029
out what those work to decrease bone

613
00:20:21,129 --> 00:20:19,669

loss there's really exciting science

614
00:20:22,299 --> 00:20:21,139
going on in the osteoporosis area in the

615
00:20:24,220 --> 00:20:22,309
bone loss areas and so we're going to

616
00:20:26,859 --> 00:20:24,230
try to solve those problems before we go

617
00:20:28,149 --> 00:20:26,869
on a long mission to Mars it's not gonna

618
00:20:29,289 --> 00:20:28,159
do you any good to go all the way to

619
00:20:30,609 --> 00:20:29,299
Mars if you end up like a boneless

620
00:20:33,460 --> 00:20:30,619
chicken when you get outside there you

621
00:20:35,320 --> 00:20:33,470
know so we got to figure this out and as

622
00:20:37,090 --> 00:20:35,330
riac say you know these these biological

623
00:20:38,739 --> 00:20:37,100
countermeasures but also just we found

624
00:20:40,779 --> 00:20:38,749
out that you know doing resistive

625
00:20:43,509 --> 00:20:40,789
exercise before and during spaceflight

626
00:20:45,369 --> 00:20:43,519
helps you know combat some of the the

627
00:20:47,229 --> 00:20:45,379
bone loss and the morphology change in

628
00:20:48,729 --> 00:20:47,239
your in your bones in your calcium so

629
00:20:50,320 --> 00:20:48,739
you know just those little things that

630
00:20:51,609 --> 00:20:50,330
we're learning so if we if we're going

631
00:20:53,200 --> 00:20:51,619
to go to Mars one day we're going to

632
00:20:55,779 --> 00:20:53,210
have to figure out a way to do that type

633
00:20:58,570 --> 00:20:55,789
of exercise or maybe combination

634
00:21:05,440 --> 00:20:58,580
exercise and medicine to help combat any

635
00:21:07,960 --> 00:21:05,450
of us paretic effects on the body ok

636
00:21:10,539 --> 00:21:07,970
next question is as a student from a

637
00:21:12,700 --> 00:21:10,549
student in mrs. Bryan's class for

638
00:21:15,340 --> 00:21:12,710

wondering how much fuel do you have and

639
00:21:19,989 --> 00:21:15,350
you take off and how much do you have to

640
00:21:22,299 --> 00:21:19,999
take to get back to earth Wow let's say

641
00:21:23,889 --> 00:21:22,309
I don't know the exact figures on my off

642
00:21:25,749 --> 00:21:23,899
my top my head but that is correct is

643
00:21:27,849 --> 00:21:25,759
it's the the major part of the fuel

644
00:21:30,700 --> 00:21:27,859
obviously is when when we launch and we

645
00:21:32,619 --> 00:21:30,710
get to we get to orbit and now getting

646
00:21:34,419 --> 00:21:32,629
home is that all the energy you put to

647
00:21:36,460 --> 00:21:34,429
get into orbit you have to take out so

648
00:21:38,379 --> 00:21:36,470
we do have to have the the thruster

649
00:21:39,909 --> 00:21:38,389
systems that can slow us down now it's

650
00:21:41,799 --> 00:21:39,919
one thing when you're going from low

651
00:21:44,320 --> 00:21:41,809
Earth orbit if you're going you're going

652
00:21:45,549 --> 00:21:44,330
about 17,500 miles an hour but when

653
00:21:46,930 --> 00:21:45,559
you're going from interplanetary where

654
00:21:48,430 --> 00:21:46,940
you're going to an asteroid or going to

655
00:21:51,460 --> 00:21:48,440
Mars it gets even higher and that's

656
00:21:52,720 --> 00:21:51,470
where it's not just the amount of energy

657
00:21:54,549 --> 00:21:52,730
to slow you down but you have to have a

658
00:21:55,960 --> 00:21:54,559
braking system that can that can arrow

659
00:21:58,359 --> 00:21:55,970
break you and that's what this that the

660
00:22:00,070 --> 00:21:58,369
heat shield of this Orion spacecraft is

661
00:22:01,060 --> 00:22:00,080
for its can have a tiles on the bottom

662
00:22:03,730 --> 00:22:01,070
and just like the Apollo

663
00:22:05,649 --> 00:22:03,740

spacecraft it'll allow you to to slow

664
00:22:07,659 --> 00:22:05,659
the vehicle down via this this heat

665
00:22:09,519 --> 00:22:07,669
shield and so it's going to be it's a

666
00:22:10,509 --> 00:22:09,529
it's a very big design challenge and

667
00:22:12,009 --> 00:22:10,519
that's one the first things we want to

668
00:22:13,509 --> 00:22:12,019
test out on this flight test next year

669
00:22:15,039 --> 00:22:13,519
so we're going to send it out you know

670
00:22:16,749 --> 00:22:15,049
about 3,000 miles out and come and

671
00:22:19,120 --> 00:22:16,759
screaming about maybe I think 80 or more

672
00:22:21,310 --> 00:22:19,130
percent of the return velocity from a

673
00:22:22,480 --> 00:22:21,320
