
NASA
SILICON
VALLE
V E
SILICON VALLEY
AMES RESEARCH CENTER
COUNTDOWN TO 2024
DAYS HOURS MIN SEC

1
00:00:20,390 --> 00:00:17,500
[Music]

2
00:00:22,730 --> 00:00:20,400
hey everybody welcome to another episode

3
00:00:25,339 --> 00:00:22,740
of NASA and Silicon Valley live

4
00:00:26,929 --> 00:00:25,349
I'm your host Abbey Taber and if this is

5
00:00:28,730 --> 00:00:26,939
your first time joining us NASA and

6
00:00:30,589 --> 00:00:28,740
Silicon Valley live is a conversational

7
00:00:33,319 --> 00:00:30,599
show out of NASA's Ames Research Center

8
00:00:36,050 --> 00:00:33,329
where we talk about all the nerdy NASA

9
00:00:39,770 --> 00:00:36,060
news you need to know so I have here

10
00:00:42,290 --> 00:00:39,780
today our old friend Tiffany hi everyone

11
00:00:44,660 --> 00:00:42,300
I am your co-host Tiffany Blake if he

12
00:00:47,780 --> 00:00:44,670
didn't know we are live on twitch

13
00:00:49,310 --> 00:00:47,790

YouTube Facebook and periscope but if

14
00:00:51,470 --> 00:00:49,320
you want to participate in the chat and

15
00:00:55,660 --> 00:00:51,480
ask our guests questions there's only

16
00:01:00,740 --> 00:00:59,210
www.twitch.tv/esa yeah and I know you're

17
00:01:03,830 --> 00:01:00,750
gonna have a lot of questions because

18
00:01:06,109 --> 00:01:03,840
today we are talking about air taxis and

19
00:01:07,850 --> 00:01:06,119
the future of urban transport and we

20
00:01:11,359 --> 00:01:07,860
have a couple of awesome guests here to

21
00:01:13,280 --> 00:01:11,369
tell us all about that hey guys hey why

22
00:01:15,380 --> 00:01:13,290
don't you tell everybody your name and

23
00:01:17,690 --> 00:01:15,390
what you do here sure hey everyone I'm

24
00:01:19,940 --> 00:01:17,700
Siobhan Dooley I'm an aerospace research

25
00:01:21,440 --> 00:01:19,950
engineer and I do research on new

26
00:01:24,709 --> 00:01:21,450
aircraft and how they enter our airspace

27
00:01:26,719 --> 00:01:24,719
awesome and I'm Joey I'm a research

28
00:01:29,389 --> 00:01:26,729
aerospace engineer and I look at new

29
00:01:32,959 --> 00:01:29,399
ways to manage air traffic okay a good

30
00:01:34,580 --> 00:01:32,969
team so Abby before we get into the show

31
00:01:37,129 --> 00:01:34,590
how about we remind our audience about

32
00:01:40,160 --> 00:01:37,139
our really cool clock here yeah yeah for

33
00:01:43,340 --> 00:01:40,170
sure this is our moon countdown clock

34
00:01:46,429 --> 00:01:43,350
where we are counting down the next five

35
00:01:49,010 --> 00:01:46,439
years to 2024 when we're planning to

36
00:01:51,440 --> 00:01:49,020
send humans to the moon as part of the

37
00:01:53,870 --> 00:01:51,450
Artemis program so this clock is

38
00:01:57,440 --> 00:01:53,880

counting down the days hours minutes and

39
00:01:59,389 --> 00:01:57,450
seconds to 2024 when the first woman and

40
00:02:00,340 --> 00:01:59,399
the next man will walk on the moon's

41
00:02:03,499 --> 00:02:00,350
South Pole

42
00:02:04,969 --> 00:02:03,509
so what exactly get excited for that and

43
00:02:10,490 --> 00:02:04,979
if you want to learn more you can go to

44
00:02:13,339 --> 00:02:10,500
nasa.gov slash artemis but for now let's

45
00:02:15,650 --> 00:02:13,349
get into the topic of the day right yeah

46
00:02:19,030 --> 00:02:15,660
can you guys start off by telling us how

47
00:02:21,980 --> 00:02:19,040
is NASA reimagining urban transportation

48
00:02:23,750 --> 00:02:21,990
yeah so there's um this new concept

49
00:02:25,910 --> 00:02:23,760
that's come about it's called urban air

50
00:02:28,540 --> 00:02:25,920
mobility so you might hear us call it um

51
00:02:29,890 --> 00:02:28,550
okay so what is like UAM yeah right so

52
00:02:32,649 --> 00:02:29,900
one can

53
00:02:34,899 --> 00:02:32,659
and above them an air to air traffic

54
00:02:38,080 --> 00:02:34,909
management system that has everything

55
00:02:40,420 --> 00:02:38,090
from small delivery drones to passenger

56
00:02:43,990 --> 00:02:40,430
carrying air taxis flying safely and

57
00:02:46,509 --> 00:02:44,000
efficiently above urban centers or you

58
00:02:48,069 --> 00:02:46,519
know almost above anywhere almost every

59
00:02:49,630 --> 00:02:48,079
day and that's that vision that we're

60
00:02:52,839 --> 00:02:49,640
really trying to enable where we have

61
00:02:55,300 --> 00:02:52,849
new aircraft new entrants making our

62
00:02:57,880 --> 00:02:55,310
lives easier yeah by providing functions

63
00:03:00,610 --> 00:02:57,890

that we all really need ok amazing so

64
00:03:02,589 --> 00:03:00,620
how did we get here what like what led

65
00:03:05,740 --> 00:03:02,599
to this moment we're working on this now

66
00:03:08,229 --> 00:03:05,750
yeah so industry has really been pushing

67
00:03:11,140 --> 00:03:08,239
things forward there's folks know right

68
00:03:12,670 --> 00:03:11,150
as you we have automobiles and as

69
00:03:14,770 --> 00:03:12,680
automobiles have been moving and

70
00:03:17,259 --> 00:03:14,780
developing you have this new advent of

71
00:03:19,539 --> 00:03:17,269
electric yeah electric cars right so

72
00:03:21,759 --> 00:03:19,549
that same technology can now actually

73
00:03:24,610 --> 00:03:21,769
also be applied to aircraft so we have

74
00:03:27,160 --> 00:03:24,620
electric propulsion for aircraft so just

75
00:03:30,160 --> 00:03:27,170
like you have this new clean and

76
00:03:32,500 --> 00:03:30,170
efficient way of providing transport for

77
00:03:34,599 --> 00:03:32,510
vehicles this new clean electric

78
00:03:37,689 --> 00:03:34,609
transport can be applied for aircraft ok

79
00:03:39,789 --> 00:03:37,699
so we have new automation also that's

80
00:03:41,530 --> 00:03:39,799
coming into play so new control systems

81
00:03:43,150 --> 00:03:41,540
that are onboard vehicles and it's

82
00:03:45,309 --> 00:03:43,160
really that combination of those two

83
00:03:47,559 --> 00:03:45,319
things electric propulsion technology

84
00:03:50,649 --> 00:03:47,569
plus automation has really led us

85
00:03:51,970 --> 00:03:50,659
towards this new kind of mode of

86
00:03:54,640 --> 00:03:51,980
transportation that we're really excited

87
00:03:56,229 --> 00:03:54,650
ok awesome awesome so these air taxis

88
00:03:58,930 --> 00:03:56,239

you've been describing I think you came

89
00:04:00,309 --> 00:03:58,940
with an image of an example yeah right

90
00:04:02,319 --> 00:04:00,319
ok let's let's bring that up and you can

91
00:04:06,520 --> 00:04:02,329
talk to us about what we're seeing sure

92
00:04:08,589 --> 00:04:06,530
cool so this is a concept vehicle this

93
00:04:11,020 --> 00:04:08,599
is what we call an electric vertical

94
00:04:14,080 --> 00:04:11,030
takeoff and landing vehicle you can see

95
00:04:17,680 --> 00:04:14,090
it has four rotors two on each side so

96
00:04:19,390 --> 00:04:17,690
what's a rotor a rotor are blades that

97
00:04:21,339 --> 00:04:19,400
spin to help generate lift kind of like

98
00:04:24,129 --> 00:04:21,349
a helicopter okay right so helicopter

99
00:04:26,230 --> 00:04:24,139
you typically have one rotor above and

100
00:04:27,939 --> 00:04:26,240
then you have a tail rotor behind and so

101
00:04:30,969 --> 00:04:27,949
what these rotors do is they provide

102
00:04:33,339 --> 00:04:30,979
lift this is just one configuration of a

103
00:04:35,800 --> 00:04:33,349
potential urban air mobility vehicle

104
00:04:37,779 --> 00:04:35,810
there are many condition figurations you

105
00:04:40,120 --> 00:04:37,789
can also see here that that vehicle also

106
00:04:41,920 --> 00:04:40,130
has a wing right yeah so how would these

107
00:04:43,700 --> 00:04:41,930
vehicles kind of fly you can imagine

108
00:04:45,320 --> 00:04:43,710
that they would take off

109
00:04:47,540 --> 00:04:45,330
and then shift to forward flight

110
00:04:49,880 --> 00:04:47,550
leveraging their wing to have efficient

111
00:04:51,770 --> 00:04:49,890
performance okay a cross between a

112
00:04:54,230 --> 00:04:51,780
helicopters take off in a plane flying

113
00:04:57,110 --> 00:04:54,240

board all right yeah you have a couple

114
00:04:59,030 --> 00:04:57,120
of questions here I'm ready we have big

115
00:05:02,990 --> 00:04:59,040
bad Tom he says don't we already had our

116
00:05:05,450 --> 00:05:03,000
taxis better known as a plane question

117
00:05:06,950 --> 00:05:05,460
that is a good question so traditional

118
00:05:09,320 --> 00:05:06,960
commercial aircrafts current-day

119
00:05:11,990 --> 00:05:09,330
aircraft that we all fly in today those

120
00:05:14,060 --> 00:05:12,000
are for longer flights typically right

121
00:05:16,490 --> 00:05:14,070
so you might fly from San Francisco to

122
00:05:18,170 --> 00:05:16,500
LA or San Francisco to New York or

123
00:05:21,830 --> 00:05:18,180
wherever you are interested in flying

124
00:05:24,050 --> 00:05:21,840
those are over longer longer trips so

125
00:05:26,660 --> 00:05:24,060
you're covering lots of miles right and

126
00:05:29,360 --> 00:05:26,670
also those aircraft use fuel so jet fuel

127
00:05:31,610 --> 00:05:29,370
these new air taxis or urban air

128
00:05:32,930 --> 00:05:31,620
mobility vehicles are electric

129
00:05:35,510 --> 00:05:32,940
propulsion vehicle so you're no longer

130
00:05:37,070 --> 00:05:35,520
relying on jet fuel and in addition

131
00:05:39,140 --> 00:05:37,080
they're typically flying shorter

132
00:05:40,790 --> 00:05:39,150
emissions there's a lot there's a kind

133
00:05:42,890 --> 00:05:40,800
of a wide range of their mission types

134
00:05:44,180 --> 00:05:42,900
but you're typically flying shorter

135
00:05:46,040 --> 00:05:44,190
missions and you're using a different

136
00:05:48,350 --> 00:05:46,050
mode of fuel right

137
00:05:49,370 --> 00:05:48,360
and in inside of within a city or yeah

138
00:05:51,170 --> 00:05:49,380

we'll see something and they're also

139
00:05:52,910 --> 00:05:51,180
small city limits yeah yeah smaller

140
00:05:54,200 --> 00:05:52,920
smaller between cities right so you

141
00:05:56,510 --> 00:05:54,210
would normally book a flight from San

142
00:06:00,190 --> 00:05:56,520
Jose to San Francisco right that's the

143
00:06:05,240 --> 00:06:02,870
right right taking us off the road like

144
00:06:08,660 --> 00:06:05,250
so hovercat here says will they be like

145
00:06:11,030 --> 00:06:08,670
large multicopter battery-powered what

146
00:06:12,170 --> 00:06:11,040
kind of range are we talking about yeah

147
00:06:14,660 --> 00:06:12,180
so there's a whole host of different

148
00:06:17,000 --> 00:06:14,670
configurations some have four rotors

149
00:06:20,180 --> 00:06:17,010
like we saw in that image some have two

150
00:06:22,250 --> 00:06:20,190
some have many and they can also have

151
00:06:24,170 --> 00:06:22,260
some with wing configurations they

152
00:06:26,600 --> 00:06:24,180
typically about four to eight passenger

153
00:06:28,460 --> 00:06:26,610
carrying in terms of this size and many

154
00:06:30,800 --> 00:06:28,470
of them are electrically powered so yes

155
00:06:32,720 --> 00:06:30,810
battery power is is where many of them

156
00:06:34,490 --> 00:06:32,730
are doing we're talking about passengers

157
00:06:36,320 --> 00:06:34,500
but actually cargo could be one of the

158
00:06:38,660 --> 00:06:36,330
first things that really starts to test

159
00:06:41,720 --> 00:06:38,670
this concept out okay makes sense yeah

160
00:06:43,550 --> 00:06:41,730
so passenger vehicles cargo delivery

161
00:06:46,310 --> 00:06:43,560
are there other applications that you

162
00:06:47,960 --> 00:06:46,320
guys see is really important yeah so one

163
00:06:50,030 --> 00:06:47,970

of the major applications we can see

164
00:06:52,390 --> 00:06:50,040
coming forward is emergency services

165
00:06:54,890 --> 00:06:52,400
okay so one can imagine if you have

166
00:06:56,890 --> 00:06:54,900
current-day helicopters being used to

167
00:06:59,260 --> 00:06:56,900
provide ambulance support services

168
00:07:00,790 --> 00:06:59,270
these vehicles could be flown in areas

169
00:07:03,160 --> 00:07:00,800
that might be dangerous or difficult to

170
00:07:05,620 --> 00:07:03,170
get to and provide those same emergency

171
00:07:08,080 --> 00:07:05,630
type services so there's a whole host of

172
00:07:09,370 --> 00:07:08,090
applications awesome right so that's

173
00:07:10,510 --> 00:07:09,380
easy to see yeah

174
00:07:12,190 --> 00:07:10,520
how we're gonna use them how it's gonna

175
00:07:14,080 --> 00:07:12,200
be super helpful mm-hmm there must be

176
00:07:16,840 --> 00:07:14,090
challenges for people like you to

177
00:07:19,240 --> 00:07:16,850
develop these systems are there a few

178
00:07:22,750 --> 00:07:19,250
that you would highlight Li yeah so I

179
00:07:25,210 --> 00:07:22,760
would actually take a phrase that's used

180
00:07:27,280 --> 00:07:25,220
by the FAA so that's the Federal

181
00:07:29,260 --> 00:07:27,290
Aviation Administration right right so

182
00:07:31,120 --> 00:07:29,270
we are working very closely with them to

183
00:07:32,920 --> 00:07:31,130
see if we can make ribbon Air Mobility a

184
00:07:34,840 --> 00:07:32,930
reality mm-hmm one of the phrases that

185
00:07:37,750 --> 00:07:34,850
they like to use is they like to focus

186
00:07:39,880 --> 00:07:37,760
on the aircraft the air man or air woman

187
00:07:42,970 --> 00:07:39,890
and the air space so what does that mean

188
00:07:44,890 --> 00:07:42,980

well these vehicles they're new right so

189
00:07:47,380 --> 00:07:44,900
these aircraft have to be certified

190
00:07:50,320 --> 00:07:47,390
there are going to be interesting

191
00:07:51,940 --> 00:07:50,330
challenges on how we a so certified

192
00:07:53,980 --> 00:07:51,950
these these vehicles as they have

193
00:07:54,820 --> 00:07:53,990
different performance characteristics we

194
00:07:56,410 --> 00:07:54,830
mentioned that they're going to be

195
00:07:58,090 --> 00:07:56,420
battery powered or electric vehicles

196
00:07:59,770 --> 00:07:58,100
that has implications on their

197
00:08:01,780 --> 00:07:59,780
certification okay certifying them is

198
00:08:03,910 --> 00:08:01,790
safe to fly like the brand new and we're

199
00:08:05,740 --> 00:08:03,920
gonna declare them safe for the the

200
00:08:07,510 --> 00:08:05,750
skies in our cities right okay yeah and

201
00:08:09,670 --> 00:08:07,520
then if you talk about the air man or

202
00:08:12,370 --> 00:08:09,680
the air woman part that import air

203
00:08:13,930 --> 00:08:12,380
person that implies that we have to also

204
00:08:15,630 --> 00:08:13,940
think about what is the role of the

205
00:08:18,370 --> 00:08:15,640
pilot and how do they interface with

206
00:08:20,470 --> 00:08:18,380
potentially new controls right like if

207
00:08:23,560 --> 00:08:20,480
they have different ways relying whole

208
00:08:25,240 --> 00:08:23,570
new trainee potentially a pool of pilots

209
00:08:27,370 --> 00:08:25,250
that may not have the same training that

210
00:08:28,900 --> 00:08:27,380
our current pilots today have so what

211
00:08:30,820 --> 00:08:28,910
how do they actually fly these vehicles

212
00:08:32,710 --> 00:08:30,830
that's also a really important question

213
00:08:34,780 --> 00:08:32,720

that we have and then the last piece

214
00:08:36,760 --> 00:08:34,790
which i think is also really important

215
00:08:39,370 --> 00:08:36,770
is how do we integrate these vehicles in

216
00:08:40,990 --> 00:08:39,380
our airspace right it's not just one or

217
00:08:43,210 --> 00:08:41,000
two of these vehicles that may be flying

218
00:08:44,860 --> 00:08:43,220
in the future you can imagine hundreds

219
00:08:47,170 --> 00:08:44,870
or thousands of them and if that's the

220
00:08:48,940 --> 00:08:47,180
case how do we integrate them safely and

221
00:08:51,280 --> 00:08:48,950
efficiently into our air transportation

222
00:08:52,570 --> 00:08:51,290
system into our national airspace right

223
00:08:53,470 --> 00:08:52,580
an interesting part of the research

224
00:08:55,750 --> 00:08:53,480
actually if you look at those three

225
00:08:58,300 --> 00:08:55,760
buckets right the the aircraft and the

226
00:08:59,350 --> 00:08:58,310
air man or a woman and the airspace some

227
00:09:01,900 --> 00:08:59,360
of the things that are done in the

228
00:09:03,540 --> 00:09:01,910
airspace now for the current traffic may

229
00:09:05,340 --> 00:09:03,550
be better handled by one of those

230
00:09:07,380 --> 00:09:05,350
other buckets some of the things that a

231
00:09:09,269 --> 00:09:07,390
pilot takes care of now maybe can be

232
00:09:11,460 --> 00:09:09,279
better handled by the airframe itself so

233
00:09:13,199 --> 00:09:11,470
understanding these where these things

234
00:09:15,210 --> 00:09:13,209
should get handled in this new way of

235
00:09:17,340 --> 00:09:15,220
travel is an important area research as

236
00:09:20,190 --> 00:09:17,350
well yeah okay we have a good question

237
00:09:22,050 --> 00:09:20,200
here from space roars he says are we

238
00:09:24,720 --> 00:09:22,060

going to have air traffic lights is

239
00:09:27,090 --> 00:09:24,730
there going to be a direct path they

240
00:09:29,280 --> 00:09:27,100
follow mannerisms things like that that

241
00:09:30,720 --> 00:09:29,290
can help you with navigating yeah this

242
00:09:32,040 --> 00:09:30,730
actually exciting part she might as we

243
00:09:33,750 --> 00:09:32,050
talked earlier about the advances and

244
00:09:35,819 --> 00:09:33,760
vehicles that are allowing us to get to

245
00:09:38,009 --> 00:09:35,829
this point in time but actually the

246
00:09:39,120 --> 00:09:38,019
advances in airspace management are

247
00:09:40,710 --> 00:09:39,130
really important as well and these two

248
00:09:42,509 --> 00:09:40,720
things are converging so yeah there

249
00:09:44,220 --> 00:09:42,519
actually will be stoplights they'll be

250
00:09:46,650 --> 00:09:44,230
digital right they won't actually be

251
00:09:48,030 --> 00:09:46,660
floating and hovering up there yellow

252
00:09:50,250 --> 00:09:48,040
green yeah and there would be a set of

253
00:09:52,530 --> 00:09:50,260
procedures and policies and rules that

254
00:09:54,030 --> 00:09:52,540
people that are operating in this in

255
00:09:55,620 --> 00:09:54,040
this airspace would need to follow in

256
00:09:58,050 --> 00:09:55,630
order to have the whole thing still work

257
00:09:59,280 --> 00:09:58,060
safely and efficiently so figuring all

258
00:10:00,900 --> 00:09:59,290
of that out is a big area of research

259
00:10:02,970 --> 00:10:00,910
and we we do collaborate with the FAA to

260
00:10:04,980 --> 00:10:02,980
figure out what is a good path forward

261
00:10:07,560 --> 00:10:04,990
yeah yeah and you said this is about

262
00:10:08,970 --> 00:10:07,570
helping these new vehicles get into the

263
00:10:10,350 --> 00:10:08,980

National Airspace right can can you

264
00:10:12,889 --> 00:10:10,360
define for everybody what that really

265
00:10:15,840 --> 00:10:12,899
means the National Airspace System yes

266
00:10:17,670 --> 00:10:15,850
it's it's what enables us to have air

267
00:10:19,410 --> 00:10:17,680
traffic and air transport in the u.s.

