



1  
00:00:05,590 --> 00:00:02,470  
it's about a really cool clock here yeah

2  
00:00:08,549 --> 00:00:05,600  
yeah for sure this is our moon countdown

3  
00:00:11,749 --> 00:00:08,559  
clock where we are counting down the

4  
00:00:14,230 --> 00:00:11,759  
next five years to 2024 when we're

5  
00:00:16,710 --> 00:00:14,240  
planning to send humans to the moon as

6  
00:00:19,109 --> 00:00:16,720  
part of the artemis program so this

7  
00:00:21,510 --> 00:00:19,119  
clock is counting down the days hours

8  
00:00:23,990 --> 00:00:21,520  
minutes and seconds to 2024

9  
00:00:26,630 --> 00:00:24,000  
when the first woman and the next man

10  
00:00:29,509 --> 00:00:26,640  
will walk on the moon's south pole

11  
00:00:30,870 --> 00:00:29,519  
so exactly get excited for that and if

12  
00:00:32,790 --> 00:00:30,880  
you want to learn more you can go to

13  
00:00:34,310 --> 00:00:32,800

nasa.gov

14

00:00:35,910 --> 00:00:34,320

artemis

15

00:00:38,229 --> 00:00:35,920

but for now

16

00:00:40,709 --> 00:00:38,239

let's get into the topic of the day

17

00:00:43,910 --> 00:00:40,719

right yeah can you guys start off by

18

00:00:45,590 --> 00:00:43,920

telling us how is nasa reimagining urban

19

00:00:47,670 --> 00:00:45,600

transportation

20

00:00:49,430 --> 00:00:47,680

yeah so there's um this new concept

21

00:00:51,189 --> 00:00:49,440

that's come about it's called urban air

22

00:00:53,990 --> 00:00:51,199

mobility so you might hear us call it

23

00:00:57,910 --> 00:00:54,000

uam okay so what is like uam yeah right

24

00:01:00,150 --> 00:00:57,920

so um one can imagine above them an air

25

00:01:03,270 --> 00:01:00,160

air traffic management system that has

26  
00:01:05,429 --> 00:01:03,280  
everything from small delivery drones to

27  
00:01:08,230 --> 00:01:05,439  
passenger carrying air taxis flying

28  
00:01:10,630 --> 00:01:08,240  
safely and efficiently above urban

29  
00:01:11,670 --> 00:01:10,640  
centers or you know almost above

30  
00:01:13,510 --> 00:01:11,680  
anywhere

31  
00:01:15,030 --> 00:01:13,520  
almost every day and that's that vision

32  
00:01:17,990 --> 00:01:15,040  
that we're really trying to enable where

33  
00:01:20,149 --> 00:01:18,000  
we have new aircraft new entrants uh

34  
00:01:21,510 --> 00:01:20,159  
making our lives easier yeah by

35  
00:01:25,429 --> 00:01:21,520  
providing functions that we all really

36  
00:01:27,510 --> 00:01:25,439  
need okay amazing so how did we get here

37  
00:01:29,910 --> 00:01:27,520  
what like what led to this moment where

38  
00:01:31,749 --> 00:01:29,920

we're working on this now yeah so um

39

00:01:35,510 --> 00:01:31,759

industry has really been pushing things

40

00:01:37,590 --> 00:01:35,520

forward there's folks know right as

41

00:01:39,670 --> 00:01:37,600

we have automobiles and as automobiles

42

00:01:41,510 --> 00:01:39,680

have been moving and developing you have

43

00:01:43,590 --> 00:01:41,520

this new advent of electric yeah

44

00:01:45,590 --> 00:01:43,600

electric cars right so that same

45

00:01:48,230 --> 00:01:45,600

technology can now actually also be

46

00:01:51,109 --> 00:01:48,240

applied to aircraft so we have electric

47

00:01:53,270 --> 00:01:51,119

propulsion for aircraft so just like

48

00:01:56,630 --> 00:01:53,280

you have this new clean and efficient

49

00:01:58,789 --> 00:01:56,640

way of providing transport for vehicles

50

00:02:01,910 --> 00:01:58,799

this new clean electric transport can be

51  
00:02:03,910 --> 00:02:01,920  
applied for aircraft okay so we have

52  
00:02:05,910 --> 00:02:03,920  
new automation also that's coming into

53  
00:02:07,670 --> 00:02:05,920  
play so new control systems that are on

54  
00:02:09,910 --> 00:02:07,680  
board vehicles and it's really that

55  
00:02:12,390 --> 00:02:09,920  
combination of those two things electric

56  
00:02:15,750 --> 00:02:12,400  
propulsion technology plus automation

57  
00:02:17,110 --> 00:02:15,760  
has really led us towards this uh new uh

58  
00:02:18,949 --> 00:02:17,120  
kind of mode of transportation that

59  
00:02:20,790 --> 00:02:18,959  
we're really excited about okay awesome

60  
00:02:22,309 --> 00:02:20,800  
awesome so these air taxis you've been

61  
00:02:24,869 --> 00:02:22,319  
describing i think you came with an

62  
00:02:25,990 --> 00:02:24,879  
image of an example concept right okay

63  
00:02:28,390 --> 00:02:26,000

let's let's bring that up and you can

64

00:02:29,270 --> 00:02:28,400

talk to us about what we're seeing sure

65

00:02:32,390 --> 00:02:29,280

cool

66

00:02:34,390 --> 00:02:32,400

so this is a concept uh vehicle this is

67

00:02:36,790 --> 00:02:34,400

what we call an electric vertical

68

00:02:40,309 --> 00:02:36,800

takeoff and landing vehicle you can see

69

00:02:41,670 --> 00:02:40,319

it has four rotors two on each side so

70

00:02:44,070 --> 00:02:41,680

what's a rotor

71

00:02:45,750 --> 00:02:44,080

a rotor are blades that spin to help

72

00:02:47,589 --> 00:02:45,760

generate lift kind of like a helicopter

73

00:02:49,270 --> 00:02:47,599

okay right so helicopter you typically

74

00:02:50,869 --> 00:02:49,280

have one rotor

75

00:02:53,110 --> 00:02:50,879

above and then you have a tail rotor

76

00:02:55,509 --> 00:02:53,120

behind and so what these rotors do is

77

00:02:58,070 --> 00:02:55,519

they provide lift this is just one

78

00:02:59,910 --> 00:02:58,080

configuration of a potential urban air

79

00:03:01,990 --> 00:02:59,920

mobility vehicle there are many

80

00:03:03,830 --> 00:03:02,000

different configurations you can also

81

00:03:05,910 --> 00:03:03,840

see here that that vehicle also has a

82

00:03:07,750 --> 00:03:05,920

wing right yeah so how would these

83

00:03:09,670 --> 00:03:07,760

vehicles kind of fly you can imagine

84

00:03:11,830 --> 00:03:09,680

that they would take off vertically and

85

00:03:13,830 --> 00:03:11,840

then shift to forward flight leveraging

86

00:03:16,229 --> 00:03:13,840

their wing to have efficient performance

87

00:03:17,910 --> 00:03:16,239

okay a cross between a helicopter's

88

00:03:19,830 --> 00:03:17,920

takeoff and a plane flying forward

89

00:03:22,630 --> 00:03:19,840

exactly all right sweet we have a couple

90

00:03:24,309 --> 00:03:22,640

of questions here already we have um

91

00:03:28,070 --> 00:03:24,319

big bad tom who says don't we already

92

00:03:30,070 --> 00:03:28,080

have air taxis better known as a plane

93

00:03:32,229 --> 00:03:30,080

good question that is a good question um

94

00:03:33,990 --> 00:03:32,239

so traditional commercial aircraft

95

00:03:37,030 --> 00:03:34,000

current day uh aircraft that we all fly

96

00:03:39,110 --> 00:03:37,040

in today those are for longer flights

97

00:03:41,670 --> 00:03:39,120

typically right so you might fly from

98

00:03:43,589 --> 00:03:41,680

san francisco to la or san francisco to

99

00:03:46,789 --> 00:03:43,599

new york or wherever you are interested

100

00:03:48,869 --> 00:03:46,799

in flying um those are over longer

101  
00:03:51,270 --> 00:03:48,879  
longer trips so you're covering lots of

102  
00:03:54,630 --> 00:03:51,280  
miles right and also those aircraft use

103  
00:03:56,869 --> 00:03:54,640  
fuel so jet fuel these new air taxis or

104  
00:03:58,630 --> 00:03:56,879  
urban air mobility vehicles are a

105  
00:04:00,789 --> 00:03:58,640  
electric propulsion vehicle so you're no

106  
00:04:02,309 --> 00:04:00,799  
longer relying on jet fuel and in

107  
00:04:04,309 --> 00:04:02,319  
addition they're typically flying

108  
00:04:05,910 --> 00:04:04,319  
shorter missions so there's a lot

109  
00:04:07,589 --> 00:04:05,920  
there's kind of a wide range of their

110  
00:04:09,589 --> 00:04:07,599  
mission types but you're typically

111  
00:04:12,309 --> 00:04:09,599  
flying shorter missions and you're using

112  
00:04:14,470 --> 00:04:12,319  
a different mode of fuel right

113  
00:04:15,670 --> 00:04:14,480

inside of within a city or a public city

114

00:04:17,509 --> 00:04:15,680

something and they're also small city

115

00:04:18,789 --> 00:04:17,519

elements yeah yeah smaller smaller

116

00:04:20,550 --> 00:04:18,799

between cities right so you would

117

00:04:22,150 --> 00:04:20,560

normally book a flight from san jose to

118

00:04:23,350 --> 00:04:22,160

san francisco right right but this

119

00:04:24,790 --> 00:04:23,360

concept that we all wish with the

120

00:04:26,310 --> 00:04:24,800

traffic

121

00:04:29,030 --> 00:04:26,320

that's exactly what right he's looking

122

00:04:31,110 --> 00:04:29,040

at right right taking us off the road so

123

00:04:34,310 --> 00:04:31,120

hovercat here says will they be like

124

00:04:36,550 --> 00:04:34,320

large multicopter battery powered what

125

00:04:37,749 --> 00:04:36,560

kind of range are we talking about

126  
00:04:40,150 --> 00:04:37,759  
yeah so there's a whole host of

127  
00:04:42,150 --> 00:04:40,160  
different configurations some have four

128  
00:04:44,870 --> 00:04:42,160  
rotors like we saw in that image some

129  
00:04:46,710 --> 00:04:44,880  
have two some have many

130  
00:04:48,950 --> 00:04:46,720  
and they also have some with wing

131  
00:04:50,870 --> 00:04:48,960  
configurations they typically about four

132  
00:04:52,710 --> 00:04:50,880  
to eight passenger carrying in terms of

133  
00:04:54,710 --> 00:04:52,720  
the size and many of them are

134  
00:04:57,590 --> 00:04:54,720  
electrically powered so yes battery

135  
00:04:58,710 --> 00:04:57,600  
power is is where many of them are going

136  
00:05:00,390 --> 00:04:58,720  
we're talking about passengers but

137  
00:05:02,150 --> 00:05:00,400  
actually cargo could be one of the first

138  
00:05:04,310 --> 00:05:02,160

things that really starts to test this

139

00:05:06,310 --> 00:05:04,320

concept out okay yeah makes sense yeah

140

00:05:07,990 --> 00:05:06,320

so passenger vehicles

141

00:05:09,909 --> 00:05:08,000

cargo delivery are there other

142

00:05:11,189 --> 00:05:09,919

applications that you guys see is really

143

00:05:13,350 --> 00:05:11,199

important

144

00:05:15,270 --> 00:05:13,360

yeah so one of the major applications we

145

00:05:17,749 --> 00:05:15,280

can see coming forward is emergency

146

00:05:18,629 --> 00:05:17,759

services okay so one can imagine if you

147

00:05:20,550 --> 00:05:18,639

have

148

00:05:23,029 --> 00:05:20,560

current day helicopters being used to

149

00:05:25,110 --> 00:05:23,039

provide ambulance support services these

150

00:05:26,710 --> 00:05:25,120

vehicles could be flown in areas that

151

00:05:29,189 --> 00:05:26,720

might be dangerous or difficult to get

152

00:05:31,350 --> 00:05:29,199

to um and provide those same emergency

153

00:05:33,830 --> 00:05:31,360

type services so there's a whole host of

154

00:05:35,670 --> 00:05:33,840

applications awesome right so that's

155

00:05:37,430 --> 00:05:35,680

easy to see yeah how we're going to use

156

00:05:39,510 --> 00:05:37,440

them how it's going to be super helpful

157

00:05:42,150 --> 00:05:39,520

there must be challenges for people like

158

00:05:44,150 --> 00:05:42,160

you to develop these systems

159

00:05:46,790 --> 00:05:44,160

are there a few that you would highlight

160

00:05:50,070 --> 00:05:46,800

yeah um so i would actually

161

00:05:51,270 --> 00:05:50,080

take a phrase that's used by the faa so

162

00:05:53,749 --> 00:05:51,280

that's the federal aviation

163

00:05:55,430 --> 00:05:53,759

administration right right so we are uh

164

00:05:57,670 --> 00:05:55,440

working very closely with them to see if

165

00:05:59,510 --> 00:05:57,680

we can make urban air mobility a reality

166

00:06:02,070 --> 00:05:59,520

one of the phrases that they like to use

167

00:06:04,070 --> 00:06:02,080

is they like to focus on the aircraft

168

00:06:06,550 --> 00:06:04,080

the air man or air woman and the air

169

00:06:08,950 --> 00:06:06,560

space so what does that mean well these

170

00:06:11,510 --> 00:06:08,960

vehicles they're new right so these

171

00:06:13,670 --> 00:06:11,520

aircraft have to be certified uh there

172

00:06:16,469 --> 00:06:13,680

are going to be interesting challenges

173

00:06:17,990 --> 00:06:16,479

on how we asso how we certify these

174

00:06:19,990 --> 00:06:18,000

these vehicles as they have different

175

00:06:21,189 --> 00:06:20,000

performance characteristics we mentioned

176  
00:06:22,870 --> 00:06:21,199  
that they're going to be battery powered

177  
00:06:24,790 --> 00:06:22,880  
or electric vehicles that has

178  
00:06:26,230 --> 00:06:24,800  
implications on their certification okay

179  
00:06:27,830 --> 00:06:26,240  
certifying them is safe to fly like

180  
00:06:29,990 --> 00:06:27,840  
they're brand new and we're going to

181  
00:06:31,749 --> 00:06:30,000  
declare them safe for the the skies in

182  
00:06:33,430 --> 00:06:31,759  
our cities right okay yeah and then if

183  
00:06:35,830 --> 00:06:33,440  
we talk about the air man or the air

184  
00:06:38,309 --> 00:06:35,840  
woman part um that import air person

185  
00:06:40,230 --> 00:06:38,319  
that implies that we have to also think

186  
00:06:42,309 --> 00:06:40,240  
about what is the role of the pilot and

187  
00:06:44,230 --> 00:06:42,319  
how do they interface with potentially

188  
00:06:46,150 --> 00:06:44,240

new controls right right right if they

189

00:06:47,270 --> 00:06:46,160

have different ways of training whole

190

00:06:49,589 --> 00:06:47,280

new training

191

00:06:51,270 --> 00:06:49,599

potentially a pool of pilots that may

192

00:06:53,350 --> 00:06:51,280

not have the same training that our

193

00:06:55,189 --> 00:06:53,360

current pilots today have so what how do

194

00:06:56,710 --> 00:06:55,199

they actually fly these vehicles that's

195

00:06:58,710 --> 00:06:56,720

also a really important question that we

196

00:07:00,870 --> 00:06:58,720

have and then the last piece which i

197

00:07:03,110 --> 00:07:00,880

think is also really important is how do

198

00:07:05,350 --> 00:07:03,120

we integrate these vehicles in our

199

00:07:07,029 --> 00:07:05,360

space right it's not just one or two of

200

00:07:09,029 --> 00:07:07,039

these vehicles that may be flying in the

201  
00:07:10,950 --> 00:07:09,039  
future you can imagine hundreds or

202  
00:07:12,870 --> 00:07:10,960  
thousands of them and if that's the case

203  
00:07:14,870 --> 00:07:12,880  
how do we integrate them safely and

204  
00:07:17,189 --> 00:07:14,880  
efficiently into our air transportation

205  
00:07:18,309 --> 00:07:17,199  
system into our national airspace right

206  
00:07:19,189 --> 00:07:18,319  
an interesting part of the research

207  
00:07:21,510 --> 00:07:19,199  
actually if you look at those three

208  
00:07:23,909 --> 00:07:21,520  
buckets right the the aircraft and the

209  
00:07:25,029 --> 00:07:23,919  
air man or a woman and the airspace some

210  
00:07:27,589 --> 00:07:25,039  
of the things that are done in the

211  
00:07:29,350 --> 00:07:27,599  
airspace now for the current traffic may

212  
00:07:31,430 --> 00:07:29,360  
be better handled by one of those other

213  
00:07:33,029 --> 00:07:31,440

buckets okay some of the things that a

214

00:07:35,430 --> 00:07:33,039

pilot takes care of now maybe can be

215

00:07:37,270 --> 00:07:35,440

better handled by the airframe itself so

216

00:07:39,029 --> 00:07:37,280

understanding these where these things

217

00:07:40,469 --> 00:07:39,039

should get handled in this new way of

218

00:07:42,469 --> 00:07:40,479

travel is is an important area of

219

00:07:44,390 --> 00:07:42,479

research as well yeah okay yeah we have

220

00:07:45,589 --> 00:07:44,400

a good question here from space roars he

221

00:07:47,749 --> 00:07:45,599

says um

222

00:07:50,469 --> 00:07:47,759

are we going to have air traffic lights

223

00:07:52,710 --> 00:07:50,479

is there going to be a direct path they

224

00:07:54,950 --> 00:07:52,720

follow mannerisms things like that that

225

00:07:56,390 --> 00:07:54,960

can help with navigating yeah this is

226

00:07:57,670 --> 00:07:56,400

actually the exciting part uh shivanji

227

00:07:59,430 --> 00:07:57,680

talked earlier about the advances in

228

00:08:01,510 --> 00:07:59,440

vehicles that are allowing us to get to

229

00:08:03,749 --> 00:08:01,520

this point in time but actually the

230

00:08:04,790 --> 00:08:03,759

advances in airspace management are

231

00:08:06,469 --> 00:08:04,800

really important as well and these two

232

00:08:08,230 --> 00:08:06,479

things are converging so yeah there

233

00:08:09,909 --> 00:08:08,240

actually will be stoplights they'll be

234

00:08:12,390 --> 00:08:09,919

digital right they won't actually be

235

00:08:13,670 --> 00:08:12,400

floating and hovering up there yellow

236

00:08:15,830 --> 00:08:13,680

green yeah and there would be a set of

237

00:08:17,749 --> 00:08:15,840

procedures and and policies and rules

238

00:08:19,270 --> 00:08:17,759

that people uh that are operating in

239

00:08:20,869 --> 00:08:19,280

this in this airspace would need to

240

00:08:23,270 --> 00:08:20,879

follow in order to have the whole thing

241

00:08:24,629 --> 00:08:23,280

still work safely and efficiently so uh

242

00:08:26,070 --> 00:08:24,639

figuring all of that out is a big area

243

00:08:28,070 --> 00:08:26,080

of research and we we do collaborate

244

00:08:30,309 --> 00:08:28,080

with the fa to figure out what is a good

245

00:08:32,870 --> 00:08:30,319

path forward yeah yeah and you said this

246

00:08:34,550 --> 00:08:32,880

is about helping these new vehicles get

247

00:08:35,909 --> 00:08:34,560

into the national airspace right can can

248

00:08:37,670 --> 00:08:35,919

you define for everybody what that

249

00:08:39,430 --> 00:08:37,680

really means the national airspace

250

00:08:41,589 --> 00:08:39,440

system is uh

251

00:08:43,430 --> 00:08:41,599

it's it's what enables us to have air

252

00:08:45,190 --> 00:08:43,440

traffic and air transport in the us

253

00:08:47,110 --> 00:08:45,200

today it's a collection of everything

254

00:08:48,550 --> 00:08:47,120

that makes that happen so it's it's the

255

00:08:51,030 --> 00:08:48,560

runways you can think of the air traffic

256

00:08:52,550 --> 00:08:51,040

control towers the airports the radars

257

00:08:53,990 --> 00:08:52,560

it's actually the vehicles as well and

258

00:08:55,190 --> 00:08:54,000

the people that

259

00:08:56,550 --> 00:08:55,200

take care of all these things and

260

00:08:58,070 --> 00:08:56,560

actually run them day to day but it's

261

00:08:59,750 --> 00:08:58,080

also things you can't touch it's things

262

00:09:01,990 --> 00:08:59,760

like rules and procedures and

263

00:09:03,269 --> 00:09:02,000

frequencies all of that stuff together

264

00:09:05,750 --> 00:09:03,279

makes up the national airspace system

265

00:09:07,269 --> 00:09:05,760

okay so how do you introduce new things

266

00:09:08,470 --> 00:09:07,279

into that you can see it's a delicate

267

00:09:10,710 --> 00:09:08,480

dance to make sure you

268

00:09:12,870 --> 00:09:10,720

don't harm what's working well now and

269

00:09:15,190 --> 00:09:12,880

enable these new new ways of travel you

270

00:09:16,020 --> 00:09:15,200

guys are the choreographers of urban air

271

00:09:18,949 --> 00:09:16,030

mobility

272

00:09:23,190 --> 00:09:18,959

[Music]