lunar mission we can really test out

674
00:22:23,950 --> 00:22:22,490
that heat shield see how it's working

675
00:22:25,779 --> 00:22:23,960
how fast is that the way back pain I

676
00:22:28,389 --> 00:22:25,789
don't remember our head but it's I

677
00:22:30,580 --> 00:22:28,399
imagine it's close to 20,000 miles an

678
00:22:32,710 --> 00:22:30,590
hour or something like that okay and you

679
00:22:34,330 --> 00:22:32,720
guys got there if you just go google and

680
00:22:37,029 --> 00:22:34,340
look up the rocket equation and look how

681
00:22:39,249 --> 00:22:37,039
the the change in mass and the mass of

682
00:22:40,659 --> 00:22:39,259
the original weight of the vehicle most

683
00:22:42,820 --> 00:22:40,669
of that weight is fuel so if we're going

684
00:22:44,560 --> 00:22:42,830
to go to Mars one day we've got to

685
00:22:47,680 --> 00:22:44,570
figure out how to really reduce the

686
00:22:49,690 --> 00:22:47,690
weight of the vehicle or have more high

687
00:22:51,009 --> 00:22:49,700
energy propellants you know these are

688
00:22:52,749 --> 00:22:51,019

the things that you guys can help us

689
00:22:58,659 --> 00:22:52,759
develop and design as we're trying to go

690
00:23:00,549 --> 00:22:58,669
to distant planets okay I think we have

691
00:23:01,990 --> 00:23:00,559
just two more questions and first one is

692
00:23:04,330 --> 00:23:02,000
what activities are planned for

693
00:23:06,369 --> 00:23:04,340
astronauts on the spacecraft during the

694
00:23:07,269 --> 00:23:06,379
transit to Mars and back to earth and is

695
00:23:08,649 --> 00:23:07,279
it going to be similar to the

696
00:23:11,499 --> 00:23:08,659
experiments performed on the space

697
00:23:12,610 --> 00:23:11,509
station yeah I'd imagine the activities

698
00:23:13,899 --> 00:23:12,620
are going to be similar to form in the

699
00:23:14,889 --> 00:23:13,909
space station but we're gonna have to be

700
00:23:16,149 --> 00:23:14,899
careful though because in the space

701
00:23:17,889 --> 00:23:16,159
station we can bring our results back

702
00:23:19,419 --> 00:23:17,899
when we're going to Mars we can't bring

703
00:23:21,490 --> 00:23:19,429
our results back so things will have to

704
00:23:22,419 --> 00:23:21,500
be much more automated and tell operated

705
00:23:24,519 --> 00:23:22,429
and the results will have to be

706
00:23:26,139 --> 00:23:24,529
electronically transmitted back to back

707
00:23:27,430 --> 00:23:26,149
to earth now you do want to have the

708
00:23:28,480 --> 00:23:27,440
crew they want to be actively involved

709
00:23:30,340 --> 00:23:28,490
the worst thing you can do is when you

710
00:23:31,509 --> 00:23:30,350
send somebody out halfway between Earth

711
00:23:33,430 --> 00:23:31,519
and Mars and he starts getting really

712
00:23:35,289 --> 00:23:33,440
bored it looks like we said that little

713
00:23:36,850 --> 00:23:35,299

tiny star that's his home planet it

714
00:23:38,379 --> 00:23:36,860
doesn't anything to do except start to

715
00:23:39,820 --> 00:23:38,389
worry and so we want to have them

716
00:23:41,919 --> 00:23:39,830
productively employed and gainfully

717
00:23:43,720 --> 00:23:41,929
working to a point that they're they

718
00:23:44,740 --> 00:23:43,730
feel like they're there they're well

719
00:23:45,700 --> 00:23:44,750
involved but not to the point that

720
00:23:47,799 --> 00:23:45,710
they're overworked so that they're

721
00:23:49,269 --> 00:23:47,809
getting fatigued and exhausted but we

722
00:23:51,700 --> 00:23:49,279
will have similar experiments like that

723
00:23:53,470 --> 00:23:51,710
to figure out you know just what it's

724
00:23:55,749 --> 00:23:53,480
like and how their buys adapting on this

725
00:23:57,340 --> 00:23:55,759
very very long journey and you know

726
00:24:00,369 --> 00:23:57,350
similar things like being able to watch

727
00:24:02,529 --> 00:24:00,379
movies and exercise and you know playing

728
00:24:04,090 --> 00:24:02,539
a game of space cards you know having

729
00:24:06,039 --> 00:24:04,100
people being able to do the same kind of

730
00:24:07,810 --> 00:24:06,049
things that they do on on the planet but

731
00:24:09,399 --> 00:24:07,820
also we do those similar things on the

732
00:24:11,230 --> 00:24:09,409
space station itself and then also you

733
00:24:13,119 --> 00:24:11,240
know sitting around the table having a

734
00:24:14,890 --> 00:24:13,129
great meal and telling stories that's a

