
esa
European Space Agency

1
00:00:46,850 --> 00:00:45,229
hi everyone welcome to a very special

2
00:00:50,779 --> 00:00:46,860
event here at NASA's Jet Propulsion

3
00:00:53,149 --> 00:00:50,789
Laboratory it's so neat to have guests

4
00:00:55,670 --> 00:00:53,159
who are so jazzed about what we do as

5
00:00:58,399 --> 00:00:55,680
much as we're jazzed about what you do

6
00:01:01,660 --> 00:00:58,409
I'd like to introduce our guest to you

7
00:01:04,310 --> 00:01:01,670
right now Lori McCreary she's the CEO of

8
00:01:06,830 --> 00:01:04,320
revelations entertainment now this is

9
00:01:10,010 --> 00:01:06,840
the production company that does through

10
00:01:16,130 --> 00:01:10,020
the wormhole with Morgan Freeman and it

11
00:01:18,620 --> 00:01:16,140
is they're wrapping up their fifth

12
00:01:20,960 --> 00:01:18,630
season on Science Channel and then of

13
00:01:28,940 --> 00:01:20,970

course I have to introduce Morgan

14
00:01:31,490 --> 00:01:28,950
Freeman okay and also host through the

15
00:01:38,630 --> 00:01:31,500
wormhole and then James younger another

16
00:01:43,940 --> 00:01:41,670
so let's put all of this into context

17
00:01:48,679 --> 00:01:43,950
about why we're here so let's go back

18
00:01:51,810 --> 00:01:48,689
forty five years ago to July 20th 1969

19
00:01:54,419 --> 00:01:51,820
now that is the day that not NASA's

20
00:01:57,120 --> 00:01:54,429
Apollo 11 crew landed on the moon and

21
00:01:59,789 --> 00:01:57,130
the world watched as astronauts Neil

22
00:02:02,789 --> 00:01:59,799
Armstrong and Buzz Aldrin set their

23
00:02:05,730 --> 00:02:02,799
lunar module Eagle down in the Sea of

24
00:02:08,070 --> 00:02:05,740
Tranquility and that's while crew mate

25
00:02:11,039 --> 00:02:08,080
Mike Collins orbited above in the

26
00:02:13,440 --> 00:02:11,049
command module now 45 years ago remember

27
00:02:16,979 --> 00:02:13,450
and that was when Armstrong said those

28
00:02:21,059 --> 00:02:16,989
famous words that's one small step for

29
00:02:22,620 --> 00:02:21,069
man one giant leap for mankind so today

30
00:02:25,110 --> 00:02:22,630
we're taking this opportunity to look

31
00:02:27,630 --> 00:02:25,120
back at that giant leap and also the

32
00:02:30,210 --> 00:02:27,640
look forward to look at head at the next

33
00:02:34,259 --> 00:02:30,220
giant leap doing things like sending

34
00:02:36,870 --> 00:02:34,269
astronauts to Mars so let's get this

35
00:02:38,699 --> 00:02:36,880
conversation started first of all I mean

36
00:02:41,550 --> 00:02:38,709
Morgan do you remember that day do you

37
00:02:44,910 --> 00:02:41,560
know where you were whoa I was yes I was

38
00:02:51,990 --> 00:02:44,920

I was I I was in my apartment in New

39
00:02:56,849 --> 00:02:52,000
York lying on the couch watching this I

40
00:02:58,890 --> 00:02:56,859
cried yeah yeah and I wanted to ask how

41
00:03:07,590 --> 00:02:58,900
many people I wanted any about a year

42
00:03:09,509 --> 00:03:07,600
old enough to have seen that you know

43
00:03:16,250 --> 00:03:09,519
that tells you that looking at something

44
00:03:23,910 --> 00:03:21,440
we learned one thing there that was very

45
00:03:31,740 --> 00:03:23,920
very I think was instructive to a lot of

46
00:03:34,410 --> 00:03:31,750
us not made of green cheese but such a

47
00:03:42,949 --> 00:03:34,420
momentous event to have actually done

48
00:03:47,790 --> 00:03:42,959
that and come back proof positive that

49
00:03:50,760 --> 00:03:47,800
whatever we can imagine we can do

50
00:03:54,150 --> 00:03:50,770
fact James where do you remember it

51
00:03:56,190 --> 00:03:54,160
aren't you too young probably seeing it

52
00:03:59,190 --> 00:03:56,200
between my building blocks that I was

53
00:04:03,150 --> 00:03:59,200
lying on my floor I don't have any great

54
00:04:04,860 --> 00:04:03,160
memories of it I don't have any memories

55
00:04:08,820 --> 00:04:04,870
of it I've only heard through people and

56
00:04:11,370 --> 00:04:08,830
but I but I do remember watching tape of

57
00:04:13,020 --> 00:04:11,380
Kennedy and his admonition that we could

58
00:04:15,090 --> 00:04:13,030
do this and I think that that's the

59
00:04:16,860 --> 00:04:15,100
great thing is that if there's enough

60
00:04:18,420 --> 00:04:16,870
leadership and enough excitement and

61
00:04:19,289 --> 00:04:18,430
enough vision we can pretty much

62
00:04:22,860 --> 00:04:19,299
accomplish anything

63
00:04:27,210 --> 00:04:22,870

well Maureen I mean you know you're here

64
00:04:28,890 --> 00:04:27,220
with an audience full a lot of students

65
00:04:30,930 --> 00:04:28,900
and student interns who are just so

66
00:04:33,270 --> 00:04:30,940
excited to see you I mean tell me a

67
00:04:35,400 --> 00:04:33,280
little bit about you were you always

68
00:04:40,140 --> 00:04:35,410
into science yourself were you excited

69
00:04:47,580 --> 00:04:40,150
about science growing up no no were you

70
00:04:52,910 --> 00:04:47,590
good at science no I listened truth I'm

71
00:04:58,140 --> 00:04:52,920
an actor been an actor all my life my

72
00:05:02,580 --> 00:04:58,150
involvement here is to me one of the

73
00:05:07,700 --> 00:05:02,590
mysteries of my life because it's on it

74
00:05:12,030 --> 00:05:07,710
through show business that I wind up

75
00:05:15,690 --> 00:05:12,040
having this this relationship with the

76
00:05:23,970 --> 00:05:15,700
JPL the JPL yeah if the Jet Propulsion

77
00:05:28,530 --> 00:05:23,980
Laboratory so yeah I am like most people

78
00:05:32,430 --> 00:05:28,540
I like science fiction and any science

79
00:05:38,220 --> 00:05:32,440
that attaches itself to my science

80
00:05:41,670 --> 00:05:38,230
fiction reading and seeing then I'm

81
00:05:44,330 --> 00:05:41,680
excited because oh it's not just an

82
00:05:46,860 --> 00:05:44,340
imagination anymore is for real I

83
00:05:49,380 --> 00:05:46,870
remember when I read the Jules Verne's

84
00:05:53,610 --> 00:05:49,390
20,000 Leagues Under the Sea the atomic

85
00:05:56,250 --> 00:05:53,620
submarine that he had invented well what

86
00:06:01,720 --> 00:05:56,260
is less it's about 100 years 150 years

87
00:06:08,180 --> 00:06:04,970
it's it's a mantra if we can imagine it

88
00:06:11,450 --> 00:06:08,190

we can do it subscrive all's into the

89
00:06:16,850 --> 00:06:11,460
category of prophetic science fiction

90
00:06:21,170 --> 00:06:16,860
writer Arthur C Clark it's another one

91
00:06:24,110 --> 00:06:21,180
so my interest in science is not an

92
00:06:26,450 --> 00:06:24,120
interest in science per se I'm not a

93
00:06:33,260 --> 00:06:26,460
scientist I'm not scientific minded I'm

94
00:06:36,970 --> 00:06:33,270
right brained I don't do math challenge

95
00:06:39,200 --> 00:06:36,980
Morgan what the the reason that we are

96
00:06:41,600 --> 00:06:39,210
we've worked together for 20 years so I

97
00:06:42,800 --> 00:06:41,610
can do that the reason that we're doing

98
00:06:45,590 --> 00:06:42,810
something like through the wormhole is

99
00:06:47,000 --> 00:06:45,600
because Morgan is interested and perhaps

100
00:06:48,590 --> 00:06:47,010
he doesn't have the scientific

101
00:06:50,600 --> 00:06:48,600
background to go in and finalize

102
00:06:52,760 --> 00:06:50,610
equations for people but he asks

103
00:06:54,050 --> 00:06:52,770
questions and the one story I love that

104
00:06:56,990 --> 00:06:54,060
you tell is when he was in high school

105
00:06:59,480 --> 00:06:57,000
he was a had a physics physics physics

106
00:07:01,430 --> 00:06:59,490
crash and and perhaps on the tests he

107
00:07:03,650 --> 00:07:01,440
wasn't making great grades but he got a

108
00:07:06,080 --> 00:07:03,660
very high grade because he asked

109
00:07:07,580 --> 00:07:06,090
questions and he was engaged and that's

110
00:07:10,130 --> 00:07:07,590
the thing that he does for us when we're

111
00:07:11,930 --> 00:07:10,140
working on wormhole and we have were

112
00:07:13,880 --> 00:07:11,940
looking at scripts he asks questions

113
00:07:15,170 --> 00:07:13,890

from a different perspective than

114
00:07:17,180 --> 00:07:15,180
perhaps someone who had scientific

115
00:07:18,980 --> 00:07:17,190
training so it gives us a unique

116
00:07:21,470 --> 00:07:18,990