273

00:09:24,949 --> 00:09:23,200

can we change our subtitles yeah

274

00:09:26,550 --> 00:09:24,959

i don't think this is a question on the

275

00:09:29,110 --> 00:09:26,560

list but i'm sure that people are asking

276

00:09:31,269 --> 00:09:29,120

themselves why does nasa work on this

277

00:09:33,750 --> 00:09:31,279

you guys have a good answer for that

278

00:09:35,590 --> 00:09:33,760

yeah i'll i'll jump in

279

00:09:37,430 --> 00:09:35,600

another thing uh people forget is that

280

00:09:40,310 --> 00:09:37,440

first day of nasa stands for aeronautics

281

00:09:41,509 --> 00:09:40,320

and we do a lot of aeronautics research

282

00:09:43,509 --> 00:09:41,519

and even people that do remember that

283

00:09:45,750 --> 00:09:43,519

aeronautics is part of what we do they

284

00:09:47,750 --> 00:09:45,760

may forget that air traffic management

285

00:09:48,949 --> 00:09:47,760

is actually a major part of aeronautics

286

00:09:50,230 --> 00:09:48,959

is how do you actually allow these

287

00:09:52,310 --> 00:09:50,240

vehicles to get up in the air and fly

288

00:09:54,150 --> 00:09:52,320

around and do what they do right and we

289

00:09:56,150 --> 00:09:54,160

have a pretty good history here at nasa

290

00:09:57,910 --> 00:09:56,160

ames and within nasa as a whole of doing

291

00:09:59,750 --> 00:09:57,920

that kind of research so it's really

292

00:10:01,590 --> 00:09:59,760

natural that this idea of this new

293

00:10:03,750 --> 00:10:01,600

airspace management concept kind of

294

00:10:05,430 --> 00:10:03,760

originated with us yeah and i would say

295

00:10:07,910 --> 00:10:05,440

we're we're also been collaborating with

296

00:10:09,829 --> 00:10:07,920

the faa for a number of years so as our

297

00:10:12,069 --> 00:10:09,839

research has been developing we've been

298

00:10:13,590 --> 00:10:12,079

collaborating with the faa to transfer

299

00:10:15,430 --> 00:10:13,600

technologies and new research

300

00:10:16,949 --> 00:10:15,440

capabilities to really make our airspace

301

00:10:18,870 --> 00:10:16,959

much more efficient our air traffic

302

00:10:20,150 --> 00:10:18,880

management really improve efficiencies

303

00:10:22,150 --> 00:10:20,160

as much as we can

304

00:10:24,710 --> 00:10:22,160

yeah i know you guys work closely and i

305

00:10:27,350 --> 00:10:24,720

know that our aeronautics research goes

306

00:10:28,870 --> 00:10:27,360

way way back here at ames we act at the

307

00:10:31,350 --> 00:10:28,880

center here aims research center we

308

00:10:36,790 --> 00:10:31,360

started as an aeronautics lab right

309

00:10:37,990 --> 00:10:36,800

in 1939 december 20th 1939 which makes

310

00:10:41,829 --> 00:10:38,000

tomorrow

311

00:10:47,030 --> 00:10:44,550

great day happy birthday it's our 80th

312

00:10:48,949 --> 00:10:47,040

anniversary tomorrow so we're glad you

313

00:10:51,350 --> 00:10:48,959

could be here and help us celebrate yeah

314

00:10:52,790 --> 00:10:51,360

so do you have any favorite fun facts

315

00:10:54,389 --> 00:10:52,800

about that air traffic management

316

00:10:55,910 --> 00:10:54,399

research that's so important that we do

317

00:11:01,110 --> 00:10:55,920

here yeah uh first of all i was told

318

00:11:03,990 --> 00:11:02,550

we have done a lot of research and air

319

00:11:05,829 --> 00:11:04,000

traffic management and you know a lot of

320

00:11:07,350 --> 00:11:05,839

the tools are behind the scenes they're

321

00:11:09,030 --> 00:11:07,360

things that people won't see every day i

322

00:11:11,350 --> 00:11:09,040

bet yeah but they are the kind of things

323

00:11:12,949 --> 00:11:11,360

that save people uh five minutes here

324

00:11:15,269 --> 00:11:12,959

ten minutes there on their way to

325

00:11:17,030 --> 00:11:15,279

somewhere right everyone has landed at

326

00:11:18,870 --> 00:11:17,040

an airport and it's kind of waited to

327

00:11:20,230 --> 00:11:18,880

get a gate right how do you optimize

328

00:11:22,710 --> 00:11:20,240

that and make people get to their gate

329

00:11:24,870 --> 00:11:22,720

faster how do you let people

330

00:11:26,790 --> 00:11:24,880

route around bad weather quickly and

331

00:11:28,389 --> 00:11:26,800

efficiently and save five minutes

332

00:11:30,389 --> 00:11:28,399

and a smoother ride to get to where

333

00:11:32,550 --> 00:11:30,399

you're going and these are time savings

334

00:11:34,389 --> 00:11:32,560

for us as passengers but that translates

335

00:11:35,590 --> 00:11:34,399

also to money savings for the airlines

336

00:11:36,949 --> 00:11:35,600

right and these things add up five

337

00:11:38,230 --> 00:11:36,959

minutes here 10 minutes there over the

338

00:11:40,230 --> 00:11:38,240

course of a year over across all the

339

00:11:41,509 --> 00:11:40,240

airlines right these savings really add

340

00:11:43,190 --> 00:11:41,519

up and these are the things that a lot

341

00:11:44,790 --> 00:11:43,200

of the things that we've we've

342

00:11:46,949 --> 00:11:44,800

originated research here at nasa ames

343

00:11:48,870 --> 00:11:46,959

awesome yeah and i think some of these

344

00:11:50,629 --> 00:11:48,880

efficiencies have come from flying in

345

00:11:52,310 --> 00:11:50,639

the air some of them actually have come

346

00:11:54,790 --> 00:11:52,320

from trying to make the surface

347

00:11:56,389 --> 00:11:54,800

operations much more efficient and so

348

00:11:57,910 --> 00:11:56,399

really like joey was saying it's it's

349

00:11:59,990 --> 00:11:57,920

all about time right that's our most

350

00:12:02,069 --> 00:12:00,000

valuable commodity and so how do we how

351

00:12:04,389 --> 00:12:02,079

do we save our time and that's where we

352

00:12:07,509 --> 00:12:04,399

develop algorithms tools work really

353

00:12:09,750 --> 00:12:07,519

closely with air traffic controllers to

354

00:12:11,590 --> 00:12:09,760

give them tools to make their jobs um

355

00:12:12,790 --> 00:12:11,600

easier and so that's something that

356

00:12:15,030 --> 00:12:12,800

we've been doing research on

357

00:12:16,629 --> 00:12:15,040

fundamentally for like last 30 years oh

358

00:12:17,990 --> 00:12:16,639

yeah yeah that's going back it's not

359

00:12:20,230 --> 00:12:18,000

just research it's transferring it to

360

00:12:21,829 --> 00:12:20,240

the faa for me to make them real right

361

00:12:23,750 --> 00:12:21,839

right right they actually put it into

362

00:12:25,750 --> 00:12:23,760

use right yeah right yeah tools in our

363

00:12:27,590 --> 00:12:25,760

air traffic controls towers almost every

364

00:12:29,110 --> 00:12:27,600

air traffic control tower today has some

365

00:12:31,190 --> 00:12:29,120

technology that we have worked on in

366

00:12:32,550 --> 00:12:31,200

here at nasa that's so awesome i don't

367

00:12:34,790 --> 00:12:32,560

think people know that

368

00:12:37,350 --> 00:12:34,800

we have a question here from just me and

369

00:12:38,870 --> 00:12:37,360

my laptop what part of the traffic or

370

00:12:42,629 --> 00:12:38,880

air traffic management do you see

371

00:12:46,790 --> 00:12:45,190

i think if if we think about how many of

372

00:12:48,949 --> 00:12:46,800

these operations there are going to be

373

00:12:50,389 --> 00:12:48,959

in the future if people people's minds

374

00:12:53,030 --> 00:12:50,399

you know race a little bit and you think

375

00:12:54,069 --> 00:12:53,040

about how how much how many new flights

376

00:12:55,590 --> 00:12:54,079

there will be

377

00:12:57,190 --> 00:12:55,600

the current system isn't set up to

378

00:12:59,190 --> 00:12:57,200

handle that many more flights that

379

00:13:00,870 --> 00:12:59,200

quickly uh so actually a lot of the

380

00:13:03,430 --> 00:13:00,880

functions to enable these new entrants

381

00:13:04,870 --> 00:13:03,440

are going to need to be automated um as

382

00:13:06,870 --> 00:13:04,880

well as some of the processes on the

383

00:13:09,350 --> 00:13:06,880

existing side in order for them to know

384

00:13:11,030 --> 00:13:09,360

how to integrate and manage this new

385

00:13:12,870 --> 00:13:11,040

traffic as well but we're not going to

386

00:13:14,470 --> 00:13:12,880

have enough controllers that can talk to

387

00:13:15,990 --> 00:13:14,480

all of these aircraft to do all of these

388

00:13:17,670 --> 00:13:16,000

things all the time like they do with

389

00:13:18,629 --> 00:13:17,680

the aircraft today yeah so a lot of

390

00:13:19,750 --> 00:13:18,639

those functions are going to be

391

00:13:22,150 --> 00:13:19,760

automated so there will be a lot of

392

00:13:23,670 --> 00:13:22,160

automation to enable this to happen

393

00:13:25,030 --> 00:13:23,680

yeah sweet yeah

394

00:13:26,870 --> 00:13:25,040

do you want to take any more right now

395

00:13:28,550 --> 00:13:26,880

oh yeah i mean there's there's plenty

396

00:13:32,069 --> 00:13:28,560

the chat is really blowing up people are

397

00:13:33,829 --> 00:13:32,079

very interested in this topic um

398

00:13:37,190 --> 00:13:33,839

there's some some questions about you

399

00:13:39,110 --> 00:13:37,200

know how do we so hobbs uh 555 says how

400

00:13:40,389 --> 00:13:39,120

do we prevent mid-air collisions with

401

00:13:43,350 --> 00:13:40,399

air traffic

402

00:13:45,189 --> 00:13:43,360

with air taxis yeah so like joey was

403

00:13:46,949 --> 00:13:45,199

mentioning there's going to be new

404

00:13:49,990 --> 00:13:46,959

automation that's going to come on board

405

00:13:52,389 --> 00:13:50,000

the vehicle potentially as well as tools

406

00:13:54,150 --> 00:13:52,399

for air traffic management services so

407

00:13:55,990 --> 00:13:54,160

what are the intersection of tools that

408

00:13:58,710 --> 00:13:56,000

are on board the vehicle as well as

409

00:14:00,949 --> 00:13:58,720

services that might be provided provided

410

00:14:02,550 --> 00:14:00,959

from potentially air traffic controllers

411

00:14:04,150 --> 00:14:02,560

or other entities and that's kind of

412

00:14:05,990 --> 00:14:04,160

what we're investigating and then where

413

00:14:09,030 --> 00:14:06,000

does automation help ensure that we

414

00:14:11,110 --> 00:14:09,040

reduce um any issues in terms of safety

415

00:14:12,629 --> 00:14:11,120

impacts so safety is kind of the number

416

00:14:13,829 --> 00:14:12,639

one goal how do you ensure safe

417

00:14:14,790 --> 00:14:13,839

operations

418

00:14:16,710 --> 00:14:14,800

yeah

419

00:14:18,470 --> 00:14:16,720

and the tools we developed they look at

420

00:14:19,430 --> 00:14:18,480

a few different layers right of how you

421

00:14:20,550 --> 00:14:19,440

make this happen their traffic

422

00:14:22,389 --> 00:14:20,560

management layer that's usually a

423

00:14:24,550 --> 00:14:22,399

strategic look ahead like how do we not

424

00:14:26,150 --> 00:14:24,560

put too many vehicles in one spot oh

425

00:14:28,150 --> 00:14:26,160

yeah it's really hard for them to avoid

426

00:14:29,269 --> 00:14:28,160

each other right so strategically you

427

00:14:31,110 --> 00:14:29,279

kind of keep them apart through this

428

00:14:32,870 --> 00:14:31,120

ground automation and having them share

429

00:14:34,870 --> 00:14:32,880

what they're going to do with each other

430

00:14:35,990 --> 00:14:34,880

um but then more tactically a lot of

431

00:14:37,350 --> 00:14:36,000

that on-board capability is going to be

432

00:14:38,230 --> 00:14:37,360

important to keep them separated yeah

433

00:14:40,069 --> 00:14:38,240

great

434

00:14:42,389 --> 00:14:40,079

so all these tools you guys are talking

435

00:14:44,870 --> 00:14:42,399

about a lot of that work is done at ames

436

00:14:46,389 --> 00:14:44,880

here but also in all other nasa centers

437

00:14:48,310 --> 00:14:46,399

across the country right so you guys

438

00:14:51,990 --> 00:14:48,320

have a lot of partners yeah definitely

439

00:14:53,670 --> 00:14:52,000

so um nasa armstrong nasa langley glenn

440

00:14:55,430 --> 00:14:53,680

almost all the nasa centers that are

441

00:14:57,590 --> 00:14:55,440

focused on aeronautics are contributing

442

00:14:59,350 --> 00:14:57,600

to making urban air mobility a reality

443

00:15:01,110 --> 00:14:59,360

so this is pretty exciting yeah yeah a

444

00:15:02,790 --> 00:15:01,120

big collaborative effort yeah the when

445

00:15:04,310 --> 00:15:02,800

did when did all this begin for urban

446

00:15:06,310 --> 00:15:04,320

air mobility and

447

00:15:09,110 --> 00:15:06,320

what's going on today yeah work is

448

00:15:10,550 --> 00:15:09,120

happening now so uh one of the the areas

449

00:15:12,389 --> 00:15:10,560

of where this kind of first started in

450

00:15:14,230 --> 00:15:12,399

terms of nasa involvement is what we

451  
00:15:16,389 --> 00:15:14,240  
call the grand challenge

452  
00:15:19,269 --> 00:15:16,399  
yeah sounds kind of exciting right yeah

453  
00:15:21,350 --> 00:15:19,279  
so the grand challenge is an activity

454  
00:15:23,350 --> 00:15:21,360  
in which we are working collaboratively

455  
00:15:25,590 --> 00:15:23,360  
with the faa as well as industry

456  
00:15:27,590 --> 00:15:25,600  
partners both vehicle industry partners

457  
00:15:29,910 --> 00:15:27,600  
and airspace industry partners okay to

458  
00:15:31,910 --> 00:15:29,920  
kind of develop an ecosystem so we can

459  
00:15:34,230 --> 00:15:31,920  
really begin testing out some of these

460  
00:15:36,150 --> 00:15:34,240  
concepts what does it mean to fly a

461  
00:15:38,069 --> 00:15:36,160  
vehicle what kind of data do we need to

462  
00:15:39,829 --> 00:15:38,079  
collect to help with the certification

463  
00:15:42,550 --> 00:15:39,839

process understand the performance of

464

00:15:44,230 --> 00:15:42,560

these vehicles and then also start

465

00:15:46,150 --> 00:15:44,240

understanding what does it mean what

466

00:15:47,829 --> 00:15:46,160

kind of tools and technologies what kind

467

00:15:49,670 --> 00:15:47,839

of software do we need to build to

468

00:15:52,150 --> 00:15:49,680

actually have some sort of air traffic

469

00:15:54,230 --> 00:15:52,160

management system for these vehicles as

470

00:15:56,150 --> 00:15:54,240

as many of them start coming up and

471

00:15:58,230 --> 00:15:56,160

becoming a reality so the grand

472

00:16:00,870 --> 00:15:58,240

challenge is a series of flight

473

00:16:03,269 --> 00:16:00,880

demonstrations and simulation activities

474

00:16:06,230 --> 00:16:03,279

where we really hope to explore all the

475

00:16:08,550 --> 00:16:06,240

safety cases as well as collect data to

476

00:16:10,310 --> 00:16:08,560

help us move the industry forward yeah

477

00:16:12,230 --> 00:16:10,320

it makes sense you get as many minds as

478

00:16:13,990 --> 00:16:12,240

possible thinking about it predicting

479

00:16:15,910 --> 00:16:14,000

what you have to work out now right and

480

00:16:17,430 --> 00:16:15,920

doing the work yeah yeah definitely it's

481

00:16:18,310 --> 00:16:17,440

definitely a very collaborative effort

482

00:16:19,430 --> 00:16:18,320

awesome

483

00:16:22,389 --> 00:16:19,440

great

484

00:16:24,550 --> 00:16:22,399

a legit twitch channel asks will there

485

00:16:25,990 --> 00:16:24,560

be miniature airports for places to pick

486

00:16:28,069 --> 00:16:26,000

up and drop off

487

00:16:30,150 --> 00:16:28,079

that'd be cool yeah so some of the

488

00:16:31,350 --> 00:16:30,160

concepts that are coming up in terms of

489

00:16:33,590 --> 00:16:31,360

infrastructure which is actually a

490

00:16:36,550 --> 00:16:33,600

really important concept uh is a concept

491

00:16:38,790 --> 00:16:36,560

of vertaport traverta pads or skyport

492

00:16:39,910 --> 00:16:38,800

sky pads however you wish to call it but

493

00:16:42,069 --> 00:16:39,920

you can kind of imagine like a

494

00:16:44,550 --> 00:16:42,079

helicopter pad right okay these could be

495

00:16:46,629 --> 00:16:44,560

