



SILICON
VALLEY

AMES RESEARCH CENTER

1
00:00:31,830 --> 00:00:01,659

[Music]

2
00:00:34,200 --> 00:00:31,840

what is up everybody you are watching

3
00:00:39,119 --> 00:00:34,210

NASA and Silicon Valley live for

4
00:00:41,400 --> 00:00:39,129

Thursday September 27th 2018 I am one of

5
00:00:44,479 --> 00:00:41,410

your hosts Matthew Buffington and today

6
00:00:47,970 --> 00:00:44,489

we have a special guest host he is a

7
00:00:50,969 --> 00:00:47,980

youtuber a twitch streamer professional

8
00:00:55,049 --> 00:00:50,979

Scotsman and all-around cool guy

9
00:00:55,770 --> 00:00:55,059

mr. Scott Manley hello guys it's going

10
00:00:57,930 --> 00:00:55,780

great

11
00:01:00,090 --> 00:00:57,940

glad to be here are you hyped to do that

12
00:01:02,970 --> 00:01:00,100

I am as hyped as you can get to be

13
00:01:04,710 --> 00:01:02,980

playing with rockets yes yes so for

14

00:01:06,570 --> 00:01:04,720

folks if you don't remember folks who

15

00:01:09,120 --> 00:01:06,580

are watching the show about I think it's

16

00:01:10,590 --> 00:01:09,130

what in January we did a NASA silicon

17

00:01:12,389 --> 00:01:10,600

valley live show we did our first space

18

00:01:15,330 --> 00:01:12,399

video game show and so as we were

19

00:01:17,070 --> 00:01:15,340

sitting there playing the game Scott was

20

00:01:18,300 --> 00:01:17,080

actually in the chat and so as we're

21

00:01:20,070 --> 00:01:18,310

sitting there going back and forth on

22

00:01:21,180 --> 00:01:20,080

lunar lander it was another one what was

23

00:01:24,690 --> 00:01:21,190

the other game that you brought it was

24

00:01:26,130 --> 00:01:24,700

nice work space he was saying like hey

25

00:01:28,520 --> 00:01:26,140

you got a lead your shots you got to

26

00:01:33,389 --> 00:01:28,530

jump on in so that was you that was

27

00:01:34,560 --> 00:01:33,399

everyone's a critic as we were going

28

00:01:35,999 --> 00:01:34,570

through we went back and forth on

29

00:01:37,649 --> 00:01:36,009

Twitter a little bit and I was like well

30

00:01:40,080 --> 00:01:37,659

hey let's bring Scott on over deck he'll

31

00:01:42,840 --> 00:01:40,090

come and help host this show so welcome

32

00:01:46,830 --> 00:01:42,850

welcome thank you so our returning

33

00:01:50,580 --> 00:01:46,840

jeopardy champions we have mr. Chad

34

00:01:53,270 --> 00:01:50,590

frost and Mary Beth Wilhelm how are you

35

00:01:55,469 --> 00:01:53,280

guys doing great great hanging in so

36

00:01:56,819 --> 00:01:55,479

anything new happening since the last

37

00:01:59,069 --> 00:01:56,829

time you were here playing video games

38

00:02:00,359 --> 00:01:59,079

with everybody what's up I know very

39

00:02:02,100 --> 00:02:00,369

much do you see the presentation yeah

40

00:02:04,289 --> 00:02:02,110

yeah we're working on developing some

41

00:02:06,510 --> 00:02:04,299

new life detection technologies and it

42

00:02:08,160 --> 00:02:06,520

did some field work in Iceland and lots

43

00:02:10,229 --> 00:02:08,170

of lab work so it's been a busy summer

44

00:02:12,000 --> 00:02:10,239

I'm ready for a vacation I think you

45

00:02:16,310 --> 00:02:12,010

even you just came from the presentation

46

00:02:19,349 --> 00:02:16,320

they had your shadows our evaluators do

47

00:02:21,390 --> 00:02:19,359

there they're actually doing their big

48

00:02:23,069 --> 00:02:21,400

presentation about a month so this was

49

00:02:26,460 --> 00:02:23,079

our opportunity to give them a little

50

00:02:28,229 --> 00:02:26,470

feedback and their fantastic ideas

51
00:02:30,630 --> 00:02:28,239
coming out from all directions it was

52
00:02:32,789 --> 00:02:30,640
super cool awesome well so for this

53
00:02:35,430 --> 00:02:32,799
episode folks if you can't tell this is

54
00:02:37,349 --> 00:02:35,440
a special let's play video games episode

55
00:02:38,819 --> 00:02:37,359
but before I let me jump into the rig

56
00:02:39,360 --> 00:02:38,829
roll because if you didn't know this is

57
00:02:42,059 --> 00:02:39,370
NASA's

58
00:02:44,399 --> 00:02:42,069
Valley live a conversational show out of

59
00:02:46,380 --> 00:02:44,409
NASA's Ames Research Center where we

60
00:02:48,750 --> 00:02:46,390
talk to researchers scientists engineers

61
00:02:50,130 --> 00:02:48,760
and all-around cool people about all the

62
00:02:52,289 --> 00:02:50,140
nerdy NASA and news you need to know

63
00:02:55,220 --> 00:02:52,299

about so if you like that I just come to

64

00:02:58,530 --> 00:02:55,230

we are live on YouTube Facebook

65

00:03:00,569 --> 00:02:58,540

periscope twitch if you want to

66

00:03:02,309 --> 00:03:00,579

participate live in the chat just like

67

00:03:06,210 --> 00:03:02,319

that lower third says you need to go to

68

00:03:08,369 --> 00:03:06,220

twitch.tv slash NASA and our friend cave

69

00:03:10,259 --> 00:03:08,379

on back behind the scenes is actually

70

00:03:12,119 --> 00:03:10,269

digging through those questions so I

71

00:03:14,190 --> 00:03:12,129

don't have to see the constant deluge of

72

00:03:16,680 --> 00:03:14,200

stuff in the chat but if you can't catch

73

00:03:18,839 --> 00:03:16,690

us live that is no big deal I you kid we

74

00:03:20,099 --> 00:03:18,849

will have video on demand on twitch and

75

00:03:21,809 --> 00:03:20,109

YouTube immediately once the show is

76

00:03:24,330 --> 00:03:21,819

over and the next week it'll be up and

77

00:03:27,569 --> 00:03:24,340

replaying or rebroadcasting over on NASA

78

00:03:29,339 --> 00:03:27,579

TV and also we'll have it on an audio

79

00:03:31,670 --> 00:03:29,349

version for podcast services or

80

00:03:35,220 --> 00:03:31,680

throughout the solar system and beyond

81

00:03:36,869 --> 00:03:35,230

so all right so before we start moving

82

00:03:39,330 --> 00:03:36,879

along folks are in the chat start

83

00:03:40,229 --> 00:03:39,340

sending in those questions now there's

84

00:03:41,729 --> 00:03:40,239

different parts throughout the show

85

00:03:44,370 --> 00:03:41,739

we're just gonna keep jumping in and

86

00:03:46,909 --> 00:03:44,380

grabbing questions from everybody but

87

00:03:50,879 --> 00:03:46,919

you know since we are doing video games

88

00:03:52,199 --> 00:03:50,889

I have to make my art our legal friends

89

00:03:55,890 --> 00:03:52,209

a little bit happy so we're gonna jump

90

00:03:58,259 --> 00:03:55,900

into a fun disclaimer we have a fun

91

00:04:00,839 --> 00:03:58,269

disclaimer over a like under layer I

92

00:04:02,369 --> 00:04:00,849

guess lower third so this is just to

93

00:04:06,690 --> 00:04:02,379

remind everybody as we're playing these

94

00:04:09,119 --> 00:04:06,700

games that NASA does not promote there

95

00:04:10,860 --> 00:04:09,129

we go there it is NASA does not promote

96

00:04:12,659 --> 00:04:10,870

or endorse or will it provide the

97

00:04:14,369 --> 00:04:12,669

appearance of that NASA promotes or

98

00:04:16,289 --> 00:04:14,379

endorses a commercial product service or

99

00:04:18,629 --> 00:04:16,299

activity individuals that playing

100

00:04:21,689 --> 00:04:18,639

specific games does not constitute an

101
00:04:25,050 --> 00:04:21,699
endorsement of such games by NASA or the

102
00:04:26,820 --> 00:04:25,060
US federal government so um yeah then

103
00:04:28,800 --> 00:04:26,830
like with that we're gonna go jump on

104
00:04:30,570 --> 00:04:28,810
into some of our first games but you

105
00:04:32,189 --> 00:04:30,580
know what we did this cool segment

106
00:04:33,659 --> 00:04:32,199
transition so we might as well just play

107
00:04:34,450 --> 00:04:33,669
that on over that we're doing for every

108
00:04:40,550 --> 00:04:34,460
episode

109
00:04:43,559 --> 00:04:40,560
[Music]