perspective I think when we're

117
00:07:25,730 --> 00:07:21,480
presenting science the dumbest person in

118
00:07:31,160 --> 00:07:25,740
the room but there are no dumb questions

119
00:07:33,920 --> 00:07:31,170
that yeah but you know I think basis of

120
00:07:38,750 --> 00:07:33,930
exploration right is to be curious and

121
00:07:41,810 --> 00:07:38,760
to ask questions and one I know how that

122
00:07:44,510 --> 00:07:41,820
works so is that pretty much what you do

123
00:07:47,270 --> 00:07:44,520
that is that your approach just asking a

124
00:07:50,240 --> 00:07:47,280
question we do ask questions we you know

125
00:07:51,740 --> 00:07:50,250
we think well you know we let's look at

126
00:07:53,870 --> 00:07:51,750
the universe we had a question well is

127
00:07:55,910 --> 00:07:53,880
there an edge to the universe something

128
00:07:57,710 --> 00:07:55,920
that a lot of scientists trained in

129
00:07:59,330 --> 00:07:57,720
cosmology wouldn't ask like well it's

130
00:08:01,520 --> 00:07:59,340
three dimensional curved space is not

131
00:08:02,750 --> 00:08:01,530
really an edge up about well it would no

132
00:08:03,890 --> 00:08:02,760
hang on a minute let's try and

133
00:08:06,140 --> 00:08:03,900
understand that what would a normal

134
00:08:09,170 --> 00:08:06,150
person think well there's a ball and

135
00:08:10,679 --> 00:08:09,180
somehow there's an inside and outside so

136
00:08:12,509 --> 00:08:10,689
we approach it from that angle

137
00:08:15,899 --> 00:08:12,519
when you when you talk to scientists and

138
00:08:18,029 --> 00:08:15,909

engage them in that way it's very

139
00:08:20,699 --> 00:08:18,039
illuminating and you know and it really

140
00:08:22,829 --> 00:08:20,709
allows us to explain very complicated

141
00:08:25,589 --> 00:08:22,839
science that's really beyond you know

142
00:08:28,049 --> 00:08:25,599
beyond any high school student we get

143
00:08:29,759 --> 00:08:28,059
into it and the you know people are

144
00:08:31,649 --> 00:08:29,769
illuminated and informed and feel like

145
00:08:34,439 --> 00:08:31,659
they know more about the universe well

146
00:08:37,170 --> 00:08:34,449
speaking of which we have an copy of a

147
00:08:39,209 --> 00:08:37,180
clip from wormhole and if you want to

148
00:08:40,819 --> 00:08:39,219
set it up and kind of explain it to us

149
00:08:43,079 --> 00:08:40,829
we'll roll it well one of the things we

150
00:08:44,939 --> 00:08:43,089
will know we do as well as explaining

151
00:08:46,290 --> 00:08:44,949
science as we try and understand let

152
00:08:48,720 --> 00:08:46,300
people understand what it's like to be a

153
00:08:49,889 --> 00:08:48,730
scientist I mean with NASA of course you

154
00:08:51,509 --> 00:08:49,899
have these glamorous lives with the

155
00:08:55,139 --> 00:08:51,519
astronauts ago and no one's gone before

156
00:08:56,759 --> 00:08:55,149
and maybe you think working in space

157
00:08:59,610 --> 00:08:56,769
science research is also going to be

158
00:09:06,840 --> 00:08:59,620
that exciting and well here's the truth

159
00:09:09,030 --> 00:09:06,850
about it 26,000 light-years away there

160
00:09:12,329 --> 00:09:09,040
is a place where we could learn the true

161
00:09:15,590 --> 00:09:12,339
nature of gravity is the supermassive

162
00:09:18,809 --> 00:09:15,600
black hole at the center of our galaxy

163
00:09:22,679 --> 00:09:18,819

astronomers think this hole in space is

164
00:09:26,040 --> 00:09:22,689
not much bigger than our Sun gene

165
00:09:29,420 --> 00:09:26,050
something that size so far away would

166
00:09:34,910 --> 00:09:29,430
take a telescope the size of our planet

167
00:09:39,480 --> 00:09:37,440
astronomer Shep dolmens career was

168
00:09:49,290 --> 00:09:39,490
launched when he answered the call to

169
00:09:51,720 --> 00:09:49,300
adventure and landed here what excited

170
00:09:53,520 --> 00:09:51,730
me about this particular brand of radio

171
00:09:55,620 --> 00:09:53,530
astronomy was that you got to travel the

172
00:09:57,120 --> 00:09:55,630
world I said well that's for me I

173
00:09:58,830 --> 00:09:57,130
definitely want to go out in the field

174
00:10:00,180 --> 00:09:58,840
and do that and then when I got here

175
00:10:03,630 --> 00:10:00,190
they said well largely that works been

176
00:10:06,510 --> 00:10:03,640
done Shep does most of his work trapped

177
00:10:09,750 --> 00:10:06,520
in his office where he often escapes by

178
00:10:15,480 --> 00:10:09,760
daydreaming about being the first

179
00:10:17,640 --> 00:10:15,490
astronomer to observe a black hole it's

180
00:10:19,950 --> 00:10:17,650
one of the hardest problems in his field

181
00:10:23,430 --> 00:10:19,960
because astronomers can only observe

182
00:10:24,780 --> 00:10:23,440
objects that radiate light when you ask

183
00:10:28,500 --> 00:10:24,790
yourself what a black hole looks like

184
00:10:31,560 --> 00:10:28,510
you really have to begin with why do we

185
00:10:34,590 --> 00:10:31,570
see black holes at all by definition

186
00:10:38,450 --> 00:10:34,600
they should be invisible when light

187
00:10:40,830 --> 00:10:38,460
enters a black hole it's gone forever

188
00:10:43,620 --> 00:10:40,840

but not all of the light around the

189
00:10:46,620 --> 00:10:43,630
black hole gets sucked in some of it

190
00:10:49,520 --> 00:10:46,630
bends around the event horizon creating

191
00:10:52,620 --> 00:10:49,530
a shadow image of the black hole that

192
00:10:56,790 --> 00:10:52,630
image could reveal how gravity behaves

193
00:10:59,310 --> 00:10:56,800
at the event horizon but by the time the

194
00:11:01,880 --> 00:10:59,320
light reaches us the signal is so

195
00:11:06,560 --> 00:11:01,890
diluted that Shep would need a telescope

196
00:11:14,300 --> 00:11:06,570
thousands of miles across to pick it up

197
00:11:19,940 --> 00:11:17,180
scheppers traveling to exotic locations

198
00:11:23,600 --> 00:11:19,950
around the world coordinating a massive

199
00:11:25,370 --> 00:11:23,610
international collaboration in the

200
00:11:27,590 --> 00:11:25,380
spring of 2015

201
00:11:30,560 --> 00:11:27,600
nearly all of the world's high-precision

202
00:11:33,650 --> 00:11:30,570
telescopes will point towards the center

203
00:11:36,260 --> 00:11:33,660
of our galaxy at the center of our

204
00:11:39,310 --> 00:11:36,270
galaxy is an extraordinary object

205
00:11:42,110 --> 00:11:39,320
it's a supermassive black hole and

206
00:11:44,510 --> 00:11:42,120
because it is so massive and because

207
00:11:48,010 --> 00:11:44,520
it's relatively close to us we have a

208
00:11:51,260 --> 00:11:48,020
shot we have a chance to resolve it

209
00:11:58,150 --> 00:11:51,270
that's great how many people relate to

210
00:12:03,019 --> 00:12:00,740
we have three four different types of

211
00:12:05,810 --> 00:12:03,029
galaxies we have the spiral galaxy we

212
00:12:07,670 --> 00:12:05,820
have the sprocket galaxy and that one it

213
00:12:12,230 --> 00:12:07,680

has armed over here in homes over here

214
00:12:16,040 --> 00:12:12,240
and a pinwheel gap does every galaxy

215
00:12:17,269 --> 00:12:16,050
create a black hole in its creation well

216
00:12:18,890 --> 00:12:17,279
you're asking the wrong guy there's some

217
00:12:25,690 --> 00:12:18,900
people here good answer but yes the

218
00:12:41,270 --> 00:12:38,510
every every galaxy how do you know so

219
00:12:45,350 --> 00:12:41,280
this is obviously a really really

220
00:12:48,350 --> 00:12:45,360
complicated subject very complicated how

221
00:12:55,490 --> 00:12:48,360
did you make it so relatable for

222
00:12:57,850 --> 00:12:55,500
everybody to get me to talk about it we

223
00:12:59,870 --> 00:12:57,860
find the scientists we talk to them we

224
00:13:02,120 --> 00:12:59,880
understand see we try to understand what

225
00:13:03,650 --> 00:13:02,130
their life is like and we try and get

226
00:13:06,800 --> 00:13:03,660
into their character and through telling

227
00:13:07,970 --> 00:13:06,810
someone's story you are able to

228
00:13:09,800 --> 00:13:07,980
understand what they're working on

229
00:13:12,140 --> 00:13:09,810
better so it's you know we there's

230
00:13:14,990 --> 00:13:12,150