on the ground or on actually the the top

496

00:16:48,550 --> 00:16:46,639

of a building right and so these could

497

00:16:50,470 --> 00:16:48,560

be locations where these aircraft could

498

00:16:52,550 --> 00:16:50,480

take off because remember they can take

499

00:16:54,310 --> 00:16:52,560

off vertically and land vertically so

500

00:16:55,749 --> 00:16:54,320

they don't need a runway yeah they don't

501  
00:16:58,069 --> 00:16:55,759  
need a runway like a normal aircraft

502  
00:17:01,269 --> 00:16:58,079  
today so that is what's going to allow

503  
00:17:03,350 --> 00:17:01,279  
operations in an urban center right

504  
00:17:06,150 --> 00:17:03,360  
yeah cool is this going to mean the end

505  
00:17:07,750 --> 00:17:06,160  
of traditional flight or is this

506  
00:17:09,029 --> 00:17:07,760  
really just complementary to everything

507  
00:17:11,829 --> 00:17:09,039  
we use today

508  
00:17:13,829 --> 00:17:11,839  
yeah so it's definitely not an end to

509  
00:17:15,669 --> 00:17:13,839  
current day aviation in fact you can

510  
00:17:17,429 --> 00:17:15,679  
think of it as a compliment to help you

511  
00:17:20,710 --> 00:17:17,439  
actually use current day aviation even

512  
00:17:22,949 --> 00:17:20,720  
more right so um one can imagine that

513  
00:17:25,110 --> 00:17:22,959

you might want to get from wherever

514

00:17:26,549 --> 00:17:25,120

you're located a suburb to your nearest

515

00:17:28,789 --> 00:17:26,559

airport and normally we would have to

516

00:17:31,350 --> 00:17:28,799

sit in traffic drive maybe half an hour

517

00:17:32,630 --> 00:17:31,360

40 minutes to get there who knows

518

00:17:34,390 --> 00:17:32,640

so depending on where you're located

519

00:17:36,870 --> 00:17:34,400

yeah but now what if you can take one of

520

00:17:38,950 --> 00:17:36,880

these air taxis or air shuttles to get

521

00:17:40,470 --> 00:17:38,960

to your airport now it's actually much

522

00:17:42,789 --> 00:17:40,480

easier to use

523

00:17:45,590 --> 00:17:42,799

uh commercial aviation like we do today

524

00:17:47,909 --> 00:17:45,600

so these are just another uh form of

525

00:17:49,909 --> 00:17:47,919

transportation to help us use current

526

00:17:52,390 --> 00:17:49,919

day aviation yeah i see yeah and about

527

00:17:54,710 --> 00:17:52,400

air taxis or air shuttles yeah you just

528

00:17:55,830 --> 00:17:54,720

kind of made a distinction there um do

529

00:17:58,150 --> 00:17:55,840

you think that these are going to be

530

00:18:00,070 --> 00:17:58,160

taxis that i i call up and i say i

531

00:18:01,990 --> 00:18:00,080

personally want to go to my specific

532

00:18:04,870 --> 00:18:02,000

friend's house or is it going to be like

533

00:18:07,830 --> 00:18:04,880

a subway or a city bus that has a route

534

00:18:09,510 --> 00:18:07,840

so most likely as this industry develops

535

00:18:11,750 --> 00:18:09,520

initially it'll probably more be more

536

00:18:13,430 --> 00:18:11,760

like a air shuttle or an air metro where

537

00:18:14,950 --> 00:18:13,440

you have a series of designated

538

00:18:18,150 --> 00:18:14,960

locations where you have pickups and

539

00:18:20,150 --> 00:18:18,160

drop-offs and um at scheduled times okay

540

00:18:21,510 --> 00:18:20,160

that's mostly to help us understand what

541

00:18:23,029 --> 00:18:21,520

are the what's the feasibility in the

542

00:18:25,190 --> 00:18:23,039

beginning yeah of this type of

543

00:18:27,430 --> 00:18:25,200

transportation but on-demand air

544

00:18:29,270 --> 00:18:27,440

mobility is something that industry as

545

00:18:31,270 --> 00:18:29,280

well as we are researching and

546

00:18:33,029 --> 00:18:31,280

investigating of how to enable it so

547

00:18:35,590 --> 00:18:33,039

we're actually looking at both how do we

548

00:18:37,990 --> 00:18:35,600

have a air metro or air shuttle as well

549

00:18:41,350 --> 00:18:38,000

as on-demand urban air mobility okay

550

00:18:42,710 --> 00:18:41,360

yeah stay tuned pretty cool right yeah

551  
00:18:44,950 --> 00:18:42,720  
we have a question here from again from

552  
00:18:47,190 --> 00:18:44,960  
uh space walrus what elevation will they

553  
00:18:50,710 --> 00:18:47,200  
be flying at what if you're you're in

554  
00:18:53,430 --> 00:18:50,720  
the city do we weave through skyscrapers

555  
00:18:54,150 --> 00:18:53,440  
yeah good question yeah good question

556  
00:18:56,310 --> 00:18:54,160  
here

557  
00:18:58,470 --> 00:18:56,320  
so since these vehicles have uh kind of

558  
00:19:00,310 --> 00:18:58,480  
a wide range of configurations they have

559  
00:19:02,310 --> 00:19:00,320  
different cruising altitudes that they

560  
00:19:03,990 --> 00:19:02,320  
would fly at you can expect though a

561  
00:19:05,990 --> 00:19:04,000  
range of typically from somewhere to

562  
00:19:08,390 --> 00:19:06,000  
like a thousand to four thousand feet is

563  
00:19:09,830 --> 00:19:08,400

on average that typical range of these

564

00:19:11,430 --> 00:19:09,840

of these vehicles of the urban air

565

00:19:13,830 --> 00:19:11,440

mobility vehicles that are a little bit

566

00:19:16,070 --> 00:19:13,840

larger than remember um then some of the

567

00:19:16,870 --> 00:19:16,080

drones that have been flying below 400

568

00:19:18,789 --> 00:19:16,880

feet

569

00:19:20,230 --> 00:19:18,799

and then they are also kind of smaller

570

00:19:21,430 --> 00:19:20,240

than your traditional aircraft because

571

00:19:23,110 --> 00:19:21,440

they only have about four to eight

572

00:19:25,029 --> 00:19:23,120

passengers typically okay so that's the

573

00:19:27,909 --> 00:19:25,039

altitude that would be flying at terms

574

00:19:30,549 --> 00:19:27,919

of weaving between skyscrapers i think

575

00:19:33,110 --> 00:19:30,559

we're looking at procedures as well as a

576

00:19:34,230 --> 00:19:33,120

ways for these aircraft to fly safely

577

00:19:35,669 --> 00:19:34,240

and that includes safety of the

578

00:19:37,350 --> 00:19:35,679

passengers on board as well as the

579

00:19:38,950 --> 00:19:37,360

safety of the people on the ground right

580

00:19:40,950 --> 00:19:38,960

of course

581

00:19:41,750 --> 00:19:40,960

i see a question here for the both of

582

00:19:43,669 --> 00:19:41,760

you

583

00:19:46,150 --> 00:19:43,679

seriously gaming asks what are

584

00:19:47,990 --> 00:19:46,160

chevangeli and joey's thoughts on noise

585

00:19:49,830 --> 00:19:48,000

pollution from these and what are their

586

00:19:50,789 --> 00:19:49,840

thoughts on potential objects falling to

587

00:19:52,710 --> 00:19:50,799

earth

588

00:19:54,310 --> 00:19:52,720

yeah is that a partisan uh definitely

589

00:19:55,750 --> 00:19:54,320

want to avoid the objects falling to

590

00:19:57,350 --> 00:19:55,760

earth

591

00:19:58,950 --> 00:19:57,360

and in general noise pollution speaks to

592

00:20:01,430 --> 00:19:58,960

a larger issue of kind of public

593

00:20:03,190 --> 00:20:01,440

acceptance of these kind of operations

594

00:20:04,950 --> 00:20:03,200

so we can solve a lot of technological

595

00:20:06,789 --> 00:20:04,960

problems and make sure things stay safe

596

00:20:08,549 --> 00:20:06,799

and efficient in the air space but if

597

00:20:09,830 --> 00:20:08,559

the public's not ready to accept these

598

00:20:11,430 --> 00:20:09,840

kind of operations for whatever reason

599

00:20:14,230 --> 00:20:11,440

whether it's environmental including

600

00:20:15,750 --> 00:20:14,240

noise or or something else

601  
00:20:18,070 --> 00:20:15,760  
then this won't ever take off so to

602  
00:20:20,310 --> 00:20:18,080  
speak right so part of the research when

603  
00:20:21,750 --> 00:20:20,320  
we do our testing is actually making

604  
00:20:23,270 --> 00:20:21,760  
sure we're starting to ask some of those

605  
00:20:25,430 --> 00:20:23,280  
questions and collect some initial data

606  
00:20:26,870 --> 00:20:25,440  
on on public acceptance so that we can

607  
00:20:28,310 --> 00:20:26,880  
feed some of those conversations to see

608  
00:20:30,310 --> 00:20:28,320  
what kind of barriers might be there

609  
00:20:32,789 --> 00:20:30,320  
yeah to kind of that public acceptance

610  
00:20:33,909 --> 00:20:32,799  
question yeah so noise is an issue and i

611  
00:20:35,350 --> 00:20:33,919  
think you'll see a lot of the

612  
00:20:36,789 --> 00:20:35,360  
manufacturers of these vehicles

613  
00:20:38,070 --> 00:20:36,799

designers of these vehicles and of the

614

00:20:39,830 --> 00:20:38,080

airspace procedures are kind of

615

00:20:42,310 --> 00:20:39,840

cognizant of that they want to be aware

616

00:20:44,950 --> 00:20:42,320

of trying to minimize the impact or

617

00:20:46,390 --> 00:20:44,960

acceptability of these operations so it

618

00:20:47,909 --> 00:20:46,400

is something that is considered in the

619

00:20:49,990 --> 00:20:47,919

design of all the pieces of the system

620

00:20:51,350 --> 00:20:50,000

right right good to hear yeah

621

00:20:57,110 --> 00:20:51,360

yeah

622

00:21:02,390 --> 00:20:59,909

uh hobbies 555 would there be weather

623

00:21:05,110 --> 00:21:02,400

restrictions on air taxis

624

00:21:07,110 --> 00:21:05,120

yeah so just like today in commercial

625

00:21:10,149 --> 00:21:07,120

aviation today weather plays a big role

626  
00:21:12,070 --> 00:21:10,159  
and how how aviation you know

627  
00:21:14,390 --> 00:21:12,080  
goes on today right and similarly it

628  
00:21:16,470 --> 00:21:14,400  
will play a role for these new vehicles

629  
00:21:17,750 --> 00:21:16,480  
for these urban air mobility vehicles

630  
00:21:19,430 --> 00:21:17,760  
one of the things that we're trying to

631  
00:21:20,950 --> 00:21:19,440  
understand is when we

632  
00:21:22,470 --> 00:21:20,960  
perform tests as part of the grand

633  
00:21:24,870 --> 00:21:22,480  
challenges understand what is your

634  
00:21:26,950 --> 00:21:24,880  
performance when can you fly at what

635  
00:21:28,630 --> 00:21:26,960  
gusts of winds are there limitations on

636  
00:21:29,830 --> 00:21:28,640  
your performance and those are some of

637  
00:21:31,590 --> 00:21:29,840  
the things that we're really trying to

638  
00:21:33,350 --> 00:21:31,600

investigate so we can answer that

639

00:21:35,350 --> 00:21:33,360

question in a better fashion once we

640

00:21:38,230 --> 00:21:35,360

have data on how these vehicles actually

641

00:21:39,909 --> 00:21:38,240

perform under different um wind under

642

00:21:41,590 --> 00:21:39,919

different wind wind levels as well as

643

00:21:43,510 --> 00:21:41,600

different types of precipitation yeah

644

00:21:44,710 --> 00:21:43,520

yeah okay so really specific stuff yeah

645

00:21:46,789 --> 00:21:44,720

yeah yeah you know what you're really

646

00:21:48,070 --> 00:21:46,799

thinking about testing for yeah yeah

647

00:21:49,270 --> 00:21:48,080

yeah really interesting kind of related

648

00:21:50,390 --> 00:21:49,280

to that is you know understanding the

649

00:21:52,390 --> 00:21:50,400

performance of the vehicle so that it

650

00:21:53,909 --> 00:21:52,400

knows what it can handle what situations

651  
00:21:55,669 --> 00:21:53,919  
it can handle but then actually on the

652  
00:21:57,510 --> 00:21:55,679  
weather side actually doing the research

653  
00:21:59,350 --> 00:21:57,520  
to make sure that that information is

654  
00:22:00,789 --> 00:21:59,360  
available to those operators okay

655  
00:22:02,390 --> 00:22:00,799  
because the weather we use today for

656  
00:22:04,789 --> 00:22:02,400  
aviation really focused around airports

657  
00:22:05,909 --> 00:22:04,799  
and the en route environment and uh you

658  
00:22:07,669 --> 00:22:05,919  
know there's some specialized stuff for

659  
00:22:09,270 --> 00:22:07,679  
helicopters and cities but that all

660  
00:22:10,870 --> 00:22:09,280  
needs to scale up quite a bit in order

661  
00:22:12,870 --> 00:22:10,880  
to provide the right information to

662  
00:22:14,390 --> 00:22:12,880  
operators so that they can fly safely

663  
00:22:15,990 --> 00:22:14,400

given the performance characteristics of

664

00:22:17,669 --> 00:22:16,000

their vehicle yeah so a lot of cities

665

00:22:20,149 --> 00:22:17,679

aren't outfitted for that level of

666

00:22:21,669 --> 00:22:20,159

granularity of weather right so how do

667

00:22:23,510 --> 00:22:21,679

you get those weather services and

668

00:22:24,789 --> 00:22:23,520

weather requirements develop so that you

669

00:22:26,870 --> 00:22:24,799

can actually enable these operations

670

00:22:28,950 --> 00:22:26,880

safely so that's a a large area of

671

00:22:31,110 --> 00:22:28,960

research that we poke into and we also

672

00:22:33,430 --> 00:22:31,120

try and encourage uh industry and

673

00:22:34,710 --> 00:22:33,440

universities and other folks to come

674

00:22:36,470 --> 00:22:34,720

along with us on that research yeah it

675

00:22:37,990 --> 00:22:36,480

makes sense kind of along those lines

676

00:22:40,789 --> 00:22:38,000

the weather is actually very interesting

677

00:22:42,950 --> 00:22:40,799

in an urban center right now yeah so as

678

00:22:44,710 --> 00:22:42,960

you have wind flow between buildings as

679

00:22:47,190 --> 00:22:44,720

you have um kind of different types of

680

00:22:49,270 --> 00:22:47,200

eddies kind of put round off of building

681

00:22:50,950 --> 00:22:49,280

building surfaces you have interesting

682

00:22:53,110 --> 00:22:50,960

effects that can occur and so that's

683

00:22:55,190 --> 00:22:53,120

really important for us to have some

684

00:22:57,190 --> 00:22:55,200

knowledge about and understand such that

685

00:22:58,710 --> 00:22:57,200

we can have safe safe performance of

686

00:23:00,310 --> 00:22:58,720

these vehicles so that's actually a

687

00:23:01,830 --> 00:23:00,320

really big part what joey was referring

688

00:23:03,510 --> 00:23:01,840

to yeah yeah i can imagine i felt that

689

00:23:05,590 --> 00:23:03,520

in cities right yeah of course walking

690

00:23:07,750 --> 00:23:05,600

between two skyscrapers and it's just

691

00:23:11,750 --> 00:23:07,760

like gusting by

692

00:23:16,310 --> 00:23:14,230

let's see what other questions we got

693

00:23:18,950 --> 00:23:16,320

we one day see a return of airships or

694

00:23:20,870 --> 00:23:18,960

zeppelins ghost of e.t asks

695

00:23:22,470 --> 00:23:20,880

who knows

696

00:23:24,070 --> 00:23:22,480

yeah so i you know airships the

697

00:23:26,230 --> 00:23:24,080

dirigibles have been have been around

698

00:23:28,630 --> 00:23:26,240

for quite some time and have been used

699

00:23:30,149 --> 00:23:28,640

um you know obviously in the past and

700

00:23:31,669 --> 00:23:30,159

now we see the goodyear blimp once in a

701  
00:23:34,549 --> 00:23:31,679  
while right yes

702  
00:23:37,029 --> 00:23:34,559  
yeah so you know airships do have some

703  
00:23:39,110 --> 00:23:37,039  
some purpose and do of our use for some

704  
00:23:41,029 --> 00:23:39,120  
some use cases but how they're going to

705  
00:23:42,470 --> 00:23:41,039  
be integrated in airspace it's a similar

706  
00:23:44,549 --> 00:23:42,480  
question just like a lot of these new

707  
00:23:45,510 --> 00:23:44,559  
entrants how do what's your performance

708  
00:23:47,590 --> 00:23:45,520  
like what's your performance

709  
00:23:49,430 --> 00:23:47,600  
characteristics based on that how do we

710  
00:23:51,430 --> 00:23:49,440  
integrate you safely into our airspace

711  
00:23:53,110 --> 00:23:51,440  
so the same types of questions apply

712  
00:23:55,110 --> 00:23:53,120  
regardless of what what type of vehicle

713  
00:23:56,310 --> 00:23:55,120

you may be yeah yeah but the vehicles

714

00:23:58,549 --> 00:23:56,320

you guys are talking about are much more

715

00:24:02,980 --> 00:23:58,559

smaller four to eight passengers smaller

716

00:24:07,990 --> 00:24:05,430

[Laughter]