110
00:04:45,929 --> 00:04:43,569
of course it's time for a let's play now

111
00:04:48,059 --> 00:04:45,939
this can include controllers 12 sided

112
00:04:50,309 --> 00:04:48,069
dice or a pop o matic bubble but for

113
00:04:52,200 --> 00:04:50,319

this episode we are playing video games

114

00:04:54,779 --> 00:04:52,210

so Scott what do you have for us first

115

00:04:57,929 --> 00:04:54,789

well I came up with a huge list of NASA

116

00:04:59,129 --> 00:04:57,939

related games I thought obviously we're

117

00:05:01,580 --> 00:04:59,139

gonna play a few of these but the first

118

00:05:05,610 --> 00:05:01,590

one that I wanted was elite dangerous

119

00:05:08,070 --> 00:05:05,620

knife which is basically a space sim set

120

00:05:09,540 --> 00:05:08,080

if those and years in the future and not

121

00:05:11,969 --> 00:05:09,550

only can you fly a spaceship but the

122

00:05:13,589 --> 00:05:11,979

game includes renderings of the entire

123

00:05:15,629 --> 00:05:13,599

galaxy so you can go anywhere in the

124

00:05:18,959 --> 00:05:15,639

galaxy including a few places that nASA

125

00:05:21,570 --> 00:05:18,969

has actually sent spacecraft nice so

126

00:05:24,029 --> 00:05:21,580

yeah this is a elite do I think we can't

127

00:05:26,369 --> 00:05:24,039

play it live because yes connection but

128

00:05:29,399 --> 00:05:26,379

we do have highlight reel of some of

129

00:05:32,249 --> 00:05:29,409

exact rare things so what are we looking

130

00:05:35,070 --> 00:05:32,259

at and what are we seeing here we are

131

00:05:37,409 --> 00:05:35,080

flying towards cheran and pluto which

132

00:05:39,510 --> 00:05:37,419

are the two most distance explored

133

00:05:42,510 --> 00:05:39,520

bodies in the solar system and how fast

134

00:05:45,809 --> 00:05:42,520

are we going and it looks like 1.5 times

135

00:05:47,820 --> 00:05:45,819

the speed of light 1,000 years in the

136

00:05:49,409 --> 00:05:47,830

future we'll take some liberties yeah

137

00:05:51,409 --> 00:05:49,419

well I think just slow down a bit so

138

00:05:54,179 --> 00:05:51,419

that we don't fly past them too fast

139

00:05:55,920 --> 00:05:54,189

it's so let's talk a little bit about

140

00:05:57,360 --> 00:05:55,930

that because obviously even being here

141

00:06:00,420 --> 00:05:57,370

over at Ames we're familiar with the new

142

00:06:02,999 --> 00:06:00,430

Horizons spacecraft as if it went

143

00:06:05,550 --> 00:06:03,009

through I mean did the whole flyby of

144

00:06:07,019 --> 00:06:05,560

Pluto got some really cool photos and

145

00:06:10,260 --> 00:06:07,029

now it's heading up to another body you

146

00:06:13,769 --> 00:06:10,270

can remember MU 49 I believe also called

147

00:06:15,389 --> 00:06:13,779

ultimate tool okay and that'll be the

148

00:06:17,939 --> 00:06:15,399

last day of the year when it's doing

149

00:06:19,290 --> 00:06:17,949

that pretty much so you can see we're

150

00:06:21,389 --> 00:06:19,300

coming down there's chair oh and and

151
00:06:23,519 --> 00:06:21,399
Pluto next to each other so the

152
00:06:25,829 --> 00:06:23,529
developers of this game try to

153
00:06:27,209 --> 00:06:25,839
incorporate as much reality as possible

154
00:06:29,369 --> 00:06:27,219
so they took textures from the real

155
00:06:31,589 --> 00:06:29,379
Pluto and Charon and map them onto this

156
00:06:33,119 --> 00:06:31,599
you can't land on Pluto but we will be

157
00:06:35,070 --> 00:06:33,129
able to get closer to a chair oh and I'm

158
00:06:38,070 --> 00:06:35,080
just looking around in the cockpit here

159
00:06:39,689 --> 00:06:38,080
yeah it's of course like you can't talk

160
00:06:41,909 --> 00:06:39,699
about Pluto without the first thing in

161
00:06:44,790 --> 00:06:41,919
chat being like is Pluto a planet that's

162
00:06:46,559 --> 00:06:44,800
tres it's a dwarf planet

163
00:06:48,420 --> 00:06:46,569

there's just a dwarf planet there's

164

00:06:50,309 --> 00:06:48,430

still a planet planet it's the only

165

00:06:52,980 --> 00:06:50,319

binary planet it's a pretty cool plan if

166

00:06:54,570 --> 00:06:52,990

you ask me and and Sharons are really

167

00:06:57,089 --> 00:06:54,580

cool moon like one of the big

168

00:06:59,430 --> 00:06:57,099

discoveries from New Horizons was that

169

00:07:01,860 --> 00:06:59,440

on the North Pole there's a deposit of

170

00:07:03,749 --> 00:07:01,870

these compounds called Dolan's it's like

171

00:07:06,180 --> 00:07:03,759

this kind of reddish material and what

172

00:07:07,950 --> 00:07:06,190

that is is a mixture of organics and and

173

00:07:09,600 --> 00:07:07,960

Pluto doesn't I don't think Pluto has

174

00:07:10,290 --> 00:07:09,610

those deposits but Sharon does which is

175

00:07:11,999 --> 00:07:10,300

pretty neat

176

00:07:16,680 --> 00:07:12,009

now is this Pluto resistor this is

177

00:07:18,089 --> 00:07:16,690

Sharon because yeah and where I wanted

178

00:07:21,059 --> 00:07:18,099

to fly through some of these canyons

179

00:07:22,740 --> 00:07:21,069

that we saw Kozma saw there's seven off

180

00:07:24,390 --> 00:07:22,750

the left that have been named on Sharon

181

00:07:27,360 --> 00:07:24,400

they're all named after fictional

182

00:07:29,430 --> 00:07:27,370

spacecraft dude what I can't remember

183

00:07:31,439 --> 00:07:29,440

which ones never I think they're being

184

00:07:32,779 --> 00:07:31,449

approved by the IAU because they're from

185

00:07:37,200 --> 00:07:32,789

mythology but we've got things like

186

00:07:39,450 --> 00:07:37,210

TARDIS cosmati and Nostromo no serenity

187

00:07:41,580 --> 00:07:39,460

I don't know which one this is I'm

188

00:07:42,869 --> 00:07:41,590

flying through but I am you know trying

189

00:07:46,649 --> 00:07:42,879

to do my best Baker's Canyon

190

00:07:48,570 --> 00:07:46,659

impersonation here nice nice I'm really

191

00:07:50,580 --> 00:07:48,580

digging the cockpit here this is this

192

00:07:53,189 --> 00:07:50,590

it's so much better in VR when you can

193

00:07:55,020 --> 00:07:53,199

look around and see everything this is

194

00:07:57,540 --> 00:07:55,030

one of the best things to have in VR

195

00:08:00,480 --> 00:07:57,550

this I was going to say for Chad as our

196

00:08:01,890 --> 00:08:00,490

as our director of engineering or acting

197

00:08:03,779 --> 00:08:01,900

director of engineering here at Ames

198

00:08:06,870 --> 00:08:03,789

like what would you give for a cockpit

199

00:08:09,659 --> 00:08:06,880

like this a lot a lot yeah this this is

200

00:08:11,129 --> 00:08:09,669

um it's easy to forget that it's

201
00:08:12,709 --> 00:08:11,139
supposedly a thousand years in the

202
00:08:15,059 --> 00:08:12,719
future right because a lot of the

203
00:08:17,640 --> 00:08:15,069
concepts and ideas that we've been

204
00:08:21,930 --> 00:08:17,650
working on sort of play into that same

205
00:08:23,249 --> 00:08:21,940
general look and feel and yet you know

206
00:08:24,870 --> 00:08:23,259
if you do it right maybe that's what

207
00:08:27,420 --> 00:08:24,880
they'll use a thousand thousand years

208
00:08:29,040 --> 00:08:27,430
hence but I love the you know he's got a

209
00:08:30,330 --> 00:08:29,050
little map whether the solar system down

210
00:08:33,180 --> 00:08:30,340
there tells you where we are and how to

211
00:08:35,050 --> 00:08:33,190
navigate there's some terrain shows up

212
00:08:37,240 --> 00:08:35,060
in there

213
00:08:39,670 --> 00:08:37,250

this is the first time I've ever seen

214

00:08:41,320 --> 00:08:39,680

this particular game it's just it's kind

215

00:08:43,149 --> 00:08:41,330

of interesting to find your way around

216

00:08:45,010 --> 00:08:43,159

in there visually and see what's going

217

00:08:47,290 --> 00:08:45,020

on in the game there's something that

218

00:08:49,000 --> 00:08:47,300

you might remember from the past year

219

00:08:53,650 --> 00:08:49,010

we're actually coming up to an ancient

220

00:08:54,850 --> 00:08:53,660

space probe the ancients possible and if

221

00:08:55,510 --> 00:08:54,860

you I don't know if you can hear the

222

00:08:59,560 --> 00:08:55,520

audio

223

00:09:04,110 --> 00:08:59,570

for the audience so that they can hear

224

00:09:10,120 --> 00:09:08,410

yeah listen to that as you me well cuz

225

00:09:11,500 --> 00:09:10,130

right now where is Voyager right now cuz

226

00:09:13,329 --> 00:09:11,510

this isn't where Voyager is right now

227

00:09:14,620 --> 00:09:13,339

right now this is where Voyager will be

228

00:09:16,570 --> 00:09:14,630

in thousand years in the future right

229

00:09:18,280 --> 00:09:16,580

yeah this is like I don't know how far

230

00:09:19,900 --> 00:09:18,290

out it is like it's alright it's left

231

00:09:21,700 --> 00:09:19,910

the solar system technically has crossed

232

00:09:24,220 --> 00:09:21,710

the heliopause into interstellar space

233

00:09:27,610 --> 00:09:24,230

it's the only man-made object ever to do

234

00:09:28,960 --> 00:09:27,620

so yeah but I brought along an

235

00:09:30,550 --> 00:09:28,970

interesting problem I don't know if we

236

00:09:34,630 --> 00:09:30,560

can I know we can do the picture in

237

00:09:37,660 --> 00:09:34,640

pictures we have printer repressing off

238

00:09:39,340 --> 00:09:37,670

the Voyager Golden Record this was done

239

00:09:43,060 --> 00:09:39,350

last year and then the insight they have

240

00:09:45,340 --> 00:09:43,070

all the they have all the music and the

241

00:09:47,620 --> 00:09:45,350

sounds the greetings from the various

242

00:09:51,000 --> 00:09:47,630

parts of the world and my favorite part

243

00:09:53,740 --> 00:09:51,010

being a DJ is a slip mat showing the

244

00:09:59,650 --> 00:09:53,750

trajectory that Voyager took on the way

245

00:10:01,360 --> 00:09:59,660

and the two voyagers took so yes gravity

246

00:10:06,490 --> 00:10:01,370

assists we've been past different

247

00:10:07,690 --> 00:10:06,500

yeah three assists for tooted but we

248

00:10:09,880 --> 00:10:07,700

should talk about like what it was it

249

00:10:11,590 --> 00:10:09,890

was a record that was put together to

250

00:10:14,230 --> 00:10:11,600

represent all of the sounds of the earth

251
00:10:16,390 --> 00:10:14,240
and the very first part of the record is

252
00:10:19,180 --> 00:10:16,400
recordings of I think like over 50

253
00:10:21,280 --> 00:10:19,190
languages greetings and then it goes

254
00:10:23,440 --> 00:10:21,290
into like the you know the best the best

255
00:10:25,420 --> 00:10:23,450
music from all over the globe was

256
00:10:27,550 --> 00:10:25,430
compiled and and put on to this record

257
00:10:32,230 --> 00:10:27,560
and affixed on to the front of the

258
00:10:34,600 --> 00:10:32,240
spacecraft and in about let's see tens

259
00:10:36,610 --> 00:10:34,610
to hundreds of thousands of years this

260
00:10:39,310 --> 00:10:36,620
uh the voyagers will pass by nearby

261
00:10:41,199 --> 00:10:39,320
stars so the idea is someday maybe

262
00:10:42,730 --> 00:10:41,209
somebody will find it and be able to

263
00:10:43,220 --> 00:10:42,740

listen to the sounds of Earth well it

264

00:10:47,630 --> 00:10:43,230

was

265

00:10:50,000 --> 00:10:47,640

right on the surface of the record

266

00:10:52,370 --> 00:10:50,010

it tells whoever might find the record

267

00:10:54,170 --> 00:10:52,380

basically what a record is and how to

268

00:10:56,570 --> 00:10:54,180

get to inflation back off of it right

269

00:10:58,550 --> 00:10:56,580

says like there's there's sound waves on

270

00:11:00,860 --> 00:10:58,560

here and this is what they look like and

271

00:11:03,440 --> 00:11:00,870

here's here's what you need to do to

272

00:11:05,690 --> 00:11:03,450

play the thing back you know plus other

273

00:11:07,400 --> 00:11:05,700

basic information content but you know

274

00:11:08,930 --> 00:11:07,410

starting with hey here's what this

275

00:11:11,240 --> 00:11:08,940

artifact is and what you might do with

276

00:11:13,280 --> 00:11:11,250

it to get at the information contained

277

00:11:14,690 --> 00:11:13,290

good summation so Before we jump over

278

00:11:16,970 --> 00:11:14,700

the next one somebody named silent

279

00:11:18,620 --> 00:11:16,980

searchlights at NASA have either of the

280

00:11:22,780 --> 00:11:18,630

Voyager probes traveled beyond the

281

00:11:25,790 --> 00:11:22,790

outermost radius of the Oort cloud yet

282

00:11:27,410 --> 00:11:25,800

no they aren't quite we for the road it

283

00:11:30,380 --> 00:11:27,420

goes out to a hundred thousand au or

284

00:11:33,980 --> 00:11:30,390

beyond so there you go silent

285

00:11:37,130 --> 00:11:33,990

searchlight i know silence or smudges on

286

00:11:38,270 --> 00:11:37,140

their way but it'll take a long time for

287

00:11:41,210 --> 00:11:38,280

them to get out that far

288

00:11:44,210 --> 00:11:41,220

and so okay so what are we looking at

289

00:11:46,370 --> 00:11:44,220

coming up over here we are yeah we've

290

00:11:48,890 --> 00:11:46,380

just continuing on our journey we flew

291

00:11:50,840 --> 00:11:48,900

past the sun past mule parkour solar

292

00:11:53,240 --> 00:11:50,850

pool but we're gonna go to the moon and

293

00:11:55,250 --> 00:11:53,250

i know NASA is talking about a space

294

00:11:56,900 --> 00:11:55,260

station around the moon well we have a

295

00:11:58,280 --> 00:11:56,910

space station around the moon a thousand

296

00:12:01,160 --> 00:11:58,290

years in the future in this fictional

297

00:12:03,530 --> 00:12:01,170

universe it's a little bit bigger than

298

00:12:06,290 --> 00:12:03,540

what nASA has in mind okay

299

00:12:08,120 --> 00:12:06,300

this is called Galileo but I just wanted

300

00:12:10,220 --> 00:12:08,130

to show the docking sequence in this

301
00:12:12,470 --> 00:12:10,230
game because it's pretty cool it is

302
00:12:16,410 --> 00:12:12,480
pretty cool obviously takes some

303
00:12:19,530 --> 00:12:16,420
inspiration from 2001 year

304
00:12:22,170 --> 00:12:19,540
this is the Galileo spacecraft Ussuri no

305
00:12:24,509 --> 00:12:22,180
spacecraft Space Station and you need to

306
00:12:27,509 --> 00:12:24,519
request docking permission from the

307
00:12:30,750 --> 00:12:27,519
space traffic control it's a future

308
00:12:33,210 --> 00:12:30,760
where they don't have magical artificial

309
00:12:34,949 --> 00:12:33,220
gravity soul for most people to get

310
00:12:36,000 --> 00:12:34,959
gravity they have to rotate the station

311
00:12:39,420 --> 00:12:36,010
which means you have to match the

312
00:12:40,920 --> 00:12:39,430
rotation the very realistic it's

313
00:12:43,199 --> 00:12:40,930

realistic in that way but this of course

314

00:12:45,269 --> 00:12:43,209

there and there's already like like

315

00:12:47,579 --> 00:12:45,279

billboards and space advertising NASA is

316

00:12:50,819 --> 00:12:47,589

not endorse any of those no that's not

317

00:12:54,000 --> 00:12:50,829

endorse or appear to promote or endorse

318

00:12:55,769 --> 00:12:54,010

any of the space advertising Titan City

319

00:12:59,850 --> 00:12:55,779

yeah there's a tiny City you can go

320

00:13:01,800 --> 00:12:59,860

there if you like it's another space

321

00:13:04,170 --> 00:13:01,810

station in orbit around Titan but

322

00:13:05,670 --> 00:13:04,180

there's probably 50 s on the surface of

323

00:13:07,500 --> 00:13:05,680

Titan but you can't land there right now

324

00:13:09,569 --> 00:13:07,510

because the game only lets you land on

325

00:13:12,180 --> 00:13:09,579

planets with no atmosphere which is a

326

00:13:14,699 --> 00:13:12,190

shame because Titan is a fantastic place

327

00:13:15,960 --> 00:13:14,709

to visit with lots of atmosphere I think

328

00:13:18,420 --> 00:13:15,970

it's the only other place in the solar

329

00:13:20,400 --> 00:13:18,430

system where it actually rains really

330

00:13:22,740 --> 00:13:20,410

yeah it rains liquid ethane and methane

331

00:13:24,569 --> 00:13:22,750

though yeah at least with a solid

332

00:13:27,420 --> 00:13:24,579

surface I think there's possibility of

333

00:13:29,340 --> 00:13:27,430

rains in some of the gas giants yeah my

334

00:13:31,470 --> 00:13:29,350

experience with Titan has been playing

335

00:13:33,090 --> 00:13:31,480

in destiny too they have Titan and they

336

00:13:34,740 --> 00:13:33,100

have these like oceans this basically

337

00:13:36,150 --> 00:13:34,750

went from a frozen planet to ocean

338

00:13:37,829 --> 00:13:36,160

worlds and the only time I'm sitting

339

00:13:39,540 --> 00:13:37,839

there they have like somebody who you

340

00:13:40,680 --> 00:13:39,550

talk to and they have their helmet off

341

00:13:45,900 --> 00:13:40,690

and they're just like chatting with you

342

00:13:48,569 --> 00:13:45,910

and I'm like pretty cool Kelvin it's

343

00:13:50,790 --> 00:13:48,579

like even if it's like okay so the

344

00:13:52,350 --> 00:13:50,800

methane isn't frozen but it's liquid

345

00:13:54,960 --> 00:13:52,360

oceans of methane it's still gonna be

346

00:13:56,699 --> 00:13:54,970

pretty cold outside pretty cool so

347

00:14:00,389 --> 00:13:56,709

anyway yeah I guess a next point after

348

00:14:03,809 --> 00:14:00,399

stopping to get some coffee time to head

349

00:14:05,430 --> 00:14:03,819

out into the outer solar system taking a

350

00:14:06,870 --> 00:14:05,440

look around as well yeah people love

351
00:14:09,600 --> 00:14:06,880
their greenhouses there's other

352
00:14:12,059 --> 00:14:09,610
spaceships obviously I'm gonna point out

353
00:14:13,530 --> 00:14:12,069
that while this game does let you shoot

354
00:14:15,540 --> 00:14:13,540
other people and it's a big part of the

355
00:14:18,059 --> 00:14:15,550
game during the sequence I decided to be

356
00:14:21,000 --> 00:14:18,069
totally a pacifist I don't even have

357
00:14:22,560 --> 00:14:21,010
guns in my spaceship no nice now and

358
00:14:25,500 --> 00:14:22,570
there are aliens

359
00:14:27,810 --> 00:14:25,510
yeah well looking through the chat a lot

360
00:14:30,360 --> 00:14:27,820
of shoutouts to Scott hello

361
00:14:33,200 --> 00:14:30,370
so hello everybody and then there was

362
00:14:36,060 --> 00:14:33,210
another person news I think it's a cap

363
00:14:38,730 --> 00:14:36,070

captain - aye aye is asking what time

364

00:14:40,440 --> 00:14:38,740

line is this said what about thousand a

365

00:14:43,380 --> 00:14:40,450

thousand years in the future and they

366

00:14:44,370 --> 00:14:43,390

has real-time advances in March with our

367

00:14:47,030 --> 00:14:44,380

own time

368

00:14:51,660 --> 00:14:47,040

so it's you know September 27th in

369

00:14:53,430 --> 00:14:51,670

whatever year it is somebody as an

370

00:14:54,360 --> 00:14:53,440

engineer like talk a little bit about

371

00:14:56,130 --> 00:14:54,370

like what are some of those

372

00:14:58,440 --> 00:14:56,140

complications to actually build these

373

00:15:00,210 --> 00:14:58,450

things I mean we're way far off but it's

374

00:15:02,250 --> 00:15:00,220

like there's a lot of stuff we have to

375

00:15:02,460 --> 00:15:02,260

figure out before anything even comes

376

00:15:04,620 --> 00:15:02,470

close

377

00:15:06,360 --> 00:15:04,630

absolutely right and some some of it

378

00:15:08,430 --> 00:15:06,370

we're starting to work on and figure out

379

00:15:10,770 --> 00:15:08,440

one of the big questions is if you want

380

00:15:13,410 --> 00:15:10,780

to build something really big in space

381

00:15:15,000 --> 00:15:13,420

yeah just how do you do that well the

382

00:15:16,710 --> 00:15:15,010

biggest thing we've ever built in space

383

00:15:20,070 --> 00:15:16,720

is the International Space Station and

384

00:15:22,170 --> 00:15:20,080

by and large we built that by sending

385

00:15:25,770 --> 00:15:22,180

all the pieces up as modules and

386

00:15:27,870 --> 00:15:25,780

assembling them on orbit with a lot of

387

00:15:31,230 --> 00:15:27,880

human labor I was mostly astronauts

388

00:15:32,580 --> 00:15:31,240

putting things together in space and you

389

00:15:35,070 --> 00:15:32,590

could do it that way but if you're

390

00:15:36,690 --> 00:15:35,080

talking a you know Space Station the

391

00:15:39,630 --> 00:15:36,700

size of this it's good if you know

392

00:15:42,480 --> 00:15:39,640

there's a huge human labor problem or

393

00:15:44,160 --> 00:15:42,490

alien labor as the case may be and so

394

00:15:45,690 --> 00:15:44,170

we've really been putting a lot of

395

00:15:48,900 --> 00:15:45,700

effort into figuring out how do you do

396

00:15:50,700 --> 00:15:48,910

this robotically yeah so that you can

397

00:15:52,350 --> 00:15:50,710

have the robots go do it you said no

398

00:15:54,120 --> 00:15:52,360

BOTS can deal with the cold wet send up

399

00:15:56,700 --> 00:15:54,130

the raw material let the robots put it

400

00:15:58,620 --> 00:15:56,710

all together will show up and live take

401
00:15:59,640 --> 00:15:58,630
take advantage of that well that's it

402
00:16:00,990 --> 00:15:59,650
one of the cool things we've talked a

403
00:16:02,340 --> 00:16:01,000
lot about like on the journey to Mars

404
00:16:03,810 --> 00:16:02,350
I've talked about going to Mars and talk

405
00:16:05,430 --> 00:16:03,820
about in the moon I was like there's a

406
00:16:06,870 --> 00:16:05,440
lot of stuff about like humans living in

407
00:16:08,550 --> 00:16:06,880
deep space that we still have to figure

408
00:16:10,320 --> 00:16:08,560
out and like a cool thing about being at

409
00:16:13,370 --> 00:16:10,330
the moon is like if something goes wrong

410
00:16:15,480 --> 00:16:13,380
you know you're not two years away

411
00:16:17,970 --> 00:16:15,490
you know you could try to get back a

412
00:16:20,070 --> 00:16:17,980
little bit sooner if you're far if

413
00:16:21,600 --> 00:16:20,080

you're far away right even as far as the

414

00:16:24,120 --> 00:16:21,610

moon you have to take a lot of those

415

00:16:25,350 --> 00:16:24,130

things that we take for granted here on

416

00:16:28,890 --> 00:16:25,360

earth you have to take them with you

417

00:16:32,400 --> 00:16:28,900

right whether it's raw material

418

00:16:34,410 --> 00:16:32,410

resources whether it's consumables you

419

00:16:37,020 --> 00:16:34,420

know whether it's water oxygen

420

00:16:39,150 --> 00:16:37,030

food all of those things that we just

421

00:16:42,180 --> 00:16:39,160

sort of you know hey I have my cup mug

422

00:16:44,970 --> 00:16:42,190

of water right here if I'm out there in

423

00:16:46,740 --> 00:16:44,980

a space station it's not readily

424

00:16:49,200 --> 00:16:46,750

accessible as a natural resource

425

00:16:52,050 --> 00:16:49,210

it's either stuff I took with me or

426

00:16:54,390 --> 00:16:52,060

stuff I'm making out of materials I took

427

00:16:58,380 --> 00:16:54,400

with me that's kind of a closed system

428

00:17:00,630 --> 00:16:58,390

yeah and that really puts puts a whole

429

00:17:02,430 --> 00:17:00,640

new load on the technology on how we do

430

00:17:04,890 --> 00:17:02,440

it and we're having to figure those

431

00:17:06,780 --> 00:17:04,900

things out all the time whether it's on

432

00:17:10,140 --> 00:17:06,790

your International Space Station or the

433

00:17:12,480 --> 00:17:10,150

new lunar gateway or you know anything

434

00:17:14,069 --> 00:17:12,490

we want to go do you have to figure out

435

00:17:16,439 --> 00:17:14,079

how to do it with the materials you've

436

00:17:20,250 --> 00:17:16,449

got that you took with you so going on

437

00:17:22,560 --> 00:17:20,260

in the in the background is we just buzz

438

00:17:25,290 --> 00:17:22,570

we passed we flew through this Saturn

439

00:17:27,920 --> 00:17:25,300

system just like Cassini but we spent a

440

00:17:32,880 --> 00:17:27,930

little less time there than Cassini yes

441

00:17:36,260 --> 00:17:32,890

yes because he's still there like in

442

00:17:39,210 --> 00:17:36,270

many pieces burnt up like it's at least

443

00:17:41,520 --> 00:17:39,220

present I'm Saturn I'm sure and Huygens

444

00:17:43,470 --> 00:17:41,530

are still intact so you know so you have

445

00:17:45,930 --> 00:17:43,480

another landing base over here yeah cuz

446

00:17:48,000 --> 00:17:45,940

I wanted to get another spaceship with a

447

00:17:50,880 --> 00:17:48,010

little rule earth I can actually go and

448

00:17:53,790 --> 00:17:50,890

visit the surface we flew past Enceladus

449

00:17:57,210 --> 00:17:53,800

okay Enceladus Enceladus which is a moon

450

00:17:58,920 --> 00:17:57,220

of Titan Saturn's honey Hey what is the

451
00:18:00,840 --> 00:17:58,930
proper what we have we were just talking

452
00:18:02,580 --> 00:18:00,850
about it of like is it Enceladus and

453
00:18:04,260 --> 00:18:02,590
saladin so how do I heard it pronounced

454
00:18:06,130 --> 00:18:04,270
Enceladus but I've heard it also

455
00:18:07,720 --> 00:18:06,140
pronounced the other way too just

456
00:18:11,560 --> 00:18:07,730
tens on how you feel how your fancy

457
00:18:13,600 --> 00:18:11,570