268
00:10:21,480 --> 00:10:19,420
today it's a collection of everything

269
00:10:22,800 --> 00:10:21,490
that makes that happen so it's it's the

270
00:10:25,050 --> 00:10:22,810
runways you can think of the air traffic

271
00:10:26,940 --> 00:10:25,060
control towers the airports the radars

272
00:10:29,100 --> 00:10:26,950
it's actually the vehicles as well and

273
00:10:30,540 --> 00:10:29,110
the people that take care of all these

274
00:10:32,040 --> 00:10:30,550
things and actually run them day to day

275
00:10:34,110 --> 00:10:32,050
but it's also things you can't touch its

276
00:10:36,150 --> 00:10:34,120
things like rules and procedures and

277
00:10:37,350 --> 00:10:36,160
frequencies all of that stuff together

278
00:10:39,720 --> 00:10:37,360
makes up the National Airspace System

279
00:10:41,610 --> 00:10:39,730
okay so how do you introduce new things

280
00:10:43,350 --> 00:10:41,620
into that you can see it's a delicate

281
00:10:45,569 --> 00:10:43,360
dance to make sure you right don't harm

282
00:10:47,550 --> 00:10:45,579
what's working well now and enable these

283
00:10:56,840 --> 00:10:47,560
new new ways of travel you guys are the

284
00:11:00,689 --> 00:10:59,189
don't think this is a question on the

285
00:11:02,819 --> 00:11:00,699
list but I'm sure the people are asking

286
00:11:05,970 --> 00:11:02,829
themselves why does NASA work on this

287
00:11:08,370 --> 00:11:05,980
it's a good answer for that yeah I

288
00:11:10,350 --> 00:11:08,380

thought so I'll jump in you know the

289
00:11:12,150 --> 00:11:10,360
thing people forget is that first day on

290
00:11:14,910 --> 00:11:12,160
NASA stands for Aeronautics and we do a

291
00:11:16,380 --> 00:11:14,920
lot of Aeronautics research and even

292
00:11:17,460 --> 00:11:16,390
people that do remember that Aeronautics

293
00:11:19,589 --> 00:11:17,470
is part of what we do

294
00:11:21,210 --> 00:11:19,599
they may forget that air traffic

295
00:11:23,099 --> 00:11:21,220
management is actually a major part of

296
00:11:24,359 --> 00:11:23,109
Aeronautics is how do you actually allow

297
00:11:26,489 --> 00:11:24,369
these vehicles to get up in the air and

298
00:11:28,199 --> 00:11:26,499
fly around and do what they do right and

299
00:11:30,089 --> 00:11:28,209
we have a pretty good history here at

300
00:11:32,069 --> 00:11:30,099
NASA Ames and within NASA as a whole of

301
00:11:33,899 --> 00:11:32,079
doing that kind of research so it's

302
00:11:35,969 --> 00:11:33,909
really natural that this idea of this

303
00:11:37,949 --> 00:11:35,979
new airspace management concept kind of

304
00:11:39,719 --> 00:11:37,959
originated with us yeah and I would say

305
00:11:41,969 --> 00:11:39,729
we're we're also been collaborating with

306
00:11:44,129 --> 00:11:41,979
the FAA for a number of years so as our

307
00:11:46,319 --> 00:11:44,139
research has been developing we've been

308
00:11:47,849 --> 00:11:46,329
collaborating with the FAA to transfer

309
00:11:49,559 --> 00:11:47,859
technologies and new research

310
00:11:51,089 --> 00:11:49,569
capabilities to really make our airspace

311
00:11:53,159 --> 00:11:51,099
much more efficient our air traffic

312
00:11:55,019 --> 00:11:53,169
management really improve efficiencies

313
00:11:57,199 --> 00:11:55,029

as much as we can mm-hmm yeah I know you

314
00:11:59,519 --> 00:11:57,209
guys work closely and I know that our

315
00:12:02,159 --> 00:11:59,529
Aeronautics research goes way way back

316
00:12:04,019 --> 00:12:02,169
here at names we act at the center here

317
00:12:07,109 --> 00:12:04,029
in this research center we started as an

318
00:12:11,489 --> 00:12:07,119
Aeronautics lab right in 1939

319
00:12:21,539 --> 00:12:11,499
December 20th 1939 which makes tomorrow

320
00:12:23,549 --> 00:12:21,549
our birthday so we're glad you could be

321
00:12:25,710 --> 00:12:23,559
here and help us celebrate yeah so do

322
00:12:27,389 --> 00:12:25,720
you have any favorite fun facts about

323
00:12:29,309 --> 00:12:27,399
that air traffic management research

324
00:12:30,389 --> 00:12:29,319
that's so important that we do here yeah

325
00:12:36,809 --> 00:12:30,399
all right first well I was told there

326
00:12:38,340 --> 00:12:36,819
would be cake yeah we've research in air

327
00:12:40,199 --> 00:12:38,350
traffic management and you know a lot of

328
00:12:41,279 --> 00:12:40,209
the tools are behind the scenes there

329
00:12:43,169 --> 00:12:41,289
are things that people won't see every

330
00:12:45,569 --> 00:12:43,179
day I bet yeah but there are the kind of

331
00:12:46,859 --> 00:12:45,579
things that save people 5 minutes here

332
00:12:49,590 --> 00:12:46,869
10 minutes they're on their way to

333
00:12:51,359 --> 00:12:49,600
somewhere right everyone has landed at

334
00:12:52,739 --> 00:12:51,369
an airport and it's kind of waited to

335
00:12:54,479 --> 00:12:52,749
get a gate right how do you optimize

336
00:12:57,179 --> 00:12:54,489
that and make people get to their gate

337
00:12:59,249 --> 00:12:57,189
faster how do you let people route

338
00:13:01,349 --> 00:12:59,259

around bad weather quickly and

339
00:13:02,879 --> 00:13:01,359
efficiently and save 5 minutes and a

340
00:13:04,919 --> 00:13:02,889
smoother ride to get to where you're

341
00:13:07,049 --> 00:13:04,929
going and these are time savings for us

342
00:13:08,909 --> 00:13:07,059
as passengers but that translates also

343
00:13:10,499 --> 00:13:08,919
to money savings for the airlines right

344
00:13:11,759 --> 00:13:10,509
and these things add a 5 minutes here 10

345
00:13:13,769 --> 00:13:11,769
minutes there over the course of a year

346
00:13:15,119 --> 00:13:13,779
over cross all the airlines right these

347
00:13:16,349 --> 00:13:15,129
savings really add up and these are the

348
00:13:18,629 --> 00:13:16,359
things that a lot of the things that

349
00:13:21,119 --> 00:13:18,639
we've we've originated research here at

350
00:13:22,949 --> 00:13:21,129
NASA is awesome and I think some of

351
00:13:24,629 --> 00:13:22,959
these efficiencies have come from flying

352
00:13:26,429 --> 00:13:24,639
in the air some of them actually have

353
00:13:28,679 --> 00:13:26,439
come from trying to make the surface

354
00:13:30,689 --> 00:13:28,689
operations much more efficient and so

355
00:13:31,570 --> 00:13:30,699
really like Joey was saying it's it's

356
00:13:33,310 --> 00:13:31,580
all about time

357
00:13:35,800 --> 00:13:33,320
that's our most valuable commodity and

358
00:13:37,750 --> 00:13:35,810
so how do we how do we save our time and

359
00:13:40,060 --> 00:13:37,760
that's where we develop algorithms tools

360
00:13:42,940 --> 00:13:40,070
work really closely with air traffic

361
00:13:45,190 --> 00:13:42,950
controllers to give them tools to make

362
00:13:46,810 --> 00:13:45,200
their jobs easier and so that's

363
00:13:48,820 --> 00:13:46,820

something that we've been doing research

364
00:13:50,950 --> 00:13:48,830
on fundamentally for the last 30 years

365
00:13:52,240 --> 00:13:50,960
so yeah yeah that's going back it's not

366
00:13:54,490 --> 00:13:52,250
just research it's transferring it to

367
00:13:56,080 --> 00:13:54,500
the FAA you make them real yeah right

368
00:13:57,550 --> 00:13:56,090
right right they actually put it into

369
00:13:59,230 --> 00:13:57,560
use right yeah right yeah there's some

370
00:14:01,060 --> 00:13:59,240
tools in our air traffic control towers

371
00:14:02,860 --> 00:14:01,070
almost every air traffic control tower

372
00:14:05,710 --> 00:14:02,870
today has some technology that we have

373
00:14:07,810 --> 00:14:05,720
worked on in here at NASA I don't think

374
00:14:10,660 --> 00:14:07,820
people know that we have a question here

375
00:14:12,790 --> 00:14:10,670
from just me and my laptop what part of

376
00:14:17,290 --> 00:14:12,800
the traffic or air traffic management do

377
00:14:19,600 --> 00:14:17,300
you see controlled autonomously I think

378
00:14:21,340 --> 00:14:19,610
if if we think about how many of these

379
00:14:23,560 --> 00:14:21,350
operations that are going to be in the

380
00:14:24,910 --> 00:14:23,570
future of people people's minds you know

381
00:14:27,550 --> 00:14:24,920
race a little bit and you think about

382
00:14:29,620 --> 00:14:27,560
how how much how many new flights there

383
00:14:31,480 --> 00:14:29,630
will be the current system isn't set up

384
00:14:33,520 --> 00:14:31,490
to handle that many more flights that

385
00:14:35,050 --> 00:14:33,530
quickly so actually a lot of the

386
00:14:37,390 --> 00:14:35,060
functions to enable these new entrants

387
00:14:39,130 --> 00:14:37,400
are going to need to be automated as

388
00:14:41,110 --> 00:14:39,140

well as some of the processes on the

389
00:14:43,600 --> 00:14:41,120
existing side in order for them to know

390
00:14:45,310 --> 00:14:43,610
how to integrate and manage this new

391
00:14:47,170 --> 00:14:45,320
traffic as well but we're not going to

392
00:14:48,700 --> 00:14:47,180
have enough controllers that can talk to

393
00:14:50,230 --> 00:14:48,710
all of these aircraft to do all of these

394
00:14:52,060 --> 00:14:50,240
things all the time like they do with

395
00:14:52,900 --> 00:14:52,070
the aircraft today yeah so a lot of

396
00:14:54,040 --> 00:14:52,910
those functions are going to be

397
00:14:57,180 --> 00:14:54,050
automated so there will be a lot of

398
00:15:00,010 --> 00:14:57,190
automation to enable this to happen

399
00:15:01,750 --> 00:15:00,020
do I take any more oh yeah I mean

400
00:15:03,040 --> 00:15:01,760
there's there's plenty the chat is

401
00:15:06,790 --> 00:15:03,050
really blowing up people are very

402
00:15:08,650 --> 00:15:06,800
interested in this topic there's some

403
00:15:11,710 --> 00:15:08,660
some questions about you know how do you

404
00:15:13,660 --> 00:15:11,720
be so Hobbs 5-5-5 says how do you

405
00:15:16,510 --> 00:15:13,670
prevent midair collisions with air

406
00:15:18,310 --> 00:15:16,520
traffic yeah we're with air taxis yeah

407
00:15:20,350 --> 00:15:18,320
so like Joey was mentioning there's

408
00:15:22,360 --> 00:15:20,360
going to be new automation that's going

409
00:15:25,030 --> 00:15:22,370
to come on board the vehicle potentially

410
00:15:27,190 --> 00:15:25,040
as well as tools for air traffic

411
00:15:28,750 --> 00:15:27,200
management services so what are the

412
00:15:30,940 --> 00:15:28,760
intersection of tools that are onboard

413
00:15:33,220 --> 00:15:30,950

the vehicle as well as services that

414
00:15:35,410 --> 00:15:33,230
might be provided provided from

415
00:15:37,030 --> 00:15:35,420
potentially air traffic controllers or

416
00:15:38,620 --> 00:15:37,040
other entities and that's kind of what

417
00:15:40,620 --> 00:15:38,630
we're investigating and then where does

418
00:15:43,900 --> 00:15:40,630
automation help ensure that we reduce

419
00:15:45,340 --> 00:15:43,910
any issues in terms of safety impact so

420
00:15:46,870 --> 00:15:45,350
safety is kind of

421
00:15:49,690 --> 00:15:46,880
one goal how do you ensure safe

422
00:15:51,310 --> 00:15:49,700
operations yeah it's kind of the tools

423
00:15:52,960 --> 00:15:51,320
we developed they look at a few

424
00:15:53,770 --> 00:15:52,970
different layers right of how you make

425
00:15:55,900 --> 00:15:53,780
this have the air traffic management

426
00:15:57,580 --> 00:15:55,910
layer there's usually a strategic look

427
00:15:59,530 --> 00:15:57,590
ahead like how do we not put too many

428
00:16:01,660 --> 00:15:59,540
vehicles in one spot oh yeah it's really

429
00:16:03,190 --> 00:16:01,670
hard for them to avoid each other it's

430
00:16:04,600 --> 00:16:03,200
logically you kind of keep them apart

431
00:16:06,100 --> 00:16:04,610
through this ground automation and

432
00:16:07,450 --> 00:16:06,110
having them share what they're gonna do

433
00:16:09,220 --> 00:16:07,460
with each other

434
00:16:10,660 --> 00:16:09,230
but then more tactically a lot of

435
00:16:12,460 --> 00:16:10,670
onboard capabilities may be important to

436
00:16:14,110 --> 00:16:12,470
keep them separated yeah great

437
00:16:15,850 --> 00:16:14,120
so all these tools that you guys are

438
00:16:18,820 --> 00:16:15,860

talking about a lot of that work is done

439
00:16:20,620 --> 00:16:18,830
at aims here but also in all other NASA

440
00:16:21,970 --> 00:16:20,630
centers across the country right so you

441
00:16:22,600 --> 00:16:21,980
guys have a lot of partners yeah

442
00:16:25,930 --> 00:16:22,610
definitely

443
00:16:28,030 --> 00:16:25,940
so NASA Armstrong NASA Langley Glen

444
00:16:29,170 --> 00:16:28,040
almost all the NASA centers that are

445
00:16:30,940 --> 00:16:29,180
focused on aeronautics aren't

446
00:16:32,500 --> 00:16:30,950
contributing to making urban air

447
00:16:34,420 --> 00:16:32,510
mobility a reality oh this is pretty

448
00:16:36,100 --> 00:16:34,430
exciting yeah yeah a big collaborative

449
00:16:38,860 --> 00:16:36,110
effort yeah the window when did all this

450
00:16:40,720 --> 00:16:38,870
begin for urban air mobility and what's

451
00:16:43,840 --> 00:16:40,730
going on today yeah work is happening

452
00:16:45,460 --> 00:16:43,850
now so one of the areas of where this

453
00:16:47,410 --> 00:16:45,470
kind of first started in terms of NASA

454
00:16:52,030 --> 00:16:47,420
involvement is what we call the Grand

455
00:16:54,910 --> 00:16:52,040
Challenge franchise the Grand Challenge

456
00:16:57,130 --> 00:16:54,920
is an activity in which we are working

457
00:16:59,350 --> 00:16:57,140
collaboratively with the FAA as well as

458
00:17:01,330 --> 00:16:59,360
industry partners both vehicle industry

459
00:17:03,910 --> 00:17:01,340
partners and airspace industry partners

460
00:17:06,010 --> 00:17:03,920
okay to kind of develop an ecosystem so

461
00:17:08,290 --> 00:17:06,020
we can really begin testing out some of

462
00:17:10,330 --> 00:17:08,300
these concepts what does it mean to fly

463
00:17:11,560 --> 00:17:10,340

a vehicle what kind of data do we need

464
00:17:13,450 --> 00:17:11,570
to collect to help with the

465
00:17:15,550 --> 00:17:13,460
certification process understand the

466
00:17:18,010 --> 00:17:15,560
performance of these vehicles and then

467
00:17:20,080 --> 00:17:18,020
also start understanding what does it

468
00:17:21,580 --> 00:17:20,090
mean what kind of tools and technologies

469
00:17:23,590 --> 00:17:21,590
with huns software do we need to build

470
00:17:25,480 --> 00:17:23,600
to actually have some sort of air

471
00:17:27,880 --> 00:17:25,490
traffic management system for these

472
00:17:30,400 --> 00:17:27,890
vehicles as as many of them start coming

473
00:17:32,500 --> 00:17:30,410
up and becoming a reality so the Grand

474
00:17:34,600 --> 00:17:32,510
Challenge is a series of flight

475
00:17:36,730 --> 00:17:34,610
demonstrations and simulation activities

476
00:17:40,120 --> 00:17:36,740
we're where we really hope to explore

477
00:17:41,620 --> 00:17:40,130
all the safety cases as well as collect

478
00:17:43,840 --> 00:17:41,630
data to help us move the industry

479
00:17:45,850 --> 00:17:43,850
forward yeah make sense you get as many

480
00:17:47,560 --> 00:17:45,860
minds as possible thinking about it

481
00:17:49,330 --> 00:17:47,570
predicting what you have to work out now

482
00:17:50,710 --> 00:17:49,340
right and doing the work yeah yeah

483
00:17:52,530 --> 00:17:50,720
definitely it's definitely a very

484
00:17:56,670 --> 00:17:52,540
collaborative effort awesome

485
00:17:58,650 --> 00:17:56,680
great legit twitch channel asks where

486
00:18:00,990 --> 00:17:58,660
they be miniature airports for places to

487
00:18:03,120 --> 00:18:01,000
pick up and drop off that'd be cool

488
00:18:05,130 --> 00:18:03,130

yeah so some of the concepts that are

489
00:18:06,330 --> 00:18:05,140
coming up in terms of infrastructure

490
00:18:09,120 --> 00:18:06,340
which is actually a really important

491
00:18:11,850 --> 00:18:09,130
concept is a concept of vert apart to

492
00:18:13,620 --> 00:18:11,860
vert apat or Skyport sky paths however

493
00:18:15,570 --> 00:18:13,630
you wish to call it but you can kind of

494
00:18:17,340 --> 00:18:15,580
imagine like a helicopter pack right you

495
00:18:19,290 --> 00:18:17,350
know kitties could be on the ground or

496
00:18:21,720 --> 00:18:19,300
on actually the the top of a building

497
00:18:23,250 --> 00:18:21,730
right and so these could be locations

498
00:18:24,900 --> 00:18:23,260
where these aircraft could take off

499
00:18:27,000 --> 00:18:24,910
because remember they can take off

500
00:18:28,800 --> 00:18:27,010
vertically and land vertically so they

501
00:18:30,780 --> 00:18:28,810
don't need a runway yeah they don't need

502
00:18:33,000 --> 00:18:30,790
a runway like a normal aircraft today so

503
00:18:36,660 --> 00:18:33,010
that was what's gonna allow operations

504
00:18:38,940 --> 00:18:36,670
in an urban center right yeah is this

505
00:18:41,760 --> 00:18:38,950
gonna mean the end of traditional flight

506
00:18:43,680 --> 00:18:41,770
or is this really just complementary to

507
00:18:46,650 --> 00:18:43,690
everything we use today yeah it's

508
00:18:48,480 --> 00:18:46,660
definitely not an end to the current day

509
00:18:49,320 --> 00:18:48,490
aviation okay in fact you can think of

510
00:18:50,940 --> 00:18:49,330
it as a compliment

511
00:18:54,270 --> 00:18:50,950
to help you actually use current day

512
00:18:56,640 --> 00:18:54,280
aviation even more right so one can

513
00:18:59,070 --> 00:18:56,650

imagine that you might want to get from

514
00:19:00,660 --> 00:18:59,080
wherever you're located a suburb to your

515
00:19:02,670 --> 00:19:00,670
nearest airport and normally we would

516
00:19:04,560 --> 00:19:02,680
have to sit in traffic drive maybe half

517
00:19:06,600 --> 00:19:04,570
an hour or 40 minutes to get there who

518
00:19:08,670 --> 00:19:06,610
knows so depending on where you're

519
00:19:11,250 --> 00:19:08,680
located now what if you can take one of

520
00:19:13,140 --> 00:19:11,260
these air taxis or air shuttles to get

521
00:19:16,320 --> 00:19:13,150
to your airport now it's actually much

522
00:19:18,740 --> 00:19:16,330
easier to use a commercial aviation like

523
00:19:21,750 --> 00:19:18,750
we do today so these are just another

524
00:19:24,390 --> 00:19:21,760
form of transportation to help us use

525
00:19:26,910 --> 00:19:24,400
current day aviation yeah and about air

526
00:19:29,190 --> 00:19:26,920
taxis or air shuttles yeah you just kind

527
00:19:30,840 --> 00:19:29,200
of made it a distinction there do you

528
00:19:33,180 --> 00:19:30,850
think that these are gonna be taxis that

529
00:19:35,730 --> 00:19:33,190
I call up and I say I personally want to

530
00:19:37,860 --> 00:19:35,740
go to my specific friend's house or is

531
00:19:40,950 --> 00:19:37,870
it gonna be like a subway or a city bus

532
00:19:42,780 --> 00:19:40,960
that has a route so most likely as this

533
00:19:44,700 --> 00:19:42,790
industry develops initially you'll

534
00:19:47,010 --> 00:19:44,710
probably more be more like a air shuttle

535
00:19:48,570 --> 00:19:47,020
or an air Metro where you have a series

536
00:19:51,540 --> 00:19:48,580
of designated locations where you have

537
00:19:53,550 --> 00:19:51,550
pickups and drop-offs and at scheduled

538
00:19:55,740 --> 00:19:53,560

times okay that's mostly to help us

539
00:19:57,240 --> 00:19:55,750
understand what are the feasibility in

540
00:19:59,490 --> 00:19:57,250
the beginnings yeah of this type of

541
00:20:01,650 --> 00:19:59,500
Transportation but on-demand air

542
00:20:03,540 --> 00:20:01,660
mobility is something that industry as

543
00:20:05,400 --> 00:20:03,550
well as we are researching and

544
00:20:07,110 --> 00:20:05,410
investigating of how to enable it

545
00:20:09,450 --> 00:20:07,120
so we're actually looking at both how do

546
00:20:11,430 --> 00:20:09,460
we have a arrow Metro or air shuttle as

547
00:20:14,190 --> 00:20:11,440
well as on-demand urban air mobility

548
00:20:16,830 --> 00:20:14,200
okay yeah stay tuned pretty cool right

549
00:20:19,200 --> 00:20:16,840
yeah we have a question here from again

550
00:20:21,450 --> 00:20:19,210
from space warmers what elevation will

551
00:20:23,040 --> 00:20:21,460
they be flying at what if you're you're

552
00:20:26,520 --> 00:20:23,050