717

00:24:09,590 --> 00:24:08,000

um a trek petrol one do you have any

718

00:24:11,350 --> 00:24:09,600

idea how much energy it takes to

719

00:24:13,510 --> 00:24:11,360

vertically lift

720

00:24:15,750 --> 00:24:13,520

the passengers he gave a number of eight

721

00:24:18,230 --> 00:24:15,760

passengers but just in general

722

00:24:20,549 --> 00:24:18,240

yeah so typically what you what is

723

00:24:23,110 --> 00:24:20,559

desired is you want to have vertical

724

00:24:25,430 --> 00:24:23,120

lift up above 50 feet

725

00:24:28,070 --> 00:24:25,440

such that you are climbing at a rate of

726

00:24:29,830 --> 00:24:28,080

about 100 feet per minute so the energy

727

00:24:32,149 --> 00:24:29,840

that's required obviously depends on the

728

00:24:33,909 --> 00:24:32,159

weight of that individual airframe plus

729

00:24:35,669 --> 00:24:33,919

the number of passengers or cargo that

730

00:24:37,430 --> 00:24:35,679

you might have on board so i would say

731

00:24:39,590 --> 00:24:37,440

it actually does vary depending on your

732

00:24:41,669 --> 00:24:39,600

configuration of your vehicle but what

733

00:24:43,029 --> 00:24:41,679

is neat is the fact that there's been

734

00:24:45,269 --> 00:24:43,039

quite a bit of development in

735

00:24:47,350 --> 00:24:45,279

distributed electrical propulsion which

736

00:24:49,269 --> 00:24:47,360

means you can use these um electrically

737

00:24:51,190 --> 00:24:49,279

powered rotors have them distributed

738

00:24:53,750 --> 00:24:51,200

across the airframe such that it's

739

00:24:55,750 --> 00:24:53,760

actually much easier to provide the lift

740

00:24:57,430 --> 00:24:55,760

for aircraft and that's that's the new

741

00:24:59,190 --> 00:24:57,440

technology like we saw in that in that

742

00:25:01,190 --> 00:24:59,200

vehicle concept right it had the rotors

743

00:25:03,110 --> 00:25:01,200

along the wings right yeah yeah right

744

00:25:04,390 --> 00:25:03,120

right cool and the airframe when you

745

00:25:06,470 --> 00:25:04,400

guys say that that means looks like the

746

00:25:07,830 --> 00:25:06,480

structure of the aircraft correct just

747

00:25:09,830 --> 00:25:07,840

just how that aircraft is configured

748

00:25:10,950 --> 00:25:09,840

does it have two rotors four rotors does

749

00:25:12,549 --> 00:25:10,960

it have a wing

750

00:25:14,390 --> 00:25:12,559

what does it look like yeah yeah make

751

00:25:17,350 --> 00:25:14,400

sense okay cool we probably have time

752

00:25:20,230 --> 00:25:17,360

for a few more questions yeah uh we have

753

00:25:22,149 --> 00:25:20,240

a question here from dakt the werewolf

754

00:25:23,510 --> 00:25:22,159

uh what power densities would be

755

00:25:26,070 --> 00:25:23,520

required to make

756

00:25:29,110 --> 00:25:26,080

long range high capacity flight possible

757

00:25:31,510 --> 00:25:29,120

using battery power yeah power's a big

758

00:25:33,750 --> 00:25:31,520

issue yeah yeah so

759

00:25:35,510 --> 00:25:33,760

the manner in which battery technology

760

00:25:37,350 --> 00:25:35,520

is developing is is something that

761

00:25:39,110 --> 00:25:37,360

industry is really moving forward with

762

00:25:41,669 --> 00:25:39,120

things that they're concerned about is

763

00:25:44,230 --> 00:25:41,679

their charge and discharge rates and

764

00:25:46,070 --> 00:25:44,240

then also how quickly can you recharge

765

00:25:47,750 --> 00:25:46,080

your your actual battery on board so

766

00:25:51,190 --> 00:25:47,760

that you can fly another mission or go

767

00:25:54,310 --> 00:25:51,200

on another trip right and so there is um

768

00:25:55,669 --> 00:25:54,320

quite a range of energy density that's

769

00:25:57,190 --> 00:25:55,679

required again depending on your

770

00:25:59,990 --> 00:25:57,200

configuration and depending on your

771

00:26:02,149 --> 00:26:00,000

mission profile am i flying 15 miles or

772

00:26:04,149 --> 00:26:02,159

am i flying 40 miles right so depending

773

00:26:06,630 --> 00:26:04,159

on the mission you wish to achieve you

774

00:26:08,630 --> 00:26:06,640

do see a kind of a range in terms of the

775

00:26:09,510 --> 00:26:08,640

battery or power requirements for that

776  
00:26:11,190 --> 00:26:09,520  
vehicle

777  
00:26:12,470 --> 00:26:11,200  
and just bring it back to the question

778  
00:26:14,789 --> 00:26:12,480  
of the verta ports

779  
00:26:17,110 --> 00:26:14,799  
kind of designing the system and the

780  
00:26:18,870 --> 00:26:17,120  
power requirements you know you you may

781  
00:26:20,310 --> 00:26:18,880  
want your verta ports close to a

782  
00:26:22,549 --> 00:26:20,320  
substation that can supply the right

783  
00:26:23,830 --> 00:26:22,559  
amount of power to recharge you quickly

784  
00:26:25,909 --> 00:26:23,840  
so all of these things are definitely

785  
00:26:27,909 --> 00:26:25,919  
interrelated right

786  
00:26:29,669 --> 00:26:27,919  
yeah you you sort of touched on this

787  
00:26:31,269 --> 00:26:29,679  
already but maybe the sum it up for

788  
00:26:32,789 --> 00:26:31,279

fergus diggings can you comment about

789

00:26:34,789 --> 00:26:32,799

the possible infrastructure that might

790

00:26:36,310 --> 00:26:34,799

be needed for the shorter range trips

791

00:26:38,470 --> 00:26:36,320

will use existing airports or a

792

00:26:40,070 --> 00:26:38,480

combination of existing anew you talk

793

00:26:41,990 --> 00:26:40,080

about rooftops but like how would you

794

00:26:42,789 --> 00:26:42,000

sum that up

795

00:26:46,789 --> 00:26:42,799

yeah

796

00:26:48,310 --> 00:26:46,799

about a new mode of transportation with

797

00:26:50,070 --> 00:26:48,320

new use cases there's probably going to

798

00:26:52,310 --> 00:26:50,080

be new infrastructure needed and that's

799

00:26:54,149 --> 00:26:52,320

when we talk about these verta ports and

800

00:26:56,070 --> 00:26:54,159

and charging stations and and all of

801  
00:26:58,310 --> 00:26:56,080  
these these things that don't exist as

802  
00:26:59,830 --> 00:26:58,320  
well as things like surveillance as well

803  
00:27:01,669 --> 00:26:59,840  
as weather monitoring we talked about

804  
00:27:04,149 --> 00:27:01,679  
earlier surveillance like keeping an eye

805  
00:27:05,669 --> 00:27:04,159  
on on them

806  
00:27:07,669 --> 00:27:05,679  
knowing where the vehicles are yeah

807  
00:27:09,190 --> 00:27:07,679  
right not so much uh

808  
00:27:10,549 --> 00:27:09,200  
how they get used but yeah just where

809  
00:27:12,070 --> 00:27:10,559  
the vehicles are right now i know we

810  
00:27:13,750 --> 00:27:12,080  
have radars and they can see all the big

811  
00:27:15,110 --> 00:27:13,760  
airplanes in the sky just keep track of

812  
00:27:16,710 --> 00:27:15,120  
them that infrastructure doesn't

813  
00:27:17,830 --> 00:27:16,720

necessarily let us have full visibility

814

00:27:20,070 --> 00:27:17,840

into the area where these things might

815

00:27:21,990 --> 00:27:20,080

be flying so surveillance as well as

816

00:27:23,430 --> 00:27:22,000

again the recharging and the landing and

817

00:27:24,630 --> 00:27:23,440

the takeoffs all that's infrastructure

818

00:27:26,470 --> 00:27:24,640

that definitely has to be considered

819

00:27:28,149 --> 00:27:26,480

when designing a system and i would say

820

00:27:30,630 --> 00:27:28,159

infrastructure is actually a big big

821

00:27:33,029 --> 00:27:30,640

part of this right and the faa is as

822

00:27:35,029 --> 00:27:33,039

well as nasa as well as industry and

823

00:27:36,549 --> 00:27:35,039

other research institutions they are

824

00:27:38,950 --> 00:27:36,559

looking to understand what are the

825

00:27:41,669 --> 00:27:38,960

infrastructure requirements and their

826

00:27:44,230 --> 00:27:41,679

sensor requirements but also things such

827

00:27:46,230 --> 00:27:44,240

as lighting requirements right what kind

828

00:27:48,789 --> 00:27:46,240

of procedures are need to be developed

829

00:27:50,470 --> 00:27:48,799

for that type of infrastructure um so

830

00:27:52,149 --> 00:27:50,480

there's a whole host of information that

831

00:27:53,510 --> 00:27:52,159

would come along with the infrastructure

832

00:27:55,830 --> 00:27:53,520

that we need that will be needed for

833

00:27:57,830 --> 00:27:55,840

these vehicles to land or take off from

834

00:28:00,630 --> 00:27:57,840

locations near us right so there's lots

835

00:28:02,389 --> 00:28:00,640

of interesting research there yeah yeah

836

00:28:04,070 --> 00:28:02,399

the research kind of leads the way to

837

00:28:06,149 --> 00:28:04,080

those answers yeah right yeah yeah

838

00:28:08,310 --> 00:28:06,159

discovers the questions yeah leads us to

839

00:28:09,990 --> 00:28:08,320

the answers yeah that's interesting um

840

00:28:12,149 --> 00:28:10,000

maybe just one more and this question

841

00:28:13,750 --> 00:28:12,159

came in a while ago from hobbs 555 so

842

00:28:15,990 --> 00:28:13,760

maybe it's been answered but i want to

843

00:28:17,909 --> 00:28:16,000

know is this like flying cars what's the

844

00:28:19,909 --> 00:28:17,919

question can we call these flying cars

845

00:28:21,669 --> 00:28:19,919

or is that something else

846

00:28:24,470 --> 00:28:21,679

well so if you

847

00:28:26,149 --> 00:28:24,480

if you want to call them flying cars um

848

00:28:28,149 --> 00:28:26,159

you technically can i mean some of these

849

00:28:30,389 --> 00:28:28,159

vehicle configurations do have

850

00:28:32,389 --> 00:28:30,399

wheels right for a landing

851

00:28:33,669 --> 00:28:32,399

some do some don't right so

852

00:28:35,669 --> 00:28:33,679

if you have wheels and you can actually

853

00:28:38,310 --> 00:28:35,679

do taxiing i guess technically if you

854

00:28:39,990 --> 00:28:38,320

can call the flying car um

855

00:28:41,669 --> 00:28:40,000

you know people do call them urban air

856

00:28:42,870 --> 00:28:41,679

mobility vehicles

857

00:28:44,389 --> 00:28:42,880

due to the fact they can perform a

858

00:28:46,149 --> 00:28:44,399

number of different functions and have

859

00:28:48,630 --> 00:28:46,159

slightly different operations than what

860

00:28:51,269 --> 00:28:48,640

we're used to today right so the the

861

00:28:53,510 --> 00:28:51,279

terms you use can change but essentially

862

00:28:55,029 --> 00:28:53,520

it's like an air taxi a flying car kind

863

00:28:56,470 --> 00:28:55,039

of whatever you wish to call it yeah and

864

00:28:57,830 --> 00:28:56,480

i think that the car implies a lot of

865

00:28:59,750 --> 00:28:57,840

freedom right and that's that on-demand

866

00:29:01,510 --> 00:28:59,760

mobility we were mentioning earlier yeah

867

00:29:03,190 --> 00:29:01,520

um so most of these initial vehicles are

868

00:29:04,549 --> 00:29:03,200

probably more like the air metro

869

00:29:05,990 --> 00:29:04,559

schwandelier was mentioning earlier

870

00:29:07,269 --> 00:29:06,000

right they're kind of designated where

871

00:29:08,950 --> 00:29:07,279

they're going to go

872

00:29:10,710 --> 00:29:08,960

so if you wanted to call that a car sure

873

00:29:13,510 --> 00:29:10,720

you could but in general it's more like

874

00:29:15,269 --> 00:29:13,520

a subway or yeah it's it's going where

875

00:29:16,870 --> 00:29:15,279

it's going to go and it can help you get

876

00:29:19,269 --> 00:29:16,880

there quickly just start us off yeah

877

00:29:21,350 --> 00:29:19,279

yeah okay cool all right well let's move

878

00:29:22,389 --> 00:29:21,360

on to our next topic so that we don't

879

00:29:24,310 --> 00:29:22,399

run out of time but we're going to come

880

00:29:26,389 --> 00:29:24,320

back to more questions later so i know

881

00:29:28,389 --> 00:29:26,399

that nasa has already done a bunch of

882

00:29:30,310 --> 00:29:28,399

research over several years that really

883

00:29:32,070 --> 00:29:30,320

helped lay the groundwork for this urban

884

00:29:34,230 --> 00:29:32,080

air mobility work that you're doing so

885

00:29:36,310 --> 00:29:34,240

joey you were a big part of that can you

886

00:29:38,710 --> 00:29:36,320

tell us about the system you worked on

887

00:29:40,950 --> 00:29:38,720

yeah so for the past five years or so we

888

00:29:43,909 --> 00:29:40,960

have been working on uh

889

00:29:46,230 --> 00:29:43,919

how do you manage small drones at low

890

00:29:47,669 --> 00:29:46,240

altitude at kind of a big scale how do

891

00:29:49,029 --> 00:29:47,679

you have thousands of small drones

892

00:29:51,029 --> 00:29:49,039

flying over the state of california

893

00:29:52,470 --> 00:29:51,039

taking care of things

894

00:29:54,230 --> 00:29:52,480

so

895

00:29:55,990 --> 00:29:54,240

again that's the current air traffic

896

00:29:58,149 --> 00:29:56,000

management system was not designed to

897

00:29:59,669 --> 00:29:58,159

handle that kind of traffic so how do we

898

00:30:01,350 --> 00:29:59,679

enable those use cases and those

899

00:30:02,950 --> 00:30:01,360

business cases to occur without

900

00:30:04,870 --> 00:30:02,960

overloading the current system and

901  
00:30:06,789 --> 00:30:04,880  
keeping everything as safe as possible

902  
00:30:09,190 --> 00:30:06,799  
so that's what came about our research

903  
00:30:10,310 --> 00:30:09,200  
was called utm uas traffic management

904  
00:30:12,310 --> 00:30:10,320  
and again u.s traffic management just

905  
00:30:14,230 --> 00:30:12,320  
means how do you manage drones right how

906  
00:30:16,070 --> 00:30:14,240  
do you manage drones yeah so the drone

907  
00:30:18,470 --> 00:30:16,080  
the uas is the drone that's right that's

908  
00:30:20,149 --> 00:30:18,480  
right yeah we love acronyms here i know

909  
00:30:25,669 --> 00:30:20,159  
that's everyone's favorite acronym with

910  
00:30:28,789 --> 00:30:27,269  
but yeah we were focused again on small

911  
00:30:30,389 --> 00:30:28,799  
drones we're talking about 55 pounds and

912  
00:30:32,389 --> 00:30:30,399  
under okay and we're talking about low

913  
00:30:34,230 --> 00:30:32,399

altitude typically 400 feet and under

914

00:30:35,909 --> 00:30:34,240

yeah but again you can accomplish a lot

915

00:30:37,510 --> 00:30:35,919

of things just in that airspace with

916

00:30:39,190 --> 00:30:37,520

these kind of vehicles

917

00:30:40,870 --> 00:30:39,200

and it made us ask certain questions and

918

00:30:43,029 --> 00:30:40,880

develop certain systems and test certain

919

00:30:44,789 --> 00:30:43,039

things with partners and the faa that

920

00:30:46,389 --> 00:30:44,799

lays the groundwork for some of the

921

00:30:48,070 --> 00:30:46,399

still open questions for urban air

922

00:30:50,230 --> 00:30:48,080

mobility that we have been talking about

923

00:30:52,310 --> 00:30:50,240

yeah yeah that sounds familiar yeah kind

924

00:30:53,909 --> 00:30:52,320

of work you're doing um you mentioned

925

00:30:56,149 --> 00:30:53,919

lots of applications what are some

926  
00:30:58,710 --> 00:30:56,159  
examples for small drones there there

927  
00:31:00,149 --> 00:30:58,720  
are a lot um

928  
00:31:01,590 --> 00:31:00,159  
usually that you can actually classify

929  
00:31:03,830 --> 00:31:01,600  
them into some of the more interesting

930  
00:31:06,230 --> 00:31:03,840  
ones into the 3ds dirty dangerous and

931  
00:31:08,389 --> 00:31:06,240  
dull jobs there's a lot of jobs you can

932  
00:31:10,149 --> 00:31:08,399  
do with these drones that can actually

933  
00:31:10,950 --> 00:31:10,159  
keep people safer that are doing them

934  
00:31:12,470 --> 00:31:10,960  
right

935  
00:31:13,909 --> 00:31:12,480  
infrastructure inspection for example

936  
00:31:15,110 --> 00:31:13,919  
you know looking at a cell tower taking

937  
00:31:16,870 --> 00:31:15,120  
pictures making sure it's working

938  
00:31:18,789 --> 00:31:16,880

correctly

939

00:31:20,470 --> 00:31:18,799

people die climbing those towers every

940

00:31:22,789 --> 00:31:20,480

year yeah right and and other kind of

941

00:31:24,549 --> 00:31:22,799

power line inspections these jobs aren't

942

00:31:27,110 --> 00:31:24,559

always the safest jobs but you can make

943

00:31:28,789 --> 00:31:27,120

them safer by using drones okay um and

944

00:31:30,389 --> 00:31:28,799

then things like there's agricultural

945

00:31:32,710 --> 00:31:30,399

applications as well taking pictures of

946

00:31:34,470 --> 00:31:32,720

your field and doing analysis on that as

947

00:31:36,070 --> 00:31:34,480

well as public safety things fire and

948

00:31:38,870 --> 00:31:36,080

police agencies are using these a lot

949

00:31:39,750 --> 00:31:38,880

more at a local level um

950

00:31:41,750 --> 00:31:39,760

large companies are talking about

951  
00:31:43,509 --> 00:31:41,760  
delivering things to your doorstep again

952  
00:31:45,750 --> 00:31:43,519  
all this can happen with drones under 55

953  
00:31:46,789 --> 00:31:45,760  
pounds and under 400 feet so there's a

954  
00:31:48,710 --> 00:31:46,799  
lot of things you can actually do with

955  
00:31:50,870 --> 00:31:48,720  
them right yeah for sure and how do you

956  
00:31:52,310 --> 00:31:50,880  
let everyone do all those things

957  
00:31:53,509 --> 00:31:52,320  
simultaneously and keep the airspace

958  
00:31:55,190 --> 00:31:53,519  
safe exactly that was kind of the

959  
00:31:56,870 --> 00:31:55,200  
research that we were looking at yes

960  
00:31:59,350 --> 00:31:56,880  
because that's always the key right yeah

961  
00:32:01,350 --> 00:31:59,360  
thank you safely yeah what was your role

962  
00:32:02,870 --> 00:32:01,360  
exactly so i was the chief engineer for

963  
00:32:04,630 --> 00:32:02,880

the project so it was really about kind

964

00:32:07,590 --> 00:32:04,640

of coordinating a lot of the technical

965

00:32:09,509 --> 00:32:07,600

aspects of it um i did focus a lot on

966

00:32:11,110 --> 00:32:09,519

the software aspect of it so we talked

967

00:32:12,470 --> 00:32:11,120

about automation earlier in the airspace

968

00:32:14,070 --> 00:32:12,480

management how it's going to have to be

969

00:32:15,750 --> 00:32:14,080

automated in the future to handle all of

970

00:32:17,110 --> 00:32:15,760

this traffic so how do you build a

971

00:32:19,269 --> 00:32:17,120

system that enables all this stuff to

972

00:32:21,029 --> 00:32:19,279

happen you know it's it's cloud-based

973

00:32:23,509 --> 00:32:21,039

and it leverages a lot of best practices

974

00:32:25,350 --> 00:32:23,519

in the software industry um with our

975

00:32:26,549 --> 00:32:25,360

knowledge and expertise at nasa for air

976  
00:32:28,470 --> 00:32:26,559  
traffic management right how do you

977  
00:32:30,310 --> 00:32:28,480  
marry those two things and that's really

978  
00:32:32,470 --> 00:32:30,320  
uh what what we were looking at

979  
00:32:34,630 --> 00:32:32,480  
and joey won't admit this but he was the

980  
00:32:36,710 --> 00:32:34,640  
brains behind the the utm project and i

981  
00:32:38,470 --> 00:32:36,720  
would say that joey and his team most

982  
00:32:39,830 --> 00:32:38,480  
recently won the nasa software of the

983  
00:32:41,669 --> 00:32:39,840  
year award so that's actually kind of a

984  
00:32:43,430 --> 00:32:41,679  
big deal so give joey a shout out for

985  
00:32:44,870 --> 00:32:43,440  
that thank you yeah we have a lot of

986  
00:32:46,389 --> 00:32:44,880  
brains on the project which is great

987  
00:32:48,070 --> 00:32:46,399  
right that's how you make it successful

988  
00:32:49,110 --> 00:32:48,080

you need a lot of perspectives having a

989

00:32:51,029 --> 00:32:49,120

lot of people with a lot of different

990

00:32:51,990 --> 00:32:51,039

backgrounds to come to that is how you

991

00:32:53,350 --> 00:32:52,000

kind of get to these innovative

992

00:32:55,269 --> 00:32:53,360

solutions and nasa is a great place to

993

00:32:58,549 --> 00:32:55,279

kind of allow that to happen yeah

994

00:33:00,389 --> 00:32:58,559

awesome congrats thanks

995

00:33:03,590 --> 00:33:00,399

um so

996

00:33:06,789 --> 00:33:03,600

what are some specific uh

997

00:33:08,870 --> 00:33:06,799

abilities you you gave the drones or the

998

00:33:10,549 --> 00:33:08,880

system um like you want to keep them

999

00:33:12,870 --> 00:33:10,559

keep them separate right

1000

00:33:14,950 --> 00:33:12,880

specific examples you know we had sort

1001  
00:33:16,549 --> 00:33:14,960  
of a clean sheet to begin thinking about

1002  
00:33:17,750 --> 00:33:16,559  
how to get this done yeah really again

1003  
00:33:19,110 --> 00:33:17,760  
it's a clean sheet with the

1004  
00:33:20,870 --> 00:33:19,120  
understanding of how the airspace works

1005  
00:33:22,310 --> 00:33:20,880  
and how the vehicles work right so with

1006  
00:33:24,149 --> 00:33:22,320  
those bounds what what do we want the

1007  
00:33:25,430 --> 00:33:24,159  
system to do one of the key things is

1008  
00:33:27,110 --> 00:33:25,440  
how do we help make sure the drones

1009  
00:33:29,029 --> 00:33:27,120  
don't run into each other right yeah for

1010  
00:33:30,950 --> 00:33:29,039  
starters build a system that helps them

1011  
00:33:32,149 --> 00:33:30,960  
stay safely separated you know to some

1012  
00:33:33,430 --> 00:33:32,159  
degree

1013  
00:33:34,630 --> 00:33:33,440

also how do we keep them separate from

1014

00:33:36,549 --> 00:33:34,640

traditional aviation how do we make sure

1015

00:33:38,310 --> 00:33:36,559

they don't fly into other aircraft right

1016

00:33:40,470 --> 00:33:38,320

can you build some system that helps

1017

00:33:41,590 --> 00:33:40,480

helps with that process you know one

1018

00:33:43,110 --> 00:33:41,600

layer of this isn't going to be the end

1019

00:33:44,950 --> 00:33:43,120

all and be all of all these answers but

1020

00:33:46,230 --> 00:33:44,960

how do we start this process of keeping

1021

00:33:48,870 --> 00:33:46,240

the airspace safe

1022

00:33:50,470 --> 00:33:48,880

um also how do we allow

1023

00:33:51,669 --> 00:33:50,480

folks that are doing these operations

1024

00:33:53,190 --> 00:33:51,679

and the vehicles that are doing is open

1025

00:33:55,029 --> 00:33:53,200

to be identifiable right we don't want

1026

00:33:56,470 --> 00:33:55,039

just rogue or unidentified objects

1027

00:33:58,310 --> 00:33:56,480

flying around the airspace people need

1028

00:33:59,669 --> 00:33:58,320

to know what's there right um to keep

1029

00:34:01,909 --> 00:33:59,679

the airspace again safe there's kind of

1030

00:34:03,430 --> 00:34:01,919

a security aspect to that as well

1031

00:34:05,350 --> 00:34:03,440

um and then how do you have some

1032

00:34:07,269 --> 00:34:05,360

priority for

1033

00:34:08,310 --> 00:34:07,279

important operations right so for

1034

00:34:10,149 --> 00:34:08,320

example

1035

00:34:12,550 --> 00:34:10,159

uh recently there was actually a drone

1036

00:34:13,589 --> 00:34:12,560

that delivered a human kidney uh for

1037

00:34:15,349 --> 00:34:13,599

transplant that was actually

1038

00:34:16,950 --> 00:34:15,359

transplanted into a person wow

1039

00:34:18,790 --> 00:34:16,960

successfully right

1040

00:34:20,950 --> 00:34:18,800

so that was demonstrated one one

1041

00:34:22,550 --> 00:34:20,960

important use case for drones oh yeah

1042

00:34:24,389 --> 00:34:22,560

how do we let that happen without being

1043

00:34:26,310 --> 00:34:24,399

hindered by drones that are delivering

1044

00:34:27,669 --> 00:34:26,320

hot dogs to people right we want to make

1045