complicated science very simply stated

231
00:13:17,120 --> 00:13:15,000
and someone's character that you get

232
00:13:18,410 --> 00:13:17,130
engaged with and you want him to get out

233
00:13:21,220 --> 00:13:18,420
of his office and go and you know

234
00:13:24,890 --> 00:13:21,230
assemble this radio telescope virtual

235
00:13:26,090 --> 00:13:24,900
array and and so you you you're dragged

236
00:13:27,720 --> 00:13:26,100
along in the story and you you

237
00:13:29,610 --> 00:13:27,730
understand the science along the way

238
00:13:31,319 --> 00:13:29,620

doesn't seem like a lecture like okay

239
00:13:34,170 --> 00:13:31,329
here's how grant black hole works here's

240
00:13:35,639 --> 00:13:34,180
the equation is the escape velocity we

241
00:13:38,819 --> 00:13:35,649
just tell us through someone's story I

242
00:13:40,230 --> 00:13:38,829
think for us to where if we didn't make

243
00:13:41,970 --> 00:13:40,240
wormhole if we didn't produce through

244
00:13:43,980 --> 00:13:41,980
the wormhole we would be fans of the

245
00:13:45,030 --> 00:13:43,990
show so we're our own worst critics when

246
00:13:46,949 --> 00:13:45,040
it comes to does that really make sense

247
00:13:48,689 --> 00:13:46,959
is it interesting and because we come

248
00:13:50,519 --> 00:13:48,699
from film and storytelling backgrounds

249
00:13:51,930 --> 00:13:50,529
were always looking for ways to engage

250
00:13:54,329 --> 00:13:51,940
whoever sitting in the audience watching

251
00:13:57,180 --> 00:13:54,339
it and then it's hard to beat Morgan's

252
00:13:59,819 --> 00:13:57,190
voice on top of it and now director and

253
00:14:01,829 --> 00:13:59,829
writer it says like James because he's

254
00:14:07,530 --> 00:14:01,839
so modest is what's your PhD in

255
00:14:10,199 --> 00:14:07,540
biophysics soft science he knows a lot

256
00:14:12,060 --> 00:14:10,209
about physics and science and he and he

257
00:14:13,800 --> 00:14:12,070
can talk one-on-one with all of our

258
00:14:16,139 --> 00:14:13,810
scientists and he's a genius writer and

259
00:14:18,689 --> 00:14:16,149
so if it's understandable it's because

260
00:14:21,180 --> 00:14:18,699
he's writing words Morgan you have a

261
00:14:23,970 --> 00:14:21,190
long history of you know relating to

262
00:14:26,340 --> 00:14:23,980
young people The Electric Company is

263
00:14:28,050 --> 00:14:26,350

that something that you've always kind

264
00:14:36,900 --> 00:14:28,060
of made a priority to reach out to

265
00:14:36,910 --> 00:14:45,410
they're annoying people as young as you

266
00:14:54,920 --> 00:14:48,720
so I kind of sometimes feel a little bit

267
00:14:58,110 --> 00:14:54,930
like WC Fields and that the only thing

268
00:15:00,420 --> 00:14:58,120
that I seem to have going for me in

269
00:15:03,090 --> 00:15:00,430
terms of young people is that I don't

270
00:15:06,750 --> 00:15:03,100
meet them as young people I meet them as

271
00:15:09,990 --> 00:15:06,760
people and and they respond to that so I

272
00:15:12,600 --> 00:15:10,000
get kind of a good pat on the back just

273
00:15:17,400 --> 00:15:12,610
for their reaction to me and absolute

274
00:15:20,370 --> 00:15:17,410
okay go away kid you bother me but you

275
00:15:23,520 --> 00:15:20,380
co-created this company and with an

276
00:15:25,920 --> 00:15:23,530
objective to bring more of this material

277
00:15:28,890 --> 00:15:25,930
out there do you think that in Hollywood

278
00:15:30,930 --> 00:15:28,900
there's just a reluctance to do more

279
00:15:33,930 --> 00:15:30,940
stuff like this because people wouldn't

280
00:15:35,310 --> 00:15:33,940
appreciate it no I personally I don't

281
00:15:37,800 --> 00:15:35,320
think so I don't think Holly was

282
00:15:41,730 --> 00:15:37,810
reluctant to do anything unless it they

283
00:15:45,330 --> 00:15:41,740
know it's not gonna make any money but

284
00:15:48,600 --> 00:15:45,340
if they can see a dollar see the whole

285
00:15:50,370 --> 00:15:48,610
point it's not just that weird money

286
00:15:52,380 --> 00:15:50,380
hungry and but it takes money to make

287
00:15:58,020 --> 00:15:52,390
them so if you don't make money making

288
00:16:00,420 --> 00:15:58,030

them you can't make them but reality

289
00:16:02,790 --> 00:16:00,430
shows have always been considered the

290
00:16:06,120 --> 00:16:02,800
the cheaper show you know you just you

291
00:16:09,420 --> 00:16:06,130
know follow people around but you've

292
00:16:15,870 --> 00:16:09,430
sort of taken reality and kind of taken

293
00:16:17,520 --> 00:16:15,880
it up a notch you know we I think the

294
00:16:18,870 --> 00:16:17,530
audience appreciates not being talked

295
00:16:21,660 --> 00:16:18,880
down to they you know the audience is

296
00:16:23,310 --> 00:16:21,670
capable of far more than most television

297
00:16:25,290 --> 00:16:23,320
shows give them credit for and when

298
00:16:26,670 --> 00:16:25,300
they're when people you engage the

299
00:16:29,460 --> 00:16:26,680
audience on a higher level people

300
00:16:32,040 --> 00:16:29,470
respond and they like it well there was

301
00:16:35,750 --> 00:16:32,050
one piece one segment that talked about

302
00:16:40,500 --> 00:16:35,760
the ocean as a conscious living beam

303
00:16:42,360 --> 00:16:40,510
that was a completely new concept why

304
00:16:46,560 --> 00:16:42,370
approach something like that why did you

305
00:16:48,840 --> 00:16:46,570
want to see us to relate to the ocean as

306
00:16:50,210 --> 00:16:48,850
like another person well because they

307
00:16:52,370 --> 00:16:50,220
were scientists who are

308
00:16:57,050 --> 00:16:52,380
getting at it in just in those terms and

309
00:16:59,210 --> 00:16:57,060
it may inform us how many times as it

310
00:17:01,700 --> 00:16:59,220
has the ocean risen up and wiped out

311
00:17:05,360 --> 00:17:01,710
everything five times five times five

312
00:17:07,910 --> 00:17:05,370
times as the ocean completely eliminated

313
00:17:10,820 --> 00:17:07,920

life on the planet except and maybe not

314
00:17:13,100 --> 00:17:10,830
even except in the ocean right most of

315
00:17:13,820 --> 00:17:13,110
the life on the planet has been wiped

316
00:17:17,440 --> 00:17:13,830
out yeah

317
00:17:21,020 --> 00:17:17,450
wiped out how did the ocean do that

318
00:17:21,920 --> 00:17:21,030
creates a virus and you know what my

319
00:17:28,370 --> 00:17:21,930
Harris's can do

320
00:17:31,430 --> 00:17:28,380
I think the ocean is sentient it there

321
00:17:39,430 --> 00:17:31,440
is entirely too much going on in there

322
00:17:41,110 --> 00:17:39,440
for it not to be now consider this for a

323
00:17:45,110 --> 00:17:41,120
minute and a half

324
00:17:50,420 --> 00:17:45,120
what if the ocean really is aware of

325
00:17:54,950 --> 00:17:50,430
itself then it's aware of what we are

326
00:18:02,380 --> 00:17:54,960
doing to it if it's aware of what we're

327
00:18:20,240 --> 00:18:06,190
don't buy that you don't like science

328
00:18:23,570 --> 00:18:20,250
I'm sorry okay science you know because

329
00:18:24,920 --> 00:18:23,580
it's clear you learned and it's clear

330
00:18:27,440 --> 00:18:24,930
you're really interested

331
00:18:30,620 --> 00:18:27,450
what happened help us if we don't learn

332
00:18:34,790 --> 00:18:30,630
and if we're not interested yeah I you

333
00:18:42,530 --> 00:18:34,800
know I'm trying to keep up so at when

334
00:18:46,580 --> 00:18:42,540
the cat I'm getting what do you call

335
00:18:51,740 --> 00:18:46,590
when the Cataclysm comes I've got a deep

336
00:18:55,100 --> 00:18:51,750
enough hole you know so I mean if there

337
00:18:58,670 --> 00:18:55,110
were one big goal that you would like to

338
00:19:03,950 --> 00:18:58,680

fulfill in terms of teaching people

339
00:19:14,370 --> 00:19:09,380
we have a telescope in space called the

340
00:19:20,549 --> 00:19:14,380
Kepler yeah Kepler we're looking for

341
00:19:24,630 --> 00:19:20,559
other signs of life in the universe we

342
00:19:29,159 --> 00:19:24,640
have discovered hundreds of star systems

343
00:19:36,830 --> 00:19:29,169
with planets we have discovered no sign

344
00:19:44,580 --> 00:19:41,250
this is the only planet we got and we're

345
00:19:47,570 --> 00:19:44,590