in the city do be weave through

553
00:20:29,130 --> 00:20:26,530
skyscrapers yeah good question good

554
00:20:31,470 --> 00:20:29,140
question so picture here so since these

555
00:20:33,150 --> 00:20:31,480
vehicles have kind of a wide range of

556
00:20:35,040 --> 00:20:33,160
configurations they have different

557
00:20:37,140 --> 00:20:35,050
cruising altitudes that they would fly

558
00:20:39,060 --> 00:20:37,150
at you can expect though a range of

559
00:20:41,730 --> 00:20:39,070
typically from some arts like a thousand

560
00:20:43,740 --> 00:20:41,740
to 4,000 feet is average that typical

561
00:20:45,300 --> 00:20:43,750
range of these of these vehicles of the

562
00:20:47,760 --> 00:20:45,310
urban air mobility vehicles that are a

563
00:20:49,410 --> 00:20:47,770

little bit larger than remember then

564
00:20:52,230 --> 00:20:49,420
some of the drones that have been flying

565
00:20:53,790 --> 00:20:52,240
below 400 feet and then they are also

566
00:20:55,230 --> 00:20:53,800
kind of smaller than your traditional

567
00:20:56,910 --> 00:20:55,240
aircraft because they only have about

568
00:20:58,170 --> 00:20:56,920
four to eight passengers typically okay

569
00:21:00,240 --> 00:20:58,180
so that's the altitude they would be

570
00:21:03,540 --> 00:21:00,250
flying at terms of weaving between

571
00:21:06,090 --> 00:21:03,550
skyscrapers we're looking at procedures

572
00:21:07,020 --> 00:21:06,100
as well as ways for these aircraft to

573
00:21:08,580 --> 00:21:07,030
fly safely

574
00:21:10,050 --> 00:21:08,590
um and that includes safety of the

575
00:21:11,520 --> 00:21:10,060
passengers on board as well as the

576
00:21:14,490 --> 00:21:11,530
safety of the people on the ground right

577
00:21:17,250 --> 00:21:14,500
of course I see a question here further

578
00:21:19,170 --> 00:21:17,260
for the both of you seriously gaming as

579
00:21:21,600 --> 00:21:19,180
what are Siobhan's Li and Joey's

580
00:21:23,340 --> 00:21:21,610
thoughts on noise pollution from these

581
00:21:26,010 --> 00:21:23,350
and what are their thoughts on potential

582
00:21:28,200 --> 00:21:26,020
objects falling to earth yeah that part

583
00:21:30,840 --> 00:21:28,210
definitely want to avoid the objects

584
00:21:32,460 --> 00:21:30,850
falling to earth and in general noise

585
00:21:34,320 --> 00:21:32,470
pollution speaks to a larger issue of

586
00:21:35,700 --> 00:21:34,330
kind of public acceptance of these kind

587
00:21:37,200 --> 00:21:35,710
of operations mm-hmm

588
00:21:39,150 --> 00:21:37,210

so we can solve a lot of technological

589
00:21:40,770 --> 00:21:39,160
problems and make sure things stay safe

590
00:21:42,840 --> 00:21:40,780
and efficient in the air space but if

591
00:21:44,220 --> 00:21:42,850
the public's not ready to accept these

592
00:21:45,750 --> 00:21:44,230
kind of operations for whatever reason

593
00:21:49,350 --> 00:21:45,760
whether its environmental including

594
00:21:51,810 --> 00:21:49,360
noise or something else then this won't

595
00:21:52,950 --> 00:21:51,820
ever take off so to speak right so part

596
00:21:55,380 --> 00:21:52,960
of the research when we do our testing

597
00:21:56,550 --> 00:21:55,390
is actually making sure we're starting

598
00:21:58,290 --> 00:21:56,560
to ask some of those questions and

599
00:22:00,180 --> 00:21:58,300
collect some initial data on public

600
00:22:01,560 --> 00:22:00,190
acceptance so that we can feed some of

601
00:22:03,480 --> 00:22:01,570
those conversations to see what kind of

602
00:22:05,250 --> 00:22:03,490
barriers might be there yeah it's a kind

603
00:22:07,470 --> 00:22:05,260
of that public acceptance question yeah

604
00:22:09,270 --> 00:22:07,480
so noise is an issue and I think you'll

605
00:22:10,830 --> 00:22:09,280
see a lot of the manufacturers of these

606
00:22:12,390 --> 00:22:10,840
vehicles designers of these vehicles and

607
00:22:13,860 --> 00:22:12,400
of the airspace procedures are kind of

608
00:22:15,870 --> 00:22:13,870
cognizant of that if they want to be

609
00:22:18,810 --> 00:22:15,880
aware of trying to minimize the impact

610
00:22:20,610 --> 00:22:18,820
or acceptability of these operations so

611
00:22:21,840 --> 00:22:20,620
it is something that is considered in

612
00:22:26,460 --> 00:22:21,850
the design of all the pieces of the

613
00:22:31,500 --> 00:22:26,470

system right right good to hear what's

614
00:22:37,800 --> 00:22:34,140
Hobie's 555 would there be weather

615
00:22:39,990 --> 00:22:37,810
restrictions on air taxis yeah so just

616
00:22:42,390 --> 00:22:40,000
like today in commercial aviation today

617
00:22:45,510 --> 00:22:42,400
weather plays a big role and how how

618
00:22:48,030 --> 00:22:45,520
aviation you know goes on today and

619
00:22:49,470 --> 00:22:48,040
similarly it will play a role for these

620
00:22:51,540 --> 00:22:49,480
new vehicles for these urban air

621
00:22:53,150 --> 00:22:51,550
mobility vehicles one of the things that

622
00:22:55,200 --> 00:22:53,160
we're trying to understand is when we

623
00:22:56,850 --> 00:22:55,210
perform tests as part of the Grand

624
00:22:58,800 --> 00:22:56,860
Challenges understand what is your

625
00:23:01,320 --> 00:22:58,810
performance when can you fly at what

626
00:23:02,940 --> 00:23:01,330
gusts of winds are there limitations on

627
00:23:03,960 --> 00:23:02,950
your performance and then those are some

628
00:23:05,700 --> 00:23:03,970
of the things that we're really trying

629
00:23:07,650 --> 00:23:05,710
to investigate so we can answer that

630
00:23:09,660 --> 00:23:07,660
question in a better fashion once we

631
00:23:12,540 --> 00:23:09,670
have data on how these vehicles actually

632
00:23:14,160 --> 00:23:12,550
perform under different win under

633
00:23:15,840 --> 00:23:14,170
different wind wind levels as well as

634
00:23:19,820 --> 00:23:15,850
different types of precipitation yeah

635
00:23:22,470 --> 00:23:19,830
okay it's a really specific stuff yeah

636
00:23:23,670 --> 00:23:22,480
yeah really interesting kind of related

637
00:23:24,690 --> 00:23:23,680
to that is you know understand the

638
00:23:26,880 --> 00:23:24,700

performance of the vehicle so that it

639
00:23:28,470 --> 00:23:26,890
knows what it can handle situations can

640
00:23:30,450 --> 00:23:28,480
handle but then actually on the weather

641
00:23:32,490 --> 00:23:30,460
side actually doing the research to make

642
00:23:34,380 --> 00:23:32,500
sure that that informations available to

643
00:23:36,090 --> 00:23:34,390
those operators okay whether we use

644
00:23:38,220 --> 00:23:36,100
today for Aviation's really focus around

645
00:23:39,930 --> 00:23:38,230
airports and the in route environment

646
00:23:41,760 --> 00:23:39,940
and you know there's some specialized

647
00:23:43,170 --> 00:23:41,770
stuff for helicopters and cities but

648
00:23:44,340 --> 00:23:43,180
that all needs to scale up quite a bit

649
00:23:46,080 --> 00:23:44,350
in order to provide the right

650
00:23:48,000 --> 00:23:46,090
information to operators so that they

651
00:23:49,800 --> 00:23:48,010
can fly safely given the performance

652
00:23:51,030 --> 00:23:49,810
characteristics of their vehicle yeah so

653
00:23:53,340 --> 00:23:51,040
a lot of cities aren't outfitted for

654
00:23:55,260 --> 00:23:53,350
that level of granularity of weather all

655
00:23:57,390 --> 00:23:55,270
right so how do you get those weather

656
00:23:58,680 --> 00:23:57,400
services and other requirements develop

657
00:24:01,200 --> 00:23:58,690
so that you can actually enable these

658
00:24:03,120 --> 00:24:01,210
operations safely so that's a larger of

659
00:24:05,070 --> 00:24:03,130
research that we poke into and we also

660
00:24:07,800 --> 00:24:05,080
try and encourage industry and

661
00:24:09,900 --> 00:24:07,810
universities and other folks to come

662
00:24:11,370 --> 00:24:09,910
along with us on that research yeah kind

663
00:24:12,720 --> 00:24:11,380

of along those lines that whether it's

664
00:24:15,600 --> 00:24:12,730
actually very interesting in an urban

665
00:24:18,300 --> 00:24:15,610
center right yeah so as you have wind

666
00:24:19,650 --> 00:24:18,310
flow between buildings as you have kind

667
00:24:21,840 --> 00:24:19,660
of different types of Eddie's kind of

668
00:24:23,880 --> 00:24:21,850
put round off of building to building

669
00:24:25,440 --> 00:24:23,890
surfaces you have interesting effects

670
00:24:27,630 --> 00:24:25,450
that can occur and so that's really

671
00:24:29,730 --> 00:24:27,640
important for us to have some knowledge

672
00:24:31,289 --> 00:24:29,740
about and understand such that we can

673
00:24:32,970 --> 00:24:31,299
have safe safe

674
00:24:34,739 --> 00:24:32,980
these vehicles so that's actually a

675
00:24:36,479 --> 00:24:34,749
really big part which I was referring to

676
00:24:37,649 --> 00:24:36,489
you can imagine I felt that in cities

677
00:24:40,639 --> 00:24:37,659
right yeah of course

678
00:24:42,869 --> 00:24:40,649
walking between two skyscrapers yeah and

679
00:24:45,289 --> 00:24:42,879
yeah it's so good to know you're

680
00:24:48,869 --> 00:24:45,299
thinking about it

681
00:24:50,609 --> 00:24:48,879
let's see what other questions we got we

682
00:24:55,379 --> 00:24:50,619
one day see a return of airships or

683
00:24:57,239 --> 00:24:55,389
Zeppelin's ghosts of ETS who knows yeah

684
00:24:58,739 --> 00:24:57,249
so I you know airships the dirigibles

685
00:25:01,200 --> 00:24:58,749
have been have been around for quite

686
00:25:03,419 --> 00:25:01,210
some time and have been used you know

687
00:25:06,779 --> 00:25:03,429
obviously in the past and now we see the

688
00:25:09,090 --> 00:25:06,789

Goodyear blimp once in a while right so

689
00:25:11,129 --> 00:25:09,100
you know airships do have some some

690
00:25:13,440 --> 00:25:11,139
purpose and due off our use for some

691
00:25:15,330 --> 00:25:13,450
some use cases but how they're going to

692
00:25:16,710 --> 00:25:15,340
be integrated in airspace it's a similar

693
00:25:18,659 --> 00:25:16,720
question just like a lot of these new

694
00:25:19,830 --> 00:25:18,669
entrants how do how was your performance

695
00:25:21,810 --> 00:25:19,840
like what's your performance

696
00:25:23,369 --> 00:25:21,820
characteristics based on that how do we

697
00:25:25,470 --> 00:25:23,379
integrate you safely into our airspace

698
00:25:27,479 --> 00:25:25,480
so the same types of questions apply

699
00:25:29,430 --> 00:25:27,489
regardless of what what type of vehicle

700
00:25:30,599 --> 00:25:29,440
you may be yeah yeah but the vehicles

701
00:25:41,940 --> 00:25:30,609
you guys are talking about are much more

702
00:25:43,529 --> 00:25:41,950
smaller for a trek petrol one do you

703
00:25:47,279 --> 00:25:43,539
have any idea how much energy it takes

704
00:25:48,960 --> 00:25:47,289
to vertically lift the passengers gave a

705
00:25:52,229 --> 00:25:48,970
number of eight passengers but just in

706
00:25:54,899 --> 00:25:52,239
general yeah so typically what you what

707
00:25:58,169 --> 00:25:54,909
is desired is you want to have vertical

708
00:26:00,479 --> 00:25:58,179
lift up above 50 feet and such that you

709
00:26:01,080 --> 00:26:00,489
are climbing at a rate of about 100 feet

710
00:26:03,570 --> 00:26:01,090
per minute

711
00:26:05,279 --> 00:26:03,580
so the energy that's required obviously

712
00:26:07,289 --> 00:26:05,289
depends on the weight of that individual

713
00:26:09,599 --> 00:26:07,299

airframe plus the number of passengers

714
00:26:10,859 --> 00:26:09,609
or cargo that you might have onboard so

715
00:26:12,659 --> 00:26:10,869
I would say it actually does vary

716
00:26:14,700 --> 00:26:12,669
depending on your configuration of your

717
00:26:16,529 --> 00:26:14,710
vehicle mm-hmm but what is neat is the

718
00:26:18,479 --> 00:26:16,539
fact that there's been quite a bit of

719
00:26:20,879 --> 00:26:18,489
development and distributed electrical

720
00:26:22,979 --> 00:26:20,889
propulsion which means you can use these

721
00:26:25,019 --> 00:26:22,989
electrically powered rotors have them

722
00:26:27,090 --> 00:26:25,029
distributed across the airframe such

723
00:26:30,060 --> 00:26:27,100
that it's actually much easier to to

724
00:26:31,889 --> 00:26:30,070
provide it for further math that's a new

725
00:26:33,930 --> 00:26:31,899
technology so in that in that vehicle

726
00:26:37,379 --> 00:26:33,940
concepts right had the rotors along the

727
00:26:38,580 --> 00:26:37,389
wings yeah cool and the airframe when

728
00:26:40,320 --> 00:26:38,590
you guys say that that means this like

729
00:26:42,210 --> 00:26:40,330
the structure of the aircraft correct

730
00:26:43,980 --> 00:26:42,220
just how that aircraft is configured

731
00:26:46,379 --> 00:26:43,990
does it have two rotors four rotors that

732
00:26:48,720 --> 00:26:46,389
wing what does it look like yeah yeah

733
00:26:51,779 --> 00:26:48,730
yeah okay cool we probably have time for

734
00:26:54,690 --> 00:26:51,789
a few more questions yeah we have a

735
00:26:56,999 --> 00:26:54,700
question here from decked the werewolf

736
00:26:59,820 --> 00:26:57,009
what Pera densities would be required to

737
00:27:02,730 --> 00:26:59,830
make long-range high-capacity flight

738
00:27:06,029 --> 00:27:02,740

possible using battery power hmm yeah

739
00:27:08,129 --> 00:27:06,039
power is a big issue yeah yeah so the

740
00:27:10,200 --> 00:27:08,139
manner in which battery technology is

741
00:27:11,909 --> 00:27:10,210
developing is is something that industry

742
00:27:13,649 --> 00:27:11,919
is really moving forward with things

743
00:27:16,320 --> 00:27:13,659
that they're concerned about is their

744
00:27:18,509 --> 00:27:16,330
charge and discharge rates and then also

745
00:27:20,519 --> 00:27:18,519
how quickly can you recharge because

746
00:27:22,169 --> 00:27:20,529
your your actual battery on boards but

747
00:27:25,739 --> 00:27:22,179
you can fly another mission or go on

748
00:27:28,619 --> 00:27:25,749
another trip right and so there is quite

749
00:27:29,999 --> 00:27:28,629
a range of energy density that's

750
00:27:31,470 --> 00:27:30,009
required again depending on your

751
00:27:32,549 --> 00:27:31,480
configuration right depending on your

752
00:27:35,129 --> 00:27:32,559
mission profile

753
00:27:37,049 --> 00:27:35,139
am i flying 50 miles or am i flying 40

754
00:27:39,239 --> 00:27:37,059
miles right so depending on the mission

755
00:27:41,599 --> 00:27:39,249
you wish to achieve you do see a kind of

756
00:27:44,129 --> 00:27:41,609
a range in terms of the battery or power

757
00:27:45,690 --> 00:27:44,139
requirements for that vehicle and just

758
00:27:48,330 --> 00:27:45,700
bring it back to the question of the

759
00:27:50,700 --> 00:27:48,340
vertebrates kind of designing the system

760
00:27:52,950 --> 00:27:50,710
and the power requirements you know you

761
00:27:54,659 --> 00:27:52,960
you may want your vertebrates close to a

762
00:27:55,999 --> 00:27:54,669
substation that can supply the right

763
00:27:57,989 --> 00:27:56,009

amount of power to recharge you quickly

764
00:28:01,440 --> 00:27:57,999
so all of these things are definitely

765
00:28:03,269 --> 00:28:01,450
interrelated yeah you you sort of

766
00:28:05,339 --> 00:28:03,279
touched on this already but maybe to sum

767
00:28:07,019 --> 00:28:05,349
it up for Fergus Diggins can you comment

768
00:28:08,399 --> 00:28:07,029
about the possible infrastructure that

769
00:28:10,589 --> 00:28:08,409
might be needed for the shorter range

770
00:28:12,779 --> 00:28:10,599
trips will use existing airports or

771
00:28:14,609 --> 00:28:12,789
combination of existing and new you talk

772
00:28:18,839 --> 00:28:14,619
about rooftops but like how did you sum

773
00:28:20,220 --> 00:28:18,849
that up yeah I think that if we're

774
00:28:21,720 --> 00:28:20,230
talking about a new mode of

775
00:28:22,889 --> 00:28:21,730
transportation with new use cases

776
00:28:24,839 --> 00:28:22,899
there's probably going to be new

777
00:28:26,729 --> 00:28:24,849
infrastructure needed and that's when we

778
00:28:28,619 --> 00:28:26,739
talk about these verda ports and and

779
00:28:30,720 --> 00:28:28,629
charging stations and and all of these

780
00:28:32,549 --> 00:28:30,730
these things that don't exist as well as

781
00:28:34,049 --> 00:28:32,559
things like surveillance as well as

782
00:28:35,879 --> 00:28:34,059
weather monitoring we talked about

783
00:28:39,029 --> 00:28:35,889
earlier surveillance like keeping an eye

784
00:28:42,180 --> 00:28:39,039
on on those like knowing where the

785
00:28:43,619 --> 00:28:42,190
vehicles are yeah right not so much how

786
00:28:44,880 --> 00:28:43,629
they get used but yeah just where the

787
00:28:46,440 --> 00:28:44,890
vehicles are right now I know freak

788
00:28:48,540 --> 00:28:46,450

radars and they can see all the bigger

789
00:28:50,040 --> 00:28:48,550
airplanes in the sky keep track of that

790
00:28:51,510 --> 00:28:50,050
infrastructure doesn't necessarily let

791
00:28:53,220 --> 00:28:51,520
us have full visibility into the area

792
00:28:55,020 --> 00:28:53,230
where these things might be flying so

793
00:28:56,400 --> 00:28:55,030
surveillance as well as again the

794
00:28:57,930 --> 00:28:56,410
recharging and the landing and the

795
00:28:59,100 --> 00:28:57,940
takeoffs all that's infrastructure that

796
00:29:00,720 --> 00:28:59,110
definitely has to be considered when

797
00:29:02,490 --> 00:29:00,730
designing a system and I would say

798
00:29:04,950 --> 00:29:02,500
infrastructure it's actually a big big

799
00:29:07,380 --> 00:29:04,960
part of this right and the FAA is as

800
00:29:09,030 --> 00:29:07,390
well as NASA as well as industry and

801
00:29:10,800 --> 00:29:09,040
other research institutions they are

802
00:29:13,200 --> 00:29:10,810
looking to understand what are the

803
00:29:15,450 --> 00:29:13,210
infrastructure requirements and there

804
00:29:17,940 --> 00:29:15,460
are sensory requirements but also things

805
00:29:19,950 --> 00:29:17,950
such as lighting requirements right and

806
00:29:21,420 --> 00:29:19,960
what kind of procedures are need to be

807
00:29:23,850 --> 00:29:21,430
developed for that type of

808
00:29:25,440 --> 00:29:23,860
infrastructure so there's a whole host

809
00:29:26,910 --> 00:29:25,450
of information that would come along

810
00:29:28,140 --> 00:29:26,920
with the infrastructure that we meet

811
00:29:30,900 --> 00:29:28,150
that will be needed for these vehicles

812
00:29:32,220 --> 00:29:30,910
to land or take off from locations near

813
00:29:34,640 --> 00:29:32,230

us right Sears there's lots of

814
00:29:36,810 --> 00:29:34,650
interesting research there yeah yeah

815
00:29:38,910 --> 00:29:36,820
research kind of lead the way to those

816
00:29:41,280 --> 00:29:38,920
answers yeah right yeah yeah discovers

817
00:29:44,040 --> 00:29:41,290
the questions yeah yeah that's

818
00:29:45,450 --> 00:29:44,050
interesting maybe just one more and this

819
00:29:47,730 --> 00:29:45,460
question came in a while ago from Hobbes

820
00:29:49,650 --> 00:29:47,740
555 so maybe it's been answered but I

821
00:29:50,760 --> 00:29:49,660
want to know is this like flying cars

822
00:29:52,650 --> 00:29:50,770
what's the mission

823
00:29:56,310 --> 00:29:52,660
can we call these flying cars or is that

824
00:29:58,520 --> 00:29:56,320
something else well so if you if you

825
00:30:00,390 --> 00:29:58,530
want to call them flying cars

826
00:30:02,700 --> 00:30:00,400
technically can I mean some of these

827
00:30:05,160 --> 00:30:02,710
vehicle configurations do have wheels

828
00:30:07,350 --> 00:30:05,170
right when we're landing cool some do

829
00:30:09,120 --> 00:30:07,360
some don't right so if you have wheels

830
00:30:10,830 --> 00:30:09,130
and you can actually do taxis I guess

831
00:30:13,890 --> 00:30:10,840
technically if you can hear y'all the

832
00:30:16,500 --> 00:30:13,900
flying car you know people do call them

833
00:30:17,850 --> 00:30:16,510
urban air mobility vehicles do the fact

834
00:30:19,280 --> 00:30:17,860
they can perform a number of different

835
00:30:21,030 --> 00:30:19,290
functions and have slightly different

836
00:30:21,390 --> 00:30:21,040
operations than what we were used to

837
00:30:24,360 --> 00:30:21,400