cancelados nice we had the same

458
00:18:16,660 --> 00:18:13,610
conversation around like Sharon is it

459
00:18:20,380 --> 00:18:16,670
Sharon okay I actually looked it up the

460
00:18:22,690 --> 00:18:20,390
moon Charon it was named in part after

461
00:18:27,910 --> 00:18:22,700
the discoverers wife whose name was

462
00:18:31,090 --> 00:18:27,920
Charlene so like I guess the community

463
00:18:34,420 --> 00:18:31,100

pronounces it Sharon after Charlene but

464

00:18:37,360 --> 00:18:34,430

it's officially named after a you know a

465

00:18:38,980 --> 00:18:37,370

mythological figure so and and the

466

00:18:42,040 --> 00:18:38,990

correct way to pronounce it in that case

467

00:18:42,970 --> 00:18:42,050

is Karen but in in a scientific

468

00:18:45,130 --> 00:18:42,980

conference you're not going to hear that

469

00:18:47,380 --> 00:18:45,140

pronunciation who was I guess that

470

00:18:51,630 --> 00:18:47,390

particular mythological figure was like

471

00:18:55,000 --> 00:18:51,640

the because Pluto was named after the

472

00:18:56,680 --> 00:18:55,010

Lord of the underworld but Karen like

473

00:18:58,690 --> 00:18:56,690

was the ferryman that took people across

474

00:19:01,060 --> 00:18:58,700

the river so it was like the river state

475

00:19:12,070 --> 00:19:01,070

yeah yes it's not the Disney character

476
00:19:13,690 --> 00:19:12,080
know which five through Europa recently

477
00:19:17,380 --> 00:19:13,700
they found ice geysers they're using

478
00:19:18,850 --> 00:19:17,390
data from Galileo and Voyager right huh

479
00:19:21,460 --> 00:19:18,860
we found that there's actually

480
00:19:24,220 --> 00:19:21,470
cryovolcanism and there's Europe is

481
00:19:25,780 --> 00:19:24,230
obviously fascinating from astrobiology

482
00:19:28,990 --> 00:19:25,790
standpoint because it's got this huge

483
00:19:31,300 --> 00:19:29,000
ocean right yeah there's just beneath

484
00:19:31,780 --> 00:19:31,310
the surface is there's a thick sheet of

485
00:19:33,310 --> 00:19:31,790
ice

486
00:19:35,830 --> 00:19:33,320
a few kilometers and then beneath that

487
00:19:37,300 --> 00:19:35,840
is there's a lot of water I know I know

488
00:19:39,490 --> 00:19:37,310

that Mary Beth can literally talk all

489

00:19:41,650 --> 00:19:39,500

day about your biology drop for at least

490

00:19:46,330 --> 00:19:41,660

a few hours and visitation that you just

491

00:19:48,040 --> 00:19:46,340

do but yeah it's kind of hard to imagine

492

00:19:50,170 --> 00:19:48,050

an ocean world like this because like

493

00:19:52,090 --> 00:19:50,180

it's completely dark so when we think of

494

00:19:53,740 --> 00:19:52,100

our Earth's oceans like we imagine light

495

00:19:56,080 --> 00:19:53,750

streaming and in like beautiful green

496

00:19:58,150 --> 00:19:56,090

algae but like if life exists on Europa

497

00:19:59,740 --> 00:19:58,160

its it's living off of chemical energy

498

00:20:02,770 --> 00:19:59,750

and complete darkness so it's like a

499

00:20:05,950 --> 00:20:02,780

totally alien way to think about living

500

00:20:08,650 --> 00:20:05,960

miss an event says you guys ought to go

501
00:20:09,400 --> 00:20:08,660
to the geysers on Europa I think we got

502
00:20:11,230 --> 00:20:09,410
you one better

503
00:20:12,289 --> 00:20:11,240
right alright we are we are at the

504
00:20:14,329 --> 00:20:12,299
geysers on

505
00:20:16,159 --> 00:20:14,339
is it Europa or is it the Enceladus well

506
00:20:18,769 --> 00:20:16,169
this is Europe by way oh there you go

507
00:20:21,049 --> 00:20:18,779
this is a relatively new discovery yes

508
00:20:22,969 --> 00:20:21,059
but it's based on old data yeah which is

509
00:20:26,629 --> 00:20:22,979
always fascinating to find new

510
00:20:28,399 --> 00:20:26,639
discoveries in old data so yeah this is

511
00:20:30,529 --> 00:20:28,409
an ASP Explorer much better code but you

512
00:20:32,479 --> 00:20:30,539
can see a lot more there so we just

513
00:20:35,599 --> 00:20:32,489

spell that's horse for a beauty or show

514

00:20:37,369 --> 00:20:35,609

nice is the Vista shot that's right

515

00:20:43,519 --> 00:20:37,379

that's Jupiter in the background there's

516

00:20:45,289 --> 00:20:43,529

free samples actually yeah I'm gonna get

517

00:20:47,749 --> 00:20:45,299

it in my Rover and go for a drive yeah

518

00:20:50,869 --> 00:20:47,759

all right so let's check this out yeah I

519

00:20:54,709 --> 00:20:50,879

mean the game has had you know volcanic

520

00:20:57,079 --> 00:20:54,719

fumaroles weird alien fungi alien

521

00:20:58,909 --> 00:20:57,089

archaeology they're all things you can

522

00:21:02,539 --> 00:20:58,919

visit but we're staying within the

523

00:21:04,399 --> 00:21:02,549

realms of reality at this point although

524

00:21:06,049 --> 00:21:04,409

these geysers are a little more powerful

525

00:21:09,859 --> 00:21:06,059

than the ones in real life I suspect

526

00:21:11,629 --> 00:21:09,869

really isn't so in fact with when the

527

00:21:12,799 --> 00:21:11,639

recent discoveries of I mean cool thing

528

00:21:15,469 --> 00:21:12,809

about these geysers the idea is like

529

00:21:19,249 --> 00:21:15,479

they found like was it like like the

530

00:21:21,169 --> 00:21:19,259

building blocks of life on Enceladus on

531

00:21:23,539 --> 00:21:21,179

Enceladus also has a geyser which is

532

00:21:26,690 --> 00:21:23,549

which I think they're much larger yeah

533

00:21:28,999 --> 00:21:26,700

yeah that means like astrobiology for

534

00:21:31,190 --> 00:21:29,009

you know future NASA missions we're

535

00:21:33,169 --> 00:21:31,200

hoping to do I mean like imagine like

536

00:21:34,849 --> 00:21:33,179

how much easier it is just to fly

537

00:21:37,459 --> 00:21:34,859

through a plume and take a sample rather

538

00:21:38,869 --> 00:21:37,469

than have to land and drive around and

539

00:21:40,489 --> 00:21:38,879

collect sample us we're doing in this or

540

00:21:42,680 --> 00:21:40,499

drill through many kilometers of ice

541

00:21:44,959 --> 00:21:42,690

yeah I mean like that's really hard to

542

00:21:46,310 --> 00:21:44,969

do on earth let alone on you know

543

00:21:49,039 --> 00:21:46,320

something that's that far away from

544

00:21:50,119 --> 00:21:49,049

Earth but yeah the the samples

545

00:21:51,680 --> 00:21:50,129

themselves are really interesting

546

00:21:53,659 --> 00:21:51,690

because they've identified all of the

547

00:21:56,989 --> 00:21:53,669

raw ingredients needed for life in those

548

00:21:58,819 --> 00:21:56,999

plumes so the hope is that you know we

549

00:22:00,979 --> 00:21:58,829

could send a more advanced type of

550

00:22:03,799 --> 00:22:00,989

instrument that could actually tell us

551
00:22:05,659 --> 00:22:03,809
if there is life contained within that

552
00:22:07,699 --> 00:22:05,669
sample and I think that's gonna be one

553
00:22:09,739 --> 00:22:07,709
of the most exciting missions you know

554
00:22:11,659 --> 00:22:09,749
in my lifetime certainly you know trying

555
00:22:13,190 --> 00:22:11,669
to answer this question of you know is

556
00:22:13,849 --> 00:22:13,200
there microbial life anywhere else in

557
00:22:16,969 --> 00:22:13,859
the solar system

558
00:22:19,039 --> 00:22:16,979
I remember the material coming up out of

559
00:22:21,919 --> 00:22:19,049
those plumes is the material from down

560
00:22:24,190 --> 00:22:21,929
below that ice layer and so we think if

561
00:22:27,090 --> 00:22:24,200
if there's life to be found it's down

562
00:22:29,169 --> 00:22:27,100
that comparatively warm environment and

563
00:22:30,759 --> 00:22:29,179

rather than having to drill down through

564

00:22:32,289 --> 00:22:30,769

the ice to get to it hey it's

565

00:22:34,210 --> 00:22:32,299

conveniently coming right up

566

00:22:36,460 --> 00:22:34,220

yeah head up through the form of a these

567

00:22:38,289 --> 00:22:36,470

guys are using these vents and so we can

568

00:22:39,789 --> 00:22:38,299

we don't even have to land on the

569

00:22:41,830 --> 00:22:39,799

surface to collect those samples we

570

00:22:44,080 --> 00:22:41,840

could just fly through them from above

571

00:22:46,330 --> 00:22:44,090

and so like one of the things I get a

572

00:22:47,889 --> 00:22:46,340

kick out of this game especially is like

573

00:22:49,600 --> 00:22:47,899

the data that it uses it's like it's

574

00:22:52,060 --> 00:22:49,610

using real damn it's really seasoned

575

00:22:54,970 --> 00:22:52,070

yeah this is the shots that we just had

576

00:22:57,250 --> 00:22:54,980

that we can have yeah bill if you want

577

00:23:00,700 --> 00:22:57,260

to jump on back a little bit to that big

578

00:23:04,090 --> 00:23:00,710

shot of all the stars yeah like so this

579

00:23:05,830 --> 00:23:04,100

is real data taken from these stars or

580

00:23:08,259 --> 00:23:05,840

real stars I mean they start to fill in

581

00:23:09,370 --> 00:23:08,269

once they get to farther right but many

582

00:23:11,560 --> 00:23:09,380

of these are some of these have been

583

00:23:14,409 --> 00:23:11,570

identified by NASA missions such as wise

584

00:23:17,590 --> 00:23:14,419

850 507 1:4 right that was the

585

00:23:19,600 --> 00:23:17,600

wide-field Infrared Survey Explorer so

586

00:23:21,970 --> 00:23:19,610

they've obviously measured the colors

587

00:23:24,220 --> 00:23:21,980

and parallaxes and put these planets in

588

00:23:27,190 --> 00:23:24,230

place but they try to extend this out to

589

00:23:28,600 --> 00:23:27,200

the entire galaxy and you can go a long

590

00:23:30,279 --> 00:23:28,610

way out you can travel to the core of

591

00:23:32,379 --> 00:23:30,289

the galaxy if you like and get to

592

00:23:34,899 --> 00:23:32,389

Sagittarius a star the supermassive

593

00:23:37,029 --> 00:23:34,909

black hole in the middle you see we've

594

00:23:39,879 --> 00:23:37,039

got nebula to California nebula

595

00:23:42,279 --> 00:23:39,889

Barnard's loop Polaris obviously pretty

596

00:23:45,159 --> 00:23:42,289

well known star so I'm really curious if

597

00:23:47,560 --> 00:23:45,169

any of exoplanets that have been

598

00:23:50,440 --> 00:23:47,570

discovered by our Kepler mission have

599

00:23:53,009 --> 00:23:50,450

found their way into the orbits around

600

00:23:55,600 --> 00:23:53,019

these stars funny you should say that

601
00:23:57,909 --> 00:23:55,610
because we haven't able to travel

602
00:24:00,090 --> 00:23:57,919
anywhere on the galaxy and I might just

603
00:24:02,769 --> 00:24:00,100
pay a visit to one of those Kepler's

604
00:24:04,629 --> 00:24:02,779
though that's where we're going next

605
00:24:07,750 --> 00:24:04,639
we've been traveling around it's not

606
00:24:09,310 --> 00:24:07,760
plan that yeah so we'd be traveling

607
00:24:11,320 --> 00:24:09,320
around at the speed of light but using

608
00:24:14,470 --> 00:24:11,330
hyperspace we can travel even faster

609
00:24:16,389 --> 00:24:14,480
nice it's a you can travel up to 2,000

610
00:24:18,009 --> 00:24:16,399
times it's B delay or we can cross 50

611
00:24:19,840 --> 00:24:18,019
light-years in a matter of seconds

612
00:24:21,820 --> 00:24:19,850
because it's a game you don't want

613
00:24:23,470 --> 00:24:21,830

people kick around forever yeah that's

614

00:24:27,750 --> 00:24:23,480

not a fun time so we're heading to

615

00:24:30,690 --> 00:24:27,760

Kepler 42 which was one of the Kepler

616

00:24:33,000 --> 00:24:30,700

points postponed was obvious in the

617

00:24:36,900 --> 00:24:33,010

field of view and the phones planets

618

00:24:39,090 --> 00:24:36,910

transiting several large hot Jupiters

619

00:24:40,920 --> 00:24:39,100

very close to this parent star I

620

00:24:44,250 --> 00:24:40,930

remember I'm talking to one of the NASA

621

00:24:45,990 --> 00:24:44,260

Kepler project scientists the way she

622

00:24:49,200 --> 00:24:46,000

described it's like you put your hand up

623

00:24:50,850 --> 00:24:49,210

into the air and what your hand covers

624

00:24:52,830 --> 00:24:50,860

is basically the field of view of what

625

00:24:55,530 --> 00:24:52,840

Kepler was looking at and all of the

626

00:24:57,090 --> 00:24:55,540

planets that it confirm of exoplanets

627

00:24:58,740 --> 00:24:57,100

are confirmed in just that little itty

628

00:25:00,990 --> 00:24:58,750

bitty space and Tess is even doing so

629

00:25:02,490 --> 00:25:01,000

much more than that yeah the Kepler kept

630

00:25:05,760 --> 00:25:02,500

it all pointing at the same place for

631

00:25:07,230 --> 00:25:05,770

months weeks years even this tas is

632

00:25:09,000 --> 00:25:07,240

spending a little less time so those are

633

00:25:11,790 --> 00:25:09,010

the three hot Jupiters so those are

634

00:25:13,860 --> 00:25:11,800

based on the real the data has been

635

00:25:16,980 --> 00:25:13,870

returned this of course does cause

636

00:25:18,840 --> 00:25:16,990

problems for the game because yeah the

637

00:25:21,020 --> 00:25:18,850

recent you know a new data said that

638

00:25:23,310 --> 00:25:21,030

gets a guy emission yes they have

639

00:25:25,080 --> 00:25:23,320

changed many of the positions of the

640

00:25:27,390 --> 00:25:25,090

stars the distances into the game is

641

00:25:32,580 --> 00:25:27,400

hasn't decided to update its release

642

00:25:34,770 --> 00:25:32,590

universe but it did add it added

643

00:25:37,610 --> 00:25:34,780

Trappist best practices oh nice yeah

644

00:25:40,920 --> 00:25:37,620

which is the closest star it's not

645

00:25:42,900 --> 00:25:40,930

Proxima okay has a pose the most but

646

00:25:45,300 --> 00:25:42,910

it's only like 4 light years is pretty

647

00:25:48,120 --> 00:25:45,310

cool spine has a lot yeah and a lot of

648

00:25:50,990 --> 00:25:48,130

exoplanet yes but the exciting thing is

649

00:25:54,810 --> 00:25:51,000

now from the results of Kepler in k2 it

650

00:25:58,470 --> 00:25:54,820

amazingly right pretty much every star

651
00:25:59,700 --> 00:25:58,480
on average has at least one planet and

652
00:26:00,720 --> 00:25:59,710
there's some stars that don't have any

653
00:26:02,970 --> 00:26:00,730
there's some stars that have a lot more

654
00:26:04,740 --> 00:26:02,980
but on average there's at least a planet

655
00:26:06,030 --> 00:26:04,750
for every star that's out there and so

656
00:26:09,060 --> 00:26:06,040
you think about the billions and

657
00:26:10,800 --> 00:26:09,070
billions of stars that's billions and

658
00:26:13,230 --> 00:26:10,810
billions of planets and even if it's a

659
00:26:15,630 --> 00:26:13,240
small fraction of them that is anything

660
00:26:18,390 --> 00:26:15,640
remotely like Earth that's still a huge

661
00:26:19,590 --> 00:26:18,400
huge number it's just exciting this is

662
00:26:21,450 --> 00:26:19,600
the part where Kavon and the chat is

663
00:26:27,000 --> 00:26:21,460

gonna put the hash tag more planets than

664

00:26:29,460 --> 00:26:27,010

stars so that's a pretty wild paradigm

665

00:26:31,000 --> 00:26:29,470

shift I mean like you know growing up

666

00:26:36,910 --> 00:26:31,010

there were only and now it's

667

00:26:41,650 --> 00:26:36,920

nine I guess alright people it out acid

668

00:26:45,280 --> 00:26:41,660

rain 1876 nights at r.i.p Pluto so but

669

00:26:46,540 --> 00:26:45,290

that was back earlier in the chat let me

670

00:26:48,310 --> 00:26:46,550

throw in another quick one that they had

671

00:26:50,500 --> 00:26:48,320

somebody had asked about some dread

672

00:26:53,590 --> 00:26:50,510

Medus asked do you have any idea about

673

00:26:58,240 --> 00:26:53,600

the temperature the plumes IRL oh yeah

674

00:27:00,640 --> 00:26:58,250

sure so the water and the plumes

675

00:27:04,720 --> 00:27:00,650

originate at the plate at the interface

676
00:27:07,390 --> 00:27:04,730
between the rocky surface and the ocean

677
00:27:11,350 --> 00:27:07,400
and the temperature is at that point our

678
00:27:13,600 --> 00:27:11,360
I think like quite high like 90 or 80 or

679
00:27:15,760 --> 00:27:13,610
90 Celsius and then it's pretty

680
00:27:17,770 --> 00:27:15,770
interesting so like at that interface

681
00:27:20,620 --> 00:27:17,780
there you have like the silica

682
00:27:22,390 --> 00:27:20,630
nanoparticles starting to form and the

683
00:27:24,820 --> 00:27:22,400
water then starts to make its way up and

684
00:27:27,790 --> 00:27:24,830
then as an exits you know obviously as

685
00:27:28,900 --> 00:27:27,800
it exits into space it freezes so like I

686
00:27:30,790 --> 00:27:28,910
don't know exactly what the temperature

687
00:27:32,740 --> 00:27:30,800
is but it's no longer in the liquid

688
00:27:34,060 --> 00:27:32,750

phase it's in the ice phase and so that

689

00:27:35,740 --> 00:27:34,070

creates a problem when you're trying to

690

00:27:37,870 --> 00:27:35,750

design a collector because you have to

691

00:27:40,540 --> 00:27:37,880

then take that sample and then remelt it

692

00:27:42,520 --> 00:27:40,550

in order to pull out any potential you

693

00:27:45,100 --> 00:27:42,530

know markers of life that you would be

694

00:27:46,270 --> 00:27:45,110

interested in analyzing so we're gonna

695

00:27:47,410 --> 00:27:46,280

eventually get to the point this is

696

00:27:49,990 --> 00:27:47,420

almost like wrapping up as these

697

00:27:52,150 --> 00:27:50,000

dangerous at the end yeah but there's

698

00:27:56,980 --> 00:27:52,160

our beautiful spacecraft as named at

699

00:27:59,260 --> 00:27:56,990

NASA Ames no sure if we zoom in on it oh

700

00:28:05,230 --> 00:27:59,270

nice oh we may have reached the end of

701
00:28:06,610 --> 00:28:05,240
the video itself so I do want to thank

702
00:28:09,520 --> 00:28:06,620
you as we're getting ready to transition

703
00:28:11,350 --> 00:28:09,530
over to a new game that's on on the iPad

704
00:28:13,750 --> 00:28:11,360
that we have over here I do want to give

705
00:28:15,040 --> 00:28:13,760
a shout out over to to to Eric our audio

706
00:28:17,650 --> 00:28:15,050
guy who's sitting over in the audio

707
00:28:20,740 --> 00:28:17,660
booth now he was pushing really hard to

708
00:28:21,850 --> 00:28:20,750
get no man's sky in on this one oh I

709
00:28:22,980 --> 00:28:21,860
believe that but it's not really

710
00:28:25,840 --> 00:28:22,990
scientific

711
00:28:27,070 --> 00:28:25,850
so well he was actually he'd gone in and

712
00:28:28,600 --> 00:28:27,080
like it played a little bit of elite

713
00:28:30,310 --> 00:28:28,610

dangerous so Eric I don't know you ever

714

00:28:32,530 --> 00:28:30,320

need questions anything's about you want

715

00:28:34,360 --> 00:28:32,540

to throw on over just Scott about elite

716

00:28:36,190 --> 00:28:34,370

dangerous cuz I know it's like I mean

717

00:28:37,600 --> 00:28:36,200

it's it's a pretty tough sim game

718

00:28:38,380 --> 00:28:37,610

there's like it's kind of hard to figure

719

00:28:40,750 --> 00:28:38,390

that out

720

00:28:43,090 --> 00:28:40,760

very hard in places for sure but I mean

721

00:28:44,950 --> 00:28:43,100

a lot of it is carried by the fact that

722

00:28:46,990 --> 00:28:44,960

is so beautiful sitting around in your

723

00:28:49,690 --> 00:28:47,000

spaceship and looking at planets yeah I

724

00:28:51,400 --> 00:28:49,700

totally totally agree yeah it was a lot

725

00:28:52,750 --> 00:28:51,410

of fun to play with and really cool to

726

00:28:54,850 --> 00:28:52,760

look at but definitely a steep learning

727

00:28:56,380 --> 00:28:54,860

curve yeah and I think it's the Sun guy

728

00:28:58,450 --> 00:28:56,390

you probably really appreciate the only

729

00:29:00,790 --> 00:28:58,460

way that game oh yeah yeah it's

730

00:29:02,830 --> 00:29:00,800

beautiful I want to try it out on the VR

731

00:29:04,570 --> 00:29:02,840

goggles now it just that would be a

732

00:29:05,950 --> 00:29:04,580

natural we were actually talking about

733

00:29:07,270 --> 00:29:05,960

that about how cool it would be to

734

00:29:09,760 --> 00:29:07,280

actually have somebody with the VR

735

00:29:11,380 --> 00:29:09,770

headset and and just actually today I

736

00:29:13,120 --> 00:29:11,390

ran by somebody who over on their desk

737

00:29:15,160 --> 00:29:13,130

they had an HTC vive and I was this

738

00:29:18,760 --> 00:29:15,170

close to just pulling it in but maybe

739

00:29:20,740 --> 00:29:18,770

that'll be for the next episode folks so

740

00:29:22,180 --> 00:29:20,750

yeah that's like switch on over to the

741

00:29:24,970 --> 00:29:22,190

next thing that we have set up here

742

00:29:27,730 --> 00:29:24,980

through the magic of an HDMI cable to an

743

00:29:30,070 --> 00:29:27,740

iPad I mean I came up with this idea

744

00:29:32,410 --> 00:29:30,080

during the last show you are showing all

745

00:29:34,450 --> 00:29:32,420

these console games you're showing PC

746

00:29:36,970 --> 00:29:34,460

games but not everybody has pcs or

747

00:29:39,300 --> 00:29:36,980

consoles many people have phones and

748

00:29:41,620 --> 00:29:39,310

there's a lot of actually really good

749

00:29:43,300 --> 00:29:41,630

simulation games for your rocket

750

00:29:46,000 --> 00:29:43,310

simulation essentially Kerbal space

751
00:29:48,010 --> 00:29:46,010
program clones that will run on mobile

752
00:29:49,720 --> 00:29:48,020
devices I'm running on an iPad because

753
00:29:52,270 --> 00:29:49,730
it's better but I've run this on like an

754
00:29:54,280 --> 00:29:52,280
old 5s so this is a space flight

755
00:29:56,050 --> 00:29:54,290
simulator your base our space simulator

756
00:29:58,090 --> 00:29:56,060
your I'm just trying to build a little

757
00:29:59,830 --> 00:29:58,100
rocket here we're just dragging the

758
00:30:04,300 --> 00:29:59,840
parts together and Mary Beth was

759
00:30:08,350 --> 00:30:04,310
launching stuff right before that if you

760
00:30:10,780 --> 00:30:08,360
like requirements right this is just the

761
00:30:12,760 --> 00:30:10,790
sandbox so I'm just I'm gonna try and

762
00:30:15,430 --> 00:30:12,770
put something up and into space you

763
00:30:18,040 --> 00:30:15,440

gotta find a big rocket I think this is

764

00:30:20,590 --> 00:30:18,050

gonna be way too big so yeah I mean this

765

00:30:22,600 --> 00:30:20,600

simulates the physics this is free we're

766

00:30:24,130 --> 00:30:22,610

in the basic mode and then you can pay a

767

00:30:25,540 --> 00:30:24,140

little extra for an expansion so it's

768

00:30:27,610 --> 00:30:25,550

actually really nice if you're

769

00:30:29,350 --> 00:30:27,620

interested in learning I Rockets work

770

00:30:31,240 --> 00:30:29,360

you don't have to pay extra further fuel

771

00:30:33,190 --> 00:30:31,250

you don't have to pay extra for the fuel

772

00:30:35,350 --> 00:30:33,200

but you know fuel is always the cheapest

773

00:30:37,570 --> 00:30:35,360

part of the rocket right compared to

774

00:30:38,500 --> 00:30:37,580

everything out oh that wasn't quite

775

00:30:40,030 --> 00:30:38,510

right well whatever

776

00:30:41,740 --> 00:30:40,040

well okay while you're sending that up

777

00:30:43,990 --> 00:30:41,750

we have a couple like comments from the

778

00:30:46,670 --> 00:30:44,000

stream one guy captain quasar asked for

779

00:30:49,460 --> 00:30:46,680

a 24 hour stream please

780

00:30:51,200 --> 00:30:49,470

we'll see what we do we normally aim for

781

00:30:52,550 --> 00:30:51,210

an hour but we have some stuff in store

782

00:30:54,560 --> 00:30:52,560

for you so it may go a little bit long

783

00:30:56,600 --> 00:30:54,570

it would get really boring when we sleep

784

00:30:59,120 --> 00:30:56,610

you'd be surprised the way you know over

785

00:31:01,790 --> 00:30:59,130

on Twitch people you know don't watch it

786

00:31:04,340 --> 00:31:01,800

yeah here let me throw this over to Chad

787

00:31:06,380 --> 00:31:04,350

cuz he said one question this comes from

788

00:31:08,690 --> 00:31:06,390

maker BRZ what kind of engineer do you

789

00:31:10,880 --> 00:31:08,700

need to even be to consider getting a

790

00:31:13,610 --> 00:31:10,890

job at NASA says I'm finishing is civil

791

00:31:16,160 --> 00:31:13,620

engineering and I wonder if if I can so

792

00:31:19,250 --> 00:31:16,170

amazingly we have civil engineers at

793

00:31:23,690 --> 00:31:19,260

NASA right because hey we have all sorts

794

00:31:26,060 --> 00:31:23,700

of projects that require moving you know

795

00:31:28,670 --> 00:31:26,070

everything from dirt facility

796

00:31:30,950 --> 00:31:28,680

construction you know we're just

797

00:31:33,590 --> 00:31:30,960

building out a whole new supercomputing

798

00:31:35,390 --> 00:31:33,600

pad right now there's been a whole lot

799

00:31:37,550 --> 00:31:35,400

of refurbishment down at Kennedy Space

800

00:31:41,090 --> 00:31:37,560

Center to get ready for the new larger

801
00:31:43,400 --> 00:31:41,100
rockets so pretty much any engineering

802
00:31:46,580 --> 00:31:43,410
discipline we have people doing that

803
00:31:48,890 --> 00:31:46,590
somewhere at NASA so pretty broad and so

804
00:31:52,760 --> 00:31:48,900
another question comes from evil mr.