00:34:29,750 --> 00:34:27,679

sure the hot dog drones get out of the

1046

00:34:32,389 --> 00:34:29,760

way right and let the kidney drone come

1047

00:34:33,430 --> 00:34:32,399

through right so that's just one example

1048

00:34:35,190 --> 00:34:33,440

here

1049

00:34:36,790 --> 00:34:35,200

so these these priority operations need

1050

00:34:38,069 --> 00:34:36,800

to be thought of as

1051  
00:34:39,589 --> 00:34:38,079  
important in the system as we designed

1052  
00:34:41,349 --> 00:34:39,599  
it out yeah there's a lot more of the

1053  
00:34:43,270 --> 00:34:41,359  
important class of operations you can

1054  
00:34:44,790 --> 00:34:43,280  
you can you can think about but the idea

1055  
00:34:46,470 --> 00:34:44,800  
is how do we make sure that that can

1056  
00:34:48,149 --> 00:34:46,480  
actually occur right and all of this can

1057  
00:34:49,909 --> 00:34:48,159  
occur right you'll get your hot dogs

1058  
00:34:53,190 --> 00:34:49,919  
you'll get it but after the kidney gets

1059  
00:34:54,869 --> 00:34:53,200  
delivered 30 seconds later

1060  
00:34:56,790 --> 00:34:54,879  
and i would actually add the services

1061  
00:34:58,710 --> 00:34:56,800  
that joey just laid out they are

1062  
00:35:00,310 --> 00:34:58,720  
extensible and applicable for any new

1063  
00:35:01,910 --> 00:35:00,320

entrant right so joey was talking about

1064

00:35:03,430 --> 00:35:01,920

how they were applied for

1065

00:35:05,510 --> 00:35:03,440

drones but yeah if you can think about

1066

00:35:07,270 --> 00:35:05,520

for these larger urban air mobility

1067

00:35:08,230 --> 00:35:07,280

vehicles for any new entrant your

1068

00:35:10,310 --> 00:35:08,240

zeppelin

1069

00:35:12,069 --> 00:35:10,320

these same tenants can be applied so

1070

00:35:14,390 --> 00:35:12,079

it's actually a really great foundation

1071

00:35:16,310 --> 00:35:14,400

for us to build off of and extend for

1072

00:35:18,630 --> 00:35:16,320

new entrants into our national airspace

1073

00:35:20,150 --> 00:35:18,640

yeah yeah it's so so clear how it right

1074

00:35:21,750 --> 00:35:20,160

supports the same things chabanjli is

1075

00:35:22,550 --> 00:35:21,760

working right right trying to make it

1076

00:35:23,910 --> 00:35:22,560

happen

1077

00:35:25,030 --> 00:35:23,920

the key thing is you know the current

1078

00:35:26,950 --> 00:35:25,040

system again air traffic controllers

1079

00:35:29,510 --> 00:35:26,960

don't want to be controlling a 40 pound

1080

00:35:30,950 --> 00:35:29,520

drone at 200 feet right they're not

1081

00:35:32,790 --> 00:35:30,960

they have enough to do with the big

1082

00:35:35,510 --> 00:35:32,800

aircraft right they don't want to hire

1083

00:35:37,109 --> 00:35:35,520

ten thousand more operators to watch you

1084

00:35:38,470 --> 00:35:37,119

know all of these traffic single drones

1085

00:35:39,750 --> 00:35:38,480

so again kind of this is the automation

1086

00:35:41,109 --> 00:35:39,760

of the air space and allowing these new

1087

00:35:43,670 --> 00:35:41,119

entrants and again a lot of these things

1088

00:35:46,069 --> 00:35:43,680

will translate over to uh this this air

1089

00:35:47,349 --> 00:35:46,079

taxi urban air mobility world yeah

1090

00:35:48,550 --> 00:35:47,359

finding out how much of that transfer is

1091

00:35:50,230 --> 00:35:48,560

over how much it has to change a little

1092

00:35:52,069 --> 00:35:50,240

bit but we have a foundation to start

1093

00:35:54,230 --> 00:35:52,079

with totally yeah yeah so that kind of

1094

00:35:56,230 --> 00:35:54,240

answers uh johnnycd25's question here

1095

00:35:58,870 --> 00:35:56,240

management will be autonomous and yes it

1096

00:36:00,870 --> 00:35:58,880

will be autonomous it will have

1097

00:36:02,150 --> 00:36:00,880

autonomous aspects right it doesn't mean

1098

00:36:04,630 --> 00:36:02,160

you just push a button and the airspace

1099

00:36:06,950 --> 00:36:04,640

is completely uh free to go um and the

1100

00:36:08,870 --> 00:36:06,960

autonomous the the autonomous nature of

1101  
00:36:10,230 --> 00:36:08,880  
it will increase over time right you

1102  
00:36:12,790 --> 00:36:10,240  
know when you get started you only have

1103  
00:36:14,310 --> 00:36:12,800  
so many operations and you might have a

1104  
00:36:15,990 --> 00:36:14,320  
good amount of human supervision but

1105  
00:36:18,069 --> 00:36:16,000  
then as things scale out how much of

1106  
00:36:20,230 --> 00:36:18,079  
that can be automated and making sure

1107  
00:36:22,870 --> 00:36:20,240  
you do it again in a safe way yeah it's

1108  
00:36:24,230 --> 00:36:22,880  
more of like a continuum right so it's

1109  
00:36:25,910 --> 00:36:24,240  
there's going to be pieces of it that

1110  
00:36:27,670 --> 00:36:25,920  
are automated some functions and then

1111  
00:36:29,829 --> 00:36:27,680  
how does that can how's that continuum

1112  
00:36:31,430 --> 00:36:29,839  
grow as well right over time yeah make

1113  
00:36:34,150 --> 00:36:31,440

sense yeah building up on it right

1114

00:36:36,390 --> 00:36:34,160

exactly yeah so uh the drone traffic

1115

00:36:39,030 --> 00:36:36,400

management system what does it look like

1116

00:36:40,390 --> 00:36:39,040

or feel like for a user a pilot like if

1117

00:36:42,150 --> 00:36:40,400

i want to fly my drone what am i going

1118

00:36:43,589 --> 00:36:42,160

to see yeah in the future hopefully it

1119

00:36:45,510 --> 00:36:43,599

would be very transparent it shouldn't

1120

00:36:47,670 --> 00:36:45,520

be a big burden to actually use the

1121

00:36:49,430 --> 00:36:47,680

system um so there's actually a layer

1122

00:36:51,030 --> 00:36:49,440

between you and the airspace and it

1123

00:36:52,870 --> 00:36:51,040

would be kind of a service provider to

1124

00:36:54,230 --> 00:36:52,880

get into the airspace almost like a cell

1125

00:36:55,589 --> 00:36:54,240

service provider right if you want to

1126

00:36:57,030 --> 00:36:55,599

make phone calls you have a sales

1127

00:36:59,510 --> 00:36:57,040

service provider and yeah you can talk

1128

00:37:00,710 --> 00:36:59,520

to other cell service providers cleanly

1129

00:37:02,069 --> 00:37:00,720

so you would have one of those providers

1130

00:37:03,430 --> 00:37:02,079

that get you access to the airspace

1131

00:37:05,030 --> 00:37:03,440

right you would tell them what you want

1132

00:37:06,310 --> 00:37:05,040

to do maybe your intent i want to fly

1133

00:37:07,510 --> 00:37:06,320

from here to here and i want to do it

1134

00:37:09,030 --> 00:37:07,520

about this time

1135

00:37:10,310 --> 00:37:09,040

the idea is that these service providers

1136

00:37:11,109 --> 00:37:10,320

share that information amongst each

1137

00:37:12,470 --> 00:37:11,119

other

1138

00:37:14,550 --> 00:37:12,480

they do what's necessary to keep the

1139

00:37:16,710 --> 00:37:14,560

airspace safe and be conflicted and

1140

00:37:18,870 --> 00:37:16,720

messages flowing that need to flow and

1141

00:37:20,390 --> 00:37:18,880

you as a pilot just take care of your

1142

00:37:22,310 --> 00:37:20,400

mission right you just fly your

1143

00:37:23,750 --> 00:37:22,320

operation how much of that operation is

1144

00:37:25,349 --> 00:37:23,760

automated and not automated you know

1145

00:37:27,990 --> 00:37:25,359

that depends in the future how far you

1146

00:37:30,069 --> 00:37:28,000

go uh but a pilot would be in charge of

1147

00:37:31,750 --> 00:37:30,079

that operation and would do it cleanly

1148

00:37:33,349 --> 00:37:31,760

and receive information back from these

1149

00:37:34,950 --> 00:37:33,359

service providers about any changes in

1150

00:37:37,030 --> 00:37:34,960

the airspace or things you need to know

1151

00:37:38,950 --> 00:37:37,040

right like there's a storm coming up

1152

00:37:40,390 --> 00:37:38,960

exactly there's an emergency operation

1153

00:37:41,990 --> 00:37:40,400

that's right yeah that kidney's coming

1154

00:37:43,270 --> 00:37:42,000

through right yeah

1155

00:37:44,390 --> 00:37:43,280

out of the way

1156

00:37:46,230 --> 00:37:44,400

yeah yeah

1157

00:37:47,829 --> 00:37:46,240

yeah no i know something and now i'm

1158

00:37:49,829 --> 00:37:47,839

just going to add that i think

1159

00:37:51,910 --> 00:37:49,839

there's the whole host of different

1160

00:37:53,990 --> 00:37:51,920

types of operations um

1161

00:37:56,230 --> 00:37:54,000

it kind of lends itself to setting up

1162

00:37:58,230 --> 00:37:56,240

different missions right and then i'd

1163

00:37:59,829 --> 00:37:58,240

also add that the tools and the

1164

00:38:02,470 --> 00:37:59,839

technologies and the integration with

1165

00:38:04,710 --> 00:38:02,480

the partners that was built up under utm

1166

00:38:06,870 --> 00:38:04,720

i think is a great model they interface

1167

00:38:09,190 --> 00:38:06,880

with a whole host of industry partners

1168

00:38:10,790 --> 00:38:09,200

along with the faa and that same model

1169

00:38:12,550 --> 00:38:10,800

of collaborative innovation is what

1170

00:38:13,670 --> 00:38:12,560

we're aiming for yeah yeah that makes

1171

00:38:16,550 --> 00:38:13,680

sense

1172

00:38:19,589 --> 00:38:16,560

and uh i wanted to go back to

1173

00:38:20,950 --> 00:38:19,599

earlier you somebody asked about um

1174

00:38:22,150 --> 00:38:20,960

like traffic lights or so i forget what

1175

00:38:23,910 --> 00:38:22,160

the question was we were saying there

1176

00:38:25,670 --> 00:38:23,920

would be digital traffic lights right

1177

00:38:27,589 --> 00:38:25,680

not physical things up in the sky but

1178

00:38:29,349 --> 00:38:27,599

you've told me that we can think of the

1179

00:38:31,270 --> 00:38:29,359

drone traffic management as like rules

1180

00:38:32,790 --> 00:38:31,280

of the road that we know when driving

1181

00:38:34,710 --> 00:38:32,800

right yeah

1182

00:38:36,069 --> 00:38:34,720

you know we think about driving today

1183

00:38:37,510 --> 00:38:36,079

the folks that are driving in general

1184

00:38:39,510 --> 00:38:37,520

you hope and expect that they know the

1185

00:38:41,190 --> 00:38:39,520

rules of the road right they know yeah

1186

00:38:42,630 --> 00:38:41,200

what a red light means they knew what to

1187

00:38:44,390 --> 00:38:42,640

do when you both come to a stop sign at

1188

00:38:45,750 --> 00:38:44,400

the same time they know how fast you can

1189

00:38:48,069 --> 00:38:45,760

go on the freeway and how to change

1190

00:38:50,470 --> 00:38:48,079

lanes those kind of things don't exist

1191

00:38:51,910 --> 00:38:50,480

for drone traffic right so how do what

1192

00:38:53,990 --> 00:38:51,920

are those procedures what are those

1193

00:38:56,069 --> 00:38:54,000

rules who has the right-of-way in

1194

00:38:57,109 --> 00:38:56,079

certain scenarios and how do you share

1195

00:38:58,710 --> 00:38:57,119

that information and make sure that

1196

00:39:00,550 --> 00:38:58,720

everyone's aware of the same rule set

1197

00:39:01,910 --> 00:39:00,560

and those sorts of things so that is a

1198

00:39:03,030 --> 00:39:01,920

lot of the research we do as well so

1199

00:39:04,790 --> 00:39:03,040

that's really the drone traffic

1200

00:39:06,790 --> 00:39:04,800

management system it's you know defining

1201

00:39:08,069 --> 00:39:06,800

those roads the procedures uh making

1202

00:39:10,150 --> 00:39:08,079

sure everyone's checked out on all those

1203

00:39:12,870 --> 00:39:10,160

things to enable all these operations to

1204

00:39:13,829 --> 00:39:12,880

happen yeah yeah that's a good question

1205

00:39:15,109 --> 00:39:13,839

and you have on your phone it tells you

1206

00:39:16,310 --> 00:39:15,119

when there's a traffic jam ahead right

1207

00:39:17,430 --> 00:39:16,320

so that's the next level of services

1208

00:39:19,030 --> 00:39:17,440

right and that would be part of the

1209

00:39:21,670 --> 00:39:19,040

ecosystem as well oh there is weather

1210

00:39:23,670 --> 00:39:21,680

ahead or there is a

1211

00:39:25,829 --> 00:39:23,680

a lot of drones over here so maybe you

1212

00:39:27,270 --> 00:39:25,839

should go over there right sharing data

1213

00:39:28,710 --> 00:39:27,280

so that you can make those decisions

1214

00:39:30,390 --> 00:39:28,720

yeah awesome yeah yeah that's really

1215

00:39:32,950 --> 00:39:30,400

clear cool oh we have a question here

1216

00:39:35,109 --> 00:39:32,960

from uh trindane uh will these drones

1217

00:39:36,069 --> 00:39:35,119

have an option for multitasking for

1218

00:39:37,670 --> 00:39:36,079

example

1219

00:39:39,829 --> 00:39:37,680

the drone could be delivering a kidney

1220

00:39:40,829 --> 00:39:39,839

and also acting as a traffic

1221

00:39:42,390 --> 00:39:40,839

camera and

1222

00:39:44,310 --> 00:39:42,400

route

1223

00:39:45,670 --> 00:39:44,320

so will they have like different yeah i

1224

00:39:46,790 --> 00:39:45,680

think the person waiting for the kidney

1225

00:39:48,630 --> 00:39:46,800

would hope maybe

1226

00:39:51,109 --> 00:39:48,640

it's focused on the kidney

1227

00:39:52,870 --> 00:39:51,119

and not doing this but in general yeah

1228

00:39:54,310 --> 00:39:52,880

it's all about the vehicle capabilities

1229

00:39:55,109 --> 00:39:54,320

right what did they design the vehicle

1230

00:39:57,109 --> 00:39:55,119

to do

1231

00:39:59,190 --> 00:39:57,119

and the idea with our research with

1232

00:40:00,390 --> 00:39:59,200

traffic management and and and all those

1233

00:40:02,230 --> 00:40:00,400

sorts of things how do we make sure we

1234

00:40:03,670 --> 00:40:02,240

don't cut off any of those use cases how

1235

00:40:04,870 --> 00:40:03,680

do we make sure we enable folks to do

1236

00:40:06,309 --> 00:40:04,880

the things they need and want to do in

1237

00:40:07,910 --> 00:40:06,319

the airspace safely

1238

00:40:09,670 --> 00:40:07,920

um so yes

1239

00:40:12,470 --> 00:40:09,680

and we have looked at drones being

1240

00:40:14,390 --> 00:40:12,480

repurposed in route right you may be

1241

00:40:15,670 --> 00:40:14,400

doing regular traffic surveillance but

1242

00:40:16,630 --> 00:40:15,680

then maybe there's a search and rescue

1243

00:40:18,230 --> 00:40:16,640

thing that has to happen and that drone

1244

00:40:19,910 --> 00:40:18,240

could be repurposed in flight and take

1245

00:40:21,990 --> 00:40:19,920

off and do something so this idea of

1246

00:40:23,829 --> 00:40:22,000

repurposing is definitely out there yeah

1247

00:40:26,470 --> 00:40:23,839

and i would say for whether it's single

1248

00:40:27,829 --> 00:40:26,480

task or repurposing or multitasks you

1249

00:40:29,910 --> 00:40:27,839

know what you need is a secure

1250

00:40:31,510 --> 00:40:29,920

communication navigation platform right

1251  
00:40:34,390 --> 00:40:31,520  
so you have to be able to communicate to

1252  
00:40:35,829 --> 00:40:34,400  
that that vehicle that drone or that uam

1253  
00:40:38,470 --> 00:40:35,839  
and be able to have that communication

1254  
00:40:40,230 --> 00:40:38,480  
be secure and that's i think as you have

1255  
00:40:42,230 --> 00:40:40,240  
multiple tasks that still is the

1256  
00:40:44,550 --> 00:40:42,240  
foundation is how do you have safe and

1257  
00:40:46,069 --> 00:40:44,560  
efficient operations right

1258  
00:40:48,390 --> 00:40:46,079  
yeah cool

1259  
00:40:50,230 --> 00:40:48,400  
so this year you guys actually had a big

1260  
00:40:52,309 --> 00:40:50,240  
milestone year right

1261  
00:40:55,109 --> 00:40:52,319  
tell us about what went down right i

1262  
00:40:57,030 --> 00:40:55,119  
mean we've been doing this since uh 2014

1263  
00:40:58,790 --> 00:40:57,040

you know uh researching this drone

1264

00:41:01,430 --> 00:40:58,800

traffic management system and we've been

1265

00:41:03,510 --> 00:41:01,440

kind of building up in complexity of the

1266

00:41:05,430 --> 00:41:03,520

kind of cases that you can handle so

1267

00:41:08,230 --> 00:41:05,440

when we got to this summer we actually

1268

00:41:09,109 --> 00:41:08,240

executed a a flight test to demonstrate

1269

00:41:11,589 --> 00:41:09,119

the

1270

00:41:14,150 --> 00:41:11,599

have and we did that in urban

1271

00:41:16,390 --> 00:41:14,160

environment so we flew in downtown reno

1272

00:41:18,790 --> 00:41:16,400

and we flew in corpus christi texas

1273

00:41:22,230 --> 00:41:18,800

with the help of the faa test sites at

1274

00:41:25,190 --> 00:41:22,240

those areas and many many partners doing

1275

00:41:26,630 --> 00:41:25,200

that with us right um and and showing

1276

00:41:27,990 --> 00:41:26,640

how the system would work in an urban

1277

00:41:29,430 --> 00:41:28,000

environment and finding out where the

1278

00:41:31,190 --> 00:41:29,440

limits are where the gaps are and where

1279

00:41:32,630 --> 00:41:31,200

it works really well uh that's what we

1280

00:41:33,990 --> 00:41:32,640

did this summer and that was a really

1281

00:41:36,630 --> 00:41:34,000

exciting time for us that's awesome yeah

1282

00:41:37,829 --> 00:41:36,640

you guys got video of that didn't you oh

1283

00:41:39,670 --> 00:41:37,839

yeah we probably have some can you tell

1284

00:41:41,430 --> 00:41:39,680

us about it if we can sure oh yeah

1285

00:41:43,510 --> 00:41:41,440

you're looking at reno here you're

1286

00:41:45,030 --> 00:41:43,520

looking at a couple of drones uh taken

1287

00:41:46,630 --> 00:41:45,040

off from the top of a building and you

1288

00:41:47,910 --> 00:41:46,640

can see they're flying near the casinos

1289

00:41:49,589 --> 00:41:47,920

and they're coming really close to each

1290

00:41:51,589 --> 00:41:49,599

other they're actually more space than

1291

00:41:53,430 --> 00:41:51,599

you can tell from the ground here and

1292

00:41:55,510 --> 00:41:53,440

the key thing is that the two pilots for

1293

00:41:56,870 --> 00:41:55,520

those vehicles know what the other one

1294

00:41:58,390 --> 00:41:56,880

is doing because they've been sharing

1295

00:42:00,069 --> 00:41:58,400

information you can see one holding up

1296

00:42:01,430 --> 00:42:00,079

here while another one passes by again

1297

00:42:02,710 --> 00:42:01,440

that's the rules of the road stuff we

1298

00:42:04,390 --> 00:42:02,720

were talking about

1299

00:42:05,990 --> 00:42:04,400

um so testing all those concepts and

1300

00:42:08,710 --> 00:42:06,000

here you see kind of a mission control

1301

00:42:11,349 --> 00:42:08,720

center with folks from nasa as well as

1302

00:42:13,750 --> 00:42:11,359

the nevada test site working together to

1303

00:42:16,790 --> 00:42:13,760

execute these these activities

1304

00:42:18,390 --> 00:42:16,800

sweet interesting so you were not the

1305

00:42:21,109 --> 00:42:18,400

only one there were you joey

1306

00:42:23,670 --> 00:42:21,119

you guys you both of you yeah i had the

1307

00:42:25,990 --> 00:42:23,680

chance to go out and observe the utm uh

1308

00:42:28,309 --> 00:42:26,000

tests both in reno and texas and i would

1309

00:42:29,990 --> 00:42:28,319

say seeing the drones flying in that

1310

00:42:32,390 --> 00:42:30,000

urban environment

1311

00:42:35,349 --> 00:42:32,400

really makes it tangible right this is a

1312

00:42:38,470 --> 00:42:35,359

reality that's coming fairly soon to see

1313

00:42:40,390 --> 00:42:38,480

how it's a combination of software

1314

00:42:42,550 --> 00:42:40,400

they leverage cloud services plus the

1315

00:42:44,550 --> 00:42:42,560

drone technology plus the interplay of

1316

00:42:46,870 --> 00:42:44,560

the folks on the ground you really see

1317

00:42:48,710 --> 00:42:46,880

what joey was referring to as earlier as

1318

00:42:50,550 --> 00:42:48,720

kind of the national airspace kind of in

1319

00:42:52,470 --> 00:42:50,560

a miniature version running in these

1320

00:42:53,190 --> 00:42:52,480

field trials which is great to see and

1321

00:42:56,790 --> 00:42:53,200

it

1322

00:42:58,630 --> 00:42:56,800

understand what are still some of the

1323

00:43:00,550 --> 00:42:58,640

major questions that we have to address

1324

00:43:02,790 --> 00:43:00,560

so all the data that's collected from

1325

00:43:05,430 --> 00:43:02,800

these uh demonstrations is really i

1326  
00:43:07,349 --> 00:43:05,440  
think very valuable oh yeah i know that

1327  
00:43:09,910 --> 00:43:07,359  
yeah what was your experience like

1328  
00:43:11,430 --> 00:43:09,920  
tiffany well so i seem to remember the

1329  
00:43:13,670 --> 00:43:11,440  
engine or anything like that so i was

1330  
00:43:15,030 --> 00:43:13,680  
going to cover and help them amplify you

1331  
00:43:16,790 --> 00:43:15,040  
know the research that they're doing for

1332  
00:43:19,109 --> 00:43:16,800  
the public but i mean i would say reno

1333  
00:43:20,390 --> 00:43:19,119  
was cold and then texas was very very

1334  
00:43:22,550 --> 00:43:20,400  
hot

1335  
00:43:24,390 --> 00:43:22,560  
um but i would say you know it was

1336  
00:43:26,950 --> 00:43:24,400  
really a great experience to see the

1337  
00:43:28,870 --> 00:43:26,960  
team kind of just i feel like every test

1338  
00:43:30,470 --> 00:43:28,880

day was different um they learned

1339

00:43:32,790 --> 00:43:30,480

something one day and they applied it

1340

00:43:34,630 --> 00:43:32,800

the next day and even when there were

1341

00:43:36,150 --> 00:43:34,640

challenges to see them all kind of come

1342

00:43:38,150 --> 00:43:36,160

together

1343

00:43:40,790 --> 00:43:38,160

fix come up with a plan fix it the next

1344

00:43:43,109 --> 00:43:40,800

day was was really great to see and to

1345

00:43:44,309 --> 00:43:43,119

have covered this project for like i

1346

00:43:46,870 --> 00:43:44,319

don't know three four years now it's

1347

00:43:48,710 --> 00:43:46,880

kind of like great to see you know

1348

00:43:50,630 --> 00:43:48,720

come together yeah this accomplishment

1349

00:43:52,630 --> 00:43:50,640

with them it's it was really really cool

1350

00:43:54,230 --> 00:43:52,640

that's awesome yeah so what would you

1351  
00:43:57,589 --> 00:43:54,240  
say you learned in the end from these

1352  
00:43:58,870 --> 00:43:57,599  
tests in downtown yeah reno uh

1353  
00:44:00,150 --> 00:43:58,880  
it sounds kind of silly to say out loud

1354  
00:44:01,670 --> 00:44:00,160  
but it was really important to know that

1355  
00:44:03,270 --> 00:44:01,680  
we learned that the system works it

1356  
00:44:04,870 --> 00:44:03,280  
works right you can actually you can

1357  
00:44:06,150 --> 00:44:04,880  
actually do the things we thought it

1358  
00:44:07,910 --> 00:44:06,160  
should be able to do right it helps

1359  
00:44:09,670 --> 00:44:07,920  
drones stay separate again it's not the

1360  
00:44:11,670 --> 00:44:09,680  
only layer of doing that right but it's

1361  
00:44:13,270 --> 00:44:11,680  
a key layer of doing that

1362  
00:44:14,630 --> 00:44:13,280  
you can make sure you have access for

1363  
00:44:16,150 --> 00:44:14,640

priority operations you can actually

1364

00:44:18,309 --> 00:44:16,160

identify the drones in the airspace

1365

00:44:21,109 --> 00:44:18,319

digitally and in other ways

1366

00:44:22,950 --> 00:44:21,119

um so all of those pieces were executed

1367

00:44:25,270 --> 00:44:22,960

in that in that airspace and the other

1368

00:44:26,870 --> 00:44:25,280

key thing is finding out more about what

1369

00:44:28,550 --> 00:44:26,880

it takes to fly in that environment

1370

00:44:30,630 --> 00:44:28,560

right like what kind of what kind of