not taking good care of it I was going

346
00:19:52,950 --> 00:19:47,580
to give anybody any advice I would say

347
00:19:58,139 --> 00:19:52,960
think better about what we're doing to

348
00:20:00,149 --> 00:19:58,149
the home so what would you like what

349
00:20:12,480 --> 00:20:00,159
would you be interested in in pursuing

350
00:20:16,279 --> 00:20:12,490
on earth then exploring on earth well

351
00:20:19,289 --> 00:20:16,289
speaking of which we've got people about

352
00:20:22,529 --> 00:20:19,299
250 miles above us right now who are

353
00:20:23,810 --> 00:20:22,539
begging to talk to you and they're right

354
00:20:32,970 --> 00:20:23,820
there

355
00:20:34,940 --> 00:20:32,980
hi guys astronaut Rees Wiseman and he's

356
00:20:38,519 --> 00:20:34,950
the person on the left and also

357
00:20:41,549 --> 00:20:38,529
commander Steve Swanson thank you so

358
00:20:47,940 --> 00:20:41,559
much for joining us today are you guys

359
00:20:52,139 --> 00:20:47,950
standing up pleasure to be here so

360
00:20:54,330 --> 00:20:52,149
there's a few seconds there's a few

361
00:20:55,860 --> 00:20:54,340
seconds of delay but I'm gonna let

362
00:20:57,960 --> 00:20:55,870
Morgan and company

363
00:21:02,970 --> 00:20:57,970

take it away and let them ask you

364
00:21:06,090 --> 00:21:02,980
questions all right okay so you guys are

365
00:21:09,529 --> 00:21:06,100
out there floating around tossing that

366
00:21:29,629 --> 00:21:09,539
microphone back and forth very cleverly

367
00:21:35,190 --> 00:21:33,960
alright one of my bucket list thing

368
00:21:37,739 --> 00:21:35,200
that's gonna be to get up there with you

369
00:21:42,989 --> 00:21:37,749
so I can just drive that what do you

370
00:21:46,519 --> 00:21:42,999
think it's going to take to get us to

371
00:21:49,080 --> 00:21:46,529
Mars know what I'm saying how does the

372
00:21:52,889 --> 00:21:49,090
International Space Station help us

373
00:21:58,799 --> 00:21:52,899
answer the question how do we get to

374
00:22:00,659 --> 00:21:58,809
Mars that's a really good question I

375
00:22:02,669 --> 00:22:00,669
mean there's definitely a few ways of

376
00:22:05,249 --> 00:22:02,679
looking at that watercourses we need the

377
00:22:07,950 --> 00:22:05,259
technology we need the ability to have

378
00:22:09,239 --> 00:22:07,960
life support that lasts for many years

379
00:22:11,639 --> 00:22:09,249
how many years but three or four years

380
00:22:13,619 --> 00:22:11,649
possibly this robust it has all the

381
00:22:15,210 --> 00:22:13,629
parts onboard you can make is there we

382
00:22:19,169 --> 00:22:15,220
need protection from when we're outside

383
00:22:20,700 --> 00:22:19,179
the Earth's Van Van Allen belts all

384
00:22:22,469 --> 00:22:20,710
sorts of things but the big thing that

385
00:22:24,149 --> 00:22:22,479
this gives us it gives us a place to try

386
00:22:25,440 --> 00:22:24,159
all these things out we can see what

387
00:22:30,649 --> 00:22:25,450
works and what doesn't work on this on

388
00:22:40,099 --> 00:22:34,710

what do you think about the idea of this

389
00:22:43,710 --> 00:22:40,109
is mine some months ago building the

390
00:22:49,340 --> 00:22:43,720
vehicle that will go to Mars in space

391
00:22:54,590 --> 00:22:51,529
well obviously since this was your idea

392
00:22:57,830 --> 00:22:54,600
it was a very very good I'd almost say a

393
00:22:59,720 --> 00:22:57,840
perfect idea certainly if we could build

394
00:23:02,720 --> 00:22:59,730
a heavy lift vehicle that can launch up

395
00:23:04,669 --> 00:23:02,730
a lot of parts and a lot of mass and

396
00:23:06,889 --> 00:23:04,679
then assemble this in low-earth orbit

397
00:23:08,899 --> 00:23:06,899
outside of our atmosphere I think that

398
00:23:10,999 --> 00:23:08,909
would be a great way to start and really

399
00:23:13,370 --> 00:23:11,009
if you just looked at the space station

400
00:23:16,249 --> 00:23:13,380
as kind of a modular design if we just

401
00:23:18,259 --> 00:23:16,259
started with a hab module and maybe a

402
00:23:19,490 --> 00:23:18,269
laboratory then that's a great start and

403
00:23:21,110 --> 00:23:19,500
we kind of already have that with the

404
00:23:23,240 --> 00:23:21,120
space station so if you just took a few

405
00:23:24,619 --> 00:23:23,250
parts off of this put some motors on it

406
00:23:26,389 --> 00:23:24,629
and start it on your way that's I think

407
00:23:28,610 --> 00:23:26,399
that's kind of the basic building block

408
00:23:30,350 --> 00:23:28,620
of what we'll need to get to Mars and

409
00:23:39,350 --> 00:23:30,360
about how much time would you imagine

410
00:23:40,700 --> 00:23:39,360
that would take that is a good question

411
00:23:42,999 --> 00:23:40,710
of course unfortunately it always

412
00:23:44,930 --> 00:23:43,009
depends on how much money you have and

413
00:23:46,519 --> 00:23:44,940

again though I think we have the

414
00:23:49,340 --> 00:23:46,529
technology for that to build the

415
00:23:51,919 --> 00:23:49,350
components capable of doing that we just

416
00:23:55,369 --> 00:23:51,929
have to get the idea desire and put the

417
00:23:57,740 --> 00:23:55,379
resources to it and get it done right

418
00:23:59,629 --> 00:23:57,750
now I think we're spending a lot of

419
00:24:02,659 --> 00:23:59,639
money doing the wrong things and we

420
00:24:10,119 --> 00:24:02,669
could do different things but where's

421
00:24:16,789 --> 00:24:13,909
well we work based on London time really

422
00:24:19,669 --> 00:24:16,799
and we we have a standard earth 24-hour

423
00:24:22,430 --> 00:24:19,679
day and we spend about 10 hours of that

424
00:24:23,690 --> 00:24:22,440
at work doing some exercise and and then

425
00:24:25,340 --> 00:24:23,700
all the science that we're doing up here

426
00:24:26,960 --> 00:24:25,350
and then we're sleeping really on

427
00:24:29,810 --> 00:24:26,970
average about seven to eight hours a

428
00:24:32,090 --> 00:24:29,820
night so even though we see 16 sunrises

429
00:24:34,519 --> 00:24:32,100
and sunsets a day our bodies are fairly

430
00:24:36,080 --> 00:24:34,529
well adjusted to a two space flight and

431
00:24:39,860 --> 00:24:36,090
it's a fairly earth-based schedule for

432
00:24:41,930 --> 00:24:39,870
us the instrument actually do does it

433
00:24:44,090 --> 00:24:41,940
tell you when to go to sleep or what

434
00:24:49,669 --> 00:24:44,100
time it is or do is it just monitoring

435
00:24:50,990 --> 00:24:49,679
you oh for the circadian rhythms science

436
00:24:54,649 --> 00:24:51,000
experiment that we're working right now

437
00:24:56,269 --> 00:24:54,659
so we we're it's a heat flux sensor on

438
00:24:58,039 --> 00:24:56,279

our forehead and on our sternum and it's

439
00:24:59,869 --> 00:24:58,049
just measuring really our core body

440
00:25:01,669 --> 00:24:59,879
temperature over 24 hours and it's

441
00:25:03,020 --> 00:25:01,679
looking at what happens to you when

442
00:25:06,020 --> 00:25:03,030
you're in a weightless environment with

443
00:25:07,760 --> 00:25:06,030
no natural light really and what is your

444
00:25:09,650 --> 00:25:07,770
body doing does it does it understand

445
00:25:11,300 --> 00:25:09,660
this this complex system that you're

446
00:25:13,040 --> 00:25:11,310
living in or not and so far it looks

447
00:25:14,450 --> 00:25:13,050
like with a few exceptions it really

448
00:25:25,340 --> 00:25:14,460
does kind of understand and it falls

449
00:25:27,620 --> 00:25:25,350
into this routine pretty well okay we

450
00:25:30,050 --> 00:25:27,630
have a question to all we have more time

451
00:25:31,970 --> 00:25:30,060
right we want to ask about a trip to

452
00:25:34,820 --> 00:25:31,980
Mars I understand it's probably going to

453
00:25:45,830 --> 00:25:34,830
be about a three-year trip and you're

454
00:25:47,240 --> 00:25:45,840
going yeah when what I've been told it's

455
00:25:49,100 --> 00:25:47,250
about nine months there given the

456
00:25:50,690 --> 00:25:49,110
current technology we have and to make

457
00:25:52,160 --> 00:25:50,700
everything line up again for when you

458
00:25:54,410 --> 00:25:52,170
come back you gotta send about a year

459
00:25:56,450 --> 00:25:54,420
and a half on Mars so it's lined up so