today

838
00:30:26,700 --> 00:30:24,370

right so the terms you use can change

839
00:30:28,530 --> 00:30:26,710
but essentially it's like an air taxi a

840
00:30:29,970 --> 00:30:28,540
flying car I know whatever you wish to

841
00:30:31,500 --> 00:30:29,980
call it yeah and I think that the car

842
00:30:32,820 --> 00:30:31,510
implies a lot of freedom right and

843
00:30:34,830 --> 00:30:32,830
that's that automatically we were

844
00:30:36,240 --> 00:30:34,840
mentioning earlier yeah so most of these

845
00:30:38,160 --> 00:30:36,250
the initial vehicles are probably more

846
00:30:39,690 --> 00:30:38,170
like the air Metro Siobhan Julie was

847
00:30:41,730 --> 00:30:39,700
mentioning earlier right there kind of

848
00:30:43,200 --> 00:30:41,740
designated where they're going to go so

849
00:30:44,940 --> 00:30:43,210
if you wanted to call that a car sure

850
00:30:47,880 --> 00:30:44,950
you could but in general it's more like

851
00:30:49,410 --> 00:30:47,890
a subway or yeah it's it's going where

852
00:30:50,910 --> 00:30:49,420
it's going to go and okay it can help

853
00:30:53,460 --> 00:30:50,920
you get there quickly just turn it off

854
00:30:55,620 --> 00:30:53,470
yeah okay cool all right well let's move

855
00:30:56,700 --> 00:30:55,630
on to our next topic so that we don't

856
00:30:57,379 --> 00:30:56,710
run out of time but we're gonna come

857
00:30:59,509 --> 00:30:57,389
back to work

858
00:31:01,639 --> 00:30:59,519
since later so I know that NASA has

859
00:31:03,289 --> 00:31:01,649
already done a bunch of research for

860
00:31:04,969 --> 00:31:03,299
several years that really help lay the

861
00:31:06,019 --> 00:31:04,979
groundwork for this urban air mobility

862
00:31:08,299 --> 00:31:06,029
work that you're doing

863
00:31:10,039 --> 00:31:08,309

so Joey you were a big part of that can

864
00:31:12,859 --> 00:31:10,049
you tell us about the system you worked

865
00:31:15,589 --> 00:31:12,869
on yeah so for the past five years or so

866
00:31:19,310 --> 00:31:15,599
we have been working on how do you

867
00:31:20,719 --> 00:31:19,320
manage small drones at low altitude at

868
00:31:22,399 --> 00:31:20,729
kind of a big scale how do you have

869
00:31:23,930 --> 00:31:22,409
thousands of small drones flying over

870
00:31:25,099 --> 00:31:23,940
the state of California taking care of

871
00:31:28,489 --> 00:31:25,109
things okay

872
00:31:29,899 --> 00:31:28,499
so again that's the current air traffic

873
00:31:32,479 --> 00:31:29,909
management system was not designed to

874
00:31:34,310 --> 00:31:32,489
handle that kind of traffic so how do we

875
00:31:36,319 --> 00:31:34,320
enable those use cases in those business

876
00:31:38,029 --> 00:31:36,329
cases to occur without overloading the

877
00:31:40,009 --> 00:31:38,039
current system and keeping everything as

878
00:31:42,529 --> 00:31:40,019
safe as possible so that's what came

879
00:31:44,449 --> 00:31:42,539
about our research was called UTM UAS

880
00:31:45,680 --> 00:31:44,459
traffic management and again us traffic

881
00:31:47,479 --> 00:31:45,690
man just means how do you manage drones

882
00:31:59,229 --> 00:31:47,489
all right how do you manage travel yeah

883
00:32:02,539 --> 00:32:01,579
but yeah we were focused again on small

884
00:32:04,279 --> 00:32:02,549
drones we're talking with fifty five

885
00:32:06,139 --> 00:32:04,289
pounds and under okay and we're talking

886
00:32:07,819 --> 00:32:06,149
about low altitude typically 400 feet

887
00:32:09,560 --> 00:32:07,829
and under yeah but again you can

888
00:32:11,930 --> 00:32:09,570

accomplish a lot of things just in that

889
00:32:13,549 --> 00:32:11,940
airspace with these kind of vehicles and

890
00:32:15,109 --> 00:32:13,559
it made us ask certain questions and

891
00:32:16,849 --> 00:32:15,119
develop certain systems and test certain

892
00:32:19,099 --> 00:32:16,859
things with partners and the FAA that

893
00:32:20,719 --> 00:32:19,109
lays the groundwork for some of the

894
00:32:22,579 --> 00:32:20,729
still open questions for urban air

895
00:32:23,839 --> 00:32:22,589
mobility that we have been talking yeah

896
00:32:26,329 --> 00:32:23,849
yeah that sounds familiar

897
00:32:28,099 --> 00:32:26,339
yeah kind of work you're doing you

898
00:32:30,109 --> 00:32:28,109
mentioned lots of applications what are

899
00:32:33,859 --> 00:32:30,119
some examples for small drones there

900
00:32:35,419 --> 00:32:33,869
there are a lot usually the you can

901
00:32:37,639 --> 00:32:35,429
actually classify them into some of the

902
00:32:39,649 --> 00:32:37,649
more interesting ones into the 3ds dirty

903
00:32:41,690 --> 00:32:39,659
dangerous and dull jobs there's a lot of

904
00:32:43,909 --> 00:32:41,700
jobs you can do with these drones that

905
00:32:45,799 --> 00:32:43,919
can actually keep people safer that are

906
00:32:47,299 --> 00:32:45,809
doing them right infrastructure

907
00:32:48,799 --> 00:32:47,309
inspection for example you know looking

908
00:32:50,319 --> 00:32:48,809
at a cell tower taking pictures and

909
00:32:53,060 --> 00:32:50,329
making sure it's working correctly

910
00:32:54,769 --> 00:32:53,070
people die climbing those towers every

911
00:32:56,899 --> 00:32:54,779
year right and and other kind of

912
00:32:58,879 --> 00:32:56,909
powerline inspection these jobs aren't

913
00:33:01,519 --> 00:32:58,889

always the safest jobs but you can make

914
00:33:02,779 --> 00:33:01,529
them safer by using drones right and

915
00:33:04,639 --> 00:33:02,789
then things like there's agricultural

916
00:33:06,799 --> 00:33:04,649
applications as well taking pictures of

917
00:33:08,839 --> 00:33:06,809
your field and doing analysis on that as

918
00:33:10,289 --> 00:33:08,849
well as public safety things fire and

919
00:33:13,499 --> 00:33:10,299
police agencies are using these

920
00:33:14,669 --> 00:33:13,509
more and at the local level large

921
00:33:16,499 --> 00:33:14,679
company talking about delivering things

922
00:33:17,759 --> 00:33:16,509
to your doorstep again all this can

923
00:33:19,859 --> 00:33:17,769
happen with drones under fifty five

924
00:33:20,789 --> 00:33:19,869
pounds and under four hundred feet so

925
00:33:22,769 --> 00:33:20,799
there's a lot of things you can actually

926
00:33:24,149 --> 00:33:22,779
do with them right yeah for sure and how

927
00:33:26,310 --> 00:33:24,159
do you will let everyone do all those

928
00:33:27,810 --> 00:33:26,320
things simultaneously and keep the

929
00:33:29,129 --> 00:33:27,820
airspace safe exactly that was kind of

930
00:33:31,339 --> 00:33:29,139
the research that we were looking at yes

931
00:33:35,039 --> 00:33:31,349
because that's always the key really

932
00:33:36,209 --> 00:33:35,049
yeah what was your role exactly so I was

933
00:33:38,039 --> 00:33:36,219
the chief engineer for the project so it

934
00:33:41,249 --> 00:33:38,049
was really about kind of coordinating a

935
00:33:43,049 --> 00:33:41,259
lot of the technical aspects of it I did

936
00:33:44,940 --> 00:33:43,059
focus a lot on the software aspect of it

937
00:33:46,379 --> 00:33:44,950
so we talked about automation earlier in

938
00:33:47,789 --> 00:33:46,389

the airspace management how it's gonna

939
00:33:49,859 --> 00:33:47,799
have to be automated in the future to

940
00:33:51,119 --> 00:33:49,869
handle all of this traffic so how do you

941
00:33:51,779 --> 00:33:51,129
build a system that enables all this

942
00:33:53,849 --> 00:33:51,789
stuff to happen

943
00:33:55,529 --> 00:33:53,859
you know it's it's cloud-based and it

944
00:33:58,349 --> 00:33:55,539
leverages a lot of best practices in the

945
00:33:59,819 --> 00:33:58,359
software industry with our knowledge and

946
00:34:01,049 --> 00:33:59,829
expertise at NASA for air traffic

947
00:34:03,180 --> 00:34:01,059
management right so how do you marry

948
00:34:05,279 --> 00:34:03,190
those two things and that's really what

949
00:34:07,289 --> 00:34:05,289
what we were looking at and Joey won't

950
00:34:09,539 --> 00:34:07,299
admit this but he was the brains behind

951
00:34:10,649 --> 00:34:09,549
the the UTM project and I would say that

952
00:34:12,779 --> 00:34:10,659
Joey and his team

953
00:34:14,129 --> 00:34:12,789
most recently won the NASA software the

954
00:34:15,839 --> 00:34:14,139
Year award so that's actually kind of a

955
00:34:17,789 --> 00:34:15,849
big deal so give Joe a shout-out for

956
00:34:18,960 --> 00:34:17,799
that yeah yeah we we have a lot of

957
00:34:20,250 --> 00:34:18,970
brains on the project which is great

958
00:34:22,529 --> 00:34:20,260
right that's how you make it successful

959
00:34:23,519 --> 00:34:22,539
in Elon perspectives having a lot of

960
00:34:25,379 --> 00:34:23,529
people with a lot of different

961
00:34:26,339 --> 00:34:25,389
backgrounds to come to that is how you

962
00:34:27,690 --> 00:34:26,349
kind of get to these innovative

963
00:34:29,220 --> 00:34:27,700

solutions and NASA's a great place to

964
00:34:35,220 --> 00:34:29,230
kind of allow that to happen yeah

965
00:34:40,079 --> 00:34:35,230
awesome Congrats Thanks so what are some

966
00:34:42,659 --> 00:34:40,089
specific abilities you you gave the

967
00:34:45,329 --> 00:34:42,669
drones or the system like you want to

968
00:34:47,700 --> 00:34:45,339
keep them keep them separate specific

969
00:34:49,680 --> 00:34:47,710
examples you know we had sort of a clean

970
00:34:51,329 --> 00:34:49,690
sheet to begin thinking about how to get

971
00:34:52,680 --> 00:34:51,339
this done really again it's a clean

972
00:34:53,849 --> 00:34:52,690
sheet but with the understanding of how

973
00:34:54,899 --> 00:34:53,859
the airspace works and the other

974
00:34:56,460 --> 00:34:54,909
vehicles work right

975
00:34:58,200 --> 00:34:56,470
so with those bounds what what do we

976
00:34:59,430 --> 00:34:58,210
want the system to do one of the key

977
00:35:00,750 --> 00:34:59,440
things is how do we help make sure the

978
00:35:03,900 --> 00:35:00,760
drones don't run into each other right

979
00:35:06,630 --> 00:35:03,910
yes for starters helps them stay safely

980
00:35:07,650 --> 00:35:06,640
separated you know at some degree also

981
00:35:08,910 --> 00:35:07,660
how do we keep them separate from

982
00:35:10,589 --> 00:35:08,920
traditional aviation how do we make sure

983
00:35:12,329 --> 00:35:10,599
they don't fly into other aircraft right

984
00:35:14,789 --> 00:35:12,339
can you build some system that helps

985
00:35:16,019 --> 00:35:14,799
helps with that process you know one

986
00:35:17,609 --> 00:35:16,029
layer of this isn't gonna be the end all

987
00:35:19,380 --> 00:35:17,619
and be all of all these answers but how

988
00:35:23,430 --> 00:35:19,390

do we start this process of keeping the

989
00:35:25,019 --> 00:35:23,440
airspace safe also how do we allow folks

990
00:35:26,190 --> 00:35:25,029
that are doing these operations and the

991
00:35:27,539 --> 00:35:26,200
vehicles that are doing a supper to be

992
00:35:29,910 --> 00:35:27,549
identifiable right we don't want just

993
00:35:31,200 --> 00:35:29,920
rogue or unidentified flying around the

994
00:35:33,329 --> 00:35:31,210
airspace is they need to know what's

995
00:35:34,890 --> 00:35:33,339
there right to keep the airspace against

996
00:35:37,230 --> 00:35:34,900
safe there's kind of a security aspect

997
00:35:40,589 --> 00:35:37,240
to that as well and then how do you have

998
00:35:43,890 --> 00:35:40,599
some priority for important operations

999
00:35:45,420 --> 00:35:43,900
right so for example recently there was

1000
00:35:47,940 --> 00:35:45,430
actually a drone that delivered a human

1001
00:35:49,499 --> 00:35:47,950
kidney for transplant that was actually

1002
00:35:51,779 --> 00:35:49,509
transplanted into a person Wow

1003
00:35:54,299 --> 00:35:51,789
successfully right so that was

1004
00:35:55,920 --> 00:35:54,309
demonstrated one one important use case

1005
00:35:58,200 --> 00:35:55,930
for drones yeah how do we let that

1006
00:35:59,390 --> 00:35:58,210
happen without being hindered by drones

1007
00:36:01,859 --> 00:35:59,400
that are delivering hot dogs to people

1008
00:36:04,079 --> 00:36:01,869
to make sure the hot dog drones get out

1009
00:36:09,539 --> 00:36:04,089
of the way right kidney drone come

1010
00:36:11,670 --> 00:36:09,549
through these priority operations need

1011
00:36:13,170 --> 00:36:11,680
to be thought of as important in the

1012
00:36:14,789 --> 00:36:13,180
system as we design it out yeah there's

1013
00:36:16,470 --> 00:36:14,799

a lot more of the important class of

1014
00:36:18,120 --> 00:36:16,480
operations you you can you can think

1015
00:36:20,400 --> 00:36:18,130
about but the idea is how do we make

1016
00:36:21,539 --> 00:36:20,410
sure that can actually occur right then

1017
00:36:22,349 --> 00:36:21,549
all of this can occur right you'll get

1018
00:36:24,180 --> 00:36:22,359
your hot dogs

1019
00:36:27,960 --> 00:36:24,190
you'll get it but after the kidney is

1020
00:36:29,910 --> 00:36:27,970
revered thirty seconds later and I would

1021
00:36:31,890 --> 00:36:29,920
actually add the services that Joey just

1022
00:36:33,809 --> 00:36:31,900
laid out they are extensible and

1023
00:36:35,010 --> 00:36:33,819
applicable for any new entrant right so

1024
00:36:37,380 --> 00:36:35,020
Joey was talking about how they were

1025
00:36:38,910 --> 00:36:37,390
applied for drones yeah if you can think

1026
00:36:41,519 --> 00:36:38,920
about for these larger urban air

1027
00:36:43,920 --> 00:36:41,529
mobility vehicles for any new entrant or

1028
00:36:45,779 --> 00:36:43,930
Zeppelin these same tenants can be

1029
00:36:47,700 --> 00:36:45,789
applied so it's actually a really great

1030
00:36:49,740 --> 00:36:47,710
foundation for us to build off of and

1031
00:36:51,779 --> 00:36:49,750
extend for new entrants into our

1032
00:36:53,849 --> 00:36:51,789
national airspace yeah yeah it's so

1033
00:36:56,549 --> 00:36:53,859
clear how right supports the same things

1034
00:36:58,529 --> 00:36:56,559
challenge Lee's working right I mean the

1035
00:36:59,490 --> 00:36:58,539
key thing is you know the current system

1036
00:37:01,529 --> 00:36:59,500
again the air traffic controllers don't

1037
00:37:04,019 --> 00:37:01,539
want to be controlling a 40-pound drone

1038
00:37:06,329 --> 00:37:04,029

at 200 feet right they're not you have

1039
00:37:11,549 --> 00:37:06,339
enough to do with their crane they don't

1040
00:37:12,390 --> 00:37:11,559
want to hire 10,000 more operators so

1041
00:37:13,829 --> 00:37:12,400
again they're kind of this is the

1042
00:37:14,940 --> 00:37:13,839
automation of the airspace and allowing

1043
00:37:17,430 --> 00:37:14,950
these new entrants and again a lot of

1044
00:37:19,499 --> 00:37:17,440
these things will translate over to this

1045
00:37:21,180 --> 00:37:19,509
this air taxi urban air the ability

1046
00:37:22,410 --> 00:37:21,190
world yeah finding out how much of that

1047
00:37:23,760 --> 00:37:22,420
transfers over how much of it has to

1048
00:37:25,470 --> 00:37:23,770
change a little bit but we have a

1049
00:37:27,329 --> 00:37:25,480
foundation to start with totally yeah

1050
00:37:29,279 --> 00:37:27,339
yeah so they're kind of enters a Jenni

1051
00:37:30,220 --> 00:37:29,289
CD 25s questionnaire management will be

1052
00:37:32,800 --> 00:37:30,230
autonomous and

1053
00:37:35,200 --> 00:37:32,810
it will be autonomous it will have a

1054
00:37:36,310 --> 00:37:35,210
autonomous aspects right it doesn't mean

1055
00:37:38,980 --> 00:37:36,320
you just push a button in the airspace

1056
00:37:40,960 --> 00:37:38,990
is completely right free to go and the

1057
00:37:42,430 --> 00:37:40,970
autonomous the the I thought it was

1058
00:37:44,260 --> 00:37:42,440
nature of it will increase over time

1059
00:37:46,330 --> 00:37:44,270
right you know when you get started you

1060
00:37:47,920 --> 00:37:46,340
only have so many operations and you

1061
00:37:49,570 --> 00:37:47,930
might have a good amount of human

1062
00:37:51,220 --> 00:37:49,580
supervision but the unit's things scale

1063
00:37:53,260 --> 00:37:51,230

out how much of that can be automated

1064
00:37:55,780 --> 00:37:53,270
and making sure you do it again in a

1065
00:37:58,300 --> 00:37:55,790
safe way it's more of like a continuing

1066
00:38:00,160 --> 00:37:58,310
right so it's there's gonna be pieces of

1067
00:38:01,480 --> 00:38:00,170
it that are automated some functions and

1068
00:38:03,400 --> 00:38:01,490
then how does that can house that

1069
00:38:05,590 --> 00:38:03,410
continuum grow that's right over time

1070
00:38:08,530 --> 00:38:05,600
yeah make sense building up on it right

1071
00:38:10,420 --> 00:38:08,540
exactly yeah so the drone traffic

1072
00:38:13,270 --> 00:38:10,430
management system what does it look like

1073
00:38:14,710 --> 00:38:13,280
or feel like for a user a pilot like if

1074
00:38:15,160 --> 00:38:14,720
I want to fly my drone what am I going

1075
00:38:16,660 --> 00:38:15,170
to see

1076
00:38:18,849 --> 00:38:16,670
yeah in the future hopefully it would be

1077
00:38:21,040 --> 00:38:18,859
very transparent it shouldn't be a big

1078
00:38:22,540 --> 00:38:21,050
burden to actually use the system so

1079
00:38:24,220 --> 00:38:22,550
there's actually be a layer between you

1080
00:38:25,840 --> 00:38:24,230
and the airspace and it would be kind of

1081
00:38:27,430 --> 00:38:25,850
a service provider to get into the

1082
00:38:28,840 --> 00:38:27,440
airspace almost like a cell service

1083
00:38:30,430 --> 00:38:28,850
provider right you want to make phone

1084
00:38:32,080 --> 00:38:30,440
calls you have a cell service provider

1085
00:38:34,390 --> 00:38:32,090
yeah you can talk to other cell service

1086
00:38:35,740 --> 00:38:34,400
providers plainly so you would have one

1087
00:38:37,000 --> 00:38:35,750
of those providers that get you access

1088
00:38:38,620 --> 00:38:37,010

to the airspace right you would tell

1089
00:38:40,060 --> 00:38:38,630
them what you want to do maybe your

1090
00:38:41,200 --> 00:38:40,070
intent I want to fly from here to here

1091
00:38:41,859 --> 00:38:41,210
and I'm gonna do it about this time

1092
00:38:42,970 --> 00:38:41,869
mm-hmm

1093
00:38:44,560 --> 00:38:42,980
the idea is that these service providers

1094
00:38:46,630 --> 00:38:44,570
share that information amongst each

1095
00:38:48,670 --> 00:38:46,640
other they do what's necessary to keep

1096
00:38:50,380 --> 00:38:48,680
the airspace safe and be conflicted and

1097
00:38:53,109 --> 00:38:50,390
and messages flowing that need to flow

1098
00:38:54,670 --> 00:38:53,119
and you as a pilot just take care of

1099
00:38:56,530 --> 00:38:54,680
your mission right you just fly your

1100
00:38:58,090 --> 00:38:56,540
operation how much of that operation is

1101
00:38:59,650 --> 00:38:58,100
automated and not automated you know

1102
00:39:02,080 --> 00:38:59,660
that depends in the future how far you

1103
00:39:04,270 --> 00:39:02,090
go but a pilot would be in charge of

1104
00:39:06,040 --> 00:39:04,280
that operation and would do it cleanly

1105
00:39:07,750 --> 00:39:06,050
and receive information back from these

1106
00:39:09,040 --> 00:39:07,760
service providers about any changes in

1107
00:39:11,230 --> 00:39:09,050
the airspace or things you need to know

1108
00:39:13,060 --> 00:39:11,240
right like there's a storm coming up

1109
00:39:14,560 --> 00:39:13,070
exactly there's an emergency operation

1110
00:39:20,380 --> 00:39:14,570
that's right yeah that kidneys coming

1111
00:39:22,420 --> 00:39:20,390
through right no it's something I know I

1112
00:39:24,520 --> 00:39:22,430
was just gonna add that I think there's

1113
00:39:27,220 --> 00:39:24,530

the whole host of different types of

1114
00:39:29,290 --> 00:39:27,230
operations yeah it kind of lends itself

1115
00:39:32,440 --> 00:39:29,300
to setting up different missions right

1116
00:39:33,880 --> 00:39:32,450
and then I'd also add that the tools and

1117
00:39:36,040 --> 00:39:33,890
the technologies and the integration

1118
00:39:38,470 --> 00:39:36,050
with the partners that was built up

1119
00:39:40,720 --> 00:39:38,480
under UTM I think is a great model they

1120
00:39:42,560 --> 00:39:40,730
interface with a whole host of industry

1121
00:39:44,180 --> 00:39:42,570