1371

00:44:32,230 --> 00:44:30,640

things makes this hard right let's go

1372

00:44:33,990 --> 00:44:32,240

there and fly that and it's not again

1373

00:44:35,349 --> 00:44:34,000

it's not just flying one drone right a

1374

00:44:36,790 --> 00:44:35,359

lot of folks can demonstrate something

1375

00:44:38,550 --> 00:44:36,800

with with one drone a lot of folks have

1376

00:44:40,630 --> 00:44:38,560

done that with a lot of use cases

1377

00:44:42,230 --> 00:44:40,640

but bringing a full system out with many

1378

00:44:43,670 --> 00:44:42,240

stakeholders trying to collaboratively

1379

00:44:45,190 --> 00:44:43,680

manage this airspace and execute

1380

00:44:46,790 --> 00:44:45,200

missions is really important to do and

1381

00:44:48,309 --> 00:44:46,800

finding out where where more work needs

1382

00:44:49,349 --> 00:44:48,319

to be done and where things look like

1383

00:44:50,710 --> 00:44:49,359

they're solved right and that's what

1384

00:44:53,109 --> 00:44:50,720

these flight tests do for us right

1385

00:44:55,750 --> 00:44:53,119

perfect yeah and so what's next for the

1386

00:44:56,710 --> 00:44:55,760

drone traffic management project uh so a

1387

00:44:58,630 --> 00:44:56,720

lot of this you know we've been

1388

00:44:59,750 --> 00:44:58,640

continually handing off to the faa we

1389

00:45:01,589 --> 00:44:59,760

talk about a partnership they have but

1390

00:45:03,910 --> 00:45:01,599

it really is a tight partnership

1391

00:45:06,150 --> 00:45:03,920

we meet with them often uh probably more

1392

00:45:07,750 --> 00:45:06,160

often than they would like right

1393

00:45:09,670 --> 00:45:07,760

we're talking with with them quite often

1394

00:45:11,349 --> 00:45:09,680

to make sure we understand what the faa

1395

00:45:12,870 --> 00:45:11,359

is thinking about where this is going to

1396

00:45:14,790 --> 00:45:12,880

make sure that what we're our research

1397

00:45:16,550 --> 00:45:14,800

is tracking with that and maybe leading

1398

00:45:18,550 --> 00:45:16,560

it a little bit if we can

1399

00:45:20,790 --> 00:45:18,560

um but they're going to be executing a

1400

00:45:22,550 --> 00:45:20,800

pilot program as well a second part of a

1401  
00:45:24,230 --> 00:45:22,560  
previous pilot program and we want to

1402  
00:45:25,670 --> 00:45:24,240  
help them in that execution and really

1403  
00:45:27,589 --> 00:45:25,680  
that's about taking the technologies

1404  
00:45:29,670 --> 00:45:27,599  
that we've been developing with the faa

1405  
00:45:31,670 --> 00:45:29,680  
and our our industry partners and making

1406  
00:45:33,270 --> 00:45:31,680  
them real in the air space so it's an

1407  
00:45:34,630 --> 00:45:33,280  
important step in that direction so

1408  
00:45:37,510 --> 00:45:34,640  
we're gonna we're gonna keep going that

1409  
00:45:40,550 --> 00:45:37,520  
way all right excellent great we have a

1410  
00:45:42,950 --> 00:45:40,560  
question here from resonator games uh is

1411  
00:45:45,430 --> 00:45:42,960  
there any fundamental concept that those

1412  
00:45:47,190 --> 00:45:45,440  
in the private or commercial

1413  
00:45:51,430 --> 00:45:47,200

sector testing of the drone should be

1414

00:45:55,670 --> 00:45:53,829

there are so many pieces to this right

1415

00:45:56,470 --> 00:45:55,680

so a lot of folks

1416

00:45:59,829 --> 00:45:56,480

are

1417

00:46:01,349 --> 00:45:59,839

on the platform itself building you know

1418

00:46:02,470 --> 00:46:01,359

uh detecting a void sensor how do you

1419

00:46:03,589 --> 00:46:02,480

actually see things in the air space and

1420

00:46:05,990 --> 00:46:03,599

get out of their way

1421

00:46:08,230 --> 00:46:06,000

um and i think that continuing to push

1422

00:46:09,750 --> 00:46:08,240

all of those lanes is important i think

1423

00:46:11,349 --> 00:46:09,760

understanding the ecosystem as a whole

1424

00:46:13,270 --> 00:46:11,359

is also really important i think folks

1425

00:46:14,950 --> 00:46:13,280

that do work on

1426

00:46:16,630 --> 00:46:14,960

important sensors and it's important

1427

00:46:18,309 --> 00:46:16,640

platforms it's important for them to

1428

00:46:20,150 --> 00:46:18,319

also understand the ecosystem in which

1429

00:46:21,750 --> 00:46:20,160

those drones will operate so just trying

1430

00:46:23,109 --> 00:46:21,760

to keep pace and understand where the

1431

00:46:24,710 --> 00:46:23,119

research is heading and where the faa

1432

00:46:26,230 --> 00:46:24,720

has signaled things are going

1433

00:46:27,910 --> 00:46:26,240

um just trying to stay abreast of all

1434

00:46:29,670 --> 00:46:27,920

that stuff is really important makes

1435

00:46:30,790 --> 00:46:29,680

sense yeah yeah yeah

1436

00:46:32,950 --> 00:46:30,800

um

1437

00:46:35,270 --> 00:46:32,960

here's a comment on the drone traffic

1438

00:46:37,750 --> 00:46:35,280

management system maybe you can respond

1439

00:46:40,630 --> 00:46:37,760

twisted metals asks the pilot will be

1440

00:46:42,230 --> 00:46:40,640

watching a movie just like now 95 of the

1441

00:46:44,470 --> 00:46:42,240

time

1442

00:46:45,829 --> 00:46:44,480

so a drone pilot will be watching on

1443

00:46:47,030 --> 00:46:45,839

screen

1444

00:46:49,109 --> 00:46:47,040

will then i don't know i would love to

1445

00:46:50,550 --> 00:46:49,119

watch movies 95

1446

00:46:51,990 --> 00:46:50,560

i'm not sure

1447

00:46:55,030 --> 00:46:52,000

95 of

1448

00:46:57,270 --> 00:46:55,040

drone pilots i understand okay are they

1449

00:46:58,550 --> 00:46:57,280

watching their flight on screen oh i see

1450

00:47:00,309 --> 00:46:58,560

are they physically watching the

1451

00:47:01,910 --> 00:47:00,319

aircraft or are they watching some

1452

00:47:03,670 --> 00:47:01,920

representation of their operation on the

1453

00:47:05,430 --> 00:47:03,680

screen i guess that's the question yeah

1454

00:47:07,030 --> 00:47:05,440

i think it's more the latter right again

1455

00:47:08,870 --> 00:47:07,040

because we're trying to build a system

1456

00:47:10,950 --> 00:47:08,880

so that these vehicles can go beyond

1457

00:47:12,790 --> 00:47:10,960

visual line of sight of the operator the

1458

00:47:14,150 --> 00:47:12,800

pilot oh yes of course right so they're

1459

00:47:16,470 --> 00:47:14,160

not going to be able to just watch it in

1460

00:47:17,829 --> 00:47:16,480

the sky right right um and that's how

1461

00:47:19,030 --> 00:47:17,839

you enable all these business cases you

1462

00:47:20,710 --> 00:47:19,040

can't have someone watching the drone if

1463

00:47:22,950 --> 00:47:20,720

you're going to go deliver that thing

1464

00:47:24,630 --> 00:47:22,960

yeah you know five miles away you know

1465

00:47:26,390 --> 00:47:24,640

you can't have someone or a line of

1466

00:47:28,069 --> 00:47:26,400

someone's watching that so how do you

1467

00:47:29,829 --> 00:47:28,079

build a system that allows that so yeah

1468

00:47:32,309 --> 00:47:29,839

there would be some representation of

1469

00:47:33,910 --> 00:47:32,319

the operation occurring that the person

1470

00:47:35,829 --> 00:47:33,920

that's in charge of that operation would

1471

00:47:37,990 --> 00:47:35,839

have access to yeah it might be as

1472

00:47:39,910 --> 00:47:38,000

simple as a moving map with some alerts

1473

00:47:42,470 --> 00:47:39,920

that are coming on to it right something

1474

00:47:44,069 --> 00:47:42,480

like you'd see on your you know

1475

00:47:45,190 --> 00:47:44,079

for for your regular driving right

1476  
00:47:46,150 --> 00:47:45,200  
something that's letting you know where

1477  
00:47:47,510 --> 00:47:46,160  
you're going

1478  
00:47:48,950 --> 00:47:47,520  
or it could be more advanced right it

1479  
00:47:50,549 --> 00:47:48,960  
could be a 3d view it could be a first

1480  
00:47:52,150 --> 00:47:50,559  
person view really depends on the

1481  
00:47:53,589 --> 00:47:52,160  
mission and the environment you're

1482  
00:47:54,950 --> 00:47:53,599  
flying in and what the future rules

1483  
00:47:57,430 --> 00:47:54,960  
actually are to do that

1484  
00:47:58,870 --> 00:47:57,440  
so i guess yes

1485  
00:48:01,270 --> 00:47:58,880  
yeah i would add regardless of whether

1486  
00:48:02,870 --> 00:48:01,280  
it's a drone pilot or a pilot on board

1487  
00:48:04,230 --> 00:48:02,880  
one of these new types of vehicles

1488  
00:48:05,589 --> 00:48:04,240

there's going to be different ways of

1489

00:48:07,510 --> 00:48:05,599

interacting with the vehicle and

1490

00:48:09,349 --> 00:48:07,520

controlling the vehicle just as

1491

00:48:11,030 --> 00:48:09,359

automation increases and

1492

00:48:12,549 --> 00:48:11,040

there's changes in how those vehicles

1493

00:48:14,950 --> 00:48:12,559

fly i think there's going to be some

1494

00:48:17,589 --> 00:48:14,960

changes in that traditional pilot flight

1495

00:48:19,270 --> 00:48:17,599

deck or cockpit relationship and how you

1496

00:48:21,030 --> 00:48:19,280

interface with that is going to change

1497

00:48:23,750 --> 00:48:21,040

and that's also another interesting area

1498

00:48:26,069 --> 00:48:23,760

of research um all the way from you know

1499

00:48:28,150 --> 00:48:26,079

human computer interface logic that goes

1500

00:48:30,870 --> 00:48:28,160

behind that as well as what button do i

1501

00:48:33,030 --> 00:48:30,880

push to land or take off or is there an

1502

00:48:36,390 --> 00:48:33,040

easy fly button right so there's all

1503

00:48:38,309 --> 00:48:36,400

kinds of new ways to engage with with

1504

00:48:40,069 --> 00:48:38,319

aircraft whether it's a drone or some of

1505

00:48:41,910 --> 00:48:40,079

these new vehicles i think that's a

1506

00:48:42,870 --> 00:48:41,920

really interesting area yeah i think one

1507

00:48:45,190 --> 00:48:42,880

of the key things we're seeing a lot of

1508

00:48:47,030 --> 00:48:45,200

research on from industry as well as you

1509

00:48:48,549 --> 00:48:47,040

know the nasa side is how do these

1510

00:48:50,549 --> 00:48:48,559

pilots maybe

1511

00:48:51,829 --> 00:48:50,559

control more than one of these right

1512

00:48:53,430 --> 00:48:51,839

does it have to be a one-to-one

1513

00:48:55,510 --> 00:48:53,440

relationship between one pilot and one

1514

00:48:57,829 --> 00:48:55,520

active operation or can you expand that

1515

00:48:59,829 --> 00:48:57,839

further right can you actually have

1516

00:49:02,549 --> 00:48:59,839

three people controlling eight vehicles

1517

00:49:03,829 --> 00:49:02,559

or can it be one controlling two like

1518

00:49:05,510 --> 00:49:03,839

what are the limits of that and what

1519

00:49:07,829 --> 00:49:05,520

tools need to exist in order to make

1520

00:49:09,750 --> 00:49:07,839

sure that again happens very safely yeah

1521

00:49:12,309 --> 00:49:09,760

yeah for sure

1522

00:49:16,470 --> 00:49:12,319

um we have a question here from uh

1523

00:49:18,390 --> 00:49:16,480

tomo101 is there any corporation uh with

1524

00:49:19,589 --> 00:49:18,400

autonomous car research i expect there

1525

00:49:21,510 --> 00:49:19,599

would be similar challenges and

1526  
00:49:23,829 --> 00:49:21,520  
opportunities for with communication and

1527  
00:49:25,750 --> 00:49:23,839  
control

1528  
00:49:28,309 --> 00:49:25,760  
so i think the same

1529  
00:49:30,470 --> 00:49:28,319  
principles of of autonomous car

1530  
00:49:32,069 --> 00:49:30,480  
autonomous vehicle self-driving cars

1531  
00:49:33,750 --> 00:49:32,079  
however you wish to call it some of

1532  
00:49:37,109 --> 00:49:33,760  
those same principles are i think

1533  
00:49:38,950 --> 00:49:37,119  
important in aviation as well so um what

1534  
00:49:41,510 --> 00:49:38,960  
can i understand what my environment is

1535  
00:49:43,589 --> 00:49:41,520  
presenting to me right so do i have some

1536  
00:49:45,589 --> 00:49:43,599  
awareness of what my environment is for

1537  
00:49:47,190 --> 00:49:45,599  
airplanes that would involve or aircraft

1538  
00:49:48,710 --> 00:49:47,200

and drones it would involve weather

1539

00:49:50,630 --> 00:49:48,720

right knowing

1540

00:49:52,870 --> 00:49:50,640

how strong your communication signal is

1541

00:49:55,349 --> 00:49:52,880

to your base operations but all of those

1542

00:49:57,190 --> 00:49:55,359

same types of of questions about

1543

00:49:59,270 --> 00:49:57,200

communication safe communication

1544

00:50:01,030 --> 00:49:59,280

reliable communication

1545

00:50:03,990 --> 00:50:01,040

understanding of the environment around

1546

00:50:05,270 --> 00:50:04,000

you being able to react appropriately to

1547

00:50:07,030 --> 00:50:05,280

the environment around you knowing the

1548

00:50:08,710 --> 00:50:07,040

rules of the road that joey kind of

1549

00:50:10,549 --> 00:50:08,720

reference whether you're actually on the

1550

00:50:12,470 --> 00:50:10,559

road or flying or flying in the air

1551  
00:50:14,390 --> 00:50:12,480  
those are all same principles that can

1552  
00:50:16,230 --> 00:50:14,400  
be simplified yeah

1553  
00:50:19,030 --> 00:50:16,240  
yeah it makes sense cool

1554  
00:50:20,309 --> 00:50:19,040  
um i want to jump back to another topic

1555  
00:50:22,150 --> 00:50:20,319  
that i want to make sure we don't miss

1556  
00:50:23,589 --> 00:50:22,160  
of course one of the coolest things i

1557  
00:50:26,549 --> 00:50:23,599  
recently learned about the urban air

1558  
00:50:28,230 --> 00:50:26,559  
mobility research is the simulation work

1559  
00:50:30,710 --> 00:50:28,240  
that you guys do yeah can you tell us

1560  
00:50:33,190 --> 00:50:30,720  
about that yeah sure so um you know i

1561  
00:50:35,109 --> 00:50:33,200  
think for all our twitch fans out there

1562  
00:50:37,589 --> 00:50:35,119  
you guys might have microsoft flight

1563  
00:50:38,549 --> 00:50:37,599

simulator have used that so just like

1564

00:50:41,750 --> 00:50:38,559

you could

1565

00:50:45,430 --> 00:50:41,760

emulate flying a cessna or a piper or

1566

00:50:47,750 --> 00:50:45,440

even like a 747 we have advanced flight

1567

00:50:49,589 --> 00:50:47,760

simulators here at ames they are kind of

1568

00:50:51,349 --> 00:50:49,599

a combination of flight simulators some

1569

00:50:53,270 --> 00:50:51,359

are fixed meaning they don't move and

1570

00:50:54,790 --> 00:50:53,280

some move and actually allow you to see

1571

00:50:56,549 --> 00:50:54,800

all feel all the forces that you would

1572

00:50:58,150 --> 00:50:56,559

experience like you were flying in in

1573

00:50:59,910 --> 00:50:58,160

real life amazing we have lots of

1574

00:51:01,990 --> 00:50:59,920

different kinds of simulators and it's

1575

00:51:03,990 --> 00:51:02,000

not just we have that fact that we have

1576  
00:51:06,230 --> 00:51:04,000  
those simulators it's that we have or

1577  
00:51:08,150 --> 00:51:06,240  
we're developing performance models for

1578  
00:51:09,670 --> 00:51:08,160  
these new types of vehicles so we can

1579  
00:51:10,870 --> 00:51:09,680  
understand how they actually fly right

1580  
00:51:13,270 --> 00:51:10,880  
right they don't exist yet so you have

1581  
00:51:14,950 --> 00:51:13,280  
to invent the right model of it right

1582  
00:51:16,950 --> 00:51:14,960  
exactly it's to take some concept

1583  
00:51:18,230 --> 00:51:16,960  
vehicles uh understand how these

1584  
00:51:20,309 --> 00:51:18,240  
vehicles would fly what would their

1585  
00:51:23,510 --> 00:51:20,319  
performance be and then how would they

1586  
00:51:25,589 --> 00:51:23,520  
actually fly in an emulated world in our

1587  
00:51:27,030 --> 00:51:25,599  
airspace and go through some of those

1588  
00:51:29,510 --> 00:51:27,040

same questions we've all been talking

1589

00:51:32,150 --> 00:51:29,520

about how do i interact with my controls

1590

00:51:34,470 --> 00:51:32,160

um do i have a joystick like i would for

1591

00:51:36,790 --> 00:51:34,480

a helicopter like a cyclic right or do i

1592

00:51:38,710 --> 00:51:36,800

have something else and what is that

1593

00:51:40,230 --> 00:51:38,720

mode of interaction those are questions

1594

00:51:41,510 --> 00:51:40,240

that we can also think about for these

1595

00:51:43,750 --> 00:51:41,520

simulators

1596

00:51:45,990 --> 00:51:43,760

along with how do i interface with some

1597

00:51:47,750 --> 00:51:46,000

new uh traffic management systems

1598

00:51:49,430 --> 00:51:47,760

specifically for my vehicles building

1599

00:51:50,870 --> 00:51:49,440

off the work that joey's been doing so

1600

00:51:52,790 --> 00:51:50,880

there's all kinds of different things we

1601  
00:51:54,069 --> 00:51:52,800  
can investigate with these simulators

1602  
00:51:55,510 --> 00:51:54,079  
right testing everything and how it

1603  
00:51:57,109 --> 00:51:55,520  
comes together right yeah exactly

1604  
00:51:58,470 --> 00:51:57,119  
exactly like what does this look like

1605  
00:51:59,589 --> 00:51:58,480  
yeah right and we're going to see what

1606  
00:52:00,950 --> 00:51:59,599  
this looks like

1607  
00:52:02,630 --> 00:52:00,960  
in a sense because you brought a video

1608  
00:52:04,790 --> 00:52:02,640  
with us with you right let's see that

1609  
00:52:06,150 --> 00:52:04,800  
simulation video and tell us what we're

1610  
00:52:09,030 --> 00:52:06,160  
seeing sure

1611  
00:52:11,109 --> 00:52:09,040  
this is going to be so this is a

1612  
00:52:12,870 --> 00:52:11,119  
video from one of our fixed based flight

1613  
00:52:15,030 --> 00:52:12,880

simulators so a flight simulator that

1614

00:52:17,589 --> 00:52:15,040

does not move this is one from one of

1615

00:52:20,150 --> 00:52:17,599

our researchers mike fury and his

1616

00:52:22,230 --> 00:52:20,160

simulator here you can see that it shows

1617

00:52:24,549 --> 00:52:22,240

a vehicle taking off vertically and now

1618

00:52:26,069 --> 00:52:24,559

it's moving forward in flight and what's

1619

00:52:27,750 --> 00:52:26,079

actually really interesting is some of

1620

00:52:28,630 --> 00:52:27,760

these vehicles as they move forward in

1621

00:52:30,309 --> 00:52:28,640

flight

1622

00:52:32,470 --> 00:52:30,319

have this transition period because you

1623

00:52:34,950 --> 00:52:32,480

have to transition from vertical takeoff

1624

00:52:36,950 --> 00:52:34,960

to forward flight and helicopters that

1625

00:52:38,150 --> 00:52:36,960

kind of occurs instantaneously but for

1626  
00:52:40,069 --> 00:52:38,160  
these vehicles you're going to have this

1627  
00:52:41,910 --> 00:52:40,079  
transition period and that's interesting

1628  
00:52:44,150 --> 00:52:41,920  
to kind of understand and now you can

1629  
00:52:45,750 --> 00:52:44,160  
see the vehicle flying in in urban

1630  
00:52:48,390 --> 00:52:45,760  
center in this case it's a model of san

1631  
00:52:50,870 --> 00:52:48,400  
francisco in our simulators we can model

1632  
00:52:52,790 --> 00:52:50,880  
almost any type of urban environment or

1633  
00:52:54,790 --> 00:52:52,800  
you know any landscape that we wish to

1634  
00:52:57,109 --> 00:52:54,800  
understand or understand the procedures

1635  
00:52:59,270 --> 00:52:57,119  
of flying how would i land how would i

1636  
00:53:00,710 --> 00:52:59,280  
come in for my approach these are some

1637  
00:53:02,790 --> 00:53:00,720  
of the things that we can explore so you

1638  
00:53:04,790 --> 00:53:02,800

can see this vehicle now coming in for

1639

00:53:06,549 --> 00:53:04,800

its approach and it's landing and this

1640

00:53:08,150 --> 00:53:06,559

is an interesting question as you come

1641

00:53:09,670 --> 00:53:08,160

in for your approach and you're landing

1642

00:53:11,349 --> 00:53:09,680

you can see that vehicle kind of pitch

1643

00:53:13,430 --> 00:53:11,359

up a little bit right so how does that

1644

00:53:15,750 --> 00:53:13,440

feel right so if joey and i were sitting

1645

00:53:17,589 --> 00:53:15,760

in the back with coffee's in hand yeah

1646

00:53:19,750 --> 00:53:17,599

would that coffee spill or kind of how

1647

00:53:22,309 --> 00:53:19,760

would we get a war me first yeah

1648

00:53:24,309 --> 00:53:22,319

yeah so understanding that passenger

1649

00:53:25,430 --> 00:53:24,319

experience is actually a really big part

1650

00:53:27,829 --> 00:53:25,440

of some of the work that these

1651  
00:53:30,390 --> 00:53:27,839  
simulators can do so it's not quite this

1652  
00:53:32,470 --> 00:53:30,400  
simulator but we have another motion

1653  
00:53:34,549 --> 00:53:32,480  
simulator that allows us to understand

1654  
00:53:36,309 --> 00:53:34,559  
what is the passion passenger experience

1655  
00:53:38,150 --> 00:53:36,319  
where the forces you feel like yeah what

1656  
00:53:40,390 --> 00:53:38,160  
does it feel like right i'm glad you're

1657  
00:53:42,470 --> 00:53:40,400  
here that's so cool i got sick on a

1658  
00:53:43,990 --> 00:53:42,480  
whale watch this year so i would like

1659  
00:53:46,950 --> 00:53:44,000  
you to find out i'm

1660  
00:53:48,549 --> 00:53:46,960  
going to get queasy

1661  
00:53:49,750 --> 00:53:48,559  
i'm going to let you figure it out first

1662  
00:53:51,430 --> 00:53:49,760  
for a while

1663  
00:53:52,790 --> 00:53:51,440

then i'll come sign up

1664

00:53:55,430 --> 00:53:52,800

for a test

1665

00:53:56,950 --> 00:53:55,440

so these simulators this this for me was

1666

00:53:59,030 --> 00:53:56,960

one of the coolest things i'd heard

1667

00:54:00,549 --> 00:53:59,040

about do you have a favorite aspect of

1668

00:54:03,030 --> 00:54:00,559

this research or what's a really cool

1669

00:54:04,790 --> 00:54:03,040

thing you want to share yeah so i'd say

1670

00:54:07,190 --> 00:54:04,800

the number of questions that this

1671

00:54:08,710 --> 00:54:07,200

research is kind of um highlighting is

1672

00:54:11,109 --> 00:54:08,720

really interesting and the fact that

1673

00:54:13,190 --> 00:54:11,119

it's this new era of aviation this new

1674

00:54:14,630 --> 00:54:13,200

mode of transportation is is very

1675

00:54:17,349 --> 00:54:14,640

exciting so

1676  
00:54:19,109 --> 00:54:17,359  
um as this technology kind of develops

1677  
00:54:20,710 --> 00:54:19,119  
and these these new vehicle

1678  
00:54:22,150 --> 00:54:20,720  
configurations come to life and we're

1679  
00:54:24,230 --> 00:54:22,160  
trying to explore them i think the

1680  
00:54:25,589 --> 00:54:24,240  
really interesting thing is that this is

1681  
00:54:27,750 --> 00:54:25,599  
um a

1682  
00:54:29,349 --> 00:54:27,760  
area of work that's going to continue so

1683  
00:54:30,630 --> 00:54:29,359  
all those folks that are interested in

1684  
00:54:32,710 --> 00:54:30,640  
understanding or maybe even

1685  
00:54:34,790 --> 00:54:32,720  
participating in this area have a chance

1686  
00:54:36,549 --> 00:54:34,800  
to really be part of it so people out

1687  
00:54:38,309 --> 00:54:36,559  
there have a chance to be part of this

1688  
00:54:39,670 --> 00:54:38,319

new era of transportation they can

1689

00:54:41,349 --> 00:54:39,680

actually be involved which i think is

1690

00:54:43,030 --> 00:54:41,359

really neat right yeah this is by no

1691

00:54:45,270 --> 00:54:43,040

means finished instead of right we said

1692

00:54:46,870 --> 00:54:45,280

right help exactly yeah awesome what

1693

00:54:48,710 --> 00:54:46,880

about you joey

1694

00:54:50,069 --> 00:54:48,720

uh

1695

00:54:52,309 --> 00:54:50,079

what what i'm looking forward to or what

1696

00:54:53,589 --> 00:54:52,319