460
00:25:58,340 --> 00:25:56,460
when you leave Mars your back end up in

461
00:26:00,140 --> 00:25:58,350
the orbit of Earth again so that tell

462
00:26:04,460 --> 00:26:00,150
adds up to about a three month

463
00:26:07,460 --> 00:26:04,470

three-year trip sorry the question of

464
00:26:09,350 --> 00:26:07,470
would we go I would say absolutely we

465
00:26:10,670 --> 00:26:09,360
would go and I sent my wife an email

466
00:26:19,150 --> 00:26:10,680
just kind of discussing this with her

467
00:26:24,320 --> 00:26:22,460
so how do you feel about being locked

468
00:26:30,710 --> 00:26:24,330
together in a room for three years how

469
00:26:32,270 --> 00:26:30,720
do you think that's gonna work out well

470
00:26:33,710 --> 00:26:32,280
that's another you have to be a good

471
00:26:36,620 --> 00:26:33,720
friends luckily I think we'd be able to

472
00:26:39,200 --> 00:26:36,630
make it of course we already come up

473
00:26:41,870 --> 00:26:39,210
with ways to handle if we have disputes

474
00:26:43,490 --> 00:26:41,880
we already have a set up for dueling up

475
00:26:46,970 --> 00:26:43,500
here so that's why we handle our

476
00:26:49,010 --> 00:26:46,980
disputes up here but overall I think if

477
00:26:50,180 --> 00:26:49,020
you do it the right compatibility and

478
00:26:53,710 --> 00:26:50,190
you have the right things to do and you

479
00:27:01,280 --> 00:26:53,720
have a right goal you can get it done

480
00:27:05,090 --> 00:27:01,290
great from Earth here this is my deepest

481
00:27:07,280 --> 00:27:05,100
birthday so we're gonna and also you

482
00:27:12,110 --> 00:27:07,290
know he asked for everybody to give six

483
00:27:14,300 --> 00:27:12,120
or seven minutes to a to the fellow man

484
00:27:32,330 --> 00:27:14,310
we won't ask you to do it because I

485
00:27:37,770 --> 00:27:35,040
do you have any more questions we were

486
00:27:39,360 --> 00:27:37,780
learning about the water and air recycle

487
00:27:42,000 --> 00:27:39,370
systems that would have to take place

488
00:27:43,890 --> 00:27:42,010

with them on a trip to Mars how was the

489
00:27:45,240 --> 00:27:43,900
International Space Station are you

490
00:27:50,160 --> 00:27:45,250
working on those systems and how are

491
00:27:52,260 --> 00:27:50,170
they working for you guys up there so we

492
00:27:53,880 --> 00:27:52,270
have some absolutely fantastic systems

493
00:27:56,520 --> 00:27:53,890
up here right now I think the one we're

494
00:27:58,530 --> 00:27:56,530
really the most proud of is the water

495
00:28:01,560 --> 00:27:58,540
reclamation system so every drop of

496
00:28:03,660 --> 00:28:01,570
sweat any condensation even our urine

497
00:28:05,250 --> 00:28:03,670
gets pulled into a system recycled and

498
00:28:07,710 --> 00:28:05,260
turned into drinking water and we're

499
00:28:10,080 --> 00:28:07,720
running I think about over 90% of water

500
00:28:11,790 --> 00:28:10,090
reclamation up here and so that's a huge

501
00:28:13,740 --> 00:28:11,800
one because water is unbelievably heavy

502
00:28:15,180 --> 00:28:13,750
just go carry around a bucket of water

503
00:28:16,560 --> 00:28:15,190
and you would see that launched on a

504
00:28:18,750 --> 00:28:16,570
bunch of water into space is going to be

505
00:28:20,970 --> 00:28:18,760
pretty difficult up mass and then for a

506
00:28:23,520 --> 00:28:20,980
four atmosphere system we're scrubbing

507
00:28:25,620 --> 00:28:23,530
co2 out we have some other systems that

508
00:28:29,070 --> 00:28:25,630
can take water turn them into oxygen so

509
00:28:31,320 --> 00:28:29,080
really we're very very close to having a

510
00:28:32,790 --> 00:28:31,330
perfect system and and it's pretty

511
00:28:35,180 --> 00:28:32,800
reliable we have a little bit further to

512
00:28:37,770 --> 00:28:35,190
go on reliability but we're almost there

513
00:28:39,990 --> 00:28:37,780

some of the other experiments you're

514
00:28:42,780 --> 00:28:40,000
working on on the space station I mean

515
00:28:49,320 --> 00:28:42,790
paving the way to us one day being able

516
00:28:51,690 --> 00:28:49,330
to travel the Mars yeah

517
00:28:55,150 --> 00:28:51,700
right now I've been working on upgrading

518
00:28:57,250 --> 00:28:55,160
Robonaut which is a robotic astronaut

519
00:28:59,169 --> 00:28:57,260
for us up here and hopefully one day it

520
00:29:01,480 --> 00:28:59,179
will be able to do tasks and help us out

521
00:29:03,250 --> 00:29:01,490
explore new places like Mars and if we

522
00:29:04,960 --> 00:29:03,260
had to go outside into a harsh

523
00:29:06,909 --> 00:29:04,970
environment we'd send it out first to

524
00:29:08,110 --> 00:29:06,919
maybe fix something or to see what it's

525
00:29:10,090 --> 00:29:08,120
like out there to make sure it's safe

526
00:29:11,860 --> 00:29:10,100
for us so I think it's definitely when

527
00:29:13,210 --> 00:29:11,870
we do explore some place like Mars it's

528
00:29:15,070 --> 00:29:13,220
going to take a human approach and a

529
00:29:20,200 --> 00:29:15,080
robotic approach together to make it

530
00:29:21,730 --> 00:29:20,210
work we are here at JPL and we're about

531
00:29:25,029 --> 00:29:21,740
to launch rapidscat

532
00:29:26,799 --> 00:29:25,039
up to you guys and so can we talk a

533
00:29:28,450 --> 00:29:26,809
little bit about the earth science that

534
00:29:34,390 --> 00:29:28,460
you guys are going to be doing and doing

535
00:29:36,159 --> 00:29:34,400
now in fact yeah absolutely

536
00:29:37,510 --> 00:29:36,169
most of the earth science that we're

537
00:29:39,640 --> 00:29:37,520
doing just like rapidscat

538
00:29:42,130 --> 00:29:39,650

these are going to be almost call them

539
00:29:44,350 --> 00:29:42,140
like strap on hardware that looks down

540
00:29:47,740 --> 00:29:44,360
at the at the earth and is managed from

541
00:29:49,270 --> 00:29:47,750
control centers like JPL across our

542
00:29:52,270 --> 00:29:49,280
country and really around the world and

543
00:29:53,740 --> 00:29:52,280
so from our perspective what we're doing

544
00:29:55,990 --> 00:29:53,750
is we're taking a lot of pictures and

545
00:29:58,330 --> 00:29:56,000
for us that's fun we really like doing

546
00:29:59,409 --> 00:29:58,340
it but really once these pictures get

547
00:30:00,580 --> 00:29:59,419
downloaded they're not just pretty

548
00:30:02,470 --> 00:30:00,590
pictures of the earth we have a whole

549
00:30:03,730 --> 00:30:02,480
team at NASA that goes through these

550
00:30:06,520 --> 00:30:03,740
pictures and they're looking at dune

551
00:30:08,860 --> 00:30:06,530
migration weather patterns what's going

552
00:30:10,720 --> 00:30:08,870
on in our oceans so really for earth

553
00:30:12,700 --> 00:30:10,730
science and earth observation right now

554
00:30:14,680 --> 00:30:12,710
this is a really robust platform

555
00:30:15,820 --> 00:30:14,690
combining the crew and the control

556
00:30:17,850 --> 00:30:15,830
centers around the world and it's

557
00:30:22,720 --> 00:30:17,860
turning out to be great valuable science

558
00:30:24,520 --> 00:30:22,730
say weed is a major Twitter guy and he

559
00:30:26,820 --> 00:30:24,530
he got right up there and starts

560
00:30:30,159 --> 00:30:26,830
snapping pictures from the space station

561
00:30:33,430 --> 00:30:30,169
sends them down you see storms from

562
00:30:34,870 --> 00:30:33,440
above and it's really been amazing

563
00:30:37,840 --> 00:30:34,880

does that help you feel more connected

564
00:30:39,490 --> 00:30:37,850
do you is it better having social media

565
00:30:46,630 --> 00:30:39,500
up there then then pre-social media

566
00:30:48,640 --> 00:30:46,640
times it definitely it adds something to

567
00:30:50,140 --> 00:30:48,650
your day and for the for the most part

568
00:30:52,539 --> 00:30:50,150
it's certainly a positive experience but

569
00:30:54,279 --> 00:30:52,549
to me I think every kid is either

570
00:30:55,510 --> 00:30:54,289
dreamed of going into space or he's at

571
00:30:56,950 --> 00:30:55,520
least had a thought of what is it like

572
00:30:59,530 --> 00:30:56,960
to look down on our planet from above

573
00:31:01,480 --> 00:30:59,540
and that's the joy is we're incredibly

574
00:31:03,010 --> 00:31:01,490