partners along with the FAA

1122
00:39:46,040 --> 00:39:44,190
that same model of collaborative

1123
00:39:51,230 --> 00:39:46,050
innovation is what we're aiming for yeah

1124
00:39:54,350 --> 00:39:51,240
yeah and I wanted to go back to earlier

1125
00:39:55,670 --> 00:39:54,360
you somebody asked about like traffic

1126
00:39:56,600 --> 00:39:55,680
light source I forget what the question

1127
00:39:58,430 --> 00:39:56,610
was maybe you're saying there would be

1128
00:40:00,110 --> 00:39:58,440
digital traffic lights right not

1129
00:40:02,270 --> 00:40:00,120
physical things up in this guy but you

1130
00:40:03,860 --> 00:40:02,280
told me that we can think of the drone

1131
00:40:05,750 --> 00:40:03,870
traffic management is like rules of the

1132
00:40:08,180 --> 00:40:05,760
road that we know when driving right

1133
00:40:10,130 --> 00:40:08,190
yeah you know we think about driving

1134
00:40:11,630 --> 00:40:10,140
today the folks that are driving in

1135
00:40:12,950 --> 00:40:11,640
general you hope and expect that they

1136
00:40:15,050 --> 00:40:12,960
know the rules of the road right they

1137
00:40:16,460 --> 00:40:15,060
know yeah what a red light means they

1138
00:40:18,350 --> 00:40:16,470

knew what to do when you both come to a

1139
00:40:19,640 --> 00:40:18,360
stop sign at the same time they know how

1140
00:40:21,620 --> 00:40:19,650
fast you can go on the freeway and how

1141
00:40:24,350 --> 00:40:21,630
to change lanes those kind of things

1142
00:40:25,820 --> 00:40:24,360
don't exist for drone traffic right so

1143
00:40:26,630 --> 00:40:25,830
how do what are those procedures what

1144
00:40:28,640 --> 00:40:26,640
are those rules

1145
00:40:30,560 --> 00:40:28,650
who has the right away in certain

1146
00:40:31,730 --> 00:40:30,570
scenarios and how do you share that

1147
00:40:33,530 --> 00:40:31,740
information to make sure that everyone's

1148
00:40:35,150 --> 00:40:33,540
aware of the same rule set and those

1149
00:40:36,470 --> 00:40:35,160
other things so that is a lot of the

1150
00:40:38,240 --> 00:40:36,480
research we do as well so that's really

1151
00:40:39,830 --> 00:40:38,250
the drone traffic management system it's

1152
00:40:41,570 --> 00:40:39,840
you know defining those rows LaRose the

1153
00:40:43,340 --> 00:40:41,580
procedures making sure everyone's

1154
00:40:44,750 --> 00:40:43,350
checked out on all those things to

1155
00:40:47,630 --> 00:40:44,760
enable all these operations to happen

1156
00:40:48,620 --> 00:40:47,640
yeah yeah and you know and you have on

1157
00:40:50,150 --> 00:40:48,630
your phone it does you want as a traffic

1158
00:40:51,500 --> 00:40:50,160
jam ahead right so that's the next level

1159
00:40:52,880 --> 00:40:51,510
of service was right and that would be

1160
00:40:56,360 --> 00:40:52,890
part of the ecosystem as well oh there

1161
00:40:58,280 --> 00:40:56,370
is weather ahead or there is a lot of

1162
00:41:00,440 --> 00:40:58,290
drones over here so maybe you should go

1163
00:41:01,700 --> 00:41:00,450

over there right sharing data so that

1164
00:41:03,650 --> 00:41:01,710
you can make those decisions yeah

1165
00:41:05,810 --> 00:41:03,660
awesome yeah that's really clear cool oh

1166
00:41:08,090 --> 00:41:05,820
we have a question here from Chen Dane

1167
00:41:10,910 --> 00:41:08,100
will Dee's Jones have an option for

1168
00:41:12,830 --> 00:41:10,920
multitasking for example the drunk could

1169
00:41:17,030 --> 00:41:12,840
be delivering a kidney and also acting

1170
00:41:18,860 --> 00:41:17,040
as a traffic camera in route so will

1171
00:41:20,150 --> 00:41:18,870
they have like different yeah I think

1172
00:41:21,980 --> 00:41:20,160
the person waiting for the kidney would

1173
00:41:25,730 --> 00:41:21,990
hope maybe this it's focused on the

1174
00:41:27,320 --> 00:41:25,740
kidney but in general yeah it's all

1175
00:41:28,880 --> 00:41:27,330
about the vehicle capabilities right

1176
00:41:31,400 --> 00:41:28,890
what did they design the vehicle to do

1177
00:41:33,560 --> 00:41:31,410
and the idea with our research with

1178
00:41:34,760 --> 00:41:33,570
traffic management and and and all those

1179
00:41:36,560 --> 00:41:34,770
sorts of things how do we make sure we

1180
00:41:37,970 --> 00:41:36,570
don't cut off any of those use cases how

1181
00:41:39,260 --> 00:41:37,980
do we make sure we enable folks to do

1182
00:41:42,680 --> 00:41:39,270
the things they need and want to do in

1183
00:41:44,930 --> 00:41:42,690
the air space safely so yes and we have

1184
00:41:46,940 --> 00:41:44,940
looked at drones being repurposed in

1185
00:41:48,890 --> 00:41:46,950
routes and right mm-hmm you may be doing

1186
00:41:50,090 --> 00:41:48,900
regular traffic surveillance but then

1187
00:41:51,110 --> 00:41:50,100
maybe there's a search and rescue thing

1188
00:41:52,820 --> 00:41:51,120

that has to happen and that drone could

1189
00:41:54,740 --> 00:41:52,830
be repurposed in flight and take off and

1190
00:41:55,640 --> 00:41:54,750
do something so this idea of repurposing

1191
00:41:57,830 --> 00:41:55,650
is definitely out there

1192
00:42:00,260 --> 00:41:57,840
yeah and I would say for whether it's a

1193
00:42:02,030 --> 00:42:00,270
single task or repurposing or multitasks

1194
00:42:03,950 --> 00:42:02,040
you know what you need is a secure

1195
00:42:05,120 --> 00:42:03,960
communication and navigation platform

1196
00:42:06,710 --> 00:42:05,130
right so you have to be able to

1197
00:42:09,380 --> 00:42:06,720
communicate to that that vehicle that

1198
00:42:11,240 --> 00:42:09,390
drone or that you am and be able to have

1199
00:42:13,940 --> 00:42:11,250
that communication be secure and that's

1200
00:42:15,620 --> 00:42:13,950
I think as you have multiple tasks that

1201
00:42:18,080 --> 00:42:15,630
still is the foundation is how do you

1202
00:42:21,860 --> 00:42:18,090
have safe and efficient operations right

1203
00:42:24,770 --> 00:42:21,870
yeah cool so this year you guys actually

1204
00:42:26,780 --> 00:42:24,780
had a big milestone yeah right yeah tell

1205
00:42:29,360 --> 00:42:26,790
us about what went down right I mean

1206
00:42:31,700 --> 00:42:29,370
we've been doing this since 2014

1207
00:42:33,410 --> 00:42:31,710
you know researching this drone traffic

1208
00:42:35,990 --> 00:42:33,420
management system and we've been kind of

1209
00:42:38,270 --> 00:42:36,000
building up in complexity of the kind of

1210
00:42:40,340 --> 00:42:38,280
cases that you can handle so when we got

1211
00:42:43,700 --> 00:42:40,350
to this summer we actually executed a

1212
00:42:45,290 --> 00:42:43,710
flight test to demonstrate the most

1213
00:42:47,090 --> 00:42:45,300

mature version of the system we have and

1214
00:42:49,100 --> 00:42:47,100
we do that an urban environment so we

1215
00:42:51,380 --> 00:42:49,110
flew in downtown Reno and we flew in

1216
00:42:54,590 --> 00:42:51,390
Corpus Christi Texas with the help of

1217
00:42:57,110 --> 00:42:54,600
the FA test sites at those areas and

1218
00:43:00,020 --> 00:42:57,120
many many partners doing that with us

1219
00:43:01,610 --> 00:43:00,030
right and and showing how this system

1220
00:43:02,990 --> 00:43:01,620
would work in an urban environment and

1221
00:43:04,220 --> 00:43:03,000
finding out where the limits are where

1222
00:43:06,110 --> 00:43:04,230
the gaps are and where it works really

1223
00:43:07,640 --> 00:43:06,120
well that's what we did this summer and

1224
00:43:09,590 --> 00:43:07,650
that was a really exciting time for us

1225
00:43:11,570 --> 00:43:09,600
awesome yeah you guys got video of that

1226
00:43:13,040 --> 00:43:11,580
didn't you oh yeah we probably have

1227
00:43:14,780 --> 00:43:13,050
something you tell us about if we can

1228
00:43:16,430 --> 00:43:14,790
for sure oh yeah you're looking at Reno

1229
00:43:18,770 --> 00:43:16,440
here are you looking at a couple of

1230
00:43:19,940 --> 00:43:18,780
drones taking off from the top of a

1231
00:43:21,500 --> 00:43:19,950
building and you can see they're flying

1232
00:43:23,180 --> 00:43:21,510
near the casinos and they're coming

1233
00:43:24,800 --> 00:43:23,190
really close to each other but actually

1234
00:43:26,630 --> 00:43:24,810
more space then you can tell from the

1235
00:43:29,060 --> 00:43:26,640
ground here and the key thing is that

1236
00:43:30,350 --> 00:43:29,070
the two pilots for those vehicles know

1237
00:43:32,030 --> 00:43:30,360
what the other one is doing because

1238
00:43:33,410 --> 00:43:32,040

they've been sharing information you can

1239
00:43:35,240 --> 00:43:33,420
see one holding up here all another one

1240
00:43:37,460 --> 00:43:35,250
passes by again that's the rules of the

1241
00:43:38,990 --> 00:43:37,470
road stuff we were talking about so

1242
00:43:40,610 --> 00:43:39,000
testing all those concepts and here you

1243
00:43:43,250 --> 00:43:40,620
seen kind of a Mission Control Center

1244
00:43:45,680 --> 00:43:43,260
with folks from NASA as well as the

1245
00:43:48,380 --> 00:43:45,690
Nevada Test Site working together to

1246
00:43:51,410 --> 00:43:48,390
execute these these activities sweet

1247
00:43:55,250 --> 00:43:51,420
interesting so you were not the only one

1248
00:43:57,560 --> 00:43:55,260
there were you doing you guys yeah I had

1249
00:44:00,320 --> 00:43:57,570
the chance to go out and observe the UTM

1250
00:44:02,570 --> 00:44:00,330
tests both in Reno and Texas and I would

1251
00:44:05,030 --> 00:44:02,580
say seeing the drones flying in that

1252
00:44:07,430 --> 00:44:05,040
urban environment really makes it

1253
00:44:08,350 --> 00:44:07,440
tangible right this is a reality that's

1254
00:44:11,240 --> 00:44:08,360
coming

1255
00:44:14,150 --> 00:44:11,250
to see how it's a combination of

1256
00:44:16,370 --> 00:44:14,160
software they leverage cloud services

1257
00:44:18,260 --> 00:44:16,380
plus the drone technology plus the

1258
00:44:20,510 --> 00:44:18,270
interplay of the folks on the ground you

1259
00:44:22,040 --> 00:44:20,520
really see what Joey was referring to as

1260
00:44:24,290 --> 00:44:22,050
earlier as kind of the National Airspace

1261
00:44:25,790 --> 00:44:24,300
kind of in a miniature version you're

1262
00:44:28,220 --> 00:44:25,800
running in these field trials which is

1263
00:44:30,830 --> 00:44:28,230

great to see and it really lends itself

1264
00:44:32,300 --> 00:44:30,840
to help us understand what are still

1265
00:44:34,100 --> 00:44:32,310
some of the major questions that we have

1266
00:44:36,590 --> 00:44:34,110
to address so all the data that's

1267
00:44:39,520 --> 00:44:36,600
collected from these demonstrations is

1268
00:44:42,080 --> 00:44:39,530
really I think very valuable oh yeah

1269
00:44:47,090 --> 00:44:42,090
what was your experience like Tiffani

1270
00:44:48,680 --> 00:44:47,100
well I was going to cover and help them

1271
00:44:50,390 --> 00:44:48,690
amplify you know the research that

1272
00:44:52,790 --> 00:44:50,400
they're doing for the public but I mean

1273
00:44:56,420 --> 00:44:52,800
I would say Reno was cold and then Texas

1274
00:44:58,280 --> 00:44:56,430
was very very hot but I would say you

1275
00:45:00,710 --> 00:44:58,290
know it was really a great experience to

1276
00:45:02,900 --> 00:45:00,720
see the team kind of just I feel like

1277
00:45:04,340 --> 00:45:02,910
every test day was different mom they

1278
00:45:06,530 --> 00:45:04,350
learned something one day and they

1279
00:45:08,600 --> 00:45:06,540
applied it the next day and even when

1280
00:45:11,330 --> 00:45:08,610
there were challenges to see them all

1281
00:45:13,550 --> 00:45:11,340
kind of come together six come up with a

1282
00:45:15,800 --> 00:45:13,560
plan fix it the next day was was really

1283
00:45:17,930 --> 00:45:15,810
great to see and to have covered this

1284
00:45:20,030 --> 00:45:17,940
project for like I don't know three four

1285
00:45:22,250 --> 00:45:20,040
years now it's kind of like great to see

1286
00:45:24,080 --> 00:45:22,260
you know they've come together yeah this

1287
00:45:25,880 --> 00:45:24,090
accomplishment with them it's it was

1288
00:45:27,590 --> 00:45:25,890

really really cool that's awesome yeah

1289
00:45:29,660 --> 00:45:27,600
but what would you say you learned in

1290
00:45:32,510 --> 00:45:29,670
the end from these tests in downtown

1291
00:45:33,620 --> 00:45:32,520
yeah you know maybe it sounds kind of

1292
00:45:34,970 --> 00:45:33,630
silly to say out loud but it's really

1293
00:45:37,130 --> 00:45:34,980
important to know that we learned that

1294
00:45:38,600 --> 00:45:37,140
the system works yes right actually

1295
00:45:40,220 --> 00:45:38,610
you'd actually do the things we've

1296
00:45:42,050 --> 00:45:40,230
thought it should be able to do right it

1297
00:45:43,730 --> 00:45:42,060
helps drones stay separate again it's

1298
00:45:46,160 --> 00:45:43,740
not the only layer of doing that right

1299
00:45:47,630 --> 00:45:46,170
but it's a key layer of doing that you

1300
00:45:48,890 --> 00:45:47,640
can make sure you have access for

1301
00:45:50,390 --> 00:45:48,900
priority operations you can actually

1302
00:45:53,810 --> 00:45:50,400
identify the drones in the airspace

1303
00:45:55,940 --> 00:45:53,820
digitally and in other ways so all of

1304
00:45:57,770 --> 00:45:55,950
those pieces were executed in that in

1305
00:46:00,020 --> 00:45:57,780
that airspace and the other key thing is

1306
00:46:01,880 --> 00:46:00,030
finding out more about what it takes to

1307
00:46:03,470 --> 00:46:01,890
fly in that environment right like what

1308
00:46:05,720 --> 00:46:03,480
kind of what kind of things makes this

1309
00:46:07,040 --> 00:46:05,730
hard right let's go there and fly that

1310
00:46:08,900 --> 00:46:07,050
and it's not again it's not just flying

1311
00:46:10,280 --> 00:46:08,910
one drone right a lot of folks can

1312
00:46:11,450 --> 00:46:10,290
demonstrate something with with one

1313
00:46:14,030 --> 00:46:11,460

drone and a lot of folks have done that

1314
00:46:15,800 --> 00:46:14,040
a lot of use cases but bringing a full

1315
00:46:17,390 --> 00:46:15,810
system out with many stakeholders trying

1316
00:46:18,170 --> 00:46:17,400
to collaboratively manage this airspace

1317
00:46:19,520 --> 00:46:18,180
and execute

1318
00:46:21,170 --> 00:46:19,530
Shen's is really important to do and

1319
00:46:22,490 --> 00:46:21,180
finding out where where more work needs

1320
00:46:23,720 --> 00:46:22,500
to be done and where things look like

1321
00:46:24,920 --> 00:46:23,730
they're solved right and that's what

1322
00:46:25,520 --> 00:46:24,930
these flight tests do for us right

1323
00:46:27,710 --> 00:46:25,530
perfect

1324
00:46:30,290 --> 00:46:27,720
yeah and so what's next for the drone

1325
00:46:31,490 --> 00:46:30,300
traffic management project so a lot of

1326
00:46:33,350 --> 00:46:31,500
this you know we've been continually

1327
00:46:34,460 --> 00:46:33,360
handing off to the FAA we talked about a

1328
00:46:36,590 --> 00:46:34,470
partnership live but it really is a

1329
00:46:38,750 --> 00:46:36,600
tight partnership yeah we meet with them

1330
00:46:41,600 --> 00:46:38,760
often probably more often than they

1331
00:46:42,890 --> 00:46:41,610
would like right we're talking with them

1332
00:46:44,900 --> 00:46:42,900
quite often to make sure we understand

1333
00:46:46,250 --> 00:46:44,910
what the FAA is thinking about where

1334
00:46:48,260 --> 00:46:46,260
this is going to make sure that what

1335
00:46:50,560 --> 00:46:48,270
we're research is tracking with that and

1336
00:46:52,640 --> 00:46:50,570
maybe leading it a little bit if we can

1337
00:46:55,100 --> 00:46:52,650
but they're going to be executing a

1338
00:46:56,900 --> 00:46:55,110

pilot program as well a second part of a

1339
00:46:58,580 --> 00:46:56,910
previous pilot program and we want to

1340
00:46:59,990 --> 00:46:58,590
help them in that execution and really

1341
00:47:01,850 --> 00:47:00,000
that's about taking the technologies

1342
00:47:04,040 --> 00:47:01,860
that we've been developing with the FAA

1343
00:47:05,960 --> 00:47:04,050
and our industry partners and making

1344
00:47:07,490 --> 00:47:05,970
them real in the airspace it's an

1345
00:47:08,900 --> 00:47:07,500
important step in that direction so

1346
00:47:10,660 --> 00:47:08,910
we're gonna we're gonna keep going that

1347
00:47:12,950 --> 00:47:10,670
way all right excellent

1348
00:47:16,340 --> 00:47:12,960
we have a question here from resonated

1349
00:47:19,090 --> 00:47:16,350
games is there any fundamental concept

1350
00:47:21,500 --> 00:47:19,100
that those in the private or commercial

1351
00:47:26,600 --> 00:47:21,510
sector testing of the drones should be

1352
00:47:29,150 --> 00:47:26,610
paying attention to there are so many

1353
00:47:31,940 --> 00:47:29,160
pieces to this right so a lot of folks

1354
00:47:33,650 --> 00:47:31,950
are specialized in a certain area might

1355
00:47:35,630 --> 00:47:33,660
be on the platform itself building you

1356
00:47:36,800 --> 00:47:35,640
know detect and avoid sensor how do you

1357
00:47:38,950 --> 00:47:36,810
actually see things in the airspace and

1358
00:47:41,150 --> 00:47:38,960
get out of their way and I think that

1359
00:47:43,130 --> 00:47:41,160
continuing to push all of those lanes is

1360
00:47:44,660 --> 00:47:43,140
important I think understanding the

1361
00:47:47,060 --> 00:47:44,670
ecosystem as a whole is also really

1362
00:47:49,250 --> 00:47:47,070
important I think folks that do work on

1363
00:47:50,900 --> 00:47:49,260

important sensors and it's important

1364
00:47:52,490 --> 00:47:50,910
platforms it's important for them to

1365
00:47:54,470 --> 00:47:52,500
also understand the ecosystem in which

1366
00:47:56,120 --> 00:47:54,480
those drones will operate so just trying

1367
00:47:57,500 --> 00:47:56,130
to keep pace and understand where the

1368
00:47:59,900 --> 00:47:57,510
research is heading and where the FAA is

1369
00:48:01,190 --> 00:47:59,910
signaled things are going just trying to

1370
00:48:06,950 --> 00:48:01,200
stay abreast of all that stuff is really

1371
00:48:08,990 --> 00:48:06,960
important here's a comment on the during

1372
00:48:11,720 --> 00:48:09,000
traffic management system maybe you can

1373
00:48:13,850 --> 00:48:11,730
respond twisted metals asks the pilot

1374
00:48:17,300 --> 00:48:13,860
will be watching a movie just like now

1375
00:48:20,840 --> 00:48:17,310
95 percent of the time so a drone pilot

1376
00:48:24,790 --> 00:48:20,850
will be watching on screen I don't know

1377
00:48:31,180 --> 00:48:28,450
95% of drone pilots I understand okay

1378
00:48:32,860 --> 00:48:31,190
are they watching their flight on screen

1379
00:48:34,570 --> 00:48:32,870
oh I see are they physically watching

1380
00:48:36,130 --> 00:48:34,580
the aircraft or are they watching some

1381
00:48:37,690 --> 00:48:36,140
representation of their operation on a

1382
00:48:39,700 --> 00:48:37,700
screen I guess that's the question yeah

1383
00:48:41,380 --> 00:48:39,710
I think it's more the latter right again

1384
00:48:43,180 --> 00:48:41,390
because we're trying to build a system

1385
00:48:45,160 --> 00:48:43,190
so that these vehicles can go beyond

1386
00:48:47,140 --> 00:48:45,170
visual line of sight of the operator of

1387
00:48:48,460 --> 00:48:47,150
the pilot oh yes all right so they're

1388
00:48:50,890 --> 00:48:48,470

not gonna be able to just watch it in

1389
00:48:52,180 --> 00:48:50,900
the sky right right and that's how you

1390
00:48:53,350 --> 00:48:52,190
enable all these business cases you

1391
00:48:55,180 --> 00:48:53,360
can't have someone watching the drone if

1392
00:48:57,700 --> 00:48:55,190
you're gonna go deliver that thing yeah

1393
00:48:59,530 --> 00:48:57,710
you know fire whales away you can't have

1394
00:49:01,300 --> 00:48:59,540
someone or a line of someone's watching

1395
00:49:03,010 --> 00:49:01,310
that so how do you build a system that

1396
00:49:05,080 --> 00:49:03,020
allows that so yeah there would be some

1397
00:49:07,060 --> 00:49:05,090
representation of the operation

1398
00:49:08,230 --> 00:49:07,070
occurring that the person that's in

1399
00:49:10,540 --> 00:49:08,240
charge of that operation would have

1400
00:49:12,580 --> 00:49:10,550
access to yeah it might be as simple as

1401