i'm excited about yeah you know just

1697

00:54:55,109 --> 00:54:53,599

taking a step back and looking at it

1698

00:54:57,270 --> 00:54:55,119

from the outside we are getting a little

1699

00:54:58,630 --> 00:54:57,280

closer to being uh jetson's world right

1700

00:55:00,630 --> 00:54:58,640

this is almost like the jets were

1701  
00:55:02,230 --> 00:55:00,640  
talking about flying cars before yeah

1702  
00:55:03,030 --> 00:55:02,240  
you know we're still a few steps away

1703  
00:55:05,190 --> 00:55:03,040  
from

1704  
00:55:07,030 --> 00:55:05,200  
that but you know we're getting there

1705  
00:55:08,230 --> 00:55:07,040  
we're going to hopefully have some more

1706  
00:55:09,589 --> 00:55:08,240  
operations in the urban environment than

1707  
00:55:10,789 --> 00:55:09,599  
we had before right they're going to

1708  
00:55:12,950 --> 00:55:10,799  
happen safely they're going to get us

1709  
00:55:14,150 --> 00:55:12,960  
closer to exactly where we want to go uh

1710  
00:55:16,309 --> 00:55:14,160  
it's really it's really neat to see

1711  
00:55:17,589 --> 00:55:16,319  
that's totally cool yeah i know right

1712  
00:55:20,950 --> 00:55:17,599  
all right well we've got a bunch of

1713  
00:55:23,270 --> 00:55:20,960

questions piling up we do some more yeah

1714

00:55:25,430 --> 00:55:23,280

um so you were speaking about like the

1715

00:55:27,349 --> 00:55:25,440

passenger passenger experience and

1716

00:55:29,349 --> 00:55:27,359

things like that uh legit twitch channel

1717

00:55:31,349 --> 00:55:29,359

has a question will people be required

1718

00:55:34,630 --> 00:55:31,359

to wear parachutes what kind of safety

1719

00:55:37,430 --> 00:55:34,640

measures would uh be expecting oxygen

1720

00:55:39,190 --> 00:55:37,440

mass life jackets things like that yeah

1721

00:55:40,870 --> 00:55:39,200

i know i think that's a great question

1722

00:55:43,109 --> 00:55:40,880

and it raises the fact that as these

1723

00:55:45,750 --> 00:55:43,119

vehicles are getting certified there is

1724

00:55:47,829 --> 00:55:45,760

that aspect of ensuring safe operations

1725

00:55:49,750 --> 00:55:47,839

and in the case of off nominal events

1726  
00:55:51,510 --> 00:55:49,760  
ensuring that those folks on board have

1727  
00:55:53,910 --> 00:55:51,520  
the appropriate mechanisms to ensure

1728  
00:55:56,470 --> 00:55:53,920  
safety of life right so just like we

1729  
00:55:58,470 --> 00:55:56,480  
have um the safety briefing we all love

1730  
00:56:00,950 --> 00:55:58,480  
to sit and when we get when we go fly on

1731  
00:56:03,190 --> 00:56:00,960  
commercial aircraft there has to be some

1732  
00:56:05,109 --> 00:56:03,200  
think most likely similar for for

1733  
00:56:06,789 --> 00:56:05,119  
passenger carrying vehicles even if

1734  
00:56:09,270 --> 00:56:06,799  
they're urban air mobility vehicles so

1735  
00:56:11,349 --> 00:56:09,280  
safety is the number one concern for us

1736  
00:56:13,430 --> 00:56:11,359  
for the faa and for industry that's

1737  
00:56:15,190 --> 00:56:13,440  
developing these vehicles so there will

1738  
00:56:17,510 --> 00:56:15,200

most likely be something similar yeah we

1739

00:56:18,390 --> 00:56:17,520

just don't know quite what yet yeah yeah

1740

00:56:20,309 --> 00:56:18,400

awesome

1741

00:56:22,789 --> 00:56:20,319

um

1742

00:56:24,630 --> 00:56:22,799

johnny cz25

1743

00:56:27,510 --> 00:56:24,640

trying to pronounce these names it's a

1744

00:56:28,950 --> 00:56:27,520

struggle um well the

1745

00:56:31,109 --> 00:56:28,960

will it have aircraft cameras with

1746

00:56:32,950 --> 00:56:31,119

special software to create a landing

1747

00:56:35,750 --> 00:56:32,960

point

1748

00:56:39,030 --> 00:56:35,760

um i know that you have worked on

1749

00:56:40,470 --> 00:56:39,040

yeah landing so terrorism

1750

00:56:42,069 --> 00:56:40,480

there's uh there's a lot in that

1751  
00:56:44,710 --> 00:56:42,079  
question yeah i thought there might be

1752  
00:56:46,069 --> 00:56:44,720  
so yeah but

1753  
00:56:47,829 --> 00:56:46,079  
it speaks to the

1754  
00:56:50,150 --> 00:56:47,839  
number of ways you can accomplish things

1755  
00:56:52,230 --> 00:56:50,160  
right um so yes you even look at the

1756  
00:56:54,789 --> 00:56:52,240  
small drones they do have cameras of

1757  
00:56:56,950 --> 00:56:54,799  
different types that help identify if a

1758  
00:56:58,150 --> 00:56:56,960  
landing location is safe to land or not

1759  
00:56:59,910 --> 00:56:58,160  
because you can plan ahead of time i'm

1760  
00:57:01,030 --> 00:56:59,920  
going to land in this open field right

1761  
00:57:02,470 --> 00:57:01,040  
and i'm going to go there and i'm going

1762  
00:57:04,150 --> 00:57:02,480  
to land there and everything is good but

1763  
00:57:05,750 --> 00:57:04,160

you get there and there's a car there or

1764

00:57:07,349 --> 00:57:05,760

people are having a picnic right right

1765

00:57:08,950 --> 00:57:07,359

um do you have a system on board that

1766

00:57:11,510 --> 00:57:08,960

can help you identify that and then go

1767

00:57:13,510 --> 00:57:11,520

to an alternate location so some visual

1768

00:57:15,109 --> 00:57:13,520

technology is used to do that uh some of

1769

00:57:16,870 --> 00:57:15,119

that has been developed at nasa langley

1770

00:57:17,750 --> 00:57:16,880

for example uh to do those sorts of

1771

00:57:18,549 --> 00:57:17,760

things

1772

00:57:20,309 --> 00:57:18,559

um

1773

00:57:21,670 --> 00:57:20,319

and in general when they're planning

1774

00:57:23,270 --> 00:57:21,680

their operations there would be some

1775

00:57:24,630 --> 00:57:23,280

visualization probably of where they

1776

00:57:27,109 --> 00:57:24,640

would like to go and how they would like

1777

00:57:28,309 --> 00:57:27,119

to get there so you could put a point on

1778

00:57:29,750 --> 00:57:28,319

a screen and then that could be

1779

00:57:31,670 --> 00:57:29,760

translated into a flight plan and that

1780

00:57:33,430 --> 00:57:31,680

can be communicated to the system all

1781

00:57:35,190 --> 00:57:33,440

these things are things that uh are are

1782

00:57:37,349 --> 00:57:35,200

possible and we've seen examples of

1783

00:57:40,950 --> 00:57:37,359

already yeah yeah neat okay so you're

1784

00:57:42,549 --> 00:57:40,960

all over that working on that yeah um we

1785

00:57:43,589 --> 00:57:42,559

have a question here

1786

00:57:46,069 --> 00:57:43,599

um

1787

00:57:47,750 --> 00:57:46,079

good for you joy uh resonator game says

1788

00:57:50,069 --> 00:57:47,760

if you could snap your fingers and solve

1789

00:57:51,430 --> 00:57:50,079

one aspect of industrial drone flight

1790

00:57:55,829 --> 00:57:51,440

what would it be

1791

00:58:00,549 --> 00:57:57,750

i mean if you can solve the detect and

1792

00:58:02,390 --> 00:58:00,559

avoid problem for all vehicles in all

1793

00:58:04,390 --> 00:58:02,400

classes with a snap of a finger that

1794

00:58:06,069 --> 00:58:04,400

that would do a lot right so that that's

1795

00:58:07,589 --> 00:58:06,079

that's the solve the last layer of

1796

00:58:09,349 --> 00:58:07,599

safety right how do you make sure that i

1797

00:58:11,750 --> 00:58:09,359

see that thing that's coming at me and

1798

00:58:13,910 --> 00:58:11,760

it's very close and i get out of its way

1799

00:58:15,589 --> 00:58:13,920

that means one drone being able to

1800

00:58:17,829 --> 00:58:15,599

see another one coming and move each

1801  
00:58:19,430 --> 00:58:17,839  
drone could avoid the things it needs to

1802  
00:58:21,510 --> 00:58:19,440  
avoid whether they're static things on

1803  
00:58:22,870 --> 00:58:21,520  
the ground okay um maybe yesterday there

1804  
00:58:24,630 --> 00:58:22,880  
wasn't a crane there and today there is

1805  
00:58:26,870 --> 00:58:24,640  
a crane there right and that's not on my

1806  
00:58:28,309 --> 00:58:26,880  
maps right how do i detect that as well

1807  
00:58:30,150 --> 00:58:28,319  
as other things flying in the air

1808  
00:58:31,670 --> 00:58:30,160  
whether it's a traditional cessna with a

1809  
00:58:34,309 --> 00:58:31,680  
real pilot on board that can't see your

1810  
00:58:35,990 --> 00:58:34,319  
little drone yeah um or maybe doesn't

1811  
00:58:39,270 --> 00:58:36,000  
have the same maneuverability as an

1812  
00:58:41,030 --> 00:58:39,280  
urban air mobility vehicle uh how do how

1813  
00:58:42,789 --> 00:58:41,040

do these vehicles uh detect those

1814

00:58:44,549 --> 00:58:42,799

problems and then avoid them right if

1815

00:58:45,910 --> 00:58:44,559

you could solve that problem you you get

1816

00:58:47,109 --> 00:58:45,920

a long way towards a lot of the safety

1817

00:58:48,390 --> 00:58:47,119

questions that

1818

00:58:49,829 --> 00:58:48,400

need to be answered

1819

00:58:51,030 --> 00:58:49,839

yeah and there's a lot of ways to do

1820

00:58:52,150 --> 00:58:51,040

that and there's a lot of folks working

1821

00:58:54,069 --> 00:58:52,160

on that and there's some very good

1822

00:58:55,589 --> 00:58:54,079

solutions toward it uh but if it could

1823

00:58:57,109 --> 00:58:55,599

be universally solved that would be that

1824

00:58:58,390 --> 00:58:57,119

would be awesome

1825

00:59:01,109 --> 00:58:58,400

yeah sweet

1826  
00:59:03,349 --> 00:59:01,119  
um how about this one from hovercat will

1827  
00:59:06,870 --> 00:59:03,359  
the flight controllers and software

1828  
00:59:08,390 --> 00:59:06,880  
firmware be open source

1829  
00:59:10,710 --> 00:59:08,400  
something to think about yeah so that's

1830  
00:59:13,430 --> 00:59:10,720  
an interesting question um for some of

1831  
00:59:14,710 --> 00:59:13,440  
these vehicles your their manufacturers

1832  
00:59:16,789 --> 00:59:14,720  
that are developing some of these

1833  
00:59:18,390 --> 00:59:16,799  
vehicles are have a whole host of

1834  
00:59:20,230 --> 00:59:18,400  
configurations and some of them are

1835  
00:59:21,750 --> 00:59:20,240  
working with the traditional flight

1836  
00:59:23,270 --> 00:59:21,760  
management computers or flight

1837  
00:59:24,710 --> 00:59:23,280  
management systems that you have in

1838  
00:59:26,309 --> 00:59:24,720

commercial aircraft today and some are

1839

00:59:28,710 --> 00:59:26,319

some are new

1840

00:59:30,470 --> 00:59:28,720

you know depending on the safety cases

1841

00:59:32,470 --> 00:59:30,480

as well as the secure communication

1842

00:59:34,309 --> 00:59:32,480

piece that's required it might not be

1843

00:59:36,950 --> 00:59:34,319

quite open source but

1844

00:59:38,870 --> 00:59:36,960

just like we have simulators today that

1845

00:59:40,950 --> 00:59:38,880

help us understand the performance as

1846

00:59:42,470 --> 00:59:40,960

well as the controls for those vehicles

1847

00:59:43,990 --> 00:59:42,480

i'm sure that something similar will be

1848

00:59:45,829 --> 00:59:44,000

developed so that folks out there who

1849

00:59:47,910 --> 00:59:45,839

want to try them out or can want to fly

1850

00:59:50,390 --> 00:59:47,920

them in in their own simulator will be

1851  
00:59:52,470 --> 00:59:50,400  
able to do so but as as the industry is

1852  
00:59:55,109 --> 00:59:52,480  
developing their tools they're pulling

1853  
00:59:56,470 --> 00:59:55,119  
from um you know existing tools for for

1854  
00:59:57,829 --> 00:59:56,480  
flight controls today as well as

1855  
00:59:59,910 --> 00:59:57,839  
developing their own so it's kind of a

1856  
01:00:01,270 --> 00:59:59,920  
mixed bag right now okay neat and you

1857  
01:00:03,349 --> 01:00:01,280  
know for the small drones we're looking

1858  
01:00:05,510 --> 01:00:03,359  
at in in general everything should be

1859  
01:00:07,109 --> 01:00:05,520  
performance based can you do how can you

1860  
01:00:09,109 --> 01:00:07,119  
prove you can stay within the bounds of

1861  
01:00:11,349 --> 01:00:09,119  
a certain performance envelope okay and

1862  
01:00:13,349 --> 01:00:11,359  
i i know i can control my vehicle under

1863  
01:00:15,190 --> 01:00:13,359

all these conditions and i can

1864

01:00:17,030 --> 01:00:15,200

show you how i do that now that may mean

1865

01:00:19,109 --> 01:00:17,040

you use an open source

1866

01:00:19,990 --> 01:00:19,119

pieces or everything's open source or

1867

01:00:21,670 --> 01:00:20,000

not

1868

01:00:23,349 --> 01:00:21,680

i can't say that if there was a single

1869

01:00:25,190 --> 01:00:23,359

open source solution for a piece of that

1870

01:00:26,710 --> 01:00:25,200

and it was proven to

1871

01:00:28,630 --> 01:00:26,720

perform in a certain way then that would

1872

01:00:30,230 --> 01:00:28,640

be very valuable yeah but i don't think

1873

01:00:33,109 --> 01:00:30,240

it'll be a requirement that everyone

1874

01:00:34,789 --> 01:00:33,119

uses an open source particular element

1875

01:00:35,750 --> 01:00:34,799

okay yeah i see

1876

01:00:37,510 --> 01:00:35,760

um

1877

01:00:38,470 --> 01:00:37,520

another question here but you made me

1878

01:00:40,230 --> 01:00:38,480

think of it you mentioned the word

1879

01:00:42,150 --> 01:00:40,240

security so

1880

01:00:43,829 --> 01:00:42,160

legit twitch channel asks could drones

1881

01:00:45,589 --> 01:00:43,839

be subject to hackers will there be

1882

01:00:48,309 --> 01:00:45,599

security measures in place to repel

1883

01:00:50,309 --> 01:00:48,319

unwanted or harmful signals

1884

01:00:53,270 --> 01:00:50,319

uh so the answer to the first question

1885

01:00:54,630 --> 01:00:53,280

is yes definitely i mean any any

1886

01:00:57,190 --> 01:00:54,640

piece of

1887

01:00:59,030 --> 01:00:57,200

i.t technology right can be it's a

1888

01:01:00,069 --> 01:00:59,040

potentially right if it's not built

1889

01:01:02,950 --> 01:01:00,079

correctly

1890

01:01:05,510 --> 01:01:02,960

um so the answer is yes and again it's

1891

01:01:06,950 --> 01:01:05,520

part of not necessarily getting to

1892

01:01:08,710 --> 01:01:06,960

uh

1893

01:01:10,789 --> 01:01:08,720

you want to be as secure as possible at

1894

01:01:12,710 --> 01:01:10,799

all layers but in general we know that's

1895

01:01:14,549 --> 01:01:12,720

not likely to happen uh so how do you

1896

01:01:15,990 --> 01:01:14,559

build enough layers in

1897

01:01:17,990 --> 01:01:16,000

such that as you layer them all on top

1898

01:01:19,589 --> 01:01:18,000

of each other that overall the whole

1899

01:01:21,190 --> 01:01:19,599

thing stays secure right it's kind of a

1900

01:01:22,549 --> 01:01:21,200

swiss cheese approach they call if you

1901

01:01:23,750 --> 01:01:22,559

layer the swiss cheese in certain ways

1902

01:01:26,470 --> 01:01:23,760

you cover up all the holes you can't see

1903

01:01:28,150 --> 01:01:26,480

through it yeah right okay so um

1904

01:01:29,109 --> 01:01:28,160

yeah so in terms of cyber security i

1905

01:01:31,190 --> 01:01:29,119

think that's what you want to look at

1906

01:01:33,670 --> 01:01:31,200

with these drones uh so that even if a

1907

01:01:35,270 --> 01:01:33,680

given drone was hacked let's say that it

1908

01:01:36,789 --> 01:01:35,280

can't cause damage to the further system

1909

01:01:38,309 --> 01:01:36,799

or the folks on the ground does it have

1910

01:01:39,030 --> 01:01:38,319

other safety mechanisms to make sure

1911

01:01:42,470 --> 01:01:39,040

that

1912

01:01:44,309 --> 01:01:42,480

so there is a lot of work in cyber

1913

01:01:45,750 --> 01:01:44,319

security related to not just the drones

1914

01:01:47,430 --> 01:01:45,760

themselves but the traffic management

1915

01:01:48,549 --> 01:01:47,440

system as a whole that if that was

1916

01:01:49,430 --> 01:01:48,559

hacked that would be bad as well that's

1917

01:01:51,030 --> 01:01:49,440

right so how do you build all these

1918

01:01:52,710 --> 01:01:51,040

layers in yeah yeah

1919

01:01:54,789 --> 01:01:52,720

i think security has to be on the

1920

01:01:56,710 --> 01:01:54,799

vehicle itself the communication

1921

01:01:58,470 --> 01:01:56,720

protocols between the vehicles and their

1922

01:02:00,309 --> 01:01:58,480

operators so there's like joey was

1923

01:02:02,390 --> 01:02:00,319

saying multiple layers of security are

1924

01:02:04,230 --> 01:02:02,400

really required so anything that's

1925

01:02:05,829 --> 01:02:04,240

learned from the sphere of drones can be

1926

01:02:07,589 --> 01:02:05,839

obviously applied to other types of

1927

01:02:09,510 --> 01:02:07,599

vehicles as well so it's a question

1928

01:02:11,910 --> 01:02:09,520

that's i think applicable for all all

1929

01:02:13,430 --> 01:02:11,920

vehicles yeah yeah all right good and

1930

01:02:15,109 --> 01:02:13,440

general research-wise we like to

1931

01:02:16,549 --> 01:02:15,119

consider security a first class citizen

1932

01:02:18,069 --> 01:02:16,559

in the research process right it's not

1933

01:02:19,750 --> 01:02:18,079

something you tack on at the end

1934

01:02:21,349 --> 01:02:19,760

something you make sure you're thinking

1935

01:02:23,109 --> 01:02:21,359

about an engaging industry with and the

1936

01:02:24,950 --> 01:02:23,119

fa with and cyber security professionals

1937

01:02:25,990 --> 01:02:24,960

with as you build up the system because

1938

01:02:28,230 --> 01:02:26,000

you don't want to come up again with a

1939

01:02:29,589 --> 01:02:28,240

great technological solution that easily

1940

01:02:31,109 --> 01:02:29,599

hacked and the whole thing falls apart

1941

01:02:32,870 --> 01:02:31,119

right so you want to make sure it's

1942

01:02:36,230 --> 01:02:32,880

robust from the beginning yeah exactly

1943

01:02:39,029 --> 01:02:36,240

consider that all along the way yep yeah

1944

01:02:40,710 --> 01:02:39,039

um how

1945

01:02:42,950 --> 01:02:40,720

third i don't know i just totally

1946

01:02:44,710 --> 01:02:42,960

butchered your name so i'm so sorry um

1947

01:02:47,270 --> 01:02:44,720

how do you deal with increased radio

1948

01:02:50,309 --> 01:02:49,109

yeah so uh

1949

01:02:51,990 --> 01:02:50,319

there's probably a couple pieces of that

1950

01:02:52,950 --> 01:02:52,000

one is like overuse of a given channel

1951

01:02:54,710 --> 01:02:52,960

right there's just too many people

1952

01:02:57,029 --> 01:02:54,720

talking on a chat not talking right and

1953

01:02:58,069 --> 01:02:57,039

then there's also just kind of uh

1954

01:03:00,630 --> 01:02:58,079

a certain

1955

01:03:02,630 --> 01:03:00,640

uh band being overused for example

1956

01:03:03,589 --> 01:03:02,640

command control we talked about earlier

1957

01:03:05,349 --> 01:03:03,599

and that's one of the things we looked

1958

01:03:07,349 --> 01:03:05,359

at in our flight test in reno and corpus

1959

01:03:09,750 --> 01:03:07,359

christi was for these small drones

1960

01:03:11,990 --> 01:03:09,760

command control uh different different

1961

01:03:13,829 --> 01:03:12,000

uh radio frequencies we use when do they

1962

01:03:15,589 --> 01:03:13,839

get saturated when do you have problems

1963

01:03:17,109 --> 01:03:15,599

with them turns out if you you know if

1964

01:03:18,309 --> 01:03:17,119

you fly near an apartment building

1965

01:03:20,470 --> 01:03:18,319

there's a lot of people with wi-fi

1966

01:03:21,750 --> 01:03:20,480

routers and if you're

1967

01:03:23,589 --> 01:03:21,760

conflicting with that you may have

1968

01:03:25,029 --> 01:03:23,599

trouble communicating with your drone

1969

01:03:26,549 --> 01:03:25,039

these are really known issues but

1970

01:03:28,829 --> 01:03:26,559

actually kind of taking a look at it in

1971

01:03:31,829 --> 01:03:28,839

a real urban environment was important

1972

01:03:33,510 --> 01:03:31,839

yeah and i would kind of add to that um

1973

01:03:35,670 --> 01:03:33,520

you would have you would want to

1974

01:03:37,829 --> 01:03:35,680

understand what kind of concept would

1975

01:03:39,589 --> 01:03:37,839

not saturate like a radio frequency too

1976

01:03:41,910 --> 01:03:39,599

much so you want to ensure that any

1977

01:03:43,910 --> 01:03:41,920

concept that's being developed joey has

1978

01:03:45,750 --> 01:03:43,920

mentioned that air traffic controllers

1979

01:03:47,990 --> 01:03:45,760

may not want to be talking to every one

1980

01:03:49,910 --> 01:03:48,000

of those trainers every one of those uam

1981

01:03:52,069 --> 01:03:49,920

vehicles so that's part of the concept

1982

01:03:53,829 --> 01:03:52,079

so understanding hey how is this

1983

01:03:55,750 --> 01:03:53,839

actually going to work that's a really

1984

01:03:57,750 --> 01:03:55,760

important part of ensuring that we don't

1985

01:03:59,670 --> 01:03:57,760

saturate certain pieces that we know

1986

01:04:02,390 --> 01:03:59,680

have limits to them and that includes

1987

01:04:03,670 --> 01:04:02,400

spectrum as well as frequency so that's

1988

01:04:05,910 --> 01:04:03,680

those go that goes back to the

1989

01:04:07,910 --> 01:04:05,920

foundational research what's the concept

1990

01:04:11,029 --> 01:04:07,920

of operations yeah a lot of what you've

1991

01:04:13,270 --> 01:04:11,039

been saying today is plan for that right

1992

01:04:15,750 --> 01:04:13,280

challenge you know figure out what it is

1993

01:04:16,549 --> 01:04:15,760

today yeah and plan around it yeah

1994

01:04:17,589 --> 01:04:16,559

um

1995

01:04:19,430 --> 01:04:17,599

here's an

1996

01:04:21,670 --> 01:04:19,440

urban air mobility question from legit

1997

01:04:23,109 --> 01:04:21,680

twitch channel again could this research

1998

01:04:25,750 --> 01:04:23,119

eventually lead to people being able to

1999

01:04:27,270 --> 01:04:25,760

own and operate their own air taxi

2000

01:04:28,789 --> 01:04:27,280

do you think that's coming

2001

01:04:31,270 --> 01:04:28,799

yeah i think there's going to be lots of

2002

01:04:33,750 --> 01:04:31,280

different use cases and modes of flying

2003

01:04:36,150 --> 01:04:33,760

i think there's going to be cases where

2004

01:04:38,549 --> 01:04:36,160

some may be some folks may be able to

2005

01:04:40,870 --> 01:04:38,559

own their own vehicles most likely will

2006

01:04:43,109 --> 01:04:40,880

be a service like we use today

2007

01:04:45,430 --> 01:04:43,119

we've seen a big rise in service-based

2008

01:04:47,510 --> 01:04:45,440

technology right so we all use

2009

01:04:49,510 --> 01:04:47,520

whether it's vehicles or food delivery

2010

01:04:52,950 --> 01:04:49,520

services yes right so we've just seen

2011

01:04:55,190 --> 01:04:52,960

more of that coming along so most likely

2012

01:04:57,750 --> 01:04:55,200

urban air mobility will be accessible as

2013

01:04:59,510 --> 01:04:57,760

a surface service but who knows right we

2014

01:05:01,829 --> 01:04:59,520

can all maybe we can all really be the

2015

01:05:03,109 --> 01:05:01,839

jetsons so joey's vision of the future

2016

01:05:05,029 --> 01:05:03,119

may come to light

2017

01:05:07,190 --> 01:05:05,039

yeah like we're closed we're closer it's

2018

01:05:08,950 --> 01:05:07,200

funny i mentioned the jetsons and yet

2019

01:05:10,470 --> 01:05:08,960

like when i told my mom we were talking

2020

01:05:12,789 --> 01:05:10,480

about drones on the show today she said

2021

01:05:14,870 --> 01:05:12,799

oh like the bruce willis movie like

2022

01:05:17,190 --> 01:05:14,880

fifth element and i was like yeah mom

2023

01:05:19,109 --> 01:05:17,200

but way safer

2024

01:05:23,720 --> 01:05:19,119

check the show out

2025

01:05:23,730 --> 01:05:29,510

[Laughter]