805
00:31:54,350 --> 00:31:52,770
muffinz that is an awesome name what

806
00:31:56,210 --> 00:31:54,360
degree should I get to work at NASA

807
00:31:58,220 --> 00:31:56,220
there's a big old smiley face I guess I

808
00:32:00,260 --> 00:31:58,230
mean do I know this the science side

809
00:32:01,580 --> 00:32:00,270
very bad what would you if people who

810
00:32:02,840 --> 00:32:01,590
are asking you what should I study to

811
00:32:04,460 --> 00:32:02,850
get a job at NASA

812
00:32:05,990 --> 00:32:04,470
what would you say wow yeah there's a

813
00:32:07,550 --> 00:32:06,000

lot of options I mean I work with people

814

00:32:11,480 --> 00:32:07,560

who have degrees in physics biology

815

00:32:13,400 --> 00:32:11,490

chemistry astronomy you know I think the

816

00:32:14,630 --> 00:32:13,410

best course of action is just choose

817

00:32:16,760 --> 00:32:14,640

something you're like super passionate

818

00:32:19,010 --> 00:32:16,770

about because let me tell you it's a lot

819

00:32:20,600 --> 00:32:19,020

of school it's like 10 years of school

820

00:32:22,940 --> 00:32:20,610

after high school to get to this point

821

00:32:24,620 --> 00:32:22,950

of being a scientist at NASA you have to

822

00:32:26,540 --> 00:32:24,630

get your your bachelor's and something

823

00:32:29,180 --> 00:32:26,550

and then your PhD so if you don't really

824

00:32:30,350 --> 00:32:29,190

love what you're doing wrong well I've

825

00:32:31,730 --> 00:32:30,360

found that it's like there's a there's a

826

00:32:33,500 --> 00:32:31,740

job for everybody I mean like for me

827

00:32:35,360 --> 00:32:33,510

Andrea I'm probably the one person at

828

00:32:39,470 --> 00:32:35,370

the table without a science degree I'm

829

00:32:43,360 --> 00:32:39,480

guessing so my communications and

830

00:32:45,650 --> 00:32:43,370

poli-sci thing works out pretty well I

831

00:32:47,330 --> 00:32:45,660

appreciate that and on the future

832

00:32:50,840 --> 00:32:47,340

wonders or assigning roles I was sure to

833

00:32:51,470 --> 00:32:50,850

be put as the tourist actually meet you

834

00:32:52,669 --> 00:32:51,480

the pilot

835

00:32:56,389 --> 00:32:52,679

really

836

00:32:58,129 --> 00:32:56,399

nice right it's not just on the

837

00:33:00,379 --> 00:32:58,139

engineering side we employ all different

838

00:33:03,470 --> 00:33:00,389

shades and varieties of Engineers but

839

00:33:05,600 --> 00:33:03,480

across the board right NASA's a big

840

00:33:07,879 --> 00:33:05,610

complicated organization that does lots

841

00:33:10,460 --> 00:33:07,889

of amazing stuff and it takes a huge

842

00:33:14,180 --> 00:33:10,470

cast of supporting characters to make

843

00:33:16,820 --> 00:33:14,190

that all happen so hey everybody from

844

00:33:18,590 --> 00:33:16,830

you know the public safety net you know

845

00:33:20,450 --> 00:33:18,600

we've got NASA house cops we have

846

00:33:24,560 --> 00:33:20,460

firefighters we have lawyers we have

847

00:33:26,810 --> 00:33:24,570

people doing procurement literally every

848

00:33:28,159 --> 00:33:26,820

profession you can think of we we have

849

00:33:29,509 --> 00:33:28,169

people that are doing that so we're

850

00:33:31,700 --> 00:33:29,519

doing a podcast episode with somebody

851
00:33:34,399 --> 00:33:31,710
who actually went through budgeting and

852
00:33:36,259 --> 00:33:34,409
procurement but then eventually ended up

853
00:33:38,119 --> 00:33:36,269
doing a temporary assignment as a

854
00:33:40,039 --> 00:33:38,129
project manager and then they're doing

855
00:33:42,919 --> 00:33:40,049
more stuff and is on the technical side

856
00:33:44,210 --> 00:33:42,929
but with like you know yeah it's like a

857
00:33:47,239 --> 00:33:44,220
whole mix and you never know where you

858
00:33:50,359 --> 00:33:47,249
can end up so so but so Scott tell us

859
00:33:51,980 --> 00:33:50,369
what are we looking at whatever yeah

860
00:33:53,419 --> 00:33:51,990
I've just been flying a spacecraft into

861
00:33:56,090 --> 00:33:53,429
orbit well you guys were talking about

862
00:33:58,159 --> 00:33:56,100
although we flew spacecraft we flew it

863
00:34:00,019 --> 00:33:58,169

into orbit we are now actually in orbit

864

00:34:01,789 --> 00:34:00,029

so this was a simple two-stage rocket

865

00:34:04,159 --> 00:34:01,799

and I built everything by dragging and

866

00:34:06,470 --> 00:34:04,169

dropping and yeah you fired the main

867

00:34:07,879 --> 00:34:06,480

engine to boost us up into us kind of

868

00:34:09,680 --> 00:34:07,889

suborbital trajectory and then we

869

00:34:11,270 --> 00:34:09,690

circularized with this little engine so

870

00:34:13,010 --> 00:34:11,280

we're now here and honestly we're just

871

00:34:14,869 --> 00:34:13,020

gonna go back and because this is like

872

00:34:17,389 --> 00:34:14,879

what kind of altitude did you get well

873

00:34:20,450 --> 00:34:17,399

this is a scaled-down earth so our

874

00:34:22,789 --> 00:34:20,460

height is reaching up to 173 kilometers

875

00:34:24,980 --> 00:34:22,799

and that is not really to scale but it's

876

00:34:26,659 --> 00:34:24,990

nice to do to have scaled down Earth's

877

00:34:28,669 --> 00:34:26,669

because it means your orbits are faster

878

00:34:30,169 --> 00:34:28,679

so I'm just gonna actually call back

879

00:34:32,690 --> 00:34:30,179

now we're gonna land this so we're gonna

880

00:34:34,639 --> 00:34:32,700

reduce the time warp and then we're

881

00:34:37,039 --> 00:34:34,649

gonna perform a retrograde burn to

882

00:34:39,559 --> 00:34:37,049

slower or a bit down and bring the Peary

883

00:34:42,169 --> 00:34:39,569

apps our perigee inside the atmosphere

884

00:34:44,180 --> 00:34:42,179

so plane what is that the perigee is the

885

00:34:47,480 --> 00:34:44,190

point in the orbit which is closest to

886

00:34:49,849 --> 00:34:47,490

the planet Earth you have the perigee

887

00:34:51,500 --> 00:34:49,859

and the apogee so I'm at Apogee or it

888

00:34:54,260 --> 00:34:51,510

says apoapsis which is the general

889

00:34:56,000 --> 00:34:54,270

version perigee is over here and that is

890

00:34:57,190 --> 00:34:56,010

the closest point and you'll see there

891

00:35:00,589 --> 00:34:57,200

periapsis

892

00:35:03,289 --> 00:35:00,599

G implies this earth so you'll also get

893

00:35:05,450 --> 00:35:03,299

like peri jewel around Jupiter which is

894

00:35:06,089 --> 00:35:05,460

June all course from its distant apple

895

00:35:10,049 --> 00:35:06,099

Jove too

896

00:35:12,120 --> 00:35:10,059

close Parrish off and with parkour Solar

897

00:35:14,009 --> 00:35:12,130

Probe you can have perihelion when it's

898

00:35:16,950 --> 00:35:14,019

really close and getting very hot and

899

00:35:19,319 --> 00:35:16,960

aphelion when it's a long way out I'm

900

00:35:21,719 --> 00:35:19,329

just gonna fire my engine and the thrust

901
00:35:24,479 --> 00:35:21,729
is dropping my orbit down into the

902
00:35:27,479 --> 00:35:24,489
atmosphere and we're then gonna use that

903
00:35:29,219 --> 00:35:27,489
to descend and land yes nice so yeah and

904
00:35:31,370 --> 00:35:29,229
then I just wanted to show this this is

905
00:35:34,469 --> 00:35:31,380
space I think a Space Flight Simulator

906
00:35:38,039 --> 00:35:34,479
it's free and you can you get it on

907
00:35:40,829 --> 00:35:38,049
Android and everything Mac OS so or not

908
00:35:42,989 --> 00:35:40,839
Mac iOS so if you've got a phone if

909
00:35:46,380 --> 00:35:42,999
you're just interested in flying rockets

910
00:35:47,910 --> 00:35:46,390
this is a fantastic option for you there

911
00:35:49,170 --> 00:35:47,920
are some other ones I want to look at so

912
00:35:51,239 --> 00:35:49,180
we're now falling through the atmosphere

913
00:35:54,690 --> 00:35:51,249

and as we fall through the atmosphere

914

00:35:56,999 --> 00:35:54,700

the drag is gonna slower orbit down you

915

00:35:59,339 --> 00:35:57,009

can see down here that our Apple apps is

916

00:36:01,680 --> 00:35:59,349

decreasing because the atmosphere is

917

00:36:03,569 --> 00:36:01,690

slowing us down we're losing energy and

918

00:36:05,729 --> 00:36:03,579

so our orbit is getting closer and

919

00:36:07,499 --> 00:36:05,739

closer to the planet and eventually

920

00:36:08,940 --> 00:36:07,509

we're gonna slow down and have to use

921

00:36:10,410 --> 00:36:08,950

the parachute but we don't want to use

922

00:36:12,959 --> 00:36:10,420

the parachute just yet

923

00:36:17,910 --> 00:36:12,969

yeah because it will tear off at this

924

00:36:19,319 --> 00:36:17,920

speed yeah yes he's gonna have well you

925

00:36:21,930 --> 00:36:19,329

the fight these I think the first time

926
00:36:23,459 --> 00:36:21,940
for me playing Kerbal I was messing

927
00:36:25,469 --> 00:36:23,469
around with it just like trying to do a

928
00:36:27,900 --> 00:36:25,479
quick suborbital launch but I got really

929
00:36:29,459 --> 00:36:27,910
high and then as the as the rocket was

930
00:36:31,709 --> 00:36:29,469
going back in I'm like alright I'm gonna

931
00:36:33,749 --> 00:36:31,719
try to land this thing and I got the the

932
00:36:36,289 --> 00:36:33,759
whether the hatch or whatever it is and

933
00:36:38,640 --> 00:36:36,299
I have it pointing straight down just

934
00:36:40,709 --> 00:36:38,650
just steamrolling like we're like right

935
00:36:42,150 --> 00:36:40,719
to planet Earth they go in land and I

936
00:36:45,239 --> 00:36:42,160
started noticing the Kerbal was having a

937
00:36:47,700 --> 00:36:45,249
very bad time it was getting redder and

938
00:36:50,670 --> 00:36:47,710

redder and like I'm like what is going

939

00:36:52,950 --> 00:36:50,680

on why is this not working and I was

940

00:36:54,719 --> 00:36:52,960

fast and it's falling and then I

941

00:36:57,539 --> 00:36:54,729

remember the conversation that I had

942

00:37:00,839 --> 00:36:57,549

with with Jack Boyd on the podcast of

943

00:37:03,359 --> 00:37:00,849

the whole blunt face idea and I flipped

944

00:37:05,579 --> 00:37:03,369

it around everything cooled off and yeah

945

00:37:09,120 --> 00:37:05,589

I don't have the exact problem I'm going

946

00:37:10,829 --> 00:37:09,130

nose-first thankfully this doesn't model

947

00:37:13,799 --> 00:37:10,839

reentry heating or I would have burned

948

00:37:15,479 --> 00:37:13,809

off my parachute and killed my crew but

949

00:37:17,249 --> 00:37:15,489

we don't get to know the crew so we can

950

00:37:18,579 --> 00:37:17,259

just treat them as faceless entities

951

00:37:20,709 --> 00:37:18,589

well it's a simulation

952

00:37:21,969 --> 00:37:20,719

simulation yes it's very hard to serious

953

00:37:24,219 --> 00:37:21,979

aside from the atmospheric heating

954

00:37:24,999 --> 00:37:24,229

you're probably not stable going

955

00:37:28,209 --> 00:37:25,009

nose-first

956

00:37:30,549 --> 00:37:28,219

so the coins are stable in both

957

00:37:32,380 --> 00:37:30,559

directions and then mercury they had to

958

00:37:34,029 --> 00:37:32,390

have a little spoiler to flip it around

959

00:37:38,200 --> 00:37:34,039

if it came down the wrong way

960

00:37:40,989 --> 00:37:38,210

I remember yeah for Chad while you're

961

00:37:42,549 --> 00:37:40,999

sitting around in school I mean these

962

00:37:44,019 --> 00:37:42,559

kind of simulations have anything I mean

963

00:37:51,670 --> 00:37:44,029

we need people are doing engineering

964

00:37:56,859 --> 00:37:51,680

school this is anything like this 25

965

00:38:01,630 --> 00:37:56,869

year old Chad frost paper it's done

966

00:38:03,670 --> 00:38:01,640

slates and chalk so one of the first one

967

00:38:06,450 --> 00:38:03,680

of the first pieces of code I had to

968

00:38:12,009 --> 00:38:06,460

write for my engineering software class

969

00:38:16,239 --> 00:38:12,019

was a a three body simulation of orbital

970

00:38:18,130 --> 00:38:16,249

dynamics right so mmm anyone could have

971

00:38:19,809 --> 00:38:18,140

you know gone out and you've done a

972

00:38:22,029 --> 00:38:19,819

three body simulation that's it's not

973

00:38:24,069 --> 00:38:22,039

that hard but boy you sure learn a lot

974

00:38:26,410 --> 00:38:24,079

about orbital mechanics when you have to

975

00:38:28,150 --> 00:38:26,420

write the code yourself right it wasn't

976

00:38:29,319 --> 00:38:28,160

a sophisticated simulation about if

977

00:38:31,390 --> 00:38:29,329

there's no better way to learn the

978

00:38:33,430 --> 00:38:31,400

basics than to actually have to code it

979

00:38:35,950 --> 00:38:33,440

up and now there's all sorts of great

980

00:38:38,349 --> 00:38:35,960

simulations and tools I think are also

981

00:38:40,499 --> 00:38:38,359

really great ways to sort of learn

982

00:38:42,880 --> 00:38:40,509

what's going on you know

983

00:38:44,650 --> 00:38:42,890

perigee Apogee what are these terms

984

00:38:46,749 --> 00:38:44,660

meanwhile there's you can just look at

985

00:38:49,269 --> 00:38:46,759

that look at that little simulation and

986

00:38:51,459 --> 00:38:49,279

it's right there and it's very instantly

987

00:38:54,670 --> 00:38:51,469

intuitive in ways that just reading it

988

00:38:56,079 --> 00:38:54,680

out of a book might not be yeah I mean a

989

00:38:59,109 --> 00:38:56,089

lot of these stuff even like terms like

990

00:39:00,519 --> 00:38:59,119

Delta V Devers like I'd heard people

991

00:39:01,779 --> 00:39:00,529

talk about it but it wasn't until

992

00:39:04,660 --> 00:39:01,789

actually playing some of the games I'm

993

00:39:16,120 --> 00:39:04,670

like oh that's what they're talking

994

00:39:18,579 --> 00:39:16,130

about one here this is simple rockets

995

00:39:21,519 --> 00:39:18,589

which is very similar it's you know it's

996

00:39:23,739 --> 00:39:21,529

older it has soft body physics when you

997

00:39:25,870 --> 00:39:23,749

build really big rockets they can you

998

00:39:27,430 --> 00:39:25,880

know you can have things break but I was

999

00:39:30,820 --> 00:39:27,440

actually gonna hand this over to Marian

1000

00:39:32,890 --> 00:39:30,830

sue she can want to try landing this

1001
00:39:35,050 --> 00:39:32,900
and this is for folks if you did not

1002
00:39:37,030 --> 00:39:35,060
watch the the previous episode of us

1003
00:39:39,490 --> 00:39:37,040
doing let's play space videogames

1004
00:39:41,470 --> 00:39:39,500
marybeth landed the lunar lander the

1005
00:39:42,070 --> 00:39:41,480
first time without any practicing

1006
00:39:43,420 --> 00:39:42,080
whatsoever

1007
00:39:46,030 --> 00:39:43,430
solutely tells you to activate your

1008
00:39:48,520 --> 00:39:46,040
landing legs yeah there you go this is

1009
00:39:52,270 --> 00:39:48,530
high pressure man it's okay does not an

1010
00:39:53,830 --> 00:39:52,280
engineer the game really provides these

1011
00:40:01,960 --> 00:39:53,840
very helpful hints like you were falling

1012
00:40:03,130 --> 00:40:01,970
too fast but I did it yeah you know

1013
00:40:04,570 --> 00:40:03,140

could have turn off your engine they're

1014

00:40:06,820 --> 00:40:04,580

getting higher you still have to land

1015

00:40:09,250 --> 00:40:06,830

this thing I want to go back to space

1016

00:40:11,680 --> 00:40:09,260

what are you talking about there's more

1017

00:40:17,340 --> 00:40:11,690

science to find you pointed the wrong

1018

00:40:20,680 --> 00:40:17,350

way no no turn off your engines here

1019

00:40:23,380 --> 00:40:20,690

there you go no no you can point in that

1020

00:40:26,920 --> 00:40:23,390

direction well what are your 250 meters

1021

00:40:29,530 --> 00:40:26,930

up and there you go you pointed the

1022

00:40:31,690 --> 00:40:29,540

wrong way though there's no it's it's no

1023

00:40:33,220 --> 00:40:31,700

catching up there you go well what are

1024

00:40:35,140 --> 00:40:33,230

the questions from the chat this is from

1025

00:40:38,810 --> 00:40:35,150

no sink he was asking are you guys going

1026

00:40:41,910 --> 00:40:38,820

back to the moon and it's like yes

1027

00:40:47,140 --> 00:40:44,770

you've landed twice already yeah I just

1028

00:40:48,700 --> 00:40:47,150

I just love space so much yes just

1029

00:40:53,650 --> 00:40:48,710

doesn't want it to end I don't want to

1030

00:40:55,630 --> 00:40:53,660

go home but listen this the moon is this

1031

00:40:57,610 --> 00:40:55,640

is another version of the moon yes this

1032

00:41:13,680 --> 00:40:57,620

would appear to be a rocky rocky planet

1033

00:41:16,930 --> 00:41:13,690

yes secret magic powers of lunar lander

1034

00:41:19,240 --> 00:41:16,940

consistently every time sign me up

1035

00:41:22,570 --> 00:41:19,250

she is a part of the nasa ames video

1036

00:41:27,160 --> 00:41:22,580

game club but that's made me like mario

1037

00:41:28,630 --> 00:41:27,170

kart oh nice nice does anyone want to

1038

00:41:33,270 --> 00:41:28,640

try docking a spacecraft I think a

1039

00:41:34,730 --> 00:41:33,280

square I salute how's that chord go yeah

1040

00:41:37,040 --> 00:41:34,740

yeah we

1041

00:41:39,410 --> 00:41:37,050

this alright we'll have a head up

1042

00:41:40,850 --> 00:41:39,420

another one before we start as long we

1043

00:41:42,650 --> 00:41:40,860

need to do here you've gotta try and

1044

00:41:45,020 --> 00:41:42,660

dolt with these two spacecraft so it's

1045

00:41:47,030 --> 00:41:45,030

you know you've got controls at the

1046

00:41:48,470 --> 00:41:47,040

bottom there well let's figure out what

1047

00:41:51,290 --> 00:41:48,480

the controls do first

1048

00:41:54,380 --> 00:41:51,300

so exactly there you go then you get

1049

00:41:57,140 --> 00:41:54,390

translate rotate there you go

1050

00:41:59,830 --> 00:41:57,150

so you can drag yep this is very

1051
00:42:05,780 --> 00:41:59,840
realistic because there's no actual

1052
00:42:08,120 --> 00:42:05,790
attitude control its computer to go full

1053
00:42:10,670 --> 00:42:08,130
twitch stream or mode then I have chat

1054
00:42:17,420 --> 00:42:10,680
explain the model of ladee while he's

1055
00:42:19,730 --> 00:42:17,430
playing at the same time you know do two

1056
00:42:21,380 --> 00:42:19,740
things at once yeah just sort of how to

1057
00:42:25,970 --> 00:42:21,390
control it seems to be the hardest part

1058
00:42:27,890 --> 00:42:25,980
yeah one of the questions people were

1059
00:42:29,420 --> 00:42:27,900
asking about going back to the moon

1060
00:42:32,270 --> 00:42:29,430
obviously we're playing around with like

1061
00:42:33,859 --> 00:42:32,280
like landing on the moon and we have

1062
00:42:36,320 --> 00:42:33,869
some other things in the store later

1063
00:42:38,060 --> 00:42:36,330

moon focus but just recently and you

1064

00:42:39,920 --> 00:42:38,070

know not the last episode but the

1065

00:42:41,540 --> 00:42:39,930

previous episode of NASA Silicon Valley

1066

00:42:43,490 --> 00:42:41,550

live we had the administrator Jim

1067

00:42:46,310 --> 00:42:43,500

bridenstine on talked a lot about going

1068

00:42:47,990 --> 00:42:46,320

to the moon and and more particularly

1069

00:42:49,430 --> 00:42:48,000

talking about how it's not flags and

1070

00:42:51,260 --> 00:42:49,440

footprints like last time it's all about

1071

00:42:57,380 --> 00:42:51,270

getting commercial partners together

1072

00:43:00,320 --> 00:42:57,390

look at that you can try again so for

1073

00:43:02,150 --> 00:43:00,330

folks who may be listening as the audio

1074

00:43:03,680 --> 00:43:02,160

version of this podcast this might be

1075

00:43:06,740 --> 00:43:03,690

one maybe you're you're sitting in your

1076

00:43:09,470 --> 00:43:06,750

car on the 101 sitting in traffic this

1077

00:43:11,630 --> 00:43:09,480

might be the episode for you to pause

1078

00:43:14,359 --> 00:43:11,640

and like actually wait till you get home

1079

00:43:15,920 --> 00:43:14,369

they can watch it you know on-demand on

1080

00:43:19,370 --> 00:43:15,930

Twitter on YouTube because it might be a

1081

00:43:21,020 --> 00:43:19,380

more visually I'm just wondering wearing

1082

00:43:22,390 --> 00:43:21,030

the docking ports on this actually are

1083

00:43:25,809 --> 00:43:22,400

he might be

1084

00:43:27,910 --> 00:43:25,819

helps us I eat there how's that yeah

1085

00:43:34,140 --> 00:43:27,920

between those solar panels that's what

1086

00:43:37,359 --> 00:43:34,150

you go there over on the slide realistic

1087

00:43:39,160 --> 00:43:37,369

engineered docking ports there the

1088

00:43:40,779 --> 00:43:39,170