00:49:14,320 --> 00:49:12,590
a moving map with some alerts that are

1402
00:49:17,380 --> 00:49:14,330
coming on to it write something like

1403
00:49:18,820 --> 00:49:17,390
you'd see on your you know for for your

1404
00:49:20,560 --> 00:49:18,830
regular driving right something that's

1405
00:49:22,000 --> 00:49:20,570
letting you know where you're going or

1406
00:49:23,410 --> 00:49:22,010
it could be more advanced right it could

1407
00:49:25,480 --> 00:49:23,420
be a 3d view it could be a first-person

1408
00:49:27,070 --> 00:49:25,490
view really depends on the mission and

1409
00:49:28,540 --> 00:49:27,080
the environment you're flying in and

1410
00:49:32,410 --> 00:49:28,550
what the future rules actually are to do

1411
00:49:34,180 --> 00:49:32,420
that so yes yes yeah yeah I would add

1412
00:49:36,160 --> 00:49:34,190
regardless of whether it's a drone pilot

1413
00:49:37,630 --> 00:49:36,170

or a pilot onboard one of these new

1414
00:49:39,400 --> 00:49:37,640
types of vehicles there's gonna be

1415
00:49:41,380 --> 00:49:39,410
different ways of interacting with the

1416
00:49:43,900 --> 00:49:41,390
vehicle and controlling the vehicle just

1417
00:49:45,850 --> 00:49:43,910
as automation increases and there's

1418
00:49:47,290 --> 00:49:45,860
changes in how those vehicles fly I

1419
00:49:49,690 --> 00:49:47,300
think there's going to be some changes

1420
00:49:51,730 --> 00:49:49,700
in that traditional pilot flight deck or

1421
00:49:53,560 --> 00:49:51,740
cockpit relationship yes and how you

1422
00:49:55,360 --> 00:49:53,570
interface with that it's gonna change

1423
00:49:57,640 --> 00:49:55,370
and that's also another interesting area

1424
00:50:00,310 --> 00:49:57,650
of research all the way from you know

1425
00:50:02,380 --> 00:50:00,320
human-computer interface logic that goes

1426
00:50:05,080 --> 00:50:02,390
behind that as well as what button do I

1427
00:50:07,180 --> 00:50:05,090
push to to land or take off or is there

1428
00:50:10,300 --> 00:50:07,190
an easy fly button right so there's all

1429
00:50:12,730 --> 00:50:10,310
kinds of new ways to engage with with

1430
00:50:14,320 --> 00:50:12,740
aircraft whether it's a drone or some of

1431
00:50:16,240 --> 00:50:14,330
these new vehicles and I think that's a

1432
00:50:17,200 --> 00:50:16,250
really interesting area yeah I think one

1433
00:50:19,540 --> 00:50:17,210
of the key things we're seeing a lot of

1434
00:50:21,340 --> 00:50:19,550
research on from industry as well as you

1435
00:50:23,800 --> 00:50:21,350
know the NASA side is how do these

1436
00:50:25,570 --> 00:50:23,810
pilots maybe control more than one of

1437
00:50:27,130 --> 00:50:25,580
these right it doesn't have to be a

1438
00:50:29,170 --> 00:50:27,140

one-to-one relationship between one

1439
00:50:31,090 --> 00:50:29,180
pilot and one active operation or can

1440
00:50:33,130 --> 00:50:31,100
you expand that further right can you

1441
00:50:35,680 --> 00:50:33,140
actually have three people controlling

1442
00:50:37,600 --> 00:50:35,690
eight vehicles or can it be one

1443
00:50:38,140 --> 00:50:37,610
controlling too like what are the limits

1444
00:50:39,849 --> 00:50:38,150
of that and

1445
00:50:43,559 --> 00:50:39,859
tools need to exist in order to make

1446
00:50:47,499 --> 00:50:43,569
sure that again happens very safely yeah

1447
00:50:51,220 --> 00:50:47,509
we have a question here from Tamil 101

1448
00:50:52,989 --> 00:50:51,230
is there any corporation with autonomous

1449
00:50:54,609 --> 00:50:52,999
car research I expect there would be

1450
00:50:58,329 --> 00:50:54,619
similar challenges and opportunities for

1451
00:51:01,359 --> 00:50:58,339
with communication and control so I

1452
00:51:03,549 --> 00:51:01,369
think the same principles of of

1453
00:51:05,289 --> 00:51:03,559
autonomous car autonomous vehicle

1454
00:51:06,759 --> 00:51:05,299
self-driving cars however you wish to

1455
00:51:08,680 --> 00:51:06,769
call it those some of those same

1456
00:51:11,710 --> 00:51:08,690
principles are I think important in

1457
00:51:13,299 --> 00:51:11,720
aviation as well so what can I

1458
00:51:15,880 --> 00:51:13,309
understand what my environment is

1459
00:51:17,890 --> 00:51:15,890
presenting to me right so do I have some

1460
00:51:19,809 --> 00:51:17,900
awareness of what my environment is for

1461
00:51:21,130 --> 00:51:19,819
airplanes that would involve or aircraft

1462
00:51:23,769 --> 00:51:21,140
and drones it would involve weather

1463
00:51:25,480 --> 00:51:23,779

alright knowing how strong your

1464
00:51:27,700 --> 00:51:25,490
communication signal is to your base

1465
00:51:30,849 --> 00:51:27,710
operations but all of those same types

1466
00:51:32,849 --> 00:51:30,859
of questions about communication safe

1467
00:51:35,019 --> 00:51:32,859
communication reliable communication

1468
00:51:38,349 --> 00:51:35,029
understanding of the environment around

1469
00:51:39,609 --> 00:51:38,359
you being able to react appropriately to

1470
00:51:41,410 --> 00:51:39,619
the environment around you knowing the

1471
00:51:43,089 --> 00:51:41,420
rules of the road that Joey kind of

1472
00:51:44,650 --> 00:51:43,099
reference whether you're actually on the

1473
00:51:47,289 --> 00:51:44,660
road or flying and flying in the air

1474
00:51:52,420 --> 00:51:47,299
those are all same principles I'm glad

1475
00:51:53,829 --> 00:51:52,430
yeah yeah make sense cool I want to jump

1476
00:51:55,299 --> 00:51:53,839
back to another topic that I want to

1477
00:51:56,950 --> 00:51:55,309
make sure we don't miss of course one of

1478
00:51:59,229 --> 00:51:56,960
the coolest things I recently learned

1479
00:52:01,509 --> 00:51:59,239
about the urban air mobility research is

1480
00:52:03,370 --> 00:52:01,519
the simulation work that you guys do

1481
00:52:05,769 --> 00:52:03,380
yeah can you tell us about that yeah

1482
00:52:08,109 --> 00:52:05,779
sure so you know I think for all our

1483
00:52:10,359 --> 00:52:08,119
twitch fans out there you guys might

1484
00:52:13,150 --> 00:52:10,369
have Microsoft Flight Simulator have

1485
00:52:16,479 --> 00:52:13,160
used that so just like you could emulate

1486
00:52:20,259 --> 00:52:16,489
flying a Cessna or a piper or even like

1487
00:52:22,210 --> 00:52:20,269
a 747 we have advanced flight simulators

1488
00:52:23,829 --> 00:52:22,220

here at Ames they are kind of a

1489
00:52:25,690 --> 00:52:23,839
combination of flight simulators some

1490
00:52:27,549 --> 00:52:25,700
are fixed meaning they don't move and

1491
00:52:29,079 --> 00:52:27,559
some move and actually allow you to see

1492
00:52:30,670 --> 00:52:29,089
all feel all the forces that you would

1493
00:52:32,470 --> 00:52:30,680
experience like you were flying in in

1494
00:52:34,239 --> 00:52:32,480
real life so using we have a lots of

1495
00:52:36,069 --> 00:52:34,249
different kinds of simulators and it's

1496
00:52:38,109 --> 00:52:36,079
not just we have that the fact that we

1497
00:52:40,569 --> 00:52:38,119
have those simulators is that we have or

1498
00:52:42,309 --> 00:52:40,579
we're developing performance models for

1499
00:52:43,660 --> 00:52:42,319
these new types of vehicles and so we

1500
00:52:45,039 --> 00:52:43,670
can know then how they actually fly

1501
00:52:47,240 --> 00:52:45,049
right right I don't exist yet so you

1502
00:52:49,310 --> 00:52:47,250
have to invent the right model of it

1503
00:52:51,470 --> 00:52:49,320
right exactly it's to take some concept

1504
00:52:53,510 --> 00:52:51,480
vehicles understand how these vehicles

1505
00:52:55,820 --> 00:52:53,520
would fly with their performance be and

1506
00:52:59,150 --> 00:52:55,830
then how would they actually fly in an

1507
00:53:00,320 --> 00:52:59,160
emulated world in our airspace and go

1508
00:53:02,300 --> 00:53:00,330
through some of those same questions

1509
00:53:04,790 --> 00:53:02,310
overall been talking about now how do I

1510
00:53:07,190 --> 00:53:04,800
interact with my controls do I have a

1511
00:53:09,380 --> 00:53:07,200
joystick like I would for a helicopter

1512
00:53:11,540 --> 00:53:09,390
like a cyclic or do I have something

1513
00:53:13,250 --> 00:53:11,550

else and what is that mode of

1514
00:53:14,570 --> 00:53:13,260
interaction those are questions that we

1515
00:53:16,880 --> 00:53:14,580
can also think about for these

1516
00:53:19,490 --> 00:53:16,890
simulators yeah along with how do i

1517
00:53:21,110 --> 00:53:19,500
interface with some new traffic

1518
00:53:22,760 --> 00:53:21,120
management system specifically for my

1519
00:53:24,470 --> 00:53:22,770
vehicles building off the work that

1520
00:53:25,820 --> 00:53:24,480
Joey's been doing so there's all kinds

1521
00:53:27,710 --> 00:53:25,830
of different things we can investigate

1522
00:53:28,700 --> 00:53:27,720
with these simulators right testing

1523
00:53:32,600 --> 00:53:28,710
everything and how it comes together

1524
00:53:36,950 --> 00:53:32,610
exactly yeah right and we're gonna see

1525
00:53:39,050 --> 00:53:36,960
what this looks like let's do that

1526
00:53:42,290 --> 00:53:39,060
simulation video and tell us what we're

1527
00:53:45,140 --> 00:53:42,300
seeing sure this is gonna be so this is

1528
00:53:46,880 --> 00:53:45,150
a video from one of our fixed base

1529
00:53:49,250 --> 00:53:46,890
flight simulators so flight simulator

1530
00:53:51,830 --> 00:53:49,260
that does not move this is what from one

1531
00:53:53,930 --> 00:53:51,840
of our researchers Mike fury and his

1532
00:53:56,240 --> 00:53:53,940
simulator here you can see that it shows

1533
00:53:58,400 --> 00:53:56,250
a vehicle taking off of vertically and

1534
00:54:00,050 --> 00:53:58,410
now it's moving forward in flight and

1535
00:54:01,460 --> 00:54:00,060
what's actually really interesting is

1536
00:54:03,740 --> 00:54:01,470
some of these vehicles as they move

1537
00:54:05,300 --> 00:54:03,750
forward in flight have this transition

1538
00:54:07,520 --> 00:54:05,310

period because you have to transition

1539
00:54:09,860 --> 00:54:07,530
from vertical takeoff to forward flight

1540
00:54:11,690 --> 00:54:09,870
and helicopters that kind of occurs

1541
00:54:13,220 --> 00:54:11,700
instantaneously but for these vehicles

1542
00:54:14,960 --> 00:54:13,230
you're gonna have this transition period

1543
00:54:16,550 --> 00:54:14,970
and that's interesting to kind of

1544
00:54:18,800 --> 00:54:16,560
understand and now you can see the

1545
00:54:20,600 --> 00:54:18,810
vehicle flying in an urban center in

1546
00:54:23,060 --> 00:54:20,610
this case it's a model of San Francisco

1547
00:54:25,370 --> 00:54:23,070
and our simulators we can model almost

1548
00:54:27,020 --> 00:54:25,380
any type of urban environment or you

1549
00:54:29,000 --> 00:54:27,030
know any landscape that we wish to

1550
00:54:31,400 --> 00:54:29,010
understand or understand the procedures

1551
00:54:33,620 --> 00:54:31,410
of flying how would I land how would I

1552
00:54:35,030 --> 00:54:33,630
come in for my approach these are some

1553
00:54:37,130 --> 00:54:35,040
of the things that we can explore so you

1554
00:54:39,260 --> 00:54:37,140
can see this vehicle now coming in for

1555
00:54:40,970 --> 00:54:39,270
its approach and its landing and this is

1556
00:54:42,650 --> 00:54:40,980
an interesting question as you come in

1557
00:54:44,180 --> 00:54:42,660
for your approach and your landing you

1558
00:54:46,310 --> 00:54:44,190
can see that vehicle kind of pitch up a

1559
00:54:47,930 --> 00:54:46,320
little bit so how does that feel right

1560
00:54:50,330 --> 00:54:47,940
so if Joey and I we're sitting in the

1561
00:54:52,280 --> 00:54:50,340
back with coffees in hand yeah that

1562
00:54:54,200 --> 00:54:52,290
coffee spill or kind of how would we get

1563
00:54:56,480 --> 00:54:54,210

a war me first

1564
00:54:58,610 --> 00:54:56,490
so understanding that passenger

1565
00:54:59,780 --> 00:54:58,620
experience is actually a really big part

1566
00:55:02,150 --> 00:54:59,790
of some of the work that these

1567
00:55:04,550 --> 00:55:02,160
simulators can do so it's not quite this

1568
00:55:06,830 --> 00:55:04,560
simulator but we have another motion

1569
00:55:08,390 --> 00:55:06,840
simulator that allows us to understand

1570
00:55:10,490 --> 00:55:08,400
what is the passion passenger experience

1571
00:55:12,320 --> 00:55:10,500
what are the forces of elements yeah

1572
00:55:13,580 --> 00:55:12,330
what does it feel like right I'm glad

1573
00:55:16,100 --> 00:55:13,590
you're here

1574
00:55:27,830 --> 00:55:16,110
I got sick on a whale watch this year so

1575
00:55:30,020 --> 00:55:27,840
I would like you to find so these

1576
00:55:31,790 --> 00:55:30,030
simulators this this for me was one of

1577
00:55:33,530 --> 00:55:31,800
the coolest things I heard about do you

1578
00:55:34,880 --> 00:55:33,540
have a favorite aspect of this

1579
00:55:37,520 --> 00:55:34,890
researcher what's a really cool thing

1580
00:55:39,440 --> 00:55:37,530
you want to share yeah so I'd say the

1581
00:55:41,780 --> 00:55:39,450
number of questions that this research

1582
00:55:43,310 --> 00:55:41,790
is kind of highlighting is really

1583
00:55:45,650 --> 00:55:43,320
interesting and the fact that it's this

1584
00:55:49,430 --> 00:55:45,660
new era of aviation this new mode of

1585
00:55:51,800 --> 00:55:49,440
transportation is is very exciting so as

1586
00:55:54,110 --> 00:55:51,810
this technology kind of develops and

1587
00:55:55,340 --> 00:55:54,120
these these new vehicle configurations

1588
00:55:56,660 --> 00:55:55,350

come to life and we're starting to

1589
00:56:00,050 --> 00:55:56,670
explore them I think the really

1590
00:56:01,520 --> 00:56:00,060
interesting thing is that this is a area

1591
00:56:03,140 --> 00:56:01,530
of work that's going to continue

1592
00:56:04,730 --> 00:56:03,150
so all those folks that are interested

1593
00:56:06,680 --> 00:56:04,740
in understanding or maybe even

1594
00:56:08,780 --> 00:56:06,690
participating in this area you have a

1595
00:56:10,580 --> 00:56:08,790
chance to really be part of it so people

1596
00:56:12,620 --> 00:56:10,590
out there have a chance to be part of

1597
00:56:13,910 --> 00:56:12,630
this new era of Transportation they can

1598
00:56:15,560 --> 00:56:13,920
actually be involved which i think is

1599
00:56:17,270 --> 00:56:15,570
really neat right yeah this is by no

1600
00:56:19,790 --> 00:56:17,280
means finished and said all right we

1601
00:56:24,080 --> 00:56:19,800
ready help me exactly yeah awesome what

1602
00:56:26,840 --> 00:56:24,090
are you doing what I'm looking forward

1603
00:56:28,130 --> 00:56:26,850
to or whatever yeah you know just taking

1604
00:56:28,430 --> 00:56:28,140
a step back and looking at it from the

1605
00:56:30,020 --> 00:56:28,440
outside

1606
00:56:33,350 --> 00:56:30,030
ameri-ghen a little closer to being

1607
00:56:35,420 --> 00:56:33,360
Jetsons world right we're talking about

1608
00:56:38,570 --> 00:56:35,430
flying cars before yeah you know we're

1609
00:56:39,350 --> 00:56:38,580
still a few steps away from that but you

1610
00:56:41,240 --> 00:56:39,360
know we're getting there

1611
00:56:42,560 --> 00:56:41,250
we're gonna hopefully have some more

1612
00:56:43,160 --> 00:56:42,570
operations in the urban environment than

1613
00:56:44,570 --> 00:56:43,170

we had before

1614
00:56:45,830 --> 00:56:44,580
great they're gonna happen safely

1615
00:56:47,750 --> 00:56:45,840
they're gonna get us closer to exactly

1616
00:56:48,410 --> 00:56:47,760
where we want to go it's real it's

1617
00:56:50,660 --> 00:56:48,420
really neat to see

1618
00:56:53,769 --> 00:56:50,670
that's totally cool yeah

1619
00:56:56,690 --> 00:56:53,779
got a bunch of questions piling up we do

1620
00:56:58,910 --> 00:56:56,700
yeah so eventually you were speaking

1621
00:57:00,589 --> 00:56:58,920
about like the pasture passenger

1622
00:57:02,690 --> 00:57:00,599
experience and things like that

1623
00:57:03,859 --> 00:57:02,700
legit twitch channel has a question well

1624
00:57:05,989 --> 00:57:03,869
people will be required to wear

1625
00:57:09,710 --> 00:57:05,999
parachutes what kind of safety measures

1626
00:57:10,489 --> 00:57:09,720
would we expect in oxygen masks life

1627
00:57:12,170 --> 00:57:10,499
jackets

1628
00:57:14,299 --> 00:57:12,180
things like that yeah I know and I think

1629
00:57:15,769 --> 00:57:14,309
that's a great question and it raises

1630
00:57:18,049 --> 00:57:15,779
the fact that as these vehicles are

1631
00:57:20,690 --> 00:57:18,059
getting certified there is that aspect

1632
00:57:22,640 --> 00:57:20,700
of ensuring safe operations and in the

1633
00:57:24,229 --> 00:57:22,650
case of off-nominal events ensuring that

1634
00:57:26,089 --> 00:57:24,239
those folks on board have the

1635
00:57:29,390 --> 00:57:26,099
appropriate mechanisms to ensure safety

1636
00:57:31,220 --> 00:57:29,400
of Larry right so just like we have the

1637
00:57:32,900 --> 00:57:31,230
safety briefing we all love to sit in

1638
00:57:35,749 --> 00:57:32,910

when we get when we go fly on the

1639
00:57:37,999 --> 00:57:35,759
aircraft there has to be some think most

1640
00:57:39,920 --> 00:57:38,009
likely similar for for passenger

1641
00:57:42,200 --> 00:57:39,930
carrying vehicles even if they're urban

1642
00:57:44,239 --> 00:57:42,210
air mobility vehicles so safety is the

1643
00:57:46,309 --> 00:57:44,249
number-one concern for us for the FAA

1644
00:57:48,410 --> 00:57:46,319
and for industry that's developing these

1645
00:57:49,849 --> 00:57:48,420
vehicles so there will most likely be

1646
00:57:57,410 --> 00:57:49,859
something similar yeah we just don't

1647
00:57:59,690 --> 00:57:57,420
know quite what yet Johnny cz 25 trying

1648
00:58:03,109 --> 00:57:59,700
to pronounce these names

1649
00:58:04,789 --> 00:58:03,119
well the will it have aircraft cameras

1650
00:58:08,839 --> 00:58:04,799
with special software to create a

1651
00:58:12,579 --> 00:58:08,849
landing point I know that you have

1652
00:58:14,839 --> 00:58:12,589
worked on yeah landing so there is ins

1653
00:58:20,660 --> 00:58:14,849
there's a there's a lot in that question

1654
00:58:23,120 --> 00:58:20,670
yeah because it it speaks to the number

1655
00:58:24,680 --> 00:58:23,130
of ways you can accomplish things right

1656
00:58:26,870 --> 00:58:24,690
so yes you even you look at the small

1657
00:58:29,450 --> 00:58:26,880
drones they do have cameras of different

1658
00:58:31,519 --> 00:58:29,460
types that help identify if a landing

1659
00:58:32,660 --> 00:58:31,529
location is safe to land or not because

1660
00:58:34,489 --> 00:58:32,670
you can plan ahead of time I'm going to

1661
00:58:35,779 --> 00:58:34,499
land in this open field right and I'm

1662
00:58:37,489 --> 00:58:35,789
gonna go there and I'm gonna land that

1663
00:58:38,960 --> 00:58:37,499

everything's good but you get there and

1664
00:58:40,640 --> 00:58:38,970
there's a car there or people are having

1665
00:58:42,109 --> 00:58:40,650
a picnic right right do you have a

1666
00:58:43,549 --> 00:58:42,119
system on board that can help you

1667
00:58:45,920 --> 00:58:43,559
identify that and then go to an

1668
00:58:47,930 --> 00:58:45,930
alternate location so some visual

1669
00:58:49,099 --> 00:58:47,940
technology is used to do that some of

1670
00:58:51,579 --> 00:58:49,109
that has been developed at NASA Langley

1671
00:58:54,470 --> 00:58:51,589
for example to do those sorts of things

1672
00:58:55,999 --> 00:58:54,480
and in general when they're planning

1673
00:58:57,620 --> 00:58:56,009
their operations there would be some

1674
00:58:58,940 --> 00:58:57,630
visualization probably of where they

1675
00:59:01,400 --> 00:58:58,950
would like to go and how they would like

1676
00:59:02,530 --> 00:59:01,410
to get there so you could put a point on

1677
00:59:03,760 --> 00:59:02,540
a screen and then that

1678
00:59:05,350 --> 00:59:03,770
be translated into a flight plan and

1679
00:59:07,450 --> 00:59:05,360
that can be communicated to the system

1680
00:59:09,460 --> 00:59:07,460
all these things are things that are

1681
00:59:11,650 --> 00:59:09,470
possible and we've seen examples of

1682
00:59:15,460 --> 00:59:11,660
already yeah yeah Annie okay so you're

1683
00:59:17,260 --> 00:59:15,470
all over that hate on that yeah we have