lucky the six of us to be up here right

575
00:31:05,860 --> 00:31:03,020
now on the space station out of seven

576
00:31:07,390 --> 00:31:05,870
billion people on a planet and it's part

577
00:31:09,220 --> 00:31:07,400
of our job is to share this experience

578
00:31:11,200 --> 00:31:09,230
and and to make it as real for the

579
00:31:13,000 --> 00:31:11,210
public as possible and it's great to

580
00:31:14,830 --> 00:31:13,010
have Instagram Twitter all these types

581
00:31:16,930 --> 00:31:14,840
of social media where we have a really

582
00:31:18,160 --> 00:31:16,940
easy outlet and people can go on if they

583
00:31:19,990 --> 00:31:18,170
like and if they don't want they don't

584
00:31:25,240 --> 00:31:20,000
have to look and it's been an extremely

585
00:31:28,210 --> 00:31:25,250
positive experience for me I was hearing

586
00:31:29,740 --> 00:31:28,220
about your delivery of a fresh apples

587
00:31:32,790 --> 00:31:29,750
this morning then you're quite excited

588
00:31:37,950 --> 00:31:32,800

about what is yeah I want to know what

589
00:31:37,960 --> 00:31:49,669
Newton to be very happy to see that

590
00:31:53,909 --> 00:31:52,320
what an important question and if you

591
00:31:59,249 --> 00:31:53,919
get tired of all this stuff then you can

592
00:32:04,229 --> 00:31:59,259
just leave at your current altitude are

593
00:32:09,450 --> 00:32:04,239
you inside or outside of Earth's what do

594
00:32:11,849 --> 00:32:09,460
you call it stare like the exosphere and

595
00:32:15,330 --> 00:32:11,859
if you inside I can understand that you

596
00:32:17,219 --> 00:32:15,340
have pretty good protection but if

597
00:32:19,979 --> 00:32:17,229
you're outside you have no protection

598
00:32:26,580 --> 00:32:19,989
against solar flares talk to me a little

599
00:32:28,200 --> 00:32:26,590
bit about that from our understanding is

600
00:32:30,239 --> 00:32:28,210
we do have protection we're inside that

601
00:32:31,710 --> 00:32:30,249
area and so we do have protection and

602
00:32:33,450 --> 00:32:31,720
that's one of the big issues of going to

603
00:32:35,519 --> 00:32:33,460
Mars when you're outside of that issue I

604
00:32:37,739 --> 00:32:35,529
started out that side of that area that

605
00:32:39,180 --> 00:32:37,749
you would get much more radiation and

606
00:32:40,919 --> 00:32:39,190
that's one thing we had to solve before

607
00:32:42,509 --> 00:32:40,929
we go on but we're lucky up here we only

608
00:32:52,049 --> 00:32:42,519
get a slight bit more radiation than on

609
00:32:53,519 --> 00:32:52,059
earth what do you guys when you get back

610
00:32:53,999 --> 00:32:53,529
from Mars or you come back from this

611
00:33:00,499 --> 00:32:54,009
trip

612
00:33:05,279 --> 00:33:03,239
yeah for me it's been I've been up here

613
00:33:07,409 --> 00:33:05,289

for 50 days actually today is my 51st

614
00:33:09,779 --> 00:33:07,419
day it's been changing a little bit but

615
00:33:11,639 --> 00:33:09,789
right now I saw somebody eating a pizza

616
00:33:14,279 --> 00:33:11,649
on a TV show last night or a couple days

617
00:33:16,049 --> 00:33:14,289
ago and man that just sparked all the

618
00:33:19,019 --> 00:33:16,059
senses so I'm gonna vote pizza right now

619
00:33:21,299 --> 00:33:19,029
swanee I'm going for the juicy juicy

620
00:33:26,869 --> 00:33:21,309
hamburger with cheese bacon the whole

621
00:33:32,039 --> 00:33:29,399
thank you so much Steve

622
00:33:34,440 --> 00:33:32,049
that's Reid's Wiseman and commander

623
00:33:36,479 --> 00:33:34,450
Steve Swanson I think Steve is going to

624
00:33:38,759 --> 00:33:36,489
be leaving a little sooner I think

625
00:33:42,299 --> 00:33:38,769
Reid's gonna stay there till November

626
00:33:44,339 --> 00:33:42,309
right okay and we're looking forward to

627
00:33:45,869 --> 00:33:44,349
all those tweets I know you hear you

628
00:34:08,270 --> 00:33:45,879
guys are staying busy but thanks for

629
00:34:08,280 --> 00:34:25,020
they're having too much

630
00:34:30,700 --> 00:34:28,990
so before we move on to questions one it

631
00:34:32,200 --> 00:34:30,710
talked a little bit about the look to

632
00:34:34,839 --> 00:34:32,210
the future some of the projects you have

633
00:34:37,210 --> 00:34:34,849
ahead one of which I understand involves

634
00:34:39,250 --> 00:34:37,220
one of our projects we have a new series

635
00:34:42,639 --> 00:34:39,260
coming out on Science Channel and I

636
00:34:44,740 --> 00:34:42,649
believe it premieres on August 13th and

637
00:34:47,349 --> 00:34:44,750
it's called man vs. the universe and

638
00:34:50,730 --> 00:34:47,359

it's a series of short series of films

639
00:34:53,649 --> 00:34:50,740
about the future of space exploration

640
00:34:56,109 --> 00:34:53,659
new projects that NASA is doing JPL is

641
00:34:58,210 --> 00:34:56,119
doing also incorporating some of the

642
00:35:01,420 --> 00:34:58,220
private sector endeavors like SpaceX and

643
00:35:02,770 --> 00:35:01,430
other people and we have one episode we

644
00:35:04,420 --> 00:35:02,780
shot a couple of things here actually

645
00:35:06,430 --> 00:35:04,430
one of them on your asteroid capture

646
00:35:09,220 --> 00:35:06,440
program the asteroid redirect mission

647
00:35:11,829 --> 00:35:09,230
which is a proposed mission and then we

648
00:35:14,559 --> 00:35:11,839
worked with your great people in Clark

649
00:35:16,930 --> 00:35:14,569
and might Meacham out of the place is

650
00:35:18,819 --> 00:35:16,940
called the snort yes what is this not

651
00:35:23,710 --> 00:35:18,829
stand for again oh it's too difficult to

652
00:35:25,390 --> 00:35:23,720
say yeah acronym what China like testing

653
00:35:28,450 --> 00:35:25,400
the parachute that we could use for

654
00:35:30,579 --> 00:35:28,460
heavy vehicles on Mars including

655
00:35:32,440 --> 00:35:30,589
including potentially you know human

656
00:35:35,349 --> 00:35:32,450
vehicles many years down the line and

657
00:35:37,300 --> 00:35:35,359
that's our ldsd project and we can just

658
00:35:42,309 --> 00:35:37,310
roll the tape and seem for ourselves

659
00:35:43,839 --> 00:35:42,319
yeah on earth the thick atmosphere will

660
00:35:46,030 --> 00:35:43,849
slow down a speeding spacecraft to

661
00:35:48,910 --> 00:35:46,040
around 200 miles an hour

662
00:35:52,180 --> 00:35:48,920
but Mars's atmosphere is a hundred times

663
00:36:05,860 --> 00:35:52,190

thinner there's only one way to slow

664
00:36:08,140 --> 00:36:05,870
down use a really big parachute the job

665
00:36:10,540 --> 00:36:08,150
of JPL engineers Ian Clark and Mike

666
00:36:13,660 --> 00:36:10,550
Meacham is to prevent crash landings on

667
00:36:16,390 --> 00:36:13,670
Mars any manned spacecraft will weigh

668
00:36:18,190 --> 00:36:16,400
close to 40 tons for those kind of loads

669
00:36:20,500 --> 00:36:18,200
they'll need a radically new type of

670
00:36:22,570 --> 00:36:20,510
parachute a year ago we just landed a

671
00:36:25,180 --> 00:36:22,580
one-ton Rover on the surface of Mars the

672
00:36:26,500 --> 00:36:25,190
Curiosity rover and that took all of the

673
00:36:28,270 --> 00:36:26,510
technologies that we've developed over

674
00:36:31,380 --> 00:36:28,280
the past four decades just to do that

675
00:36:34,060 --> 00:36:31,390
and we've now reached the max of that

676
00:36:35,740 --> 00:36:34,070
the parachute we're testing is designed

677
00:36:37,480 --> 00:36:35,750
to hold a hundred thousand pounds of

678
00:36:38,950 --> 00:36:37,490
drag it's something remarkable

679
00:36:41,050 --> 00:36:38,960
considering the parachute itself only

680
00:36:43,480 --> 00:36:41,060
weighs about 200 pounds it's a very

681
00:36:44,770 --> 00:36:43,490
light structure it's made from materials

682
00:36:46,570 --> 00:36:44,780
like you would have build your camping

683
00:36:47,830 --> 00:36:46,580
tent out of nylon predominantly with a

684
00:36:50,230 --> 00:36:47,840
little bit of Kevlar like we build

685
00:36:51,700 --> 00:36:50,240
bulletproof vests out of comes through

686
00:36:54,250 --> 00:36:51,710
the back of the sled here on that small

687
00:36:55,570 --> 00:36:54,260
pulley it goes up through this whole

688
00:36:58,120 --> 00:36:55,580