problem is I can't like flight over the

1089

00:43:42,579 --> 00:43:40,789

solar arrays I guess this is two

1090

00:43:45,160 --> 00:43:42,589

dimension piers like I have to go up

1091

00:43:46,690 --> 00:43:45,170

it's gonna say yeah you're supposed to

1092

00:43:49,269 --> 00:43:46,700

slide around like that and the other

1093

00:43:51,220 --> 00:43:49,279

thing that's no we did have one other

1094

00:43:53,049 --> 00:43:51,230

game but I I'm having trouble starting

1095

00:43:55,930 --> 00:43:53,059

it with the right now and I'm not sure

1096

00:43:58,660 --> 00:43:55,940

maybe we can try it towards the end but

1097

00:44:01,630 --> 00:43:58,670

we're hitting it about like what 15

1098

00:44:04,930 --> 00:44:01,640

minutes left so we'll pop on over to the

1099

00:44:07,420 --> 00:44:04,940

next once once we get Chad let's do this

1100

00:44:10,990 --> 00:44:07,430

you can do it Chad everybody believes in

1101
00:44:12,940 --> 00:44:11,000
you there we go just thread the needle

1102
00:44:14,529 --> 00:44:12,950
here and then I'll just jump in another

1103
00:44:18,400 --> 00:44:14,539
question from the chat this is from that

1104
00:44:19,960 --> 00:44:18,410
one fish is does studying in the field

1105
00:44:23,200 --> 00:44:19,970
of aerospace engineering help in

1106
00:44:26,500 --> 00:44:23,210
becoming an astronaut yes I would say

1107
00:44:30,640 --> 00:44:26,510
absolutely yes oh it hasn't worked for

1108
00:44:33,279 --> 00:44:30,650
me as a aerospace engineer I'm not yet

1109
00:44:34,809 --> 00:44:33,289
an astronaut so no guarantees well that

1110
00:44:38,170 --> 00:44:34,819
was one night remember I like to Steve

1111
00:44:40,299 --> 00:44:38,180
Smith he was he's our local astronaut

1112
00:44:42,160 --> 00:44:40,309
that we always default to he's from the

1113
00:44:44,410 --> 00:44:42,170

Bay Area when he talked them you know he

1114

00:44:46,210 --> 00:44:44,420

was an engineer and locally and then

1115

00:44:49,120 --> 00:44:46,220

eventually he took an engineering job at

1116

00:44:50,920 --> 00:44:49,130

NASA Johnson and I hate get applied to

1117

00:44:53,200 --> 00:44:50,930

the astronaut class like four or five

1118

00:44:54,480 --> 00:44:53,210

times until he finally got in so I'm

1119

00:44:56,920 --> 00:44:54,490

gonna say if you're applying to be an

1120

00:45:07,000 --> 00:44:56,930

astronaut life system you have to be

1121

00:45:08,529 --> 00:45:07,010

persistent because you never know now

1122

00:45:09,549 --> 00:45:08,539

I've got the set now I got the satellite

1123

00:45:11,920 --> 00:45:09,559

moving around

1124

00:45:16,920 --> 00:45:11,930

ya know you can know you're in a Salyut

1125

00:45:25,599 --> 00:45:23,799

almost wasn't pretty but it was

1126
00:45:27,069 --> 00:45:25,609
successful yes and you now have to

1127
00:45:28,720 --> 00:45:27,079
repair the solar panels but you're an

1128
00:45:30,760 --> 00:45:28,730
engineer so you can figure that out I'll

1129
00:45:31,839 --> 00:45:30,770
take that one so for folks who are just

1130
00:45:33,290 --> 00:45:31,849
jumping in what we're gonna do is we're

1131
00:45:35,960 --> 00:45:33,300
gonna transition to the next

1132
00:45:37,970 --> 00:45:35,970
to the next game which basically means

1133
00:45:41,570 --> 00:45:37,980
that Scott is gonna unplug one HDMI

1134
00:45:44,390 --> 00:45:41,580
cable and plug it into another PC here

1135
00:45:46,550 --> 00:45:44,400
but for our on the chat if you are

1136
00:45:50,240 --> 00:45:46,560
joining us live you're watching us on

1137
00:45:52,850 --> 00:45:50,250
twitch TV slash NASA that is where you

1138
00:45:57,200 --> 00:45:52,860

need to go in order to to join the chat

1139

00:45:59,090 --> 00:45:57,210

our friend Kavon is actually he's

1140

00:46:02,660 --> 00:45:59,100

actually moderating and then he's the

1141

00:46:03,710 --> 00:46:02,670

NASA behind behind on the chat so yeah

1142

00:46:06,230 --> 00:46:03,720

so go ahead and send in those questions

1143

00:46:08,180 --> 00:46:06,240

in fact we may just jump in yeah go to

1144

00:46:09,170 --> 00:46:08,190

twitch.tv slash NASA I'm gonna do a

1145

00:46:13,400 --> 00:46:09,180

quick rapid-fire

1146

00:46:15,800 --> 00:46:13,410

as we get the next game all riled up but

1147

00:46:17,600 --> 00:46:15,810

also in fact even as we're doing this I

1148

00:46:20,690 --> 00:46:17,610

could do a shout out over to Bill and

1149

00:46:27,260 --> 00:46:20,700

Dave over in the the bill and Dave cam

1150

00:46:29,120 --> 00:46:27,270

so bill Dave it's like do you guys have

1151
00:46:30,590 --> 00:46:29,130
any questions for the group as we start

1152
00:46:34,130 --> 00:46:30,600
getting things transitioned over about

1153
00:46:36,380 --> 00:46:34,140
these games well I no not really but I

1154
00:46:39,440 --> 00:46:36,390
can't come up with one what I was just

1155
00:46:41,990 --> 00:46:39,450
wondering is how do game designers have

1156
00:46:44,750 --> 00:46:42,000
to balance the the fact of space

1157
00:46:47,030 --> 00:46:44,760
exploration by nature is kind of boring

1158
00:46:49,520 --> 00:46:47,040
because it takes so long and we can't go

1159
00:46:52,700 --> 00:46:49,530
very fast versus all the entertainment

1160
00:46:55,070 --> 00:46:52,710
value of things like hyperspace things

1161
00:46:56,750 --> 00:46:55,080
like you know how how do you think game

1162
00:46:59,920 --> 00:46:56,760
designers come up with a good balance

1163
00:47:02,540 --> 00:46:59,930

between making it fun and making it real

1164

00:47:04,190 --> 00:47:02,550

Wow yeah I mean games they love to

1165

00:47:06,320 --> 00:47:04,200

include time warp for all those boring

1166

00:47:08,030 --> 00:47:06,330

things so that you basically run time

1167

00:47:10,190 --> 00:47:08,040

forward so you don't have to spend a

1168

00:47:12,320 --> 00:47:10,200

whole week traveling to the moon you may

1169

00:47:13,640 --> 00:47:12,330

want to click on the space bar or maybe

1170

00:47:16,280 --> 00:47:13,650

on the map that's what I've been trying

1171

00:47:19,460 --> 00:47:16,290

it's trying to get the next game place

1172

00:47:22,330 --> 00:47:19,470

this thing is hot but yeah I mean

1173

00:47:25,550 --> 00:47:22,340

balancing game design is really you know

1174

00:47:27,530 --> 00:47:25,560

fascinating question the staff at these

1175

00:47:29,210 --> 00:47:27,540

things work but with Kerbal also it

1176

00:47:31,010 --> 00:47:29,220

helps you have lots of explosions so

1177

00:47:33,890 --> 00:47:31,020

there's lots of moments of Terror and

1178

00:47:36,590 --> 00:47:33,900

fire and then the rest of the time is

1179

00:47:38,570 --> 00:47:36,600

very slow and maybe trying to figure out

1180

00:47:40,490 --> 00:47:38,580

your orbital rendezvous and very

1181

00:47:42,710 --> 00:47:40,500

carefully put you put together

1182

00:47:45,250 --> 00:47:42,720

there's also this interesting balance

1183

00:47:47,410 --> 00:47:45,260

between your realism

1184

00:47:49,690 --> 00:47:47,420

and playability right so you can have

1185

00:47:53,260 --> 00:47:49,700

something that's that really models the

1186

00:47:54,520 --> 00:47:53,270

physics very authentically but at the

1187

00:47:57,190 --> 00:47:54,530

same time if you make it too authentic

1188

00:47:59,200 --> 00:47:57,200

right in the game I was just playing if

1189

00:48:00,700 --> 00:47:59,210

I had bumped my little spacecraft into

1190

00:48:02,380 --> 00:48:00,710

the satellite right there would have

1191

00:48:04,360 --> 00:48:02,390

been death and destruction all over well

1192

00:48:06,190 --> 00:48:04,370

that happens in Kerbal space program did

1193

00:48:08,260 --> 00:48:06,200

that so there's this trade between why

1194

00:48:10,540 --> 00:48:08,270

do I make it so authentic that it's

1195

00:48:13,060 --> 00:48:10,550

unplayable or do i back off a little bit

1196

00:48:15,370 --> 00:48:13,070

on the authenticity and have enough

1197

00:48:17,320 --> 00:48:15,380

realism but still make it kind of a fun

1198

00:48:19,210 --> 00:48:17,330

to play game we should fly space

1199

00:48:20,500 --> 00:48:19,220

simulator instead I know well you know

1200

00:48:23,440 --> 00:48:20,510

what we're gonna do in fact what I'm

1201

00:48:25,480 --> 00:48:23,450

gonna try and do so Chad so I'm gonna

1202

00:48:28,630 --> 00:48:25,490

flip on over because this is the joy of

1203

00:48:31,720 --> 00:48:28,640

being on live television on twitch.tv

1204

00:48:34,000 --> 00:48:31,730

slash NASA is that sometimes even when

1205

00:48:36,400 --> 00:48:34,010

you have the game working for an hour

1206

00:48:38,860 --> 00:48:36,410

plus before we went live sometimes

1207

00:48:41,560 --> 00:48:38,870

things tend to go wrong and that's okay

1208

00:48:42,790 --> 00:48:41,570

so I'm gonna hop on over to go see if I

1209

00:48:45,010 --> 00:48:42,800

can get that thing up and running

1210

00:48:48,910 --> 00:48:45,020

because it's actually my personal PC

1211

00:48:51,010 --> 00:48:48,920

which is for whatever reason the cable

1212

00:48:52,900 --> 00:48:51,020

isn't working I'm not sure if the if

1213

00:48:54,850 --> 00:48:52,910

it's too hot or whatever but I mean it's

1214

00:48:57,160 --> 00:48:54,860

like turn it over to to my friend Chad

1215

00:48:58,930 --> 00:48:57,170

over here to look at this to look at the

1216

00:49:00,820 --> 00:48:58,940

chat and so we can start rapid-fire

1217

00:49:02,830 --> 00:49:00,830

through some questions okay

1218

00:49:04,600 --> 00:49:02,840

so why don't you just go through here

1219

00:49:06,130 --> 00:49:04,610

and I'm gonna hop on over to see if I

1220

00:49:07,420 --> 00:49:06,140

can help Scott over there alright we're

1221

00:49:10,140 --> 00:49:07,430

just gonna go right down from the top

1222

00:49:12,970 --> 00:49:10,150

rapid-fire all right can you explain

1223

00:49:16,540 --> 00:49:12,980

lagravis this is from snack liske herbal

1224

00:49:19,050 --> 00:49:16,550

I guess he's hungry up in space I'm sure

1225

00:49:22,420 --> 00:49:19,060

so the garage points are those

1226

00:49:24,790 --> 00:49:22,430

interesting spots in our in our solar

1227

00:49:27,130 --> 00:49:24,800

system where the the gravitational

1228

00:49:27,670 --> 00:49:27,140

attraction of different bodies cancel

1229

00:49:30,400 --> 00:49:27,680

each other out

1230

00:49:32,680 --> 00:49:30,410

all right so we have Lagrange points

1231

00:49:36,280 --> 00:49:32,690

between Earth and the moon between Earth

1232

00:49:41,020 --> 00:49:36,290

and the Sun where if you you know put a

1233

00:49:43,450 --> 00:49:41,030

put a spacecraft at that point it's sort

1234

00:49:45,910 --> 00:49:43,460

of right in this nice little point of

1235

00:49:48,430 --> 00:49:45,920

balance between them and so you can't

1236

00:49:50,230 --> 00:49:48,440

they don't just sit there of their own

1237

00:49:52,090 --> 00:49:50,240

accord they typically have to be sort of

1238

00:49:55,390 --> 00:49:52,100

a little bit of a drift around that

1239

00:49:57,310 --> 00:49:55,400

point to be stable but it let's but lets

1240

00:49:58,470 --> 00:49:57,320

us put some scientific spacecraft out

1241

00:50:00,269 --> 00:49:58,480

there

1242

00:50:02,819 --> 00:50:00,279

and they don't have to use a lot of fuel

1243

00:50:05,759 --> 00:50:02,829

to stay there and they're not in an

1244

00:50:07,200 --> 00:50:05,769

orbit around the Earth there they're

1245

00:50:09,359 --> 00:50:07,210

nice and far away they can do their

1246

00:50:12,720 --> 00:50:09,369

science very Beth you get anything you

1247

00:50:14,549 --> 00:50:12,730

want to understand I was thinking about

1248

00:50:16,680 --> 00:50:14,559

like what are the cool missions or

1249

00:50:18,930 --> 00:50:16,690

spacecraft that we have at lagrangian's

1250

00:50:19,650 --> 00:50:18,940

right now like I know James Webb where

1251

00:50:25,259 --> 00:50:19,660

is that one going

1252

00:50:29,099 --> 00:50:25,269

nothing else : exactly but it's a common

1253

00:50:30,509 --> 00:50:29,109

place to go park big big experiments

1254

00:50:32,999 --> 00:50:30,519

things that need to be out there for a

1255

00:50:35,160 --> 00:50:33,009

long time and then you've also got Lucie

1256

00:50:37,559 --> 00:50:35,170

which is planning to actually visit the

1257

00:50:40,289 --> 00:50:37,569

Julian Lagrange points where you've got

1258

00:50:42,059 --> 00:50:40,299

these asteroids these very old asteroids

1259

00:50:43,440 --> 00:50:42,069

that have been trapped there since the

1260

00:50:45,809 --> 00:50:43,450

formation of the solar system

1261

00:50:49,349 --> 00:50:45,819

so headed out there to get a close look

1262

00:50:51,239 --> 00:50:49,359

at these things of course one of the one

1263

00:50:53,519 --> 00:50:51,249

of the challenges for example with the

1264

00:50:56,430 --> 00:50:53,529

James Webb Space Telescope is you know

1265

00:50:58,529 --> 00:50:56,440

it's a far distance out there so once we

1266

00:51:00,359 --> 00:50:58,539

send something there we can't just at

1267

00:51:02,039 --> 00:51:00,369

this point send astronauts out to go fix

1268

00:51:04,890 --> 00:51:02,049

it if there's a problem it really has to

1269

00:51:09,329 --> 00:51:04,900

be pretty self-sufficient okay next one

1270

00:51:13,769 --> 00:51:09,339

on the list from test has ace can people

1271

00:51:17,220 --> 00:51:13,779

live on the moon for how long is that a

1272

00:51:19,710 --> 00:51:17,230

real answer I think if you magically

1273

00:51:21,420 --> 00:51:19,720

dropped somebody teleported them onto

1274

00:51:24,749 --> 00:51:21,430

the moon they could live there for you

1275

00:51:28,019 --> 00:51:24,759

know a few moments it would be longer if

1276

00:51:30,299 --> 00:51:28,029

they had a spacesuit longer yet if they

1277

00:51:31,589 --> 00:51:30,309

had some protection from the radiation

1278

00:51:34,109 --> 00:51:31,599

environment and the heat and the cold

1279

00:51:37,170 --> 00:51:34,119

some sort of a habitat so as long as we

1280

00:51:39,930 --> 00:51:37,180

provide them with the necessary habitat

1281

00:51:42,900 --> 00:51:39,940

that sure eventually we have to feed

1282

00:51:45,120 --> 00:51:42,910

them so they know you know snack less

1283

00:51:47,309 --> 00:51:45,130

Kerbal may be hungry because we already

1284

00:51:50,789 --> 00:51:47,319

gave the food to the people living on

1285

00:51:52,079 --> 00:51:50,799

the moon snacks are the fundamental unit

1286

00:51:53,970 --> 00:51:52,089

of life supports in the carville

1287

00:51:57,960 --> 00:51:53,980

universe they don't run out of air they

1288

00:52:01,660 --> 00:51:57,970

run out of snacks snacks okay it looks

1289

00:52:04,210 --> 00:52:01,670

like these guys have it running yeah

1290

00:52:05,650 --> 00:52:04,220

rebidding so you're not quite there but

1291

00:52:08,500 --> 00:52:05,660

we're actually gonna end up doing is

1292

00:52:10,720 --> 00:52:08,510

like hey how you doing so what we're

1293

00:52:12,190 --> 00:52:10,730

gonna end up doing is it is booting up

1294

00:52:14,680 --> 00:52:12,200

right now so we're gonna go do some more

1295

00:52:15,910 --> 00:52:14,690

rapid-fire before we go ahead and jump

1296

00:52:18,760 --> 00:52:15,920

on in so I'm gonna hop over there

1297

00:52:20,200 --> 00:52:18,770

everything yeah okay well yeah I'm just

1298

00:52:22,960 --> 00:52:20,210

wondering if we unplug this whether old

1299

00:52:24,700 --> 00:52:22,970

break it or not well I think the things

1300

00:52:27,250 --> 00:52:24,710

that we won't be able to get steam up

1301
00:52:27,940 --> 00:52:27,260
and running game going so let's just

1302
00:52:32,410 --> 00:52:27,950
keep going this

1303
00:52:36,010 --> 00:52:32,420
let's keep answering questions decided

1304
00:52:37,780 --> 00:52:36,020
to do a Windows Update it's a Windows

1305
00:52:40,599 --> 00:52:37,790
Update that's what happened it's so

1306
00:52:42,640 --> 00:52:40,609
funny okay welcome to live television

1307
00:52:46,960 --> 00:52:42,650
folks there's a good one for Marybeth

1308
00:52:49,569 --> 00:52:46,970
shade of dead he says what about rain on

1309
00:52:52,000 --> 00:52:49,579
Venus on Venus oh I don't I think it's

1310
00:52:54,370 --> 00:52:52,010
too hot what would be rain in the upper

1311
00:52:56,589 --> 00:52:54,380
atmosphere apparently but it evaporates

1312
00:52:58,510 --> 00:52:56,599
before it hits the surface okay that's

1313
00:53:01,539 --> 00:52:58,520

what I've I've seen some evidence of

1314

00:53:02,740 --> 00:53:01,549

that and it was supporting an NIAC air

1315

00:53:05,620 --> 00:53:02,750

stream and that we're talking about a

1316

00:53:07,839 --> 00:53:05,630

balloon that would look at this and also

1317

00:53:09,190 --> 00:53:07,849

considered looking at dust they would be

1318

00:53:12,670 --> 00:53:09,200

blown up from the surface because of the

1319

00:53:14,410 --> 00:53:12,680

very dense atmosphere I think also at

1320

00:53:17,589 --> 00:53:14,420

this point we don't think we you know we

1321

00:53:19,900 --> 00:53:17,599

have there's hypotheses we've talked

1322

00:53:22,030 --> 00:53:19,910

about sending a new generation of probes

1323

00:53:24,250 --> 00:53:22,040

to Venus at some point it's been a long

1324

00:53:26,020 --> 00:53:24,260

time since we sent any it may be that'd

1325

00:53:29,470 --> 00:53:26,030

be a great question to try and seek

1326

00:53:32,200 --> 00:53:29,480

answers to yeah let's see

1327

00:53:34,450 --> 00:53:32,210

so robotics this is from ki-netic so

1328

00:53:47,740 --> 00:53:34,460

robotics will have to advanced for us to

1329

00:53:49,750 --> 00:53:47,750

advance in outer space steam by the way

1330

00:53:53,200 --> 00:53:49,760

we're gonna send we're gonna send humans

1331

00:53:56,140 --> 00:53:53,210

deeper into space and that we're gonna

1332

00:53:57,819 --> 00:53:56,150

send robots right alongside them you

1333

00:54:01,839 --> 00:53:57,829

know right now one of the one of the

1334

00:54:04,450 --> 00:54:01,849

NASA plans is to have a future you know

1335

00:54:06,010 --> 00:54:04,460

outpost in the vicinity of the moon and

1336

00:54:08,589 --> 00:54:06,020

we're not going to be able to have

1337

00:54:10,329 --> 00:54:08,599

humans there full-time humans might be

1338

00:54:12,430 --> 00:54:10,339

there you know a month out of the year

1339

00:54:14,049 --> 00:54:12,440

and so the question is well how do we

1340

00:54:14,970 --> 00:54:14,059

take care of the place the rest of the

1341

00:54:17,849 --> 00:54:14,980

other 11 months

1342

00:54:19,920 --> 00:54:17,859

of the year so we really need to have

1343

00:54:21,800 --> 00:54:19,930

some robots to help with that we talked

1344

00:54:24,330 --> 00:54:21,810

earlier about having robots help build

1345

00:54:26,220 --> 00:54:24,340

the future things that we're going to

1346

00:54:29,010 --> 00:54:26,230

have in space like habitats and space

1347

00:54:31,980 --> 00:54:29,020

stations so yeah I think especially the

1348

00:54:33,830 --> 00:54:31,990

further out into space we go the more

1349

00:54:37,800 --> 00:54:33,840

robotics we'll need and the more

1350

00:54:40,530 --> 00:54:37,810

autonomy we'll have to have as well so

1351
00:54:42,660 --> 00:54:40,540
we are getting steam booted up the game

1352
00:54:45,359 --> 00:54:42,670
is about to go and ladies and gentlemen

1353
00:54:46,770 --> 00:54:45,369
my laptop just died so we're gonna keep

1354
00:54:52,380 --> 00:54:46,780
doing some questions but I'm gonna do

1355
00:54:53,790 --> 00:54:52,390
this from my mobile phone because it is

1356
00:54:55,980 --> 00:54:53,800
live television so it's going to be

1357
00:54:57,480 --> 00:54:55,990
really fun but let me jump on into the

1358
00:54:59,849 --> 00:54:57,490
chat which I have some stuff right here

1359
00:55:02,010 --> 00:54:59,859
okay what information can be gathered

1360
00:55:07,320 --> 00:55:02,020
from the newly landed Japanese probes on

1361
00:55:09,480 --> 00:55:07,330
ragu obviously cameras on there right

1362
00:55:11,820 --> 00:55:09,490
now but these people should appreciate

1363
00:55:14,280 --> 00:55:11,830

these are just the first of many Landers

1364

00:55:15,930 --> 00:55:14,290

there's gonna be a second Lander and a

1365

00:55:18,390 --> 00:55:15,940

third and they're also gonna shoot it

1366

00:55:21,060 --> 00:55:18,400

with an anti-tank round to make a hole

1367

00:55:24,000 --> 00:55:21,070

on it so they can get a sample yeah the