735
00:24:16,810 --> 00:24:14,900
lot of the things that we we

736
00:24:18,460 --> 00:24:16,820
learn how to do when we were in our and

737
00:24:20,290 --> 00:24:18,470
our training with nolles our other

738
00:24:22,060 --> 00:24:20,300

leadership training school but that that

739
00:24:23,230 --> 00:24:22,070
all this stuff kind of plays back into

740
00:24:25,960 --> 00:24:23,240
when you get in space and when you're

741
00:24:28,770 --> 00:24:25,970
working together just those common

742
00:24:30,910 --> 00:24:28,780
things that everyone does on the ground

743
00:24:32,890 --> 00:24:30,920
okay and our last question it's a good

744
00:24:34,750 --> 00:24:32,900
one any advice for today's high school

745
00:24:38,740 --> 00:24:34,760
kids who are interested in pursuing a

746
00:24:41,470 --> 00:24:38,750
career with NASA I guess the advice for

747
00:24:43,690 --> 00:24:41,480
me is just to stay curious when I was a

748
00:24:45,130 --> 00:24:43,700
kid I loved building things creating

749
00:24:46,990 --> 00:24:45,140
things even had little chemistry set and

750
00:24:48,700 --> 00:24:47,000
created an explosion in my mother's

751
00:24:50,380 --> 00:24:48,710
living room which got me in trouble but

752
00:24:52,600 --> 00:24:50,390
I became a chemistry major because of

753
00:24:54,940 --> 00:24:52,610
that so believe in yourself don't let

754
00:24:57,190 --> 00:24:54,950
anyone bully you I mean we want you to

755
00:24:59,140 --> 00:24:57,200
be the kind of students that are

756
00:25:00,940 --> 00:24:59,150
confident they can come up with ideas

757
00:25:02,110 --> 00:25:00,950
and build something like a radiation

758
00:25:04,690 --> 00:25:02,120
show for this exploration design

759
00:25:06,610 --> 00:25:04,700
challenge and be leaders in your classes

760
00:25:08,770 --> 00:25:06,620
be dumped you know don't necessarily be

761
00:25:09,610 --> 00:25:08,780
a follower be a leader and sometimes you

762
00:25:11,140 --> 00:25:09,620
don't have to be a follower right

763
00:25:13,180 --> 00:25:11,150

because someone's in charge and you have

764
00:25:15,850 --> 00:25:13,190
to follow but but from the standpoint of

765
00:25:17,590 --> 00:25:15,860
your ideas in your leadership helped

766
00:25:19,150 --> 00:25:17,600
bring that to the forefront and we want

767
00:25:21,010 --> 00:25:19,160
people that just are passionate about

768
00:25:23,560 --> 00:25:21,020
science technology engineering and

769
00:25:24,910 --> 00:25:23,570
mathematics yeah that sounds great you

770
00:25:26,860 --> 00:25:24,920
really have to find what you love

771
00:25:28,660 --> 00:25:26,870
because in order to work in a business

772
00:25:29,980 --> 00:25:28,670
like this you need to excel and the way

773
00:25:31,030 --> 00:25:29,990
the best way to excel is find something

774
00:25:33,580 --> 00:25:31,040
you love and then you book don't mind

775
00:25:35,110 --> 00:25:33,590
working hard at it and yeah if the space

776
00:25:36,700 --> 00:25:35,120
business is your blood there's just

777
00:25:38,560 --> 00:25:36,710
nothing like working at the Johnson

778
00:25:40,120 --> 00:25:38,570
Space Center or one of the NASA centers

779
00:25:41,440 --> 00:25:40,130
I mean it's just so fun to work here

780
00:25:43,150 --> 00:25:41,450
it's like not coming to work because

781
00:25:44,200 --> 00:25:43,160
it's so much fun so you don't have to

782
00:25:45,760 --> 00:25:44,210
work in their day in your life because

783
00:25:47,980 --> 00:25:45,770
you're having fun the whole time so find

784
00:25:50,020 --> 00:25:47,990
your passion and if it's involved if it

785
00:25:51,910 --> 00:25:50,030
involves spaceflight just you know keep

786
00:25:53,470 --> 00:25:51,920
working as hard you can and and you'll

787
00:25:55,120 --> 00:25:53,480
be able to do some incredible things and

788
00:25:56,890 --> 00:25:55,130

have a have a have a career that is

789
00:26:00,760 --> 00:25:56,900
really really enjoyable and get to work

790
00:26:02,950 --> 00:26:00,770
with really cool people like Rex all

791
00:26:04,750 --> 00:26:02,960
right Willie window open and Rex Walheim

792
00:26:06,430 --> 00:26:04,760
thanks so much for joining us and doing

793
00:26:08,440 --> 00:26:06,440
this answering our questions today and I

794
00:26:09,730 --> 00:26:08,450
think you look great inside that module

795
00:26:14,290 --> 00:26:09,740
maybe we'll see you in the real one