structure through what we call the pipe

689
00:37:00,970 --> 00:36:58,130
guide Mike Meacham is the mad scientist

690
00:37:03,220 --> 00:37:00,980
of the group it's his job to figure out

691
00:37:05,640 --> 00:37:03,230
how to design and test a parachute that

692
00:37:07,870 --> 00:37:05,650
won't rip apart at supersonic speeds

693
00:37:10,600 --> 00:37:07,880
parachutes that we're looking at testing

694
00:37:12,070 --> 00:37:10,610
ours so large no wind tunnel that exists

695
00:37:14,260 --> 00:37:12,080
right now can hold them they're just not

696
00:37:16,240 --> 00:37:14,270
big enough so we started looking at

697
00:37:17,560 --> 00:37:16,250
every possible way you could test a Mars

698
00:37:19,090 --> 00:37:17,570
parachute all the way up hang it upside

699
00:37:20,200 --> 00:37:19,100
down and putting potatoes inside of it

700
00:37:22,000 --> 00:37:20,210
we just thought of everything you could

701
00:37:25,330 --> 00:37:22,010
possibly do what they came up with

702
00:37:29,710 --> 00:37:25,340
includes a Nighthawk military helicopter

703
00:37:32,620 --> 00:37:29,720
for mark 70 missile rocket engines 4,000

704
00:37:36,030 --> 00:37:32,630
feet of rope and a 30-person support

705
00:37:42,000 --> 00:37:39,040
first the helicopter lifts the 200-pound

706
00:37:45,609 --> 00:37:42,010
parachute trailing a long rope behind it

707
00:37:49,570 --> 00:37:45,619
at 40 100 feet that chopper releases the

708
00:37:51,160 --> 00:37:49,580
parachute and it inflates at the bottom

709
00:37:53,620 --> 00:37:51,170
of the Rope is a piece of hardware

710
00:37:55,270 --> 00:37:53,630
called a bullet which must drop into a

711
00:37:58,870 --> 00:37:55,280
large funnel at the end of a

712
00:38:00,520 --> 00:37:58,880
rocket-powered sled so this structure is

713
00:38:02,380 --> 00:38:00,530

fifty thousand pounds of Steel and you

714
00:38:03,609 --> 00:38:02,390
add it up it's got this enormous steel

715
00:38:05,890 --> 00:38:03,619
pulley that's what's doing the real work

716
00:38:07,510 --> 00:38:05,900
actually in order to react all that load

717
00:38:09,640 --> 00:38:07,520
we had to pour two million pounds of

718
00:38:11,859 --> 00:38:09,650
concrete at the ground that was a picnic

719
00:38:13,420 --> 00:38:11,869
so these concrete anchors you see around

720
00:38:14,890 --> 00:38:13,430
you that this structure is bolted down

721
00:38:17,920 --> 00:38:14,900
to that go they go down eighteen feet

722
00:38:20,020 --> 00:38:17,930
into the ground once the bullet drops

723
00:38:23,950 --> 00:38:20,030
into the funnel it triggers the rocket

724
00:38:25,510 --> 00:38:23,960
sled to fire simulating the supersonic

725
00:38:30,370 --> 00:38:25,520
speeds the parachute will have to endure

726
00:38:31,990 --> 00:38:30,380
on Mars I'm like the outside Rockets

727
00:38:33,700 --> 00:38:32,000
first that's our first stage that kind

728
00:38:36,010 --> 00:38:33,710
of gets this big hundred thousand pound

729
00:38:37,390 --> 00:38:36,020
sled moving and once we get up to speed

730
00:38:41,050 --> 00:38:37,400
a little bit we light the inside two

731
00:38:43,000 --> 00:38:41,060
rakahs Ian and Mike have run the test

732
00:39:06,340 --> 00:38:43,010
once before with a prototype parachute

733
00:39:11,090 --> 00:39:08,720
the parachute didn't survive

734
00:39:13,300 --> 00:39:11,100
but it didn't need to that was just a

735
00:39:15,710 --> 00:39:13,310
proof of the concept for the system

736
00:39:17,960 --> 00:39:15,720
really the only thing that went wrong

737
00:39:20,150 --> 00:39:17,970
during that test was a parachute failure

738
00:39:21,560 --> 00:39:20,160

on one of the scenes so as far as the

739
00:39:23,510 --> 00:39:21,570
architecture is concerned it worked

740
00:39:24,950 --> 00:39:23,520
perfectly in some ways that makes us a

741
00:39:26,270 --> 00:39:24,960
little nervous but this next test you

742
00:39:27,980 --> 00:39:26,280
know it's almost it's almost going to

743
00:39:29,330 --> 00:39:27,990
well you've set expectations though

744
00:39:32,030 --> 00:39:29,340
right

745
00:39:35,510 --> 00:39:32,040
for Ian and Mike the stakes couldn't be

746
00:39:38,390 --> 00:39:35,520
higher our ability to land humans on

747
00:39:41,330 --> 00:39:38,400
Mars rests on the success of this test

748
00:39:45,320 --> 00:39:41,340
it's a massive and complicated operation

749
00:39:48,050 --> 00:39:45,330
that costs millions one more thing there

750
00:39:50,750 --> 00:39:48,060
is no plan B they only have one

751
00:39:53,030 --> 00:39:50,760
parachute tonight I won't be sleeping

752
00:39:54,800 --> 00:39:53,040
for sure so we've got a three a.m. start

753
00:39:57,260 --> 00:39:54,810
tomorrow I'll just be my bed thinking

754
00:40:10,480 --> 00:39:57,270
about it extremely nervous so many

755
00:40:16,300 --> 00:40:13,960
actually we did the full test not too

756
00:40:18,910 --> 00:40:16,310
long ago the ldsd test out of kawaii

757
00:40:20,710 --> 00:40:18,920
Hawaii yes big what's the call to

758
00:40:23,800 --> 00:40:20,720
pancake or something they did the Flying

759
00:40:27,820 --> 00:40:23,810
Saucer and released the the the sayad

760
00:40:30,070 --> 00:40:27,830
which is the inflatable kind of donut to

761
00:40:33,660 --> 00:40:30,080
slow it down and then the parachute and

762
00:40:35,440 --> 00:40:33,670
the test itself was complete success

763
00:40:37,390 --> 00:40:35,450

really happy about that

764
00:40:38,980 --> 00:40:37,400
incredible work I mean the amount of

765
00:40:40,930 --> 00:40:38,990
effort and ingenuity that goes into

766
00:40:42,970 --> 00:40:40,940
testing those things I just think it's

767
00:40:45,160 --> 00:40:42,980
remarkable that's the amazing spirit of

768
00:40:47,770 --> 00:40:45,170
this place which a lot of folks don't

769
00:40:50,020 --> 00:40:47,780
realize you collaborate a lot with us

770
00:40:51,970 --> 00:40:50,030
don't you you've done quite a few

771
00:40:54,340 --> 00:40:51,980
projects with us through the wormhole

772
00:40:56,950 --> 00:40:54,350
itself not man versus universe third

773
00:40:59,740 --> 00:40:56,960
through the wormhole itself was based on

774
00:41:02,920 --> 00:40:59,750
short internet films that we made here

775
00:41:04,300 --> 00:41:02,930
at JPL and Science Channel and Discovery

776
00:41:07,320 --> 00:41:04,310
saw them and said this should be

777
00:41:10,420 --> 00:41:07,330
something bigger so it was birthed here

778
00:41:11,650 --> 00:41:10,430
so we have just a little bit of time for

779
00:41:15,790 --> 00:41:11,660
questions

780
00:41:20,160 --> 00:41:15,800
hope you're ready and we we have mics

781
00:41:23,099 --> 00:41:20,170
out and let's well take one question oh

782
00:41:28,150 --> 00:41:23,109
we have one question do you have a mic

783
00:41:29,830 --> 00:41:28,160
alright this is Clara ma hey hi thank

784
00:41:32,170 --> 00:41:29,840
you all so much for being here my name

785
00:41:35,140 --> 00:41:32,180
is Clara I'm a high school summer intern

786
00:41:40,390 --> 00:41:35,150
at JPL and my question for you is if you

787
00:41:48,490 --> 00:41:40,400
could give put the mic down now let me

788
00:41:49,780 --> 00:41:48,500

see I hear you do I hear you oh see cuz

789
00:41:52,359 --> 00:41:49,790
I can't hear you through the mic that's

790
00:41:53,710 --> 00:41:52,369
what I'm saying so just pick up I'm here

791
00:41:56,170 --> 00:41:53,720
okay

792
00:41:58,510 --> 00:41:56,180
my question for you is if you could give

793
00:41:59,980 --> 00:41:58,520
any piece of advice to the over 700

794
00:42:01,540 --> 00:41:59,990
students who are interning at the Jet

795
00:42:03,240 --> 00:42:01,550
Propulsion Laboratory this summer what

796
00:42:07,390 --> 00:42:03,250
would it be

797
00:42:13,190 --> 00:42:07,400
advice for 700 student interns many of

798
00:42:21,289 --> 00:42:15,329
raise your hand if you're an intern

799
00:42:26,670 --> 00:42:21,299
quite a few they were first in life I

800
00:42:29,279 --> 00:42:26,680
have no advice for you the advice that I

801
00:42:40,480 --> 00:42:29,289
would give you if you are not here was

802
00:42:43,900 --> 00:42:42,790
so now I'm going to switch over to a

803
00:42:46,660 --> 00:42:43,910
Twitter question

804