1368

00:55:26,450 --> 00:55:24,010

real GU asteroid I'm fascinated by this

1369

00:55:28,890 --> 00:55:26,460

because it's a very very

1370

00:55:30,780 --> 00:55:28,900

undifferentiated kind of rock so it's

1371

00:55:32,640 --> 00:55:30,790

gonna give us some real interesting old

1372

00:55:34,520 --> 00:55:32,650

look at the kind of pristine material

1373

00:55:37,440 --> 00:55:34,530

from the solar system early solar system

1374

00:55:39,150 --> 00:55:37,450

I'm a big fan of that the old school you

1375

00:55:40,890 --> 00:55:39,160

know if you want to know what it's made

1376
00:55:42,630 --> 00:55:40,900
of and what its characteristics are you

1377
00:55:44,430 --> 00:55:42,640
know poke it with a stick yeah so

1378
00:55:45,840 --> 00:55:44,440
they're gonna hit it hard and then

1379
00:55:47,400 --> 00:55:45,850
they're gonna bring a sample from

1380
00:55:48,560 --> 00:55:47,410
underneath the surface back home

1381
00:55:51,480 --> 00:55:48,570
eventually

1382
00:55:53,550 --> 00:55:51,490
so I'm also just kind of realizing how

1383
00:55:56,430 --> 00:55:53,560
like a lot of the stuff that we worked

1384
00:55:59,130 --> 00:55:56,440
on before we started if they dip the

1385
00:56:01,620 --> 00:55:59,140
save if the computer actually say oh you

1386
00:56:02,250 --> 00:56:01,630
did save it yes we actually have Kerbal

1387
00:56:04,500 --> 00:56:02,260
up note

1388
00:56:07,020 --> 00:56:04,510

all right so spoiler ladies and

1389

00:56:09,870 --> 00:56:07,030

gentlemen that our third and final game

1390

00:56:11,490 --> 00:56:09,880

for the evening is going to be an encore

1391

00:56:13,290 --> 00:56:11,500

presentation of Kerrville Jessie I'm

1392

00:56:15,270 --> 00:56:13,300

good if we think we have like three

1393

00:56:16,560 --> 00:56:15,280

minutes liquor bowls so this is what

1394

00:56:18,330 --> 00:56:16,570

we're gonna basically end up doing

1395

00:56:20,790 --> 00:56:18,340

because we have we normally go for about

1396

00:56:21,990 --> 00:56:20,800

an hour and so let's throw it up to the

1397

00:56:23,310 --> 00:56:22,000

chat you know we got about like two

1398

00:56:24,780 --> 00:56:23,320

minutes I think we're just gonna go for

1399

00:56:27,780 --> 00:56:24,790

another half hour

1400

00:56:29,760 --> 00:56:27,790

and let's keep the keep the party going

1401

00:56:30,960 --> 00:56:29,770

and we're gonna get Kerbal up and

1402

00:56:34,050 --> 00:56:30,970

running and so we have that going on

1403

00:56:36,240 --> 00:56:34,060

behind us right now yes so I know you

1404

00:56:37,890 --> 00:56:36,250

mentioned that NASA doesn't necessarily

1405

00:56:39,990 --> 00:56:37,900

endorse anything but they did actually

1406

00:56:42,180 --> 00:56:40,000

work with the developers actually a

1407

00:56:44,940 --> 00:56:42,190

space act agreement where there was an

1408

00:56:48,090 --> 00:56:44,950

Tenten and yeah they added the parts to

1409

00:56:50,610 --> 00:56:48,100

make the SLS in Kerbal space program and

1410

00:56:53,760 --> 00:56:50,620

this was a slightly older version of the

1411

00:56:55,890 --> 00:56:53,770

SLS with a different paintwork so it

1412

00:56:58,020 --> 00:56:55,900

doesn't have the sweeps or whatever on

1413

00:57:00,210 --> 00:56:58,030

the external boosters but I built up

1414

00:57:02,520 --> 00:57:00,220

something that's pretty close to a it

1415

00:57:04,440 --> 00:57:02,530

looks a block one roughly it's obvious

1416

00:57:06,870 --> 00:57:04,450

the Kerbal scale but it has a crew of

1417

00:57:09,210 --> 00:57:06,880

three we have an Orion spacecraft at the

1418

00:57:12,930 --> 00:57:09,220

top this is a hypergolic upper stage so

1419

00:57:15,180 --> 00:57:12,940

it actually oh wait a second that's not

1420

00:57:16,920 --> 00:57:15,190

the I've missed I'm missing a stage here

1421

00:57:19,110 --> 00:57:16,930

oh no did we miss the stage I'm missing

1422

00:57:22,620 --> 00:57:19,120

a stage go check your staging I gotta

1423

00:57:26,130 --> 00:57:22,630

check my stage sorry for folk audio

1424

00:57:28,340 --> 00:57:26,140

listeners yes because yes the the upper

1425

00:57:31,170 --> 00:57:28,350

stage on the block one is gonna use for

1426
00:57:33,420 --> 00:57:31,180
r10 engines and then it's gonna use an

1427
00:57:34,890 --> 00:57:33,430
AGA ten hypergolic engine on the final

1428
00:57:37,680 --> 00:57:34,900
stage but the mainstage is going to be

1429
00:57:40,470 --> 00:57:37,690
powered by liquid hydrogen and oxygen

1430
00:57:43,230 --> 00:57:40,480
and for these rs.25 engines which were

1431
00:57:45,800 --> 00:57:43,240
the same engines that powered the space

1432
00:57:50,180 --> 00:57:45,810
shuttle those things are absolutely

1433
00:57:53,130 --> 00:57:50,190
impressively enormous I was out there

1434
00:57:55,290 --> 00:57:53,140
standing next to one of those not long

1435
00:57:57,810 --> 00:57:55,300
ago and I didn't fully appreciate just

1436
00:57:59,430 --> 00:57:57,820
how huge they were until I was standing

1437
00:58:00,930 --> 00:57:59,440
right next to one of them and it just

1438
00:58:03,150 --> 00:58:00,940

kind of was looking up just at the

1439

00:58:07,200 --> 00:58:03,160

engine is my oh my goodness that's just

1440

00:58:08,940 --> 00:58:07,210

huge yeah yeah the rs.25 engines are

1441

00:58:11,940 --> 00:58:08,950

still right up there as some of the best

1442

00:58:13,380 --> 00:58:11,950

engines ever developed and everybody's

1443

00:58:17,970 --> 00:58:13,390

you know in terms of specific impulse

1444

00:58:19,410 --> 00:58:17,980

they're way out there and newer engines

1445

00:58:20,910 --> 00:58:19,420

are switching over to different fuel

1446

00:58:22,680 --> 00:58:20,920

cycles but they're not gonna get the

1447

00:58:24,990 --> 00:58:22,690

same efficiency and so basically what

1448

00:58:27,240 --> 00:58:25,000

we're trying to do here this is SLS em1

1449

00:58:28,770 --> 00:58:27,250

is what I always hear referred to yes so

1450

00:58:34,250 --> 00:58:28,780

don't you guys explain to me what is

1451

00:58:38,780 --> 00:58:34,260

e-m1 for us for the noobs what is that

1452

00:58:42,170 --> 00:58:38,790

is the upcoming sort of test mission to

1453

00:58:42,589 --> 00:58:42,180

take the system out around the moon and

1454

00:58:45,710 --> 00:58:42,599

back

1455

00:58:47,240 --> 00:58:45,720

alright so yeah I'm one as is the first

1456

00:58:48,920 --> 00:58:47,250

one that will take the the complete

1457

00:58:50,000 --> 00:58:48,930

system up and out and around the moon

1458

00:58:52,849 --> 00:58:50,010

and back

1459

00:58:57,680 --> 00:58:52,859

won't have any crew on board have a

1460

00:58:59,630 --> 00:58:57,690

whole bunch of experiments the SLS is

1461

00:59:02,930 --> 00:58:59,640

carrying along with it in addition to

1462

00:59:04,400 --> 00:59:02,940

the Orion on the top it's actually

1463

00:59:09,200 --> 00:59:04,410

carrying along a whole bunch of

1464

00:59:11,720 --> 00:59:09,210

additional cube sets around the the

1465

00:59:13,880 --> 00:59:11,730

interim cryogenic propulsion stages ICPs

1466

00:59:16,310 --> 00:59:13,890

sort of that big conical ring down there

1467

00:59:18,620 --> 00:59:16,320

and on its way out it will deploy a

1468

00:59:20,870 --> 00:59:18,630

whole bunch of those little secondary

1469

00:59:22,400 --> 00:59:20,880

spacecraft too so it's doing a whole

1470

00:59:24,020 --> 00:59:22,410

bunch of interesting things on that

1471

00:59:34,910 --> 00:59:24,030

mission so we see those boosters just

1472

00:59:37,130 --> 00:59:34,920

fell off ya know it's launching from

1473

00:59:40,040 --> 00:59:37,140

Kerbal Space Center I don't remember

1474

00:59:46,010 --> 00:59:40,050

that ASC though there's not many

1475

00:59:49,460 --> 00:59:46,020

mountains but yeah there's no boats out

1476
00:59:51,410 --> 00:59:49,470
there yeah there are some islands that

1477
00:59:52,460 --> 00:59:51,420
you can land on so this is one of the

1478
00:59:54,470 --> 00:59:52,470
great things about Kerbal space program

1479
00:59:56,690 --> 00:59:54,480
is it's been around for like eight years

1480
00:59:59,359 --> 00:59:56,700
now and I mentioned that people that

1481
01:00:01,670 --> 00:59:59,369
have played this game are actually now

1482
01:00:04,430 --> 01:00:01,680
working at NASA what are you like yes

1483
01:00:06,079 --> 01:00:04,440
change people's you know views and

1484
01:00:08,569 --> 01:00:06,089
turned them into actual rocket

1485
01:00:10,280 --> 01:00:08,579
scientists but the great thing about

1486
01:00:13,220 --> 01:00:10,290
Kerbal space program is it is

1487
01:00:16,880 --> 01:00:13,230
essentially simulating these Rockets as

1488
01:00:18,680 --> 01:00:16,890

multiple parts I'm gonna just throw it

1489

01:00:20,150 --> 01:00:18,690

alone my main engine so I guess we're

1490

01:00:22,790 --> 01:00:20,160

gonna carry our main stage because we're

1491

01:00:24,670 --> 01:00:22,800

gonna go out to the moon so right now

1492

01:00:27,650 --> 01:00:24,680

we're just kind of holding attitude I

1493

01:00:29,599 --> 01:00:27,660

was gonna say related to what you were

1494

01:00:31,250 --> 01:00:29,609

just talking about I recently had gone

1495

01:00:32,329 --> 01:00:31,260

through like a training over at Wallops

1496

01:00:35,420 --> 01:00:32,339

and there was a couple of people from

1497

01:00:37,160 --> 01:00:35,430

you know from Marshall and they had seen

1498

01:00:38,720 --> 01:00:37,170

the previous episode where we were doing

1499

01:00:41,120 --> 01:00:38,730

kerbals Facebook and they they were

1500

01:00:42,770 --> 01:00:41,130

quite like they're very adamant that you

1501
01:00:45,109 --> 01:00:42,780
really need to get some people from the

1502
01:00:46,670 --> 01:00:45,119
Marshall Space Flight Center onto the

1503
01:00:47,109 --> 01:00:46,680
show to play some Kerbal because there's

1504
01:00:49,150 --> 01:00:47,119
old

1505
01:00:51,849 --> 01:00:49,160
got incredible fans over at Marshalls

1506
01:00:56,529 --> 01:00:51,859
good those guys know way more about

1507
01:00:58,959 --> 01:00:56,539
rockets than we do we are not rocket

1508
01:01:01,209 --> 01:00:58,969
folks here no no we need to know about

1509
01:01:01,890 --> 01:01:01,219
rock as we go ask them those guys are

1510
01:01:05,289 --> 01:01:01,900
the experts

1511
01:01:06,940 --> 01:01:05,299
well yeah music herbal uses a slightly

1512
01:01:08,589 --> 01:01:06,950
smaller version of reality that

1513
01:01:10,719 --> 01:01:08,599

everything is scaled down by a factor of

1514

01:01:11,920 --> 01:01:10,729

10 and that makes it kind of easier for

1515

01:01:14,739 --> 01:01:11,930

the players because they have to spend

1516

01:01:16,809 --> 01:01:14,749

less time trying to chase down targets

1517

01:01:18,489 --> 01:01:16,819

for docking and everything space is big

1518

01:01:21,489 --> 01:01:18,499

if you make it smaller it makes things

1519

01:01:23,529 --> 01:01:21,499

easier but you know physics wise the

1520

01:01:25,779 --> 01:01:23,539

game engine models the thrust from the

1521

01:01:30,039 --> 01:01:25,789

Rockets the aerodynamics the thermal

1522

01:01:31,989 --> 01:01:30,049

transfer power flow you know you get it

1523

01:01:34,569 --> 01:01:31,999

all in there and and it kind of the

1524

01:01:36,640 --> 01:01:34,579

natural behavior of aircraft and rockets

1525

01:01:39,609 --> 01:01:36,650

all just comes out of modeling it like

1526

01:01:42,219 --> 01:01:39,619

this you can even have your Rockets

1527

01:01:45,279 --> 01:01:42,229

disintegrate at max Q because you over

1528

01:01:46,989 --> 01:01:45,289

stress the airframe like it has mainly

1529

01:01:48,549 --> 01:01:46,999

if the great thing is you play this game

1530

01:01:50,890 --> 01:01:48,559

and there'll be a failure and your

1531

01:01:52,359 --> 01:01:50,900

rocket explodes and you can typically

1532

01:01:54,729 --> 01:01:52,369

think back to some point in the past

1533

01:01:57,549 --> 01:01:54,739

where real rocket did exactly the same

1534

01:01:59,229 --> 01:01:57,559

thing for the same reason so I'm just

1535

01:02:00,700 --> 01:01:59,239

gonna I'm just putting ourselves into

1536

01:02:02,499 --> 01:02:00,710

orbit I think I'm gonna try going out to

1537

01:02:05,469 --> 01:02:02,509

the moon right now or we could you know

1538

01:02:07,150 --> 01:02:05,479

go somewhere else we have a pretty big

1539

01:02:09,549 --> 01:02:07,160

rocket here I think I gave it way more

1540

01:02:11,499 --> 01:02:09,559

fuel and we need it we actually carried

1541

01:02:13,779 --> 01:02:11,509

the entire first stage and talked about

1542

01:02:15,880 --> 01:02:13,789

the first day we still a fuel in it so

1543

01:02:17,529 --> 01:02:15,890

we might as well use that let's go

1544

01:02:20,259 --> 01:02:17,539

somewhere we're gonna head out to the

1545

01:02:22,440 --> 01:02:20,269

moon here so to travel to the moon we

1546

01:02:29,349 --> 01:02:22,450

have to perform what's called a trans

1547

01:02:30,329 --> 01:02:29,359

trans moon or injection in this case yes

1548

01:02:32,920 --> 01:02:30,339

TMI

1549

01:02:34,809 --> 01:02:32,930

so what you can actually do is use the

1550

01:02:36,969 --> 01:02:34,819

navigation computer you click on the

1551
01:02:38,380 --> 01:02:36,979
orbit to create what's called a maneuver

1552
01:02:40,930 --> 01:02:38,390
nord and then you say it this maneuver i

1553
01:02:43,239 --> 01:02:40,940
want to add some thrust and you can see

1554
01:02:46,239 --> 01:02:43,249
that it's showing you after this

1555
01:02:48,009 --> 01:02:46,249
maneuver that my orbit will go up so we

1556
01:02:50,309 --> 01:02:48,019
want this orbit to go up towards the

1557
01:02:53,769 --> 01:02:50,319
moon and I've carefully placed this

1558
01:02:55,450 --> 01:02:53,779
noise so that it should put me near the

1559
01:02:57,219 --> 01:02:55,460
moon you see and it's actually telling

1560
01:02:58,569 --> 01:02:57,229
it's gonna actually be moving while

1561
01:02:59,089 --> 01:02:58,579
you're trying to get it so you're kind

1562
01:03:01,309 --> 01:02:59,099
of interested

1563
01:03:02,960 --> 01:03:01,319

yes I've there we go we're actually

1564

01:03:04,880 --> 01:03:02,970

gonna get an encounter with the moon

1565

01:03:06,680 --> 01:03:04,890

there and then get kicked off into a

1566

01:03:09,950 --> 01:03:06,690

slightly different orbit but I think we

1567

01:03:11,569 --> 01:03:09,960

can well as we're on our way over to the

1568

01:03:15,349 --> 01:03:11,579

moon we'll throw that over to the chat

1569

01:03:17,420 --> 01:03:15,359

and Kavon will let me know do you guys

1570

01:03:20,059 --> 01:03:17,430

want to keep do we want to go to the

1571

01:03:23,509 --> 01:03:20,069

moon land or circle around and come back

1572

01:03:24,950 --> 01:03:23,519

or do we want to go somewhere else so go

1573

01:03:26,749 --> 01:03:24,960

ahead and jump into the chat and let us

1574

01:03:30,229 --> 01:03:26,759

know what you want to do yeah I'm gonna

1575

01:03:32,029 --> 01:03:30,239

I'm gonna take this do this oh I'm just

1576

01:03:35,809 --> 01:03:32,039

gonna use time acceleration to get here

1577

01:03:37,969 --> 01:03:35,819

so warps annex maneuver yes it's so Mary

1578

01:03:39,890 --> 01:03:37,979

Beth as a scientist it's like you know

1579

01:03:43,099 --> 01:03:39,900

coming up with experiments it's looking

1580

01:03:44,870 --> 01:03:43,109

like astrobiology um it's kind of I

1581

01:03:46,759 --> 01:03:44,880

don't know how much time do you guys

1582

01:03:49,789 --> 01:03:46,769

spent thinking about this kind of stuff

1583

01:03:51,499 --> 01:03:49,799

of just like getting into orbit and it's

1584

01:03:52,940 --> 01:03:51,509

just like this is the engineers world or

1585

01:03:54,469 --> 01:03:52,950

how often do you guys like like work

1586

01:03:57,200 --> 01:03:54,479

together yeah I mean it's really

1587

01:03:58,969 --> 01:03:57,210

important to understand you know how the

1588

01:04:01,190 --> 01:03:58,979

engineering is gonna impact whatever

1589

01:04:03,349 --> 01:04:01,200

instrument payload you're developing and

1590

01:04:04,910 --> 01:04:03,359

so it's important for especially even

1591

01:04:06,859 --> 01:04:04,920

early on to start to think about those

1592

01:04:09,499 --> 01:04:06,869

types of problems so you can you can

1593

01:04:11,719 --> 01:04:09,509

make sure that whatever experiment

1594

01:04:14,089 --> 01:04:11,729

you're trying to do no part of launch or

1595

01:04:18,200 --> 01:04:14,099

getting into space will affect that

1596

01:04:19,549 --> 01:04:18,210

experiment so I often think of there's

1597

01:04:22,549 --> 01:04:19,559

people here at Ames who are creating

1598

01:04:23,900 --> 01:04:22,559

like you know like experiments right and

1599

01:04:25,609 --> 01:04:23,910

they're they're putting them together in

1600

01:04:26,930 --> 01:04:25,619

this nice little box that they send over

1601
01:04:30,200 --> 01:04:26,940
and get launched in a rocket and I'm

1602
01:04:31,910 --> 01:04:30,210
like your experimental activity exactly

1603
01:04:33,620 --> 01:04:31,920
it's like surviving like a launch is a

1604
01:04:36,589 --> 01:04:33,630
pretty traumatic thing for whatever is

1605
01:04:38,029 --> 01:04:36,599
in that experiment and in that box yeah

1606
01:04:39,620 --> 01:04:38,039
the test drive scene you know the test

1607
01:04:42,049 --> 01:04:39,630
rigs that they use for all this and this

1608
01:04:44,509 --> 01:04:42,059
vibration heats the electrical

1609
01:04:46,789 --> 01:04:44,519
interference is you know yeah acoustic

1610
01:04:48,920 --> 01:04:46,799
Zac cycling it's yeah it's pretty brutal

1611
01:04:51,709 --> 01:04:48,930
one of my good friends works over at

1612
01:04:53,479 --> 01:04:51,719
Goddard and they have this beautiful

1613
01:04:55,999 --> 01:04:53,489

like I don't even know how to describe

1614

01:04:58,849 --> 01:04:56,009

it there it's like where all the

1615

01:05:00,920 --> 01:04:58,859

spacecraft get born intestine and like

1616

01:05:03,709 --> 01:05:00,930

the size of the thermal vac chambers is

1617

01:05:05,180 --> 01:05:03,719

huge and and on my friend gives us like

1618

01:05:06,739 --> 01:05:05,190

excellent tour and at the end of the

1619

01:05:09,640 --> 01:05:06,749

tour she takes you like downstairs into

1620

01:05:13,670 --> 01:05:09,650

the basement where they have

1621

01:05:16,570 --> 01:05:13,680

seamstresses who actually like so to get

1622

01:05:18,950 --> 01:05:16,580

like they cut out and sew together the

1623

01:05:22,850 --> 01:05:18,960

like the spacecraft blankets like the

1624

01:05:24,290 --> 01:05:22,860

things that but like it you know you

1625

01:05:26,570 --> 01:05:24,300

think that you were at like a fabric

1626

01:05:28,460 --> 01:05:26,580

store like nope you're like using this

1627

01:05:29,960 --> 01:05:28,470

amazing material that help like insulate

1628

01:05:31,940 --> 01:05:29,970

it and she's a thermal engineer so she

1629

01:05:33,710 --> 01:05:31,950

really cares about that that stage so

1630

01:05:36,560 --> 01:05:33,720

that stuff's hard to so I tried it once

1631

01:05:38,900 --> 01:05:36,570

really a bunch of layers of super super

1632

01:05:41,720 --> 01:05:38,910

super thin kinda like mylar

1633

01:05:43,910 --> 01:05:41,730

yeah it's slippery it's quickly you

1634

01:05:47,330 --> 01:05:43,920

train so you can't do it on a sewing

1635

01:05:49,670 --> 01:05:47,340

machine I least I couldn't sew something

1636

01:05:53,570 --> 01:05:49,680

from the chat we have dial our 42 is

1637

01:05:55,880 --> 01:05:53,580

saying send chat on a spacewalk is this

1638

01:05:58,430 --> 01:05:55,890

something we can do on route yeah we

1639

01:05:59,780 --> 01:05:58,440

yeah I mean they did that with Apollo on

1640

01:06:01,790 --> 01:05:59,790

the way back they had to go in a

1641

01:06:03,830 --> 01:06:01,800

spacewalk to recover one of the cameras

1642

01:06:05,270 --> 01:06:03,840

I'm just putting this into a slight I'm

1643

01:06:06,680 --> 01:06:05,280

putting this into an orbit that will

1644

01:06:10,160 --> 01:06:06,690

swing over the North Pole of the moon

1645

01:06:11,900 --> 01:06:10,170

here so yeah on route yeah let's get out

1646

01:06:13,940 --> 01:06:11,910

for a little spacewalk here this is that

1647

01:06:15,560 --> 01:06:13,950

Chad and that's oh yeah there we go we

1648

01:06:18,800 --> 01:06:15,570

have the nature and picture is right