1684
00:59:20,440 --> 00:59:17,270
a question here

1685
00:59:21,970 --> 00:59:20,450
goofy joy resonator ticket game says if

1686
00:59:24,190 --> 00:59:21,980
you could snap your fingers and solve

1687
00:59:25,500 --> 00:59:24,200
one aspect of industrial drone flight

1688
00:59:31,630 --> 00:59:25,510

what would it be

1689
00:59:33,640 --> 00:59:31,640
question I mean if you can solve the

1690
00:59:36,010 --> 00:59:33,650
detect and avoid problem for all

1691
00:59:37,780 --> 00:59:36,020
vehicles in all classes with a sample of

1692
00:59:40,270 --> 00:59:37,790
a finger that that was doing live right

1693
00:59:41,590 --> 00:59:40,280
so that that's that's the last layer

1694
00:59:43,690 --> 00:59:41,600
safety right how do you make sure that I

1695
00:59:45,270 --> 00:59:43,700
see that thing that's coming at me and

1696
00:59:48,370 --> 00:59:45,280
it's very close and I'm out of its way

1697
00:59:50,170 --> 00:59:48,380
that means one drone being able to see

1698
00:59:52,120 --> 00:59:50,180
another one coming and move each drone

1699
00:59:53,740 --> 00:59:52,130
could avoid the things that needs to

1700
00:59:55,870 --> 00:59:53,750
avoid whether they're static things on

1701
00:59:57,160 --> 00:59:55,880
the ground okay um maybe yesterday there

1702
00:59:58,870 --> 00:59:57,170
wasn't a crane there and today there is

1703
01:00:01,330 --> 00:59:58,880
a crane there right and that's not on my

1704
01:00:02,860 --> 01:00:01,340
maps how do I detect that as well as

1705
01:00:04,630 --> 01:00:02,870
other things flying in the air whether

1706
01:00:05,950 --> 01:00:04,640
it's a traditional Cessna with a real

1707
01:00:08,830 --> 01:00:05,960
pilot on board that can't see your

1708
01:00:10,690 --> 01:00:08,840
little drone yeah or maybe doesn't have

1709
01:00:13,810 --> 01:00:10,700
the same maneuverability as an urban air

1710
01:00:16,000 --> 01:00:13,820
mobility vehicle how do how do these

1711
01:00:17,680 --> 01:00:16,010
vehicles detect those problems and then

1712
01:00:19,600 --> 01:00:17,690
avoid them right if you could solve that

1713
01:00:21,700 --> 01:00:19,610

problem you you get a long way towards a

1714
01:00:23,470 --> 01:00:21,710
lot of the safety questions that need to

1715
01:00:24,940 --> 01:00:23,480
be answered yeah and there's a lot of

1716
01:00:25,960 --> 01:00:24,950
ways to do that and there's a lot of

1717
01:00:28,330 --> 01:00:25,970
folks working on that and there's some

1718
01:00:29,470 --> 01:00:28,340
very good solutions toward it but if it

1719
01:00:32,760 --> 01:00:29,480
could be universally solved that would

1720
01:00:37,630 --> 01:00:35,380
how about this one from hovercat will

1721
01:00:41,500 --> 01:00:37,640
the flight controllers and software

1722
01:00:41,950 --> 01:00:41,510
firmware be open-source it's something

1723
01:00:44,050 --> 01:00:41,960
to think about

1724
01:00:46,710 --> 01:00:44,060
yeah so that's an interesting question

1725
01:00:48,760 --> 01:00:46,720
for some of these vehicles you're their

1726
01:00:50,950 --> 01:00:48,770
manufacturers that are developing some

1727
01:00:52,570 --> 01:00:50,960
of these vehicles are have a whole host

1728
01:00:54,580 --> 01:00:52,580
of configurations and some of them are

1729
01:00:56,140 --> 01:00:54,590
working with the traditional flight

1730
01:00:57,460 --> 01:00:56,150
management computers or flight

1731
01:00:59,050 --> 01:00:57,470
management systems that you have in

1732
01:01:02,140 --> 01:00:59,060
commercial aircraft today and some are

1733
01:01:03,910 --> 01:01:02,150
some are you you know depending on the

1734
01:01:06,250 --> 01:01:03,920
safety cases as well as the secure

1735
01:01:08,920 --> 01:01:06,260
communication piece that's required it

1736
01:01:11,470 --> 01:01:08,930
might not be quite open-source but just

1737
01:01:13,390 --> 01:01:11,480
like we have simulators today that help

1738
01:01:15,750 --> 01:01:13,400

us understand the performance as well as

1739
01:01:17,340 --> 01:01:15,760
the controls for those vehicles I'm sure

1740
01:01:18,780 --> 01:01:17,350
something similar will be developed so

1741
01:01:20,700 --> 01:01:18,790
that folks out there who want to try

1742
01:01:22,710 --> 01:01:20,710
them out or can want to fly them and and

1743
01:01:25,290 --> 01:01:22,720
their own simulator will be able to do

1744
01:01:27,900 --> 01:01:25,300
so but as as the industry is developing

1745
01:01:29,670 --> 01:01:27,910
their tools they're pulling from you

1746
01:01:31,260 --> 01:01:29,680
know existing tools for flip for flight

1747
01:01:32,520 --> 01:01:31,270
controls today as well as developing

1748
01:01:34,560 --> 01:01:32,530
their own so it's kind of a mixed bag

1749
01:01:36,570 --> 01:01:34,570
right now okay yeah you know for the

1750
01:01:37,410 --> 01:01:36,580
small drones we're looking at in and

1751
01:01:39,510 --> 01:01:37,420
generally everything should be

1752
01:01:41,040 --> 01:01:39,520
performance based can you do that how

1753
01:01:42,540 --> 01:01:41,050
can you prove you can stay within the

1754
01:01:45,030 --> 01:01:42,550
bounds of a certain performance envelope

1755
01:01:46,950 --> 01:01:45,040
okay like I know I can control my

1756
01:01:48,570 --> 01:01:46,960
vehicle under all these conditions and I

1757
01:01:50,010 --> 01:01:48,580
can show you how I do that

1758
01:01:52,920 --> 01:01:50,020
mm-hmm now that may mean you use an

1759
01:01:55,110 --> 01:01:52,930
open-source pieces or everything's open

1760
01:01:56,850 --> 01:01:55,120
source or not I can't say that if there

1761
01:01:58,910 --> 01:01:56,860
was a single open source solution for a

1762
01:02:01,050 --> 01:01:58,920
piece of that and it was proven to

1763
01:02:03,000 --> 01:02:01,060

perform in a certain way then that would

1764
01:02:04,440 --> 01:02:03,010
be very valuable yeah but I don't think

1765
01:02:06,480 --> 01:02:04,450
it'll be a requirement that everyone

1766
01:02:10,380 --> 01:02:06,490
uses an open source in particular

1767
01:02:12,090 --> 01:02:10,390
element okay yeah yeah I see another

1768
01:02:13,880 --> 01:02:12,100
question here but you made me think of

1769
01:02:16,650 --> 01:02:13,890
it you mentioned the word security so

1770
01:02:18,150 --> 01:02:16,660
legit twitch channel s could drones be

1771
01:02:19,830 --> 01:02:18,160
subject to hackers will there be

1772
01:02:24,000 --> 01:02:19,840
security measures in place to repel

1773
01:02:24,930 --> 01:02:24,010
unwanted or harmful signals so the

1774
01:02:29,160 --> 01:02:24,940
answer the first question is yes

1775
01:02:31,560 --> 01:02:29,170
definitely I mean any any piece of IT

1776
01:02:33,150 --> 01:02:31,570
technology right it can be some

1777
01:02:36,270 --> 01:02:33,160
potentially that's right if it's not

1778
01:02:38,610 --> 01:02:36,280
built correctly so the answer is yes and

1779
01:02:42,480 --> 01:02:38,620
again it's part of not necessarily

1780
01:02:44,670 --> 01:02:42,490
getting to you want to be as secure as

1781
01:02:46,890 --> 01:02:44,680
possible at all layers but in general we

1782
01:02:49,290 --> 01:02:46,900
know that's not likely to happen so how

1783
01:02:50,520 --> 01:02:49,300
do you build enough layers and such that

1784
01:02:52,740 --> 01:02:50,530
as you layer them all on top of each

1785
01:02:54,210 --> 01:02:52,750
other that overall the whole thing stays

1786
01:02:55,890 --> 01:02:54,220
secure right it's kind of a Swiss cheese

1787
01:02:57,180 --> 01:02:55,900
approach they call if you layer the

1788
01:02:58,110 --> 01:02:57,190

Swiss cheese in certain ways you cover

1789
01:03:02,880 --> 01:02:58,120
up all the holes and you can't see

1790
01:03:04,860 --> 01:03:02,890
through it security I think that's what

1791
01:03:06,720 --> 01:03:04,870
you want to look at with these drones so

1792
01:03:08,790 --> 01:03:06,730
that even if a given drone was hacked

1793
01:03:10,230 --> 01:03:08,800
let's say that it can't cause damage to

1794
01:03:10,620 --> 01:03:10,240
the further system or the folks on the

1795
01:03:12,330 --> 01:03:10,630
ground

1796
01:03:14,370 --> 01:03:12,340
does it have other safety mechanisms to

1797
01:03:16,500 --> 01:03:14,380
make sure that no harm can really come

1798
01:03:18,390 --> 01:03:16,510
from that so there's a lot of work in

1799
01:03:19,740 --> 01:03:18,400
cyber security related to not just the

1800
01:03:21,480 --> 01:03:19,750
drones themselves but the traffic

1801
01:03:22,620 --> 01:03:21,490
management system as a whole that if

1802
01:03:22,800 --> 01:03:22,630
that was hacked that would be bad as

1803
01:03:23,760 --> 01:03:22,810
well

1804
01:03:24,920 --> 01:03:23,770
right so how do you build all these

1805
01:03:27,050 --> 01:03:24,930
layers and yeah

1806
01:03:29,090 --> 01:03:27,060
yeah I think security has to be the

1807
01:03:31,040 --> 01:03:29,100
vehicle itself the communication

1808
01:03:32,780 --> 01:03:31,050
protocols between the vehicles and their

1809
01:03:34,580 --> 01:03:32,790
operators so there's like Joey was

1810
01:03:36,650 --> 01:03:34,590
saying multiple layers of security are

1811
01:03:38,360 --> 01:03:36,660
really required so anything that's

1812
01:03:40,160 --> 01:03:38,370
learned from this fear of drones can be

1813
01:03:41,810 --> 01:03:40,170

obviously applied to other types of

1814
01:03:43,460 --> 01:03:41,820
vehicles as well so it's a question

1815
01:03:44,420 --> 01:03:43,470
that's something applicable for all all

1816
01:03:46,760 --> 01:03:44,430
vehicles

1817
01:03:48,440 --> 01:03:46,770
yeah all right good and general research

1818
01:03:49,970 --> 01:03:48,450
wise we like to consider security a

1819
01:03:51,260 --> 01:03:49,980
first-class citizen in the research

1820
01:03:52,790 --> 01:03:51,270
process right it's not something you

1821
01:03:54,560 --> 01:03:52,800
tack on at the end there's nothing you

1822
01:03:56,450 --> 01:03:54,570
make sure you're thinking about an

1823
01:03:58,280 --> 01:03:56,460
engaging industry within the FA with and

1824
01:03:59,480 --> 01:03:58,290
cybersecurity professionals with as you

1825
01:04:00,500 --> 01:03:59,490
build up the system because you don't

1826
01:04:02,570 --> 01:04:00,510
want to come up again with a great

1827
01:04:03,800 --> 01:04:02,580
technological solution that easily

1828
01:04:05,450 --> 01:04:03,810
hacked and the whole thing falls apart

1829
01:04:06,830 --> 01:04:05,460
breaks so you want to make sure its

1830
01:04:13,520 --> 01:04:06,840
robust from the beginning yeah exactly

1831
01:04:17,510 --> 01:04:13,530
consider that a long way yeah how third

1832
01:04:20,770 --> 01:04:17,520
I just totally butchered your name how

1833
01:04:23,990 --> 01:04:20,780
do you deal with increased radio traffic

1834
01:04:25,880 --> 01:04:24,000
yeah so I it there's probably a couple

1835
01:04:26,900 --> 01:04:25,890
pieces of that one is like overuse of a

1836
01:04:28,250 --> 01:04:26,910
given channel right there's just too

1837
01:04:31,130 --> 01:04:28,260
many people talking on his chat sake

1838
01:04:34,460 --> 01:04:31,140

right and there's also just kind of a

1839
01:04:35,960 --> 01:04:34,470
certain band being overused

1840
01:04:37,640 --> 01:04:35,970
for example command control we talked

1841
01:04:39,140 --> 01:04:37,650
about earlier that's one of the things

1842
01:04:41,210 --> 01:04:39,150
we looked at in our flight test in Reno

1843
01:04:43,280 --> 01:04:41,220
and Corpus Christi was for these small

1844
01:04:46,160 --> 01:04:43,290
drones command control different

1845
01:04:47,720 --> 01:04:46,170
different radio frequencies we use when

1846
01:04:49,700 --> 01:04:47,730
do they get saturated when do you have

1847
01:04:51,230 --> 01:04:49,710
problems with them turns out if you you

1848
01:04:52,220 --> 01:04:51,240
know if you fly near an apartment

1849
01:04:55,340 --> 01:04:52,230
building there's a lot of people with

1850
01:04:56,270 --> 01:04:55,350
Wi-Fi routers and if you're conflicting

1851
01:04:58,220 --> 01:04:56,280
with that you may have trouble

1852
01:04:59,840 --> 01:04:58,230
communicating with their drone these are

1853
01:05:01,490 --> 01:04:59,850
really known issues but actually kind of

1854
01:05:04,880 --> 01:05:01,500
taking a look at it in a real open

1855
01:05:07,160 --> 01:05:04,890
environment was important and I would

1856
01:05:08,960 --> 01:05:07,170
kind of add to that you would have you

1857
01:05:11,330 --> 01:05:08,970
would want to understand what kind of

1858
01:05:13,280 --> 01:05:11,340
concept would not saturate like a radio

1859
01:05:15,350 --> 01:05:13,290
frequency too much so you want to ensure

1860
01:05:17,630 --> 01:05:15,360
that any concept that's being developed

1861
01:05:19,460 --> 01:05:17,640
Joey has mentioned that air traffic

1862
01:05:21,830 --> 01:05:19,470
controllers may not want to be talking

1863
01:05:23,660 --> 01:05:21,840

to every one of those every one of those

1864
01:05:26,300 --> 01:05:23,670
UAM vehicles so that's part of the

1865
01:05:28,130 --> 01:05:26,310
concept so understanding hey how is this

1866
01:05:29,840 --> 01:05:28,140
actually gonna work that's a really

1867
01:05:31,970 --> 01:05:29,850
important part of ensuring that we don't

1868
01:05:33,950 --> 01:05:31,980
saturate certain pieces that we know

1869
01:05:36,410 --> 01:05:33,960
have limits to them and that includes

1870
01:05:37,800 --> 01:05:36,420
spectrum as well as frequency so that's

1871
01:05:39,660 --> 01:05:37,810
coast but that goes

1872
01:05:42,060 --> 01:05:39,670
to the foundational research what's the

1873
01:05:44,280 --> 01:05:42,070
concept of operations yeah a lot of what

1874
01:05:45,990 --> 01:05:44,290
you've been saying today is plan for

1875
01:05:48,060 --> 01:05:46,000
that right challenge

1876
01:05:51,230 --> 01:05:48,070
I know figure out what it is today and

1877
01:05:53,190 --> 01:05:51,240
yeah and plan around it yeah here's a

1878
01:05:55,380 --> 01:05:53,200
turbine air mobility question from

1879
01:05:56,910 --> 01:05:55,390
widget tricks channel again could this

1880
01:05:58,830 --> 01:05:56,920
research eventually lead to people being

1881
01:06:01,860 --> 01:05:58,840
able to own and operate their own air

1882
01:06:03,480 --> 01:06:01,870
taxi do you think that's coming yeah I

1883
01:06:05,910 --> 01:06:03,490
think there's gonna be lots of different

1884
01:06:08,460 --> 01:06:05,920
use cases and modes of flying I think

1885
01:06:10,590 --> 01:06:08,470
there's gonna be cases where some made

1886
01:06:12,900 --> 01:06:10,600
maybe some folks may be able to own

1887
01:06:15,930 --> 01:06:12,910
their own vehicles most likely you'll be

1888
01:06:17,940 --> 01:06:15,940

serviced like we use today we've seen a

1889
01:06:20,160 --> 01:06:17,950
big rise in service based technology

1890
01:06:22,650 --> 01:06:20,170
right so we're all used whether it's

1891
01:06:24,960 --> 01:06:22,660
vehicles or food delivery services yes

1892
01:06:28,170 --> 01:06:24,970
right so we've seen more of that coming

1893
01:06:30,720 --> 01:06:28,180
along so most likely urban air mobility

1894
01:06:32,760 --> 01:06:30,730
will be accessible as a surface service

1895
01:06:34,860 --> 01:06:32,770
but who knows right you know maybe we

1896
01:06:36,870 --> 01:06:34,870
can all really be the Jetsons so Joey's

1897
01:06:40,320 --> 01:06:36,880
vision of the future may come to life

1898
01:06:42,270 --> 01:06:40,330
yeah we're close it's funny I mentioned

1899
01:06:43,950 --> 01:06:42,280
the Jetsons and yet like when I told my

1900
01:06:45,840 --> 01:06:43,960
mom we were talking about drones on the

1901
01:06:48,120 --> 01:06:45,850
show today she said oh like the Bruce

1902
01:07:02,040 --> 01:06:48,130
Willis movie like element that was like

1903
01:07:03,690 --> 01:07:02,050
yeah mom exactly like that because a

1904
01:07:05,910 --> 01:07:03,700
question from hurricanes

1905
01:07:11,760 --> 01:07:05,920
what's your a reasonable tip for a

1906
01:07:14,130 --> 01:07:11,770
flying taxi driver great question so I

1907
01:07:15,690 --> 01:07:14,140
would say I go back to like the

1908
01:07:17,520 --> 01:07:15,700
foundation so what is the National

1909
01:07:18,720 --> 01:07:17,530
Airspace you gotta know your rules of

1910
01:07:20,850 --> 01:07:18,730
the road you have to know your

1911
01:07:22,800 --> 01:07:20,860
procedures you have to know your safety

1912
01:07:25,260 --> 01:07:22,810
and your certification aspects if you

1913
01:07:26,910 --> 01:07:25,270

know those right you can fly safely and

1914
01:07:28,890 --> 01:07:26,920
get to where you want to go from point A

1915
01:07:30,390 --> 01:07:28,900
to point B you have to have those

1916
01:07:32,160 --> 01:07:30,400
foundations just get like a driver's

1917
01:07:33,780 --> 01:07:32,170
license before you operate great you've

1918
01:07:36,330 --> 01:07:33,790
got to have some sort of certification

1919
01:07:38,490 --> 01:07:36,340
before you before you fly yeah for sure

1920
01:07:41,450 --> 01:07:38,500
yeah the old joke is what a Seabiscuit

1921
01:07:43,440 --> 01:07:41,460
in the third that's my tip so that's it

1922
01:07:46,110 --> 01:07:43,450
you guys actually understood that

1923
01:07:48,760 --> 01:07:46,120
question differently I was taking it I

1924
01:07:56,800 --> 01:07:48,770
was gonna say 10% 15%

1925
01:08:00,520 --> 01:07:56,810
my hairdresser what's the tip in a

1926
01:08:02,830 --> 01:08:00,530
right relationship it's awkward but am I

1927
01:08:04,720 --> 01:08:02,840
saying I want all of all of the advice

1928
01:08:05,980 --> 01:08:04,730
that she finds we gave I want my driver

1929
01:08:08,740 --> 01:08:05,990
yes

1930
01:08:10,030 --> 01:08:08,750
he Tyvek well read up on all of that

1931
01:08:11,800 --> 01:08:10,040
right right

1932
01:08:16,510 --> 01:08:11,810
all right well let's take a few more

1933
01:08:18,550 --> 01:08:16,520
yeah we have Joseph urban here says well

1934
01:08:21,960 --> 01:08:18,560
cargo air taxis be allowed to fly

1935
01:08:24,910 --> 01:08:21,970
autonomously before passenger air taxis

1936
01:08:27,849 --> 01:08:24,920
so maybe Joey and I will tag-team this

1937
01:08:31,660 --> 01:08:27,859
one but I'll start I think as autonomous

1938
01:08:33,280 --> 01:08:31,670

applications come forth certification I

1939
01:08:35,200 --> 01:08:33,290
go back to that because that's also part

1940
01:08:37,360 --> 01:08:35,210
of this how do you certify and an

1941
01:08:39,820 --> 01:08:37,370
autonomous system right so that's a

1942
01:08:41,940 --> 01:08:39,830
question that we have and we're doing

1943
01:08:44,860 --> 01:08:41,950
research to explore what that means

1944
01:08:47,650 --> 01:08:44,870
generally folks do believe you know car

1945
01:08:48,910 --> 01:08:47,660
flying cargo may come before flying

1946
01:08:51,490 --> 01:08:48,920
passengers right just as a natural

1947
01:08:53,410 --> 01:08:51,500
progression but there are still lots of

1948
01:08:55,630 --> 01:08:53,420
questions even if you're a cargo

1949
01:08:57,730 --> 01:08:55,640
autonomous flight mm-hmm yeah no I

1950
01:08:59,890 --> 01:08:57,740
totally agree I think but cargo stuff is

1951
01:09:01,769 --> 01:08:59,900
where we'll learn a lot probably before

1952
01:09:03,940 --> 01:09:01,779
the passenger stuff but that's a

1953
01:09:05,289 --> 01:09:03,950
somewhat separate question from how

1954
01:09:06,550 --> 01:09:05,299
autonomous they're allowed to be in the

1955
01:09:08,260 --> 01:09:06,560
air space how do they prove that they

1956
01:09:10,180 --> 01:09:08,270
can still stay safe you know you have

1957
01:09:12,280 --> 01:09:10,190
the benefit of not having people on

1958
01:09:13,480 --> 01:09:12,290
board but you still can't have it doing

1959
01:09:15,400 --> 01:09:13,490
bad things in the air space or to

1960
01:09:16,900 --> 01:09:15,410
anything on the ground right so there's

1961
01:09:18,789 --> 01:09:16,910
a lot of questions to answer but I would

1962
01:09:21,700 --> 01:09:18,799
guess yeah a lot of the things in cargo

1963
01:09:23,530 --> 01:09:21,710

would happen prior to passenger activity

1964
01:09:25,000 --> 01:09:23,540
mm-hmm make sense I think it goes back

1965
01:09:26,710 --> 01:09:25,010
to what you said Joey its performance

1966
01:09:28,510 --> 01:09:26,720
based solution right so let's understand

1967