00:42:50,170 --> 00:42:46,670
it's from Cindy Qin in your illustrious

805
00:42:52,750 --> 00:42:50,180
and long career what is the one thing

806
00:42:55,359 --> 00:42:52,760
the one project that got away

807
00:42:57,700 --> 00:42:55,369
what else is it that you'd love to do

808
00:43:02,920 --> 00:42:57,710
besides what you're doing now well a lot

809
00:43:05,020 --> 00:43:02,930
of things got away because I didn't make

810
00:43:09,270 --> 00:43:05,030
the audition I didn't pass the audition

811
00:43:14,620 --> 00:43:09,280
process or the interview whatever it was

812
00:43:20,380 --> 00:43:14,630
at this stage in my long and illustrious

813
00:43:25,060 --> 00:43:20,390

career I don't know what to look forward

814
00:43:32,550 --> 00:43:25,070
to I just looked forward you know what I

815
00:43:38,910 --> 00:43:32,560
mean all right we have another question

816
00:43:44,500 --> 00:43:41,560
hello can hear me through the mic

817
00:43:48,040 --> 00:43:44,510
virtually okay but my name is hunter

818
00:43:50,079 --> 00:43:48,050
Rodriguez and my question is that if you

819
00:43:51,370 --> 00:43:50,089
were to design a mission to go anywhere

820
00:43:54,010 --> 00:43:51,380
in the universe where would you go and

821
00:43:54,820 --> 00:43:54,020
what would you want to discover I would

822
00:43:57,099 --> 00:43:54,830
go to Jupiter

823
00:43:58,810 --> 00:43:57,109
I think that's the most exciting place

824
00:44:00,329 --> 00:43:58,820
and in an hour

825
00:44:02,920 --> 00:44:00,339
will you mean in the whole universe

826
00:44:08,079 --> 00:44:02,930
whole universe but I don't know that

827
00:44:10,800 --> 00:44:08,089
much about the whole universe so so I

828
00:44:12,880 --> 00:44:10,810
think I wouldn't I go through the

829
00:44:16,270 --> 00:44:12,890
asteroid belt if I was on my way to

830
00:44:18,070 --> 00:44:16,280
Jupiter yeah you know spend a couple of

831
00:44:22,060 --> 00:44:18,080
more bits in the asteroid belt looking

832
00:44:24,579 --> 00:44:22,070
around tagging things you know and then

833
00:44:27,690 --> 00:44:24,589
I would like to proceed to one of those

834
00:44:31,240 --> 00:44:27,700
exciting planets there are one of the

835
00:44:33,280 --> 00:44:31,250
moons of Jupiter and just much Jupiter

836
00:44:35,650 --> 00:44:33,290
for a little while what would you like

837
00:44:37,810 --> 00:44:35,660
to discovery that huh what would you

838
00:44:43,300 --> 00:44:37,820

like to discover there what do I like to

839
00:44:45,270 --> 00:44:43,310
discover do you think there's something

840
00:44:49,590 --> 00:44:45,280
there to discover that we have

841
00:44:52,280 --> 00:44:49,600
already done already I have no idea what

842
00:44:57,060 --> 00:44:52,290
you say your name was

843
00:44:59,460 --> 00:44:57,070
my name is hunter Rodriguez okay well

844
00:45:03,600 --> 00:44:59,470
how do I die I wouldn't know what to

845
00:45:08,730 --> 00:45:03,610
just discover you know I know there's no

846
00:45:11,070 --> 00:45:08,740
life and but there are all kinds of

847
00:45:19,290 --> 00:45:11,080
possibilities out there in terms of

848
00:45:23,280 --> 00:45:19,300
ocean water volcanic action but what

849
00:45:25,440 --> 00:45:23,290
you're gonna discover I don't know all

850
00:45:27,360 --> 00:45:25,450
right here's another social media

851
00:45:30,420 --> 00:45:27,370
question in fact there are two questions

852
00:45:35,930 --> 00:45:30,430
but they're very similar if you get a

853
00:45:40,380 --> 00:45:35,940
one-way trip for Mars will you go No

854
00:45:43,080 --> 00:45:40,390
here's another one then if offered the

855
00:45:53,340 --> 00:45:43,090
chance to go to space would you accept

856
00:45:55,950 --> 00:45:53,350
yes why why why did you see those guys I

857
00:45:58,350 --> 00:45:55,960
think that would probably be the

858
00:46:01,200 --> 00:45:58,360
adventure of a lifetime for Chuck you

859
00:46:03,210 --> 00:46:01,210
know for an average person to have a

860
00:46:08,450 --> 00:46:03,220
shot at we used to send them up there

861
00:46:13,110 --> 00:46:08,460
you know teachers and people who I'd go

862
00:46:18,030 --> 00:46:13,120
yeah alright one more question here in

863
00:46:19,830 --> 00:46:18,040

right there howdy my name is Kerry beam

864
00:46:22,410 --> 00:46:19,840
I'm an early career higher here at JPL

865
00:46:24,930 --> 00:46:22,420
and I wanted to ask you outside of the

866
00:46:26,550 --> 00:46:24,940
traditional media how can the scientists

867
00:46:28,410 --> 00:46:26,560
and engineers here in the room how can

868
00:46:34,280 --> 00:46:28,420
we help reach out to the general public

869
00:46:39,480 --> 00:46:36,420
you've had some thoughts on this

870
00:46:41,970 --> 00:46:39,490
obviously right yes I run a very active

871
00:46:44,700 --> 00:46:41,980
Twitter account okay so what do you

872
00:46:47,460 --> 00:46:44,710
think um I think social media has really

873
00:46:49,080 --> 00:46:47,470
helped recently social media a lot of us

874
00:46:50,400 --> 00:46:49,090
can really interact one-on-one with

875
00:46:52,800 --> 00:46:50,410
people that we wouldn't normally be able

876
00:46:54,750 --> 00:46:52,810
to reach out to and then also I have a

877
00:46:56,340 --> 00:46:54,760
whole bunch of stickers on my laptop so

878
00:46:57,840 --> 00:46:56,350
if I'm traveling on a plane and an

879
00:46:59,250 --> 00:46:57,850
airport people are like oh NASA isn't

880
00:47:00,810 --> 00:46:59,260
that like shutdown with the Space

881
00:47:02,640 --> 00:47:00,820
Shuttle and I'm like no and then I tell

882
00:47:05,430 --> 00:47:02,650
them all about the cool stuff that we're

883
00:47:09,660 --> 00:47:05,440
doing so this is some of the things I'm

884
00:47:27,770 --> 00:47:13,320
I don't know that I couldn't have

885
00:47:35,220 --> 00:47:30,870
I'm Rob's turbo from JPL I want to ask

886
00:47:37,830 --> 00:47:35,230
hi I you you got my wife interested in

887
00:47:39,930 --> 00:47:37,840
science and she's not a science person I

888
00:47:42,210 --> 00:47:39,940

wanted to say for the science people is

889
00:47:45,450 --> 00:47:42,220
there some way you can construct a

890
00:47:47,160 --> 00:47:45,460
website references of papers of all

891
00:47:50,099 --> 00:47:47,170
these people you interview because I've

892
00:47:53,130 --> 00:47:50,109
been trying like very hard to find this

893
00:47:55,380 --> 00:47:53,140
fellow hurrah toofs who was a

894
00:47:57,060 --> 00:47:55,390
deterministic physics guy and there's no

895
00:47:59,130 --> 00:47:57,070
place I saw on the internet that's got a

896
00:48:01,140 --> 00:47:59,140
listing of the people you interview so

897
00:48:05,250 --> 00:48:01,150
you can follow up so that would be a

898
00:48:07,410 --> 00:48:05,260
great thing to to put on the website we

899
00:48:10,620 --> 00:48:07,420
definitely would like to do that and

900
00:48:12,359 --> 00:48:10,630
yeah we will we should I noticed that

901
00:48:13,650 --> 00:48:12,369
there in the wormhole episodes yeah we

902
00:48:14,730 --> 00:48:13,660
don't we just say their names and

903
00:48:16,859 --> 00:48:14,740
they're gone then you have to go and

904
00:48:18,599 --> 00:48:16,869
hunt around and find them so we'll

905
00:48:21,660 --> 00:48:18,609
certainly trying to help thank you so

906
00:48:25,390 --> 00:48:21,670
much thank you the safe ass rod is we

907
00:48:31,030 --> 00:48:27,790
thank you thank you so much I certainly

908
00:48:34,450 --> 00:48:31,040
hope you guys had fun because we

909
00:48:35,890 --> 00:48:34,460
certainly just are so pleased to have

910
00:48:38,530 --> 00:48:35,900
this opportunity to be with you

911
00:48:41,340 --> 00:48:38,540
so I'd like to thank you for taking this

912
00:48:45,280 --> 00:48:41,350
opportunity to be with us and on NASA TV

913
00:48:47,650 --> 00:48:45,290

and if there was one parting word you

914
00:48:49,840 --> 00:48:47,660
have what do you think what kind of

915
00:48:52,540 --> 00:48:49,850
advice do you think you can give NASA to

916
00:48:55,090 --> 00:48:52,550
inspire the next generation to keep

917
00:49:08,650 --> 00:48:55,100
exploring keep asking questions

918
00:49:11,040 --> 00:49:08,660
a little more information about Apollo