1649

01:06:21,950 --> 01:06:18,810

over there we go there's Chad and I

1650

01:06:24,740 --> 01:06:21,960

guess I'm just gonna they're just gonna

1651

01:06:27,350 --> 01:06:24,750

let go and hey way to go Ted you're

1652

01:06:31,820 --> 01:06:27,360

doing great did I do I have a tether no

1653

01:06:34,460 --> 01:06:31,830

no you but you do have a you can fly

1654

01:06:36,260 --> 01:06:34,470

around I think you're super excited as

1655

01:06:38,240 --> 01:06:36,270

long as I have a jetpack I'm good yeah

1656

01:06:40,790 --> 01:06:38,250

you're good now look we can see the

1657

01:06:44,000 --> 01:06:40,800

rocket with all this we still have fuel

1658

01:06:45,920 --> 01:06:44,010

in that main tank I think I haven't

1659

01:06:48,980 --> 01:06:45,930

really SPECT this up I put this together

1660

01:06:50,510 --> 01:06:48,990

very quickly but yeah you know with this

1661

01:06:51,980 --> 01:06:50,520

game I mean it's tough I told you how

1662

01:06:56,000 --> 01:06:51,990

they scaled everything down by a factor

1663

01:06:57,380 --> 01:06:56,010

of 10 well you know you can actually mod

1664

01:07:00,020 --> 01:06:57,390

the game up to make it a hundred percent

1665

01:07:01,390 --> 01:07:00,030

realistic and try to replicate real

1666

01:07:03,950 --> 01:07:01,400

spacecraft

1667

01:07:05,300 --> 01:07:03,960

so as Chad's doing a spacewalk I'm gonna

1668

01:07:08,090 --> 01:07:05,310

keep jumping into the check there's a

1669

01:07:09,740 --> 01:07:08,100

whole bunch of questions in here this is

1670

01:07:11,900 --> 01:07:09,750

kind of thing I'm looking happier now

1671

01:07:14,270 --> 01:07:11,910

but you're having a good time still kind

1672

01:07:14,480 --> 01:07:14,280

of green curly chad is super happy right

1673

01:07:15,780 --> 01:07:14,490

now

1674

01:07:18,330 --> 01:07:15,790

Dramamine in there

1675

01:07:19,740 --> 01:07:18,340

exactly yeah so one of the questions

1676

01:07:21,360 --> 01:07:19,750

from the chat this is from seriously

1677

01:07:23,580 --> 01:07:21,370

gaming asks what are the opinions of

1678

01:07:26,250 --> 01:07:23,590

gravitational waves are you all excited

1679

01:07:28,230 --> 01:07:26,260

for gravitational astronomy no that

1680

01:07:31,020 --> 01:07:28,240

might be a little bit out of I'm very

1681

01:07:33,930 --> 01:07:31,030

excited I mean I University at Glasgow

1682

01:07:35,880 --> 01:07:33,940

where I yeah my alma mater they they did

1683

01:07:38,070 --> 01:07:35,890

a lot of this work on this and it's

1684

01:07:39,930 --> 01:07:38,080

really fascinating to see this stuff

1685

01:07:42,720 --> 01:07:39,940

that was talked about you know when I

1686

01:07:44,970 --> 01:07:42,730

was at university 20 years ago finally

1687

01:07:47,030 --> 01:07:44,980

working finally showing off finally

1688

01:07:49,170 --> 01:07:47,040

getting results

1689

01:07:50,640 --> 01:07:49,180

Chad Meredith that's fall into your

1690

01:07:53,010 --> 01:07:50,650

world cuz I think the funny thing about

1691

01:07:55,740 --> 01:07:53,020

like it Ames is there's a little bit of

1692

01:07:57,300 --> 01:07:55,750

everything so we have astrobiology next

1693

01:07:59,340 --> 01:07:57,310

to the supercomputing next to the

1694

01:08:00,180 --> 01:07:59,350

aeronautics next to engineering and

1695

01:08:02,100 --> 01:08:00,190

small SATs

1696

01:08:04,860 --> 01:08:02,110

so there's a whole mismatch of like

1697

01:08:05,910 --> 01:08:04,870

disciplines at this Center so but I

1698

01:08:09,300 --> 01:08:05,920

don't know because like interact with

1699

01:08:11,910 --> 01:08:09,310

that is not sure yeah not happy hour not

1700

01:08:13,440 --> 01:08:11,920

space yeah happy hours about it the one

1701
01:08:16,320 --> 01:08:13,450
thing I was thinking about in terms of

1702
01:08:18,990 --> 01:08:16,330
gravitational waves right is so one of

1703
01:08:21,210 --> 01:08:19,000
the things we do here at Ames is you

1704
01:08:23,039 --> 01:08:21,220
know especially small spacecraft or

1705
01:08:27,329 --> 01:08:23,049
missions with lots of small spacecraft

1706
01:08:29,340 --> 01:08:27,339
and there's the potential to you know do

1707
01:08:31,260 --> 01:08:29,350
some really fascinating science with

1708
01:08:32,940 --> 01:08:31,270
these little or little or spacecraft but

1709
01:08:35,670 --> 01:08:32,950
it depends on having you know really

1710
01:08:37,440 --> 01:08:35,680
small compact instruments as well and we

1711
01:08:39,320 --> 01:08:37,450
were talking to some colleagues at one

1712
01:08:41,880 --> 01:08:39,330
of the other government agencies about

1713
01:08:45,390 --> 01:08:41,890

really really tiny highly highly

1714

01:08:47,730 --> 01:08:45,400

sensitive magnetometers yeah I had the

1715

01:08:49,349 --> 01:08:47,740

thought well I wonder if you could put

1716

01:08:52,650 --> 01:08:49,359

those in a small spacecraft and use that

1717

01:08:54,720 --> 01:08:52,660

to do some research in the gravitational

1718

01:08:56,460 --> 01:08:54,730

wave area I don't know the answer I'm

1719

01:08:59,160 --> 01:08:56,470

not the not the scientist to answer the

1720

01:09:00,900 --> 01:08:59,170

question but and I know but I know a guy

1721

01:09:02,820 --> 01:09:00,910

and it really intrigued me as to the

1722

01:09:06,630 --> 01:09:02,830

possibilities were embarking into this

1723

01:09:09,150 --> 01:09:06,640

whole new this new age a new new era of

1724

01:09:12,420 --> 01:09:09,160

being able to kind of go down this new

1725

01:09:15,480 --> 01:09:12,430

path of research and we don't yet know

1726

01:09:18,240 --> 01:09:15,490

how to do some of it so it's exciting

1727

01:09:19,950 --> 01:09:18,250

it's also that came up in the chat one

1728

01:09:22,410 --> 01:09:19,960

of the comments has been let's go to the

1729

01:09:24,720 --> 01:09:22,420

Moon or Mars or and since the name of

1730

01:09:26,519 --> 01:09:24,730

the game has been moon to Mars but like

1731

01:09:28,399 --> 01:09:26,529

speaking of which the moon we have this

1732

01:09:29,840 --> 01:09:28,409

ladee model sitting right in

1733

01:09:31,760 --> 01:09:29,850

if you could talk a little bit about

1734

01:09:33,260 --> 01:09:31,770

what the ladee model is what ladee did

1735

01:09:34,970 --> 01:09:33,270

and even Mary Beth it's like there's

1736

01:09:36,829 --> 01:09:34,980

like the moon is still right for science

1737

01:09:38,660 --> 01:09:36,839

there's a lot of stuff that we I mean

1738

01:09:40,160 --> 01:09:38,670

you think about it was in the 70s was

1739

01:09:42,349 --> 01:09:40,170

the last time we actually had footprints

1740

01:09:44,539 --> 01:09:42,359

on the moon but since then we learned a

1741

01:09:47,749 --> 01:09:44,549

whole lot more about like how much water

1742

01:09:49,459 --> 01:09:47,759

ice is there's quite crazy sadhana the

1743

01:09:55,520 --> 01:09:49,469

delicate model that I tried to move

1744

01:09:57,290 --> 01:09:55,530

earlier it's supposed to come apart Matt

1745

01:09:59,419 --> 01:09:57,300

so I figured we're talking about

1746

01:10:01,790 --> 01:09:59,429

spacecraft it's always good to have a

1747

01:10:03,590 --> 01:10:01,800

toy to you know sort of illustrate

1748

01:10:05,330 --> 01:10:03,600

questions as they come up and this

1749

01:10:08,990 --> 01:10:05,340

happens to be a model of our of our

1750

01:10:11,330 --> 01:10:09,000

ladee spacecraft that went and orbited

1751
01:10:14,629 --> 01:10:11,340
the moon lots and lots and lots of times

1752
01:10:17,629 --> 01:10:14,639
a few years ago doing doing amazing

1753
01:10:19,760 --> 01:10:17,639
science and now is in many many tiny

1754
01:10:21,740 --> 01:10:19,770
little pieces on the surface because at

1755
01:10:24,530 --> 01:10:21,750
the end of its mission we just crashed

1756
01:10:28,729 --> 01:10:24,540
it into the surface carefully avoiding

1757
01:10:31,760 --> 01:10:28,739
any historical artifacts but right so

1758
01:10:34,000 --> 01:10:31,770
that ladee is a good example of what you

1759
01:10:36,800 --> 01:10:34,010
can do with a comparatively low-cost

1760
01:10:39,140 --> 01:10:36,810
spacecraft right this is something not

1761
01:10:42,620 --> 01:10:39,150
just not just actual size but it is to

1762
01:10:44,750 --> 01:10:42,630
scale this was about the size of a you

1763
01:10:48,770 --> 01:10:44,760

know of a refrigerator right good sized

1764

01:10:51,260 --> 01:10:48,780

refrigerator and and it was designed as

1765

01:10:53,090 --> 01:10:51,270

a as a modular spacecraft so as

1766

01:10:54,830 --> 01:10:53,100

different missions came along we could

1767

01:10:56,810 --> 01:10:54,840

reconfigure it to the needs of the

1768

01:10:58,459 --> 01:10:56,820

mission right you might not need all

1769

01:11:01,100 --> 01:10:58,469

these different pieces you might just

1770

01:11:03,470 --> 01:11:01,110

need the top piece and one of the bottom

1771

01:11:05,330 --> 01:11:03,480

pieces right propulsion depending on

1772

01:11:07,129 --> 01:11:05,340

okay depending on what you were doing we

1773

01:11:09,200 --> 01:11:07,139

designed a version of this that was a

1774

01:11:11,000 --> 01:11:09,210

little bit bigger it had two more of

1775

01:11:14,660 --> 01:11:11,010

these middle segments that could do a

1776

01:11:16,790 --> 01:11:14,670

Mars mission for example right and the

1777

01:11:18,950 --> 01:11:16,800

cool thing is right we can now do all

1778

01:11:21,620 --> 01:11:18,960

this amazing science with smaller

1779

01:11:24,740 --> 01:11:21,630

spacecraft because the our ability to

1780

01:11:27,169 --> 01:11:24,750

squeeze the science into smaller more

1781

01:11:29,300 --> 01:11:27,179

compact and more efficient instruments

1782

01:11:32,060 --> 01:11:29,310

has allowed us to do more with smaller

1783

01:11:34,070 --> 01:11:32,070

spacecraft so it opens up all these new

1784

01:11:36,500 --> 01:11:34,080

opportunities for folks like Mary Beth

1785

01:11:38,209 --> 01:11:36,510

like okay we can actually go do some

1786

01:11:41,310 --> 01:11:38,219

amazing stuff with with little tiny

1787

01:11:44,100 --> 01:11:41,320

spacecraft now JPL has the

1788

01:11:46,890 --> 01:11:44,110

Marco cube sets right there the size of

1789

01:11:50,130 --> 01:11:46,900

a briefcase and they're on their way out

1790

01:11:52,680 --> 01:11:50,140

to support the latest Mars mission so

1791

01:11:55,500 --> 01:11:52,690

there there's just so much potential and

1792

01:11:58,020 --> 01:11:55,510

it's enabled in part by technology in

1793

01:12:00,330 --> 01:11:58,030

part by new ways of thinking about

1794

01:12:02,100 --> 01:12:00,340

science so I see that we're from behind

1795

01:12:04,950 --> 01:12:02,110

us we are at the moon right now yeah I'm

1796

01:12:06,240 --> 01:12:04,960

trying to we have a lunar gateway in

1797

01:12:08,790 --> 01:12:06,250

orbit around the moon I figured it's

1798

01:12:10,230 --> 01:12:08,800

let's go and visit it might as well

1799

01:12:12,810 --> 01:12:10,240

we're going slightly further than what

1800

01:12:15,480 --> 01:12:12,820

e-m1 as because somebody's got a space

1801
01:12:17,310 --> 01:12:15,490
station there already oh nice I'm just

1802
01:12:18,870 --> 01:12:17,320
trying to match orbital planes with it

1803
01:12:20,760 --> 01:12:18,880
so we can perform this rendezvous and

1804
01:12:22,260 --> 01:12:20,770
yeah actually that's pushed me out of

1805
01:12:23,850 --> 01:12:22,270
the sphere of influence will figure this

1806
01:12:24,660 --> 01:12:23,860
Omar while you're figuring that out Mary

1807
01:12:27,750 --> 01:12:24,670
Beth why don't you talk a little bit

1808
01:12:29,490 --> 01:12:27,760
about what about the moon that you see

1809
01:12:32,010 --> 01:12:29,500
like interesting or you know as a

1810
01:12:33,330 --> 01:12:32,020
planetary scientist yeah there's so many

1811
01:12:36,270 --> 01:12:33,340
interesting things about the moon that

1812
01:12:37,620 --> 01:12:36,280
we're still learning it's I think the

1813
01:12:39,630 --> 01:12:37,630

most interesting thing about the Moon is

1814

01:12:43,050 --> 01:12:39,640

that it came from Earth right like it

1815

01:12:45,720 --> 01:12:43,060

was formed by very early on in Earth's

1816

01:12:48,240 --> 01:12:45,730

history by an object that was believed

1817

01:12:50,250 --> 01:12:48,250

to be about the size of Mars impacting

1818

01:12:54,090 --> 01:12:50,260

the proto-earth and then turning into

1819

01:12:56,400 --> 01:12:54,100

this this object right and you know I

1820

01:12:58,290 --> 01:12:56,410

think about this often times from an

1821

01:13:00,060 --> 01:12:58,300

astro biological perspective it's like

1822

01:13:02,580 --> 01:13:00,070

what what is it what is so special about

1823

01:13:04,740 --> 01:13:02,590

Earth to allow life to develop and

1824

01:13:06,600 --> 01:13:04,750

evolve and I think the moon is a big

1825

01:13:08,340 --> 01:13:06,610

part of that story because if you if you

1826

01:13:11,220 --> 01:13:08,350

look at the far side of the Moon it's

1827

01:13:12,690 --> 01:13:11,230

littered with with craters and so what

1828

01:13:14,550 --> 01:13:12,700

does that mean it means that things that

1829

01:13:17,490 --> 01:13:14,560

would have if there was no moon would

1830

01:13:20,340 --> 01:13:17,500

have impacted earth and instead hit the

1831

01:13:23,550 --> 01:13:20,350

moon and maybe protected you know early

1832

01:13:27,000 --> 01:13:23,560

life on earth and allowed it to to

1833

01:13:29,670 --> 01:13:27,010

continue to evolve but I think it's one

1834

01:13:33,180 --> 01:13:29,680

of the coolest discoveries in the last

1835

01:13:35,340 --> 01:13:33,190

10 years was a mission that Kate was out

1836

01:13:37,020 --> 01:13:35,350

of Ames called El cross and what

1837

01:13:38,820 --> 01:13:37,030

happened with El cross is they took the

1838

01:13:42,210 --> 01:13:38,830

upper stage of a rocket and they

1839

01:13:44,430 --> 01:13:42,220

actually impacted the still the one of

1840

01:13:48,060 --> 01:13:44,440

the so called permanently shadowed

1841

01:13:50,340 --> 01:13:48,070

craters on the moon and within those

1842

01:13:52,440 --> 01:13:50,350

craters they actually found evidence for

1843

01:13:54,660 --> 01:13:52,450

for water and so why do we care about

1844

01:13:57,540 --> 01:13:54,670

that especially if we start

1845

01:13:59,189 --> 01:13:57,550

thinking about you know going and living

1846

01:14:01,740 --> 01:13:59,199

on the moon that's a resource that could

1847

01:14:03,650 --> 01:14:01,750

be potentially used in stitch you so I

1848

01:14:06,270 --> 01:14:03,660

thought that was a pretty cool design

1849

01:14:08,820 --> 01:14:06,280

for a mission they you know they didn't

1850

01:14:10,380 --> 01:14:08,830

land anything they just impacted kicked

1851

01:14:11,610 --> 01:14:10,390

up a bunch of dust and then analyzed and

1852

01:14:13,890 --> 01:14:11,620

flew through the dust I think that's a

1853

01:14:17,729 --> 01:14:13,900

really cool cool design one of the big

1854

01:14:20,130 --> 01:14:17,739

questions now for for our return to the

1855

01:14:23,820 --> 01:14:20,140

moon is you know what's the distribution

1856

01:14:25,380 --> 01:14:23,830

of the various materials present on the

1857

01:14:26,939 --> 01:14:25,390

surface of the Moon right so okay we

1858

01:14:29,939 --> 01:14:26,949

know there's water now we know that

1859

01:14:32,550 --> 01:14:29,949

there's actually quite a bit of ice not

1860

01:14:34,260 --> 01:14:32,560

buried necessarily but near or on the

1861

01:14:37,350 --> 01:14:34,270

surface especially in some of these

1862

01:14:39,660 --> 01:14:37,360

shadowed craters okay well you know

1863

01:14:41,550 --> 01:14:39,670

where is it how much is there how do we

1864

01:14:43,350 --> 01:14:41,560

get it what do we do with it they're all

1865

01:14:44,760 --> 01:14:43,360

really important questions that need to

1866

01:14:47,490 --> 01:14:44,770

be answered if we want to have any sort

1867

01:14:48,930 --> 01:14:47,500

of a presence there like a long-term

1868

01:14:51,120 --> 01:14:48,940

President Walter present second the

1869

01:14:52,530 --> 01:14:51,130

Apollo era we went and we were tourists

1870

01:14:54,990 --> 01:14:52,540

we were visitors but we didn't stay for

1871

01:14:56,880 --> 01:14:55,000

very long so much since since those

1872

01:14:57,900 --> 01:14:56,890

initial flags and footprints well even

1873

01:15:00,000 --> 01:14:57,910

with just one thing I think of it's like

1874

01:15:01,680 --> 01:15:00,010

a lot of precious earth metals which

1875

01:15:03,780 --> 01:15:01,690

really aren't earth metals they came in

1876

01:15:05,729 --> 01:15:03,790

asteroids and they're like formed in the

1877

01:15:07,979 --> 01:15:05,739

solar system and impacted and hit earth

1878

01:15:09,930 --> 01:15:07,989

but I mean there's a lot of craters on

1879

01:15:12,630 --> 01:15:09,940

the moon there could be a chance that

1880

01:15:15,870 --> 01:15:12,640

there's precious earth metals or moon or

1881

01:15:17,880 --> 01:15:15,880

asteroid really profitable together yeah

1882

01:15:20,669 --> 01:15:17,890

the thing about metals and asteroids is

1883

01:15:22,590 --> 01:15:20,679

that on the earth you have metals that

1884

01:15:24,450 --> 01:15:22,600

love to dissolve an iron and then they

1885

01:15:26,300 --> 01:15:24,460

just sink to the core so all our gold

1886

01:15:29,729 --> 01:15:26,310

and platinum is all in the core

1887

01:15:31,590 --> 01:15:29,739

whereas on asteroids well they're there

1888

01:15:33,450 --> 01:15:31,600

all the planets apart and we can

1889

01:15:35,430 --> 01:15:33,460

actually get bits of the cores of

1890

01:15:37,680 --> 01:15:35,440

crucial planets that's why asteroid

1891

01:15:40,260 --> 01:15:37,690

mining has these bits of metal these

1892

01:15:41,400 --> 01:15:40,270

huge amounts of metal in them so I see

1893

01:15:43,620 --> 01:15:41,410

that we're getting a little bit closer

1894

01:15:44,970 --> 01:15:43,630

on on Kerbal but there was a question

1895

01:15:46,620 --> 01:15:44,980

that came in for Scott it was like could

1896

01:15:50,209 --> 01:15:46,630

you please ask Scott about the KSP

1897

01:15:53,189 --> 01:15:50,219

Kraken the Kraken yes the Kraken is a

1898

01:15:57,209 --> 01:15:53,199

fantastic result of game rolling yes

1899

01:15:59,310 --> 01:15:57,219

so the Kraken is what happens when

1900

01:16:02,959 --> 01:15:59,320

physics goes wrong

1901

01:16:06,359 --> 01:16:02,969

okay it's it's kind of fascinating

1902

01:16:08,040 --> 01:16:06,369

sometimes there's a physics engine in

1903

01:16:10,080 --> 01:16:08,050

the game that's modeling how it works

1904

01:16:13,379 --> 01:16:10,090

how the physics and everything works and

1905

01:16:15,450 --> 01:16:13,389

sometimes it has mathematical errors

1906

01:16:17,669 --> 01:16:15,460

which can cause the spacecraft to

1907

01:16:19,919 --> 01:16:17,679

disintegrate so in the old days when you

1908

01:16:21,450 --> 01:16:19,929

got very very fast and very very close

1909

01:16:23,220 --> 01:16:21,460

to the Sun the spacecraft would just

1910

01:16:26,399 --> 01:16:23,230

spin out of control and disintegrate and

1911

01:16:28,140 --> 01:16:26,409

we called that the Kraken and you the

1912

01:16:30,209 --> 01:16:28,150

developers have slowly fixed these

1913

01:16:32,459 --> 01:16:30,219

things bit by bit but every now and then

1914

01:16:34,350 --> 01:16:32,469

you will just find the most bizarre bug

1915

01:16:37,319 --> 01:16:34,360

where your spacecraft just spontaneously

1916

01:16:39,359 --> 01:16:37,329

explodes or you know you hit some weird

1917

01:16:41,700 --> 01:16:39,369

singularity in the mathematics and

1918

01:16:43,169 --> 01:16:41,710

everything disintegrates and and then

1919

01:16:44,939 --> 01:16:43,179

people have learned to harness the

1920

01:16:47,640 --> 01:16:44,949

kraken for good and they've learned to

1921

01:16:50,609 --> 01:16:47,650

build kraken drives reaction 'less

1922

01:16:53,250 --> 01:16:50,619

thrusters that don't need fuel so yeah

1923

01:16:55,680 --> 01:16:53,260

the kraken is a great friend and enemy

1924

01:16:57,780 --> 01:16:55,690

in the game and is actually out on one

1925

01:17:00,300 --> 01:16:57,790

of the moons there's a kraken corpse

1926

01:17:03,149 --> 01:17:00,310

available that you can find if you're

1927

01:17:05,010 --> 01:17:03,159