2026

01:05:33,430 --> 01:05:31,589

what's your a reasonable tip for a

2027

01:05:36,309 --> 01:05:33,440

flying taxi driver

2028

01:05:38,710 --> 01:05:36,319

you're good practical information here

2029

01:05:40,710 --> 01:05:38,720

that's a great question so i would say

2030

01:05:42,549 --> 01:05:40,720

i go back to like the foundations what

2031

01:05:44,230 --> 01:05:42,559

is the national airspace you got to know

2032

01:05:46,150 --> 01:05:44,240

your rules of the road you have to know

2033

01:05:48,390 --> 01:05:46,160

your procedures you have to know your

2034

01:05:51,029 --> 01:05:48,400

safety and your certification aspects if

2035

01:05:52,230 --> 01:05:51,039

you know those right you can fly safely

2036

01:05:53,750 --> 01:05:52,240

and get to where you want to go from

2037

01:05:54,950 --> 01:05:53,760

point a to point b

2038

01:05:56,470 --> 01:05:54,960

but you have to have those foundations

2039

01:05:58,069 --> 01:05:56,480

just to get like a driver's license

2040

01:06:00,230 --> 01:05:58,079

before you operate right you've got to

2041

01:06:02,069 --> 01:06:00,240

have some sort of certification before

2042

01:06:04,150 --> 01:06:02,079

you before you fly right yeah for sure

2043

01:06:06,230 --> 01:06:04,160

yeah the old joke is what uh seabiscuit

2044

01:06:07,990 --> 01:06:06,240

in the third that's my tip right so

2045

01:06:09,190 --> 01:06:08,000

that's what

2046

01:06:11,270 --> 01:06:09,200

you guys actually understood that

2047

01:06:14,630 --> 01:06:11,280

question differently before i was taking

2048

01:06:16,150 --> 01:06:14,640

it i was going to say 10 15 like a tip

2049

01:06:18,470 --> 01:06:16,160

my hairdresser

2050

01:06:19,829 --> 01:06:18,480

what's the tip that's a good one i

2051

01:06:20,870 --> 01:06:19,839

didn't think about it that way right

2052

01:06:24,309 --> 01:06:20,880

because

2053

01:06:27,029 --> 01:06:24,319

we would be reasonable right in a ride

2054

01:06:29,190 --> 01:06:27,039

it's awkward but i must say i want all

2055

01:06:32,789 --> 01:06:29,200

of uh all of the advice that she finally

2056

01:06:36,150 --> 01:06:32,799

gave i want my driver yes he to that

2057

01:06:37,990 --> 01:06:36,160

well read up on all of that right right

2058

01:06:39,589 --> 01:06:38,000

all right well let's take a few more

2059

01:06:42,069 --> 01:06:39,599

yeah

2060

01:06:44,230 --> 01:06:42,079

uh we have uh joseph urban here says

2061

01:06:48,470 --> 01:06:44,240

will cargo air taxis be allowed to fly

2062

01:06:50,470 --> 01:06:48,480

autonomously before passenger air taxis

2063

01:06:52,710 --> 01:06:50,480

so um maybe joey and i will tag team

2064

01:06:55,109 --> 01:06:52,720

this one but i'll start i think

2065

01:06:56,549 --> 01:06:55,119

as autonomous applications

2066

01:06:58,230 --> 01:06:56,559

come forth

2067

01:06:59,670 --> 01:06:58,240

certification i go back to that because

2068

01:07:02,789 --> 01:06:59,680

that's also part of this how do you

2069

01:07:05,029 --> 01:07:02,799

certify an autonomous system right so

2070

01:07:06,789 --> 01:07:05,039

that's a question that we have um and

2071

01:07:08,470 --> 01:07:06,799

we're doing research to explore what

2072

01:07:10,870 --> 01:07:08,480

that means

2073

01:07:13,349 --> 01:07:10,880

generally folks do believe you know car

2074

01:07:14,789 --> 01:07:13,359

flying cargo may come before flying

2075

01:07:17,029 --> 01:07:14,799

passengers right just as a natural

2076

01:07:19,190 --> 01:07:17,039

progression but um there are still lots

2077

01:07:20,870 --> 01:07:19,200

of questions even if you're a cargo

2078

01:07:22,710 --> 01:07:20,880

autonomous flight

2079

01:07:24,950 --> 01:07:22,720

yeah no i totally agree i think uh the

2080

01:07:26,870 --> 01:07:24,960

cargo stuff is where we'll learn a lot

2081

01:07:29,190 --> 01:07:26,880

probably before the passenger stuff

2082

01:07:30,630 --> 01:07:29,200

but that's a somewhat separate question

2083

01:07:31,910 --> 01:07:30,640

from how autonomous they're allowed to

2084

01:07:33,670 --> 01:07:31,920

be in the air space how do they prove

2085

01:07:35,430 --> 01:07:33,680

that they can still stay safe you know

2086

01:07:37,589 --> 01:07:35,440

you have the benefit of not having

2087

01:07:39,029 --> 01:07:37,599

people on board but you still can't have

2088

01:07:40,870 --> 01:07:39,039

it doing bad things in the air space or

2089

01:07:42,309 --> 01:07:40,880

to anything on the ground right um so

2090

01:07:43,910 --> 01:07:42,319

there's a lot of questions to answer but

2091

01:07:46,950 --> 01:07:43,920

i would guess yeah a lot of the things

2092

01:07:48,870 --> 01:07:46,960

in cargo would happen prior to passenger

2093

01:07:50,150 --> 01:07:48,880

activity yeah it makes sense i think it

2094

01:07:51,750 --> 01:07:50,160

goes back to what you said joey it's

2095

01:07:53,190 --> 01:07:51,760

performance-based solution right so

2096

01:07:54,710 --> 01:07:53,200

let's understand the performance of

2097

01:07:56,230 --> 01:07:54,720

these vehicles and then how do we

2098

01:07:57,750 --> 01:07:56,240

integrate them into our national

2099

01:07:59,109 --> 01:07:57,760

airspace yeah those are still the

2100

01:08:01,510 --> 01:07:59,119

questions that need to be

2101

01:08:04,069 --> 01:08:01,520

resolved yeah always the same cool

2102

01:08:05,910 --> 01:08:04,079

here's a cool idea from spacetvnet

2103

01:08:08,950 --> 01:08:05,920

they're asking will augmented reality be

2104

01:08:10,710 --> 01:08:08,960

used to display virtual roads in the sky

2105

01:08:11,510 --> 01:08:10,720

could you do that yeah you definitely

2106

01:08:13,589 --> 01:08:11,520

can

2107

01:08:14,870 --> 01:08:13,599

we sort of have uh we've seen it and

2108

01:08:16,630 --> 01:08:14,880

we've done a little bit here as well

2109

01:08:18,630 --> 01:08:16,640

awesome and the roads you know it can be

2110

01:08:20,149 --> 01:08:18,640

as simple as just you know cylinders

2111

01:08:21,269 --> 01:08:20,159

that you know you have to stay within

2112

01:08:23,349 --> 01:08:21,279

okay but again when we're getting to

2113

01:08:24,789 --> 01:08:23,359

these beyond visual insight things uh and

2114

01:08:27,030 --> 01:08:24,799

there's not necessarily a pilot on board

2115

01:08:28,789 --> 01:08:27,040

for the small drones obviously it would

2116

01:08:29,829 --> 01:08:28,799

be hard to carry a pilot

2117

01:08:32,309 --> 01:08:29,839

um

2118

01:08:34,630 --> 01:08:32,319

you know it it is more about how much

2119

01:08:36,390 --> 01:08:34,640

can this be an autonomous operation

2120

01:08:38,229 --> 01:08:36,400

right but visualizing your plan

2121

01:08:39,510 --> 01:08:38,239

visualizing the airspace structure

2122

01:08:42,149 --> 01:08:39,520

visualizing

2123

01:08:44,149 --> 01:08:42,159

different aspects of your operation

2124

01:08:46,149 --> 01:08:44,159

augmented reality could be a key part of

2125

01:08:48,709 --> 01:08:46,159

that we actually tested some of that in

2126

01:08:50,950 --> 01:08:48,719

texas as well we had folks with the

2127

01:08:52,550 --> 01:08:50,960

goggles on looking at the data from the

2128

01:08:54,709 --> 01:08:52,560

air traffic side as well as the

2129

01:08:56,390 --> 01:08:54,719

management side of that and interacting

2130

01:08:58,229 --> 01:08:56,400

with the aircraft in the air in terms of

2131

01:09:00,229 --> 01:08:58,239

you know zooming in on them and seeing

2132

01:09:02,390 --> 01:09:00,239

information that's available digitally

2133

01:09:04,149 --> 01:09:02,400

um so you could see folks managing in a

2134

01:09:05,349 --> 01:09:04,159

dense environment maybe

2135

01:09:07,430 --> 01:09:05,359

just being aware of everything that's

2136

01:09:08,630 --> 01:09:07,440

going on uh could have a lot of value so

2137

01:09:10,789 --> 01:09:08,640

yeah a lot of some work is actually

2138

01:09:12,789 --> 01:09:10,799

going on in that direction already

2139

01:09:14,550 --> 01:09:12,799

that's awesome that seems like a perfect

2140

01:09:17,349 --> 01:09:14,560

use for that kind of technology yeah

2141

01:09:20,630 --> 01:09:17,359

yeah and this is really helpful yeah

2142

01:09:22,870 --> 01:09:20,640

uh we have a question here from mega man

2143

01:09:24,870 --> 01:09:22,880

bxr do you think drones will play a

2144

01:09:27,269 --> 01:09:24,880

bigger part in crime prevention i.e

2145

01:09:29,910 --> 01:09:27,279

monitor the streets overhead in real

2146

01:09:31,189 --> 01:09:29,920

time etc

2147

01:09:33,430 --> 01:09:31,199

we already know that a lot of public

2148

01:09:36,070 --> 01:09:33,440

safety organizations are looking at

2149

01:09:38,070 --> 01:09:36,080

using drones more and more department um

2150

01:09:39,430 --> 01:09:38,080

yeah and if you think about safety and

2151  
01:09:41,030 --> 01:09:39,440  
security one of the big things we've

2152  
01:09:42,550 --> 01:09:41,040  
seen a lot of success on you can just

2153  
01:09:46,149 --> 01:09:42,560  
see it in the news is you know search

2154  
01:09:49,990 --> 01:09:47,510  
cities are able to buy these drones that

2155  
01:09:51,910 --> 01:09:50,000  
can actually see heat on the ground so

2156  
01:09:54,149 --> 01:09:51,920  
at night they can be flying and see

2157  
01:09:57,030 --> 01:09:54,159  
a lost child in a field right

2158  
01:09:58,149 --> 01:09:57,040  
um and and then send folks to that

2159  
01:09:59,990 --> 01:09:58,159  
location

2160  
01:10:01,990 --> 01:10:00,000  
uh you know obviously you can do a lot

2161  
01:10:03,910 --> 01:10:02,000  
of good things with drones right

2162  
01:10:05,430 --> 01:10:03,920  
one of the other use cases is a fire

2163  
01:10:06,630 --> 01:10:05,440

department wanting to send a drone out

2164

01:10:09,030 --> 01:10:06,640

ahead of the truck because it can get

2165

01:10:11,110 --> 01:10:09,040

there faster to survey the scene before

2166

01:10:13,030 --> 01:10:11,120

the people get there to fight the fire

2167

01:10:14,709 --> 01:10:13,040

that's another use case that people

2168

01:10:16,550 --> 01:10:14,719

envision again the airspace has to be

2169

01:10:18,310 --> 01:10:16,560

ready for that right because you go back

2170

01:10:19,830 --> 01:10:18,320

to the the hot dog drones you they they

2171

01:10:21,990 --> 01:10:19,840

have to get out of the way of that that

2172

01:10:23,990 --> 01:10:22,000

fire drone coming through right so yeah

2173

01:10:26,550 --> 01:10:24,000

absolutely and without a unified a

2174

01:10:28,630 --> 01:10:26,560

system to share that information you

2175

01:10:30,229 --> 01:10:28,640

can't really make that happen cleanly

2176

01:10:33,590 --> 01:10:30,239

right um but yeah there's a lot of

2177

01:10:36,070 --> 01:10:33,600

interest in in from police and fire and

2178

01:10:38,149 --> 01:10:36,080

other agencies to to use these for the

2179

01:10:39,189 --> 01:10:38,159

things that they already do

2180

01:10:41,350 --> 01:10:39,199

i think we already see a lot of

2181

01:10:43,189 --> 01:10:41,360

emergency response applications right um

2182

01:10:45,110 --> 01:10:43,199

i think with the recent fires here in

2183

01:10:46,709 --> 01:10:45,120

california we saw some of that here as

2184

01:10:48,310 --> 01:10:46,719

well um and

2185

01:10:50,310 --> 01:10:48,320

the tools provided

2186

01:10:52,709 --> 01:10:50,320

a great insight for some of those for

2187

01:10:55,189 --> 01:10:52,719

example firefighters to fight fight the

2188

01:10:57,350 --> 01:10:55,199

fires that were blazing and then also

2189

01:10:58,790 --> 01:10:57,360

for um like volcanic eruptions there's

2190

01:11:01,110 --> 01:10:58,800

been you there's been a whole host of

2191

01:11:03,110 --> 01:11:01,120

other use cases uh for surveying and

2192

01:11:04,870 --> 01:11:03,120

providing emergency response but like

2193

01:11:06,630 --> 01:11:04,880

joey was saying we need the rules of the

2194

01:11:07,990 --> 01:11:06,640

road there right and how these aircraft

2195

01:11:09,430 --> 01:11:08,000

are going to operate or these drones are

2196

01:11:11,270 --> 01:11:09,440

going to operate to really enable them

2197

01:11:12,950 --> 01:11:11,280

to do their missions right and we think

2198

01:11:14,630 --> 01:11:12,960

about you know public safety keeping the

2199

01:11:16,470 --> 01:11:14,640

public safe but these drones can

2200

01:11:18,229 --> 01:11:16,480

actually keep the first responders safe

2201

01:11:20,470 --> 01:11:18,239

as well right right so they can send a

2202

01:11:22,070 --> 01:11:20,480

drone to the top of a roof to see bad

2203

01:11:24,070 --> 01:11:22,080

guys or whatever it might be or someone

2204

01:11:26,310 --> 01:11:24,080

might help without actually putting

2205

01:11:28,390 --> 01:11:26,320

people in harm's way first right so

2206

01:11:29,750 --> 01:11:28,400

public safety does go both ways uh so

2207

01:11:31,430 --> 01:11:29,760

there's a lot of really good uses for

2208

01:11:33,270 --> 01:11:31,440

this uh in the in the police and fire

2209

01:11:34,630 --> 01:11:33,280

realm right and in some cases like in

2210

01:11:36,709 --> 01:11:34,640

the testing i don't know in corpus

2211

01:11:38,149 --> 01:11:36,719

christi we had the fire department there

2212

01:11:39,990 --> 01:11:38,159

with their drone as well also working

2213

01:11:41,350 --> 01:11:40,000

closely with the research and helping

2214

01:11:42,870 --> 01:11:41,360

exactly yeah we had the fire department

2215

01:11:44,790 --> 01:11:42,880

as well corpus christi uh police and

2216

01:11:47,669 --> 01:11:44,800

fire were great partners awesome they're

2217

01:11:50,470 --> 01:11:47,679

organized by the faa test site in texas

2218

01:11:51,750 --> 01:11:50,480

um and again they had drones already in

2219

01:11:53,350 --> 01:11:51,760

their inventory they were already using

2220

01:11:54,790 --> 01:11:53,360

them for missions they're ready they're

2221

01:11:56,470 --> 01:11:54,800

participating with us in the flight

2222

01:11:58,470 --> 01:11:56,480

testing right giving you some feedback

2223

01:11:59,910 --> 01:11:58,480

on the concept as a whole and us

2224

01:12:02,070 --> 01:11:59,920

understanding how they already use their

2225

01:12:03,430 --> 01:12:02,080

drones and make sure that the traffic

2226

01:12:05,350 --> 01:12:03,440

management system and the concept still

2227

01:12:06,310 --> 01:12:05,360

accommodates what they would like to do

2228

01:12:08,630 --> 01:12:06,320

it's really important to get that

2229

01:12:10,229 --> 01:12:08,640

feedback early and often uh so yeah

2230

01:12:11,910 --> 01:12:10,239

we're already seeing these agencies do

2231

01:12:13,590 --> 01:12:11,920

that and the police were interested in

2232

01:12:15,350 --> 01:12:13,600

using it obviously to identify drones

2233

01:12:16,470 --> 01:12:15,360

right like if in the future there's more

2234

01:12:17,510 --> 01:12:16,480

of these in the air they want to know

2235

01:12:18,550 --> 01:12:17,520

that they're supposed to be there or

2236

01:12:20,310 --> 01:12:18,560

they're allowed to be there or they're

2237

01:12:22,229 --> 01:12:20,320

doing something good and not bad

2238

01:12:23,910 --> 01:12:22,239

so uh police who have an interest in

2239

01:12:25,830 --> 01:12:23,920

knowing that the airspace is safe around

2240

01:12:26,630 --> 01:12:25,840

the public as well of course yeah yeah

2241

01:12:28,070 --> 01:12:26,640

yeah

2242

01:12:31,750 --> 01:12:28,080

um i have a question here that's making

2243

01:12:34,310 --> 01:12:31,760

me picture the fifth element scenario um

2244

01:12:36,149 --> 01:12:34,320

dono asks with drones you can have many

2245

01:12:38,550 --> 01:12:36,159

many small missions starting and ending

2246

01:12:40,149 --> 01:12:38,560

constantly so how do you ensure

2247

01:12:41,669 --> 01:12:40,159

efficient use of air space with an

2248

01:12:43,669 --> 01:12:41,679

unknown number of vehicles entering the

2249

01:12:45,990 --> 01:12:43,679

airspace at any time it sounds like a

2250

01:12:47,590 --> 01:12:46,000

lot of unknowns it is a lot of potential

2251

01:12:49,030 --> 01:12:47,600

drones yeah and i think you do want to

2252

01:12:50,870 --> 01:12:49,040

take a

2253

01:12:52,550 --> 01:12:50,880

a stepped approach right a gradual

2254

01:12:55,189 --> 01:12:52,560

approach you know we don't have to build

2255

01:12:56,630 --> 01:12:55,199

the system right now to handle

2256

01:12:57,270 --> 01:12:56,640

twenty thousand operations a minute and

2257

01:13:37,030 --> 01:12:57,280

a

2258

01:13:38,470 --> 01:13:37,040

support them in the future don't box off

2259

01:13:40,709 --> 01:13:38,480

any solutions

2260

01:13:42,630 --> 01:13:40,719

um and and it's it's gonna work it's

2261

01:13:44,310 --> 01:13:42,640

it's gonna work and i would even up

2262

01:13:47,030 --> 01:13:44,320

level that complexity right so you can

2263

01:13:48,390 --> 01:13:47,040

have drones operating below 400 feet

2264

01:13:50,550 --> 01:13:48,400

then above that you could have these

2265

01:13:53,110 --> 01:13:50,560

electric urban air mobility vehicles

2266

01:13:54,950 --> 01:13:53,120

flying across urban centers and then

2267

01:13:56,550 --> 01:13:54,960

above that your commercial and air

2268

01:13:58,390 --> 01:13:56,560

traffic so how do you have

2269

01:14:00,390 --> 01:13:58,400

interoperability across all of those

2270

01:14:02,070 --> 01:14:00,400

layers and that same density of

2271

01:14:04,470 --> 01:14:02,080

operations and that's actually where

2272

01:14:06,550 --> 01:14:04,480

where the real fun research is kind of

2273

01:14:08,630 --> 01:14:06,560

like where where some of our work comes

2274

01:14:10,390 --> 01:14:08,640

into play is how do you have that air

2275

01:14:12,310 --> 01:14:10,400

traffic management system to support all

2276

01:14:14,149 --> 01:14:12,320

of these new entrants and all this uh

2277

01:14:15,830 --> 01:14:14,159

density of operations we would expect in

2278

01:14:17,590 --> 01:14:15,840

the future right i'd raise you one up

2279

01:14:19,189 --> 01:14:17,600

level right we'll go 60 000 feet plus

2280

01:14:20,790 --> 01:14:19,199

right so really traditional air traffic

2281

01:14:22,790 --> 01:14:20,800

and then you have folks that want to fly

2282

01:14:24,950 --> 01:14:22,800

over 60 000 feet drones

2283

01:14:26,630 --> 01:14:24,960

no not maybe autonomous vehicles maybe

2284

01:14:28,070 --> 01:14:26,640

not but how do they show that airspace

2285

01:14:29,669 --> 01:14:28,080

up there with autonomous vehicles how do

2286

01:14:31,030 --> 01:14:29,679

they get up there first in the first

2287

01:14:33,110 --> 01:14:31,040

place in an efficient way it's such a

2288

01:14:36,149 --> 01:14:33,120

busy exactly so all these things have to

2289

01:14:37,750 --> 01:14:36,159

interoperate and you know uh work well

2290

01:14:39,270 --> 01:14:37,760

together yeah that's a level up hunter

2291

01:14:40,709 --> 01:14:39,280

yeah

2292

01:14:44,229 --> 01:14:40,719

i left space for you you could have gone

2293

01:14:48,550 --> 01:14:45,510

do you want to take maybe one more

2294

01:14:50,470 --> 01:14:48,560

question over there do you have sure

2295

01:14:51,830 --> 01:14:50,480

well we have a question um here like

2296

01:14:53,510 --> 01:14:51,840

what was the biggest barrier for you

2297

01:14:54,790 --> 01:14:53,520

personally getting hired but we always

2298

01:14:56,229 --> 01:14:54,800

get questions like this and people want

2299

01:14:59,590 --> 01:14:56,239

to know like how did you get started at

2300

01:15:02,310 --> 01:14:59,600

nasa and you know yeah yeah yeah what's

2301  
01:15:03,430 --> 01:15:02,320  
your background exactly sure so um i'll

2302  
01:15:05,830 --> 01:15:03,440  
start first

2303  
01:15:07,270 --> 01:15:05,840  
so i'm an aerospace engineer so that's

2304  
01:15:09,910 --> 01:15:07,280  
what i studied in school that's what i

2305  
01:15:11,910 --> 01:15:09,920  
got my my bachelor's my master's in and

2306  
01:15:14,390 --> 01:15:11,920  
to be honest i've always been passionate

2307  
01:15:15,910 --> 01:15:14,400  
about aircraft and flight and

2308  
01:15:18,630 --> 01:15:15,920  
specifically flight controls and that's

2309  
01:15:20,390 --> 01:15:18,640  
how i got started but i think there's

2310  
01:15:22,790 --> 01:15:20,400  
a whole host of opportunities and

2311  
01:15:25,189 --> 01:15:22,800  
avenues i don't think you have to study

2312  
01:15:26,950 --> 01:15:25,199  
aerospace engineering nor necessarily

2313  
01:15:29,030 --> 01:15:26,960

even just arrows so there's there's a

2314

01:15:30,950 --> 01:15:29,040

whole different set of fields and

2315

01:15:33,350 --> 01:15:30,960

discipline that make our research a

2316

01:15:35,510 --> 01:15:33,360

reality right we have people who are

2317

01:15:37,189 --> 01:15:35,520

psychologists engineers

2318

01:15:39,910 --> 01:15:37,199

you know analysts people who work with

2319

01:15:41,270 --> 01:15:39,920

data so there's it you can really do

2320

01:15:43,110 --> 01:15:41,280

anything so i think it's all about the

2321

01:15:44,950 --> 01:15:43,120

passion if you're interested in kind of

2322

01:15:47,030 --> 01:15:44,960

seeing how we can push the bounds to

2323

01:15:49,430 --> 01:15:47,040

bring in all of these new entrants bring

2324

01:15:50,709 --> 01:15:49,440

in and innovation into air traffic

2325

01:15:52,630 --> 01:15:50,719

management i think there's so many ways

2326

01:15:54,630 --> 01:15:52,640

you could come in and play a role here

2327

01:15:56,149 --> 01:15:54,640

yeah definitely and just to illustrate

2328

01:15:59,030 --> 01:15:56,159

that with the this drone traffic

2329

01:16:00,950 --> 01:15:59,040

management project that we had um

2330

01:16:02,390 --> 01:16:00,960

we had folks that were aero engineers

2331

01:16:03,910 --> 01:16:02,400

very important to understanding the

2332

01:16:05,510 --> 01:16:03,920

system and how the vehicles work and and

2333

01:16:07,750 --> 01:16:05,520

all those sorts of things

2334

01:16:09,350 --> 01:16:07,760

i'm a computer engineer so i'm not an

2335

01:16:10,149 --> 01:16:09,360

aero engineer by training

2336

01:16:11,830 --> 01:16:10,159

um

2337

01:16:13,189 --> 01:16:11,840

so that's important in kind of building

2338

01:16:14,470 --> 01:16:13,199

out the systems we had a lot of computer

2339

01:16:15,910 --> 01:16:14,480

scientists computer engineers helping

2340

01:16:17,669 --> 01:16:15,920

with this as well

2341

01:16:19,430 --> 01:16:17,679

and then you do get systems engineers

2342

01:16:21,350 --> 01:16:19,440

and physicists and other folks that

2343

01:16:23,430 --> 01:16:21,360

really matter in doing these human

2344

01:16:24,870 --> 01:16:23,440

factors people right that understand

2345

01:16:26,310 --> 01:16:24,880

again chabanjali was talking earlier

2346

01:16:27,590 --> 01:16:26,320

about what do these new control systems

2347

01:16:29,270 --> 01:16:27,600

look like how do people interact with

2348

01:16:31,350 --> 01:16:29,280

them it's a completely new system we're

2349

01:16:33,270 --> 01:16:31,360

talking about so we don't really know

2350

01:16:34,950 --> 01:16:33,280

how the human needs to interact that's

2351  
01:16:36,709 --> 01:16:34,960  
going to impact the humans exactly and

2352  
01:16:37,990 --> 01:16:36,719  
what makes what makes their job easier

2353  
01:16:39,590 --> 01:16:38,000  
or harder right

2354  
01:16:40,790 --> 01:16:39,600  
um so all of those kind of folks are

2355  
01:16:42,310 --> 01:16:40,800  
really important in building out a

2356  
01:16:44,630 --> 01:16:42,320  
system like utm and that's what we had

2357  
01:16:46,550 --> 01:16:44,640  
on our team yeah it sounds like it makes

2358  
01:16:48,310 --> 01:16:46,560  
sense right you've talked about so many

2359  
01:16:49,590 --> 01:16:48,320  
aspects of this work different facets

2360  
01:16:51,830 --> 01:16:49,600  
different layers you kept saying

2361  
01:16:53,590 --> 01:16:51,840  
different layers of the the system you

2362  
01:16:55,510 --> 01:16:53,600  
need so many different perspectives on

2363  
01:16:57,350 --> 01:16:55,520

that so that's awesome so that's good

2364

01:16:58,870 --> 01:16:57,360

news for people out there yeah

2365

01:17:01,110 --> 01:16:58,880

it really does take a team i think you

2366

01:17:02,790 --> 01:17:01,120

have a team with a whole wide range of

2367

01:17:04,870 --> 01:17:02,800

disciplines that really allows some of

2368

01:17:06,470 --> 01:17:04,880

this technology to come to light right

2369

01:17:08,070 --> 01:17:06,480

sounds like it it's a great place to

2370

01:17:09,910 --> 01:17:08,080

solve hard problems that's what

2371

01:17:10,950 --> 01:17:09,920

aeronautics really offers and i think is

2372

01:17:12,390 --> 01:17:10,960

what it brings a lot of people that's

2373

01:17:13,510 --> 01:17:12,400

what brought me in

2374

01:17:15,430 --> 01:17:13,520

it's a good place to solve really hard

2375

01:17:17,750 --> 01:17:15,440

problems that make an impact

2376

01:17:19,990 --> 01:17:17,760

fascinating awesome yeah well this has

2377

01:17:22,229 --> 01:17:20,000

been awesome thank you guys for joining

2378

01:17:24,470 --> 01:17:22,239

us today we have just about run out of

2379

01:17:26,149 --> 01:17:24,480

time but thank you for being here and

2380

01:17:28,390 --> 01:17:26,159

thank you to everybody who joined us in

2381

01:17:30,950 --> 01:17:28,400

the chat on twitch we'll be back in the

2382

01:17:33,910 --> 01:17:30,960

new year so follow nasa on social media

2383

01:17:35,990 --> 01:17:33,920

to hear about upcoming shows and to see

2384

01:17:37,750 --> 01:17:36,000

past episodes of this show you can check

2385

01:17:39,030 --> 01:17:37,760

out nasa.gov

2386

01:17:42,310 --> 01:17:39,040

ames

2387

01:17:43,669 --> 01:17:42,320

nasa in silicon valley live all right