you're sufficiently interested so

1928

01:17:06,300 --> 01:17:05,020

there's another thing from the chat

1929

01:17:08,819 --> 01:17:06,310

another question this is from Fox

1930

01:17:10,470 --> 01:17:08,829

underscore tango which like welcome back

1931

01:17:13,080 --> 01:17:10,480

I remember Fox tango has been there

1932

01:17:16,979 --> 01:17:13,090

quite a bit so in previous episodes but

1933

01:17:18,750 --> 01:17:16,989

have any samples physio electric stone

1934

01:17:22,319 --> 01:17:18,760

been collected from the moon Mars or

1935

01:17:24,600 --> 01:17:22,329

other astral body okay I'm probably

1936

01:17:27,350 --> 01:17:24,610

butchering the name people are looking

1937

01:17:29,250 --> 01:17:27,360

at me and shaking their heads the

1938

01:17:31,740 --> 01:17:29,260

materials that came back from from the

1939

01:17:34,069 --> 01:17:31,750
moon that have been analyzed

1940

01:17:36,479 --> 01:17:34,079
I don't recall them having any

1941

01:17:38,010 --> 01:17:36,489
piezoelectric or semiconductor

1942

01:17:40,080 --> 01:17:38,020
properties but I'm not a material

1943

01:17:41,520 --> 01:17:40,090
scientist so I could be a fizzy electric

1944

01:17:43,800 --> 01:17:41,530
the word that I'd butchered what is that

1945

01:17:49,550 --> 01:17:43,810
so if you have a material that you

1946

01:17:50,729 --> 01:17:49,560
impose stress on it produces voltage

1947

01:17:52,740 --> 01:17:50,739
okay

1948

01:17:54,750 --> 01:17:52,750
right and vice-versa so you can apply

1949

01:17:57,240 --> 01:17:54,760
voltage and it'll displace the material

1950

01:17:58,589 --> 01:17:57,250
so like the it's like metal for example

1951

01:18:00,510 --> 01:17:58,599

it's some of the materials in your

1952

01:18:02,280 --> 01:18:00,520

microphone my admite might be a

1953

01:18:04,680 --> 01:18:02,290

piezoelectric microphone certainly the

1954

01:18:07,350 --> 01:18:04,690

probably the one in your phone is yeah

1955

01:18:11,040 --> 01:18:07,360

right so it's converting the pressure

1956

01:18:11,700 --> 01:18:11,050

from the sound waves in your voice into

1957

01:18:15,540 --> 01:18:11,710

electric

1958

01:18:17,700 --> 01:18:15,550

signal materials materials that do that

1959

01:18:22,350 --> 01:18:17,710

right a family of those materials is

1960

01:18:25,290 --> 01:18:22,360

it's a piezoelectric effect the more you

1961

01:18:30,060 --> 01:18:25,300

know so the short version the short

1962

01:18:32,640 --> 01:18:30,070

answer to their question yes no we don't

1963

01:18:35,640 --> 01:18:32,650

know we don't know we don't recall any

1964

01:18:38,340 --> 01:18:35,650

of that coming in but that doesn't mean

1965

01:18:41,459 --> 01:18:38,350

it hasn't yeah they're very easy to make

1966

01:18:43,140 --> 01:18:41,469

I mean they're they're pretty much very

1967

01:18:45,300 --> 01:18:43,150

simple industrial I mean they're types

1968

01:18:47,850 --> 01:18:45,310

of corpse what's doping yeah it's

1969

01:18:50,370 --> 01:18:47,860

everywhere so so alright are we are we

1970

01:18:57,300 --> 01:18:50,380

at the moon or real and another but Oh

1971

01:18:59,250 --> 01:18:57,310

apparently we know one use sticky keys I

1972

01:19:00,900 --> 01:18:59,260

was trying to rendezvous but it's

1973

01:19:02,750 --> 01:19:00,910

actually very hard because there you

1974

01:19:06,150 --> 01:19:02,760

have to minimize big picture mode

1975

01:19:07,860 --> 01:19:06,160

minimize big picture yeah okay my

1976

01:19:09,930 --> 01:19:07,870

desktop it's a good thing I wasn't

1977

01:19:11,459 --> 01:19:09,940

trying to land at that time I can't tell

1978

01:19:15,540 --> 01:19:11,469

ladies and gentlemen this is not Scott's

1979

01:19:17,940 --> 01:19:15,550

normal PC I'm actually having some

1980

01:19:20,370 --> 01:19:17,950

interesting problems here because I have

1981

01:19:23,250 --> 01:19:20,380

I can't see the orbit as easily as I

1982

01:19:25,020 --> 01:19:23,260

normally would I think yeah I'm just

1983

01:19:28,170 --> 01:19:25,030

trying to make figure out how to make

1984

01:19:30,540 --> 01:19:28,180

this rendezvous here but you go on yeah

1985

01:19:33,450 --> 01:19:30,550

so well there is somebody there's a

1986

01:19:36,720 --> 01:19:33,460

Hazen canet 42 was saying do a suicide

1987

01:19:38,310 --> 01:19:36,730

burn landing on the moon please okay but

1988

01:19:40,350 --> 01:19:38,320

never right let's just try landing this

1989

01:19:44,270 --> 01:19:40,360

everybody wants to see me try a landing

1990

01:19:46,920 --> 01:19:44,280

right why so move to another another

1991

01:19:49,470 --> 01:19:46,930

question from alpha King gore

1992

01:19:52,080 --> 01:19:49,480

how big how big a problem is space

1993

01:19:54,690 --> 01:19:52,090

debris is there that up to everybody for

1994

01:19:57,450 --> 01:19:54,700

what you think well it's a at the moment

1995

01:20:00,540 --> 01:19:57,460

it's a pretty problem but it's not a

1996

01:20:02,970 --> 01:20:00,550

gigantic problem right now it's in the

1997

01:20:04,260 --> 01:20:02,980

news frequently these days because it

1998

01:20:06,780 --> 01:20:04,270

has the potential to become a huge

1999

01:20:08,729 --> 01:20:06,790

problem alright so right now there's

2000

01:20:10,920 --> 01:20:08,739

plenty of space debris up there there's

2001

01:20:13,680 --> 01:20:10,930

spent rocket bodies there's dead

2002

01:20:15,870 --> 01:20:13,690

satellites there's little bits of nuts

2003

01:20:18,090 --> 01:20:15,880

and bolts and junk that's blown up over

2004

01:20:20,850 --> 01:20:18,100

the years there's a whole big cloud of

2005

01:20:24,430 --> 01:20:20,860

debris from satellites that have

2006

01:20:28,320 --> 01:20:24,440

collided the good news is

2007

01:20:30,610 --> 01:20:28,330

most of it is not where we have people

2008

01:20:34,990 --> 01:20:30,620

right for example on the space station

2009

01:20:37,660 --> 01:20:35,000

and most of it is not where it's gonna

2010

01:20:39,490 --> 01:20:37,670

run into other satellites at the moment

2011

01:20:41,170 --> 01:20:39,500

right we do occasionally have to move

2012

01:20:45,150 --> 01:20:41,180

satellites to get out of the way of

2013

01:20:48,280 --> 01:20:45,160

space debris as it's floating around

2014

01:20:49,720 --> 01:20:48,290

however right with all the spacecraft

2015

01:20:51,100 --> 01:20:49,730

that are being launched and there's more

2016

01:20:54,580 --> 01:20:51,110

and more spacecraft being launched all

2017

01:20:58,060 --> 01:20:54,590

the time all it would take is a couple

2018

01:21:01,630 --> 01:20:58,070

of bad days ok they're suddenly to be a

2019

01:21:04,720 --> 01:21:01,640

whole lot of space debris in a bad place

2020

01:21:07,030 --> 01:21:04,730

right so the potential for there to be a

2021

01:21:10,689 --> 01:21:07,040

really big space debris problem is very

2022

01:21:12,640 --> 01:21:10,699

high so let me jump into one more are we

2023

01:21:14,800 --> 01:21:12,650

ready to land are we get in there well

2024

01:21:16,920 --> 01:21:14,810

we're gonna I got a fun Mars one and I

2025

01:21:20,020 --> 01:21:16,930

know Marybeth Mars is her favorite

2026

01:21:21,910 --> 01:21:20,030

subjects a Martian yes she's very much

2027

01:21:24,280 --> 01:21:21,920

the Martian if folks didn't know that

2028

01:21:25,600 --> 01:21:24,290

the you you co-authored the paper for

2029

01:21:28,209 --> 01:21:25,610

when they discovered liquid water on

2030

01:21:36,400 --> 01:21:28,219

Mars you know whatever just kind of

2031

01:21:40,330 --> 01:21:36,410

dusted on you know but okay here's a

2032

01:21:43,750 --> 01:21:40,340

question from Jared on who's asking what

2033

01:21:47,080 --> 01:21:43,760

to do about perchloric chloride on Mars

2034

01:21:49,900 --> 01:21:47,090

when crews for correctly when crews

2035

01:21:51,820 --> 01:21:49,910

visit when crews yep so perchlorate as a

2036

01:21:54,340 --> 01:21:51,830

salt and it's not on earth that actually

2037

01:21:56,500 --> 01:21:54,350

comprises rocket fuel too and it

2038

01:21:58,240 --> 01:21:56,510

accumulates an extremely dry places so

2039

01:22:00,130 --> 01:21:58,250

it's a it's a problem in a lot of desert

2040

01:22:03,220 --> 01:22:00,140

environments including in Southern

2041

01:22:06,670 --> 01:22:03,230

California for example and it's toxic to

2042

01:22:08,650 --> 01:22:06,680

humans so if you consume perchlorate

2043

01:22:10,810 --> 01:22:08,660

because it's so soluble meaning it like

2044

01:22:13,180 --> 01:22:10,820

goes into water very easily and you

2045

01:22:15,189 --> 01:22:13,190

drink that water it can cost I roid

2046

01:22:18,220 --> 01:22:15,199

issues and actually I think it used to

2047

01:22:21,340 --> 01:22:18,230

be used as a treatment for overactive

2048

01:22:23,080 --> 01:22:21,350

thyroid like back in the day anyway so

2049

01:22:25,420 --> 01:22:23,090

Pirkle there's a ton of perchlorate on

2050

01:22:27,850 --> 01:22:25,430

Mars and that ties into the whole water

2051
01:22:30,760 --> 01:22:27,860
on Mars story because what we detected

2052
01:22:33,790 --> 01:22:30,770
was actually hydrated perchlorates

2053
01:22:35,919 --> 01:22:33,800
so water banned sat or water within the

2054
01:22:37,870 --> 01:22:35,929
mineral structure of perchlorates so

2055
01:22:40,270 --> 01:22:37,880
anyway yeah if we if we

2056
01:22:43,660 --> 01:22:40,280
using any resources there on Mars

2057
01:22:48,250 --> 01:22:43,670
someday perchlorate remediation might be

2058
01:22:49,689 --> 01:22:48,260
an issue depending on you know how how

2059
01:22:51,310 --> 01:22:49,699
and what we use that type of water for

2060
01:22:53,560 --> 01:22:51,320
it's a mark watney's gonna have a hard

2061
01:22:58,840 --> 01:22:53,570
time growing his potatoes well he might

2062
01:23:01,629 --> 01:22:58,850
have a hard time having a thyroid there

2063
01:23:05,020 --> 01:23:01,639

are chemical solutions to this and I'm

2064

01:23:06,760 --> 01:23:05,030

sure we could figure out a way to to

2065

01:23:09,490 --> 01:23:06,770

remove it if we need it to but it also

2066

01:23:11,229 --> 01:23:09,500

gets in the way just from a science

2067

01:23:13,870 --> 01:23:11,239

perspective when we're doing analyses of

2068

01:23:15,939 --> 01:23:13,880

the soils it can actually react with

2069

01:23:18,850 --> 01:23:15,949

some of the the organic the carbon

2070

01:23:20,620 --> 01:23:18,860

bearing compounds in the soil and turn

2071

01:23:24,669 --> 01:23:20,630

into a big chemistry reaction so it's

2072

01:23:26,500 --> 01:23:24,679

been problematic for for previous Mars

2073

01:23:29,410 --> 01:23:26,510

missions looking for organic compounds

2074

01:23:31,000 --> 01:23:29,420

so so as we're looking on the screen

2075

01:23:34,570 --> 01:23:31,010

right now what do you have going for us

2076

01:23:37,030 --> 01:23:34,580

I think we decided to break with the

2077

01:23:39,490 --> 01:23:37,040

actual mission plan yeah we're just

2078

01:23:41,620 --> 01:23:39,500

gonna land we're gonna lend this using

2079

01:23:43,209 --> 01:23:41,630

its we just left all that extra fuel out

2080

01:23:45,910 --> 01:23:43,219

there we figure you know what let's just

2081

01:23:47,740 --> 01:23:45,920

jump well you know I should we finally

2082

01:23:50,590 --> 01:23:47,750

depleted that big tank so I think I'm

2083

01:23:52,750 --> 01:23:50,600

gonna aim between these creatures here

2084

01:23:54,910 --> 01:23:52,760

so this little version of the Orion is

2085

01:23:56,740 --> 01:23:54,920

this have some landing gear no no we're

2086

01:23:59,620 --> 01:23:56,750

just gonna land on the engine hills yeah

2087

01:24:01,419 --> 01:23:59,630

just checking just yeah we just solar

2088

01:24:04,260 --> 01:24:01,429

panels we should probably open those up

2089

01:24:07,030 --> 01:24:04,270

just so we can get some electrical power

2090

01:24:08,770 --> 01:24:07,040

nice it just could be more thrust or no

2091

01:24:10,149 --> 01:24:08,780

just we don't want to run out of

2092

01:24:12,490 --> 01:24:10,159

electrical power when we're trying to

2093

01:24:14,560 --> 01:24:12,500

land do we I think that would be bad

2094

01:24:16,149 --> 01:24:14,570

yeah so we're just gonna put it down

2095

01:24:18,669 --> 01:24:16,159

between these craters and hopefully we

2096

01:24:20,169 --> 01:24:18,679

won't fall over yeah this is a standard

2097

01:24:22,060 --> 01:24:20,179

Kerbal maneuver landing on the engine

2098

01:24:23,890 --> 01:24:22,070

bells do not do it in a real rocket

2099

01:24:25,870 --> 01:24:23,900

because engine bells Tanner

2100

01:24:28,090 --> 01:24:25,880

yeah well crush them you will crush them

2101
01:24:29,890 --> 01:24:28,100
yeah even on one of the Apollo missions

2102
01:24:32,350 --> 01:24:29,900
they came down too close to the surface

2103
01:24:34,330 --> 01:24:32,360
and the engine bail got sort of crushed

2104
01:24:37,300 --> 01:24:34,340
just by the force of the rocket exhaust

2105
01:24:39,430 --> 01:24:37,310
there's a famous photo of it being earth

2106
01:24:40,840 --> 01:24:39,440
with a fold in it and that wasn't

2107
01:24:43,090 --> 01:24:40,850
because it hit the surface it's just

2108
01:24:45,700 --> 01:24:43,100
because the rocket exhaust bounced off

2109
01:24:47,320 --> 01:24:45,710
and came back like a sound wave I'd like

2110
01:24:50,330 --> 01:24:47,330
to point out that the solar arrays are a

2111
01:24:56,580 --> 01:24:50,340
little dinky they are

2112
01:24:58,770 --> 01:24:56,590
we're very efficient I know one thing

2113
01:25:01,350 --> 01:24:58,780

I'm not sure off here is I can't see I

2114

01:25:09,050 --> 01:25:01,360

don't have an altitude meter there we go

2115

01:25:13,290 --> 01:25:09,060

there you approach yes here we go oh

2116

01:25:17,280 --> 01:25:13,300

good okay yes we did it and we can all

2117

01:25:18,480 --> 01:25:17,290

evie a I'll just get you off there oh

2118

01:25:20,280 --> 01:25:18,490

look at that

2119

01:25:21,870 --> 01:25:20,290

shut yeah we just wanted to go to the

2120

01:25:24,690 --> 01:25:21,880

moon yep you're on the moon and we're

2121

01:25:26,850 --> 01:25:24,700

just gonna let you use the cheese though

2122

01:25:28,410 --> 01:25:26,860

as we learn from the first episode that

2123

01:25:29,910 --> 01:25:28,420

we did about four weeks ago with the

2124

01:25:31,080 --> 01:25:29,920

administrator Jim Brian Sam we learned

2125

01:25:37,070 --> 01:25:31,090

that the moon was made of spare wet

2126
01:25:44,550 --> 01:25:40,440
for commercial use I'm sure the moon has

2127
01:25:49,380 --> 01:25:44,560
meaning great but I don't think Jesus

2128
01:25:51,240 --> 01:25:49,390
parents a veritable cornucopia it's

2129
01:25:53,940 --> 01:25:51,250
harder to prove that the moon isn't made

2130
01:25:56,850 --> 01:25:53,950
of cheese than it is to prove or the

2131
01:25:59,880 --> 01:25:56,860
earth isn't flat nice so why isn't a

2132
01:26:02,790 --> 01:25:59,890
mushi Society no boon to society exactly

2133
01:26:04,650 --> 01:26:02,800
there is and they could be raining every

2134
01:26:07,490 --> 01:26:04,660
single twitch stream every single NASA

2135
01:26:11,100 --> 01:26:07,500
stream or social media platform with the

2136
01:26:14,250 --> 01:26:11,110
moon cheese or like truthers we should

2137
01:26:17,700 --> 01:26:14,260
plant a flag here there I claim this

2138
01:26:20,760 --> 01:26:17,710

moon in the name of we got to come up

2139

01:26:23,820 --> 01:26:20,770

with a message for all humanity yes yes

2140

01:26:27,660 --> 01:26:23,830

I think that's yours yeah what are you

2141

01:26:29,520 --> 01:26:27,670

gonna tell the world what are you

2142

01:26:30,510 --> 01:26:29,530

looking for what's the first thing you

2143

01:26:33,330 --> 01:26:30,520

do you've landed on the moon

2144

01:26:35,970 --> 01:26:33,340

I got a quote Pete Conrad okay that may

2145

01:26:41,610 --> 01:26:35,980

have been one small step for uh but that

2146

01:26:43,200 --> 01:26:41,620

was one long one for me yes nice we're

2147

01:26:45,930 --> 01:26:43,210

counting down to about like two minutes

2148

01:26:47,780 --> 01:26:45,940

until we wrap up so I'm wondering we

2149

01:26:50,760 --> 01:26:47,790

could fight you another rapid-fire one

2150

01:26:52,260 --> 01:26:50,770

we have some okay if bigger rockets

2151
01:26:54,180 --> 01:26:52,270
increase efficiency for launching

2152
01:26:56,370 --> 01:26:54,190
experiments why don't we launch even

2153
01:26:58,680 --> 01:26:56,380
bigger rockets this is asked by Frank a

2154
01:27:01,230 --> 01:26:58,690
fifth grader in red from resonator games

2155
01:27:02,549 --> 01:27:01,240
because building bigger rocket engines

2156
01:27:05,040 --> 01:27:02,559
is actually harder

2157
01:27:06,719 --> 01:27:05,050
you imagine that's why the fYI engines

2158
01:27:08,489 --> 01:27:06,729
are probably the biggest rocket engines

2159
01:27:12,000 --> 01:27:08,499
I've ever been built due to combustion

2160
01:27:14,250 --> 01:27:12,010
instability and things like that yeah I

2161
01:27:16,379 --> 01:27:14,260
would I don't know that building bigger

2162
01:27:19,829 --> 01:27:16,389
necessarily buys you more efficiency

2163
01:27:22,290 --> 01:27:19,839

right in the case of SLS it's bigger

2164

01:27:24,089 --> 01:27:22,300

because we've got some pretty big

2165

01:27:27,750 --> 01:27:24,099

massive stuff that we want to send

2166

01:27:30,059 --> 01:27:27,760

fairly far out beyond Earth orbit at the

2167

01:27:31,619 --> 01:27:30,069

same time NASA's building the big SLS we

2168

01:27:33,509 --> 01:27:31,629

have a bunch of commercial companies

2169

01:27:35,939 --> 01:27:33,519

that are building really small launch

2170

01:27:38,729 --> 01:27:35,949

vehicles to send really small things

2171

01:27:40,229 --> 01:27:38,739

into Earth orbit and so we're looking

2172

01:27:42,000 --> 01:27:40,239

forward to the day when we're just

2173

01:27:43,829 --> 01:27:42,010

sending little little tiny things up on

2174

01:27:45,959 --> 01:27:43,839

little tiny Rockets all the time

2175

01:27:48,989 --> 01:27:45,969

but they're those Rockets aren't going

2176
01:27:50,609 --> 01:27:48,999
to be sending things out to the moon so

2177
01:27:52,259 --> 01:27:50,619
there's a there's a happy mix of the

2178
01:27:54,809 --> 01:27:52,269
great big Rockets to send big things

2179
01:27:56,669 --> 01:27:54,819
really far out and little tiny Rockets

2180
01:28:00,209 --> 01:27:56,679
sending little tiny things into the

2181
01:28:03,509 --> 01:28:00,219
vicinity of the earth so that folks is

2182
01:28:06,149 --> 01:28:03,519
about all the time that we have as you

2183
01:28:07,679 --> 01:28:06,159
can look from behind us Chad and

2184
01:28:12,149 --> 01:28:07,689
Marybeth are going to continue their Eve

2185
01:28:13,529 --> 01:28:12,159
EA out on the moon so hey this is a

2186
01:28:15,509 --> 01:28:13,539
reminder this has been NASA in Silicon

2187
01:28:17,579 --> 01:28:15,519
Valley live is a conversational show

2188
01:28:19,020 --> 01:28:17,589

where we talk to proud of the Ames

2189

01:28:21,029 --> 01:28:19,030

Research Center where we talked to the

2190

01:28:24,329 --> 01:28:21,039

scientists researchers engineers and

2191

01:28:26,790 --> 01:28:24,339

overall cool people here at NASA if you

2192

01:28:29,250 --> 01:28:26,800

like that then we are live on twitch on

2193

01:28:31,049 --> 01:28:29,260

YouTube Facebook periscope to join us

2194

01:28:33,239 --> 01:28:31,059

live yet to jump into twitch.tv slash

2195

01:28:34,919 --> 01:28:33,249

NASA but if you can't catch us live

2196

01:28:36,659 --> 01:28:34,929

that's totally cool on twitch and

2197

01:28:38,520 --> 01:28:36,669

YouTube you can catch us on demand

2198

01:28:40,889 --> 01:28:38,530

immediately after this broadcast is over

2199

01:28:42,509 --> 01:28:40,899

and it'll also be up on NASA TV as a

2200

01:28:44,369 --> 01:28:42,519

rebroadcast I think about next week

2201

01:28:46,349 --> 01:28:44,379

along with an audio version of the

2202

01:28:49,199 --> 01:28:46,359

podcast but I want to give his great

2203

01:28:51,719 --> 01:28:49,209

thanks to all of our guests - Scott Mary

2204

01:28:53,819 --> 01:28:51,729

Beth and Chad and a huge thank you to

2205

01:28:54,569 --> 01:28:53,829

everybody in the chat thank you so much

2206

01:28:55,889 --> 01:28:54,579

for joining us

2207

01:28:58,290 --> 01:28:55,899

and don't forget to join us back here in