01:09:30,010 --> 01:09:28,520
the performance of these vehicles and

1968
01:09:31,570 --> 01:09:30,020
then how do we integrate them into our

1969
01:09:32,910 --> 01:09:31,580
national air space you know those are

1970
01:09:35,440 --> 01:09:32,920
still the questions that need to be

1971
01:09:38,200 --> 01:09:35,450
resolved yeah always the same cool

1972
01:09:40,240 --> 01:09:38,210
here's a cool idea from space TV net

1973
01:09:42,510 --> 01:09:40,250
they're asking will augmented reality be

1974
01:09:45,789 --> 01:09:42,520
used to display virtual roads in the sky

1975
01:09:48,099 --> 01:09:45,799
could you do that yeah definitely can we

1976
01:09:49,480 --> 01:09:48,109
sort of have and we've seen it and we've

1977
01:09:51,099 --> 01:09:49,490
done a little bit here as well awesome

1978
01:09:53,140 --> 01:09:51,109
and the roads you know it can be as

1979
01:09:54,910 --> 01:09:53,150
simple as just you know cylinders that

1980
01:09:56,080 --> 01:09:54,920
you know you have to stay within but

1981
01:09:58,030 --> 01:09:56,090
again when we're getting to these beyond

1982
01:09:59,320 --> 01:09:58,040
visual insight things and there's not

1983
01:10:00,430 --> 01:09:59,330
necessarily a pilot on board for the

1984
01:10:03,300 --> 01:10:00,440
small drones

1985
01:10:06,459 --> 01:10:03,310
obviously be hard to carry a pilot um

1986
01:10:09,130 --> 01:10:06,469
you know it it is more about how much

1987
01:10:11,350 --> 01:10:09,140
can s be an autonomous operation right

1988
01:10:13,209 --> 01:10:11,360

but visualizing your plan visualizing

1989
01:10:16,330 --> 01:10:13,219
the airspace structure visualizing

1990
01:10:18,459 --> 01:10:16,340
different aspects of your operation

1991
01:10:20,470 --> 01:10:18,469
augmented reality could be a key part of

1992
01:10:22,410 --> 01:10:20,480
that we actually tested some of that in

1993
01:10:25,270 --> 01:10:22,420
Texas as well we had folks with the

1994
01:10:26,860 --> 01:10:25,280
goggles on looking at the data from the

1995
01:10:29,050 --> 01:10:26,870
air traffic side as well as the

1996
01:10:30,640 --> 01:10:29,060
management side of that and interacting

1997
01:10:32,410 --> 01:10:30,650
with the aircraft in the air in terms of

1998
01:10:34,000 --> 01:10:32,420
you know zooming in on them and saying

1999
01:10:36,670 --> 01:10:34,010
information that's available digitally

2000
01:10:39,040 --> 01:10:36,680
so you could see folks managing in a

2001
01:10:40,900 --> 01:10:39,050
dense environment maybe just being aware

2002
01:10:42,310 --> 01:10:40,910
of everything that's going on it could

2003
01:10:43,660 --> 01:10:42,320
have a lot of value so yeah a lot of

2004
01:10:45,760 --> 01:10:43,670
some work is actually going on in that

2005
01:10:47,890 --> 01:10:45,770
direction already that's awesome that

2006
01:10:52,689 --> 01:10:47,900
seems like a perfect use for that kind

2007
01:10:56,350 --> 01:10:52,699
of psychology yeah yeah we have a

2008
01:10:57,850 --> 01:10:56,360
question here from Megaman bxr do you

2009
01:11:00,100 --> 01:10:57,860
think drones will play a bigger part in

2010
01:11:04,630 --> 01:11:00,110
crime prevention ie monitor the streets

2011
01:11:05,650 --> 01:11:04,640
overhead in real time etc we already

2012
01:11:07,959 --> 01:11:05,660
know that a lot of public safety

2013
01:11:10,840 --> 01:11:07,969

organizations are looking at using

2014
01:11:13,150 --> 01:11:10,850
drones more and more um yeah and if you

2015
01:11:14,200 --> 01:11:13,160
think about safety and security one of

2016
01:11:15,820 --> 01:11:14,210
the big things we've seen a lot of

2017
01:11:17,320 --> 01:11:15,830
success on you can just see it in the

2018
01:11:21,310 --> 01:11:17,330
news is you know search and rescue

2019
01:11:23,709 --> 01:11:21,320
operations cities are able to buy these

2020
01:11:25,270 --> 01:11:23,719
drones that can actually see heat on the

2021
01:11:27,930 --> 01:11:25,280
ground so at night they can be flying

2022
01:11:32,250 --> 01:11:27,940
and see a lost child in a field right

2023
01:11:34,300 --> 01:11:32,260
and and then send folks to that location

2024
01:11:36,520 --> 01:11:34,310
you know obviously you can do a lot of

2025
01:11:37,930 --> 01:11:36,530
good things with drones right yeah one

2026
01:11:39,700 --> 01:11:37,940
of the other use cases is a fire

2027
01:11:40,900 --> 01:11:39,710
department wanting to send a drone out

2028
01:11:42,729 --> 01:11:40,910
ahead of the truck because it can get

2029
01:11:44,830 --> 01:11:42,739
there faster to survey the scene before

2030
01:11:46,450 --> 01:11:44,840
the people get there to fight the fire

2031
01:11:48,910 --> 01:11:46,460
mm-hmm that's another use case that

2032
01:11:51,340 --> 01:11:48,920
people envision again the airspace has

2033
01:11:53,050 --> 01:11:51,350
to be ready for that go back to the the

2034
01:11:53,709 --> 01:11:53,060
hot dog drones you they have to get out

2035
01:11:56,080 --> 01:11:53,719
of the way of that

2036
01:11:59,890 --> 01:11:56,090
that fire drone coming through right so

2037
01:12:01,510 --> 01:11:59,900
without a unified a system to share that

2038
01:12:04,390 --> 01:12:01,520

information you can't really make that

2039
01:12:07,720 --> 01:12:04,400
happen completely but yeah there's a lot

2040
01:12:10,450 --> 01:12:07,730
of interest in from police and fire and

2041
01:12:11,849 --> 01:12:10,460
other agencies to use these for the

2042
01:12:13,439 --> 01:12:11,859
things that they already do

2043
01:12:15,540 --> 01:12:13,449
I think we already see a lot of

2044
01:12:17,520 --> 01:12:15,550
emergency response applications right I

2045
01:12:19,379 --> 01:12:17,530
think with the recent fires here in

2046
01:12:20,279 --> 01:12:19,389
California we saw some of that here as

2047
01:12:23,729 --> 01:12:20,289
well

2048
01:12:24,889 --> 01:12:23,739
and the tools provided a great insight

2049
01:12:27,209 --> 01:12:24,899
for some of those for example

2050
01:12:29,219 --> 01:12:27,219
firefighters to fight to fight the fires

2051
01:12:31,859 --> 01:12:29,229
that were we're blazing and then also

2052
01:12:33,270 --> 01:12:31,869
for like volcanic eruptions there's been

2053
01:12:35,879 --> 01:12:33,280
you there's been a whole host of other

2054
01:12:37,770 --> 01:12:35,889
use cases for surveying and providing

2055
01:12:39,359 --> 01:12:37,780
emergency response but like Joey was

2056
01:12:41,159 --> 01:12:39,369
saying we need the rules of the road

2057
01:12:42,419 --> 01:12:41,169
there right how these aircraft are going

2058
01:12:43,949 --> 01:12:42,429
to operate or these drones are gonna

2059
01:12:45,689 --> 01:12:43,959
operate to really enable them to do

2060
01:12:47,250 --> 01:12:45,699
their missions right and we think about

2061
01:12:47,879 --> 01:12:47,260
you know Public Safety keeping the

2062
01:12:49,619 --> 01:12:47,889
public safe

2063
01:12:51,839 --> 01:12:49,629

but these drones can actually keep the

2064
01:12:53,639 --> 01:12:51,849
first responders safe as well right so

2065
01:12:55,979 --> 01:12:53,649
they can send a drone to the top of roof

2066
01:12:57,750 --> 01:12:55,989
to see bad guys or whatever it might be

2067
01:12:59,129 --> 01:12:57,760
or someone who might help without

2068
01:13:01,439 --> 01:12:59,139
actually putting people in harm's way

2069
01:13:03,270 --> 01:13:01,449
first right yeah so a bublik safety does

2070
01:13:05,339 --> 01:13:03,280
go both ways so there's a lot of really

2071
01:13:07,439 --> 01:13:05,349
good uses for this in the police and

2072
01:13:08,909 --> 01:13:07,449
fire realm right and in some cases like

2073
01:13:10,799 --> 01:13:08,919
in a testing I didn't know in Corpus

2074
01:13:12,419 --> 01:13:10,809
Christi we had the fire department there

2075
01:13:14,009 --> 01:13:12,429
with their drone as well so working

2076
01:13:15,750 --> 01:13:14,019
closely with the research in helping

2077
01:13:17,369 --> 01:13:15,760
exactly yeah we had the fire department

2078
01:13:18,839 --> 01:13:17,379
as well Corpus Christi police and fire

2079
01:13:21,500 --> 01:13:18,849
were great partners awesome they're

2080
01:13:24,750 --> 01:13:21,510
organized by the FAA test site in Texas

2081
01:13:26,279 --> 01:13:24,760
and again they had drones already in

2082
01:13:28,020 --> 01:13:26,289
their inventory they're using them

2083
01:13:29,790 --> 01:13:28,030
permissions already you're participating

2084
01:13:31,619 --> 01:13:29,800
with us in the flight testing right yeah

2085
01:13:33,599 --> 01:13:31,629
getting some feedback on the concept as

2086
01:13:35,069 --> 01:13:33,609
a whole and us understanding how they

2087
01:13:37,109 --> 01:13:35,079
are to use their drones and make sure

2088
01:13:38,639 --> 01:13:37,119

that the traffic management system and

2089
01:13:40,049 --> 01:13:38,649
the concept still accommodates what they

2090
01:13:41,459 --> 01:13:40,059
would like to do yeah it's really

2091
01:13:43,919 --> 01:13:41,469
important to get that feedback early and

2092
01:13:45,569 --> 01:13:43,929
often so yeah we're already seeing these

2093
01:13:47,009 --> 01:13:45,579
agencies do that and the police were

2094
01:13:49,020 --> 01:13:47,019
interested in using it obviously to

2095
01:13:50,250 --> 01:13:49,030
identify drones right like if in the

2096
01:13:51,419 --> 01:13:50,260
future there's more of these in the air

2097
01:13:52,409 --> 01:13:51,429
they want to know that they're supposed

2098
01:13:53,489 --> 01:13:52,419
to be there or they're allowed to be

2099
01:13:55,979 --> 01:13:53,499
there or they're doing something good

2100
01:13:57,359 --> 01:13:55,989
and not bad so uh police who have an

2101
01:13:59,279 --> 01:13:57,369
interest in knowing that the airspace is

2102
01:14:01,979 --> 01:13:59,289
safe around the public as well of course

2103
01:14:03,389 --> 01:14:01,989
yeah yeah yeah I have a question here

2104
01:14:05,469 --> 01:14:03,399
that's making me picture the fifth

2105
01:14:08,449 --> 01:14:05,479
elements and

2106
01:14:10,459 --> 01:14:08,459
dohno asks with drones you can have many

2107
01:14:12,339 --> 01:14:10,469
many small missions starting and ending

2108
01:14:14,419 --> 01:14:12,349
constantly so how do you ensure

2109
01:14:16,040 --> 01:14:14,429
efficient use of airspace with an

2110
01:14:18,049 --> 01:14:16,050
unknown number of vehicles entering the

2111
01:14:20,000 --> 01:14:18,059
airspace at any time it sounds like a

2112
01:14:21,739 --> 01:14:20,010
lot of unknowns there's a lot of

2113
01:14:24,589 --> 01:14:21,749

potential groans yeah and I think you do

2114
01:14:26,569 --> 01:14:24,599
want to take a step approach right a

2115
01:14:29,080 --> 01:14:26,579
gradual approach you know we don't have

2116
01:14:31,790 --> 01:14:29,090
to build the system right now to handle

2117
01:14:32,989 --> 01:14:31,800
20,000 operations a minute than a city

2118
01:14:33,979 --> 01:14:32,999
block right they don't have to have that

2119
01:14:36,979 --> 01:14:33,989
system ready today

2120
01:14:39,469 --> 01:14:36,989
yeah but how can you start to enable 30

2121
01:14:41,540 --> 01:14:39,479
40 50 operations over a city at once

2122
01:14:43,159 --> 01:14:41,550
right and then you'll start to see where

2123
01:14:45,350 --> 01:14:43,169
there are some issues with them sharing

2124
01:14:46,549 --> 01:14:45,360
the airspace or information so that they

2125
01:14:47,779 --> 01:14:46,559
can all accomplish what they want to do

2126
01:14:48,979 --> 01:14:47,789
and it slowly you can build up those

2127
01:14:50,750 --> 01:14:48,989
densities and that's kind of an our

2128
01:14:52,219 --> 01:14:50,760
approach in the research yeah and we see

2129
01:14:53,540 --> 01:14:52,229
that approach being adopted as well in

2130
01:14:54,890 --> 01:14:53,550
industry right as they come up with

2131
01:14:57,259 --> 01:14:54,900
standards around this based on our

2132
01:14:59,600 --> 01:14:57,269
research to help inform the use of the

2133
01:15:01,459 --> 01:14:59,610
airspace they're not looking to solve

2134
01:15:02,959 --> 01:15:01,469
the problem 20 years from now they want

2135
01:15:04,790 --> 01:15:02,969
to enable more and more operations today

2136
01:15:07,069 --> 01:15:04,800
and tomorrow and it is that scaled

2137
01:15:08,149 --> 01:15:07,079
approach so we'll come up with those

2138
01:15:09,319 --> 01:15:08,159

solutions we want to make sure that the

2139
01:15:11,299 --> 01:15:09,329
architecture and the concept will

2140
01:15:14,330 --> 01:15:11,309
support them in the future don't box off

2141
01:15:16,489 --> 01:15:14,340
any solutions and and it's it's gonna

2142
01:15:18,319 --> 01:15:16,499
work it's it's gonna work and I would

2143
01:15:20,779 --> 01:15:18,329
even up level that complexity right so

2144
01:15:22,520 --> 01:15:20,789
you can have drones operating below 400

2145
01:15:24,350 --> 01:15:22,530
feet then above that you could have

2146
01:15:27,319 --> 01:15:24,360
these electric urban air mobility

2147
01:15:29,239 --> 01:15:27,329
vehicles flying across urban centers and

2148
01:15:30,770 --> 01:15:29,249
then above that your commercial air

2149
01:15:32,600 --> 01:15:30,780
traffic so how do you have

2150
01:15:34,699 --> 01:15:32,610
interoperability across all of those

2151
01:15:36,080 --> 01:15:34,709
layers and that same density of

2152
01:15:38,810 --> 01:15:36,090
operations and that's actually where

2153
01:15:40,580 --> 01:15:38,820
where the real fun research is kind of

2154
01:15:42,890 --> 01:15:40,590
like where where some of our work comes

2155
01:15:44,629 --> 01:15:42,900
into play is how do you have that air

2156
01:15:46,129 --> 01:15:44,639
traffic management system to support all

2157
01:15:48,589 --> 01:15:46,139
of these new entrants and all this

2158
01:15:50,419 --> 01:15:48,599
density of operations we respect in the

2159
01:15:52,489 --> 01:15:50,429
future right I'd raise you one up level

2160
01:15:53,899 --> 01:15:52,499
right now go 60,000 feet right so really

2161
01:15:56,029 --> 01:15:53,909
additional air traffic and then you have

2162
01:15:59,000 --> 01:15:56,039
folks that want to fly over 60,000 feet

2163
01:16:00,620 --> 01:15:59,010

rows no not maybe autonomous vehicles

2164
01:16:01,909 --> 01:16:00,630
maybe not but how do they show that

2165
01:16:03,439 --> 01:16:01,919
airspace up there with autonomous

2166
01:16:05,089 --> 01:16:03,449
vehicles how do they get up there first

2167
01:16:06,979 --> 01:16:05,099
and the phrase in an efficient way it's

2168
01:16:08,980 --> 01:16:06,989
actually busy exactly so all these

2169
01:16:11,290 --> 01:16:08,990
things have to interoperate and

2170
01:16:14,140 --> 01:16:11,300
to work well together yeah that's a

2171
01:16:19,750 --> 01:16:14,150
level of cartoon yeah oh I love space

2172
01:16:23,350 --> 01:16:19,760
for you don't take maybe one more

2173
01:16:25,420 --> 01:16:23,360
question are there well we have a

2174
01:16:27,100 --> 01:16:25,430
question here what was the biggest

2175
01:16:28,630 --> 01:16:27,110
barrier for you personally getting hired

2176
01:16:29,920 --> 01:16:28,640
but we always get questions like this

2177
01:16:32,710 --> 01:16:29,930
and people want to know like how did you

2178
01:16:36,900 --> 01:16:32,720
get started at NASA and you know yeah

2179
01:16:40,120 --> 01:16:36,910
yeah your background exactly sure so um

2180
01:16:41,560 --> 01:16:40,130
so I'm an aerospace engineer so that's

2181
01:16:43,450 --> 01:16:41,570
what I studied in school that's what I

2182
01:16:45,520 --> 01:16:43,460
got my my bachelor's and my master's in

2183
01:16:48,280 --> 01:16:45,530
and to be honest I've always been

2184
01:16:50,230 --> 01:16:48,290
passionate about aircraft and flight and

2185
01:16:52,570 --> 01:16:50,240
specifically flight controls and that's

2186
01:16:54,820 --> 01:16:52,580
how I got started but I think there's a

2187
01:16:56,680 --> 01:16:54,830
whole host of opportunities and avenues

2188
01:16:59,200 --> 01:16:56,690

I don't think you have to study

2189
01:17:01,210 --> 01:16:59,210
aerospace engineering or necessarily

2190
01:17:03,400 --> 01:17:01,220
even just aero so there's there's a

2191
01:17:05,260 --> 01:17:03,410
whole different set of fields and

2192
01:17:07,350 --> 01:17:05,270
disciplines that make our research a

2193
01:17:10,000 --> 01:17:07,360
reality right we have people who are

2194
01:17:12,370 --> 01:17:10,010
psychologists engineers you know

2195
01:17:14,200 --> 01:17:12,380
analysts people who work with data so

2196
01:17:15,580 --> 01:17:14,210
there's a you can really do anything

2197
01:17:17,470 --> 01:17:15,590
it's all I think it's all about the

2198
01:17:19,060 --> 01:17:17,480
passion if you're interested in kind of

2199
01:17:21,370 --> 01:17:19,070
seeing how we can push the bounds you

2200
01:17:23,620 --> 01:17:21,380
bring in all of these new entrants bring

2201
01:17:24,970 --> 01:17:23,630
in an innovation into air traffic

2202
01:17:26,850 --> 01:17:24,980
management I think there's so many ways

2203
01:17:29,920 --> 01:17:26,860
you could come in and play a role here

2204
01:17:31,390 --> 01:17:29,930
and just to illustrate that with this

2205
01:17:34,750 --> 01:17:31,400
drone traffic management project that we

2206
01:17:35,860 --> 01:17:34,760
had we had folks that were Aero

2207
01:17:37,330 --> 01:17:35,870
engineers that are important to

2208
01:17:38,860 --> 01:17:37,340
understanding the system and how the

2209
01:17:41,770 --> 01:17:38,870
vehicles work and and all those sorts of

2210
01:17:44,590 --> 01:17:41,780
things I'm a computer engineer so I'm

2211
01:17:46,090 --> 01:17:44,600
not an aero engineer by training so

2212
01:17:47,170 --> 01:17:46,100
that's important in kind of building

2213
01:17:48,490 --> 01:17:47,180

help the systems we had a lot of

2214
01:17:50,560 --> 01:17:48,500
computer scientists computer engineers

2215
01:17:52,630 --> 01:17:50,570
helping with this as well and then you

2216
01:17:54,940 --> 01:17:52,640
do get systems engineers and physicists

2217
01:17:56,770 --> 01:17:54,950
and other folks that really matter and

2218
01:17:58,660 --> 01:17:56,780
doing these human factors people right

2219
01:17:59,890 --> 01:17:58,670
that understand again Siobhan Julie was

2220
01:18:01,210 --> 01:17:59,900
talking earlier about what are these new

2221
01:18:03,190 --> 01:18:01,220
control systems look like how do people

2222
01:18:04,540 --> 01:18:03,200
interact with them it's a completely new

2223
01:18:06,790 --> 01:18:04,550
system we're talking about so I don't

2224
01:18:08,290 --> 01:18:06,800
really know how the human needs to

2225
01:18:10,480 --> 01:18:08,300
interact that's gonna impact them

2226
01:18:13,090 --> 01:18:10,490
exactly and what makes what makes their

2227
01:18:14,530 --> 01:18:13,100
job easier or harder right so all of

2228
01:18:16,030 --> 01:18:14,540
those kind of folks are really important

2229
01:18:18,150 --> 01:18:16,040
in building out a system like UTM and

2230
01:18:19,380 --> 01:18:18,160
that's what we had on our team yeah

2231
01:18:21,450 --> 01:18:19,390
it sounds like it makes sense really

2232
01:18:22,950 --> 01:18:21,460
you've talked about so many aspects of

2233
01:18:24,450 --> 01:18:22,960
this work to profess its different

2234
01:18:27,090 --> 01:18:24,460
layers you kept saying different layers

2235
01:18:29,040 --> 01:18:27,100
of the system you need so many different

2236
01:18:30,690 --> 01:18:29,050
perspectives on that so that's awesome

2237
01:18:32,820 --> 01:18:30,700
that's good news for people out there

2238
01:18:34,950 --> 01:18:32,830

yeah it really does take a team I think

2239
01:18:36,570 --> 01:18:34,960
it you have a team with a whole wide

2240
01:18:38,370 --> 01:18:36,580
range of disciplines that really allows

2241
01:18:40,710 --> 01:18:38,380
some of this technology to come to light

2242
01:18:41,700 --> 01:18:40,720
right sounds like it it's a great place

2243
01:18:43,530 --> 01:18:41,710
to solve hard problems

2244
01:18:45,030 --> 01:18:43,540
that's what Aeronautics really offers

2245
01:18:46,890 --> 01:18:45,040
and I think what it brings a lot of

2246
01:18:48,180 --> 01:18:46,900
people that's what brought me in it's a

2247
01:18:51,030 --> 01:18:48,190
good place to solve really hard problems

2248
01:18:52,920 --> 01:18:51,040
I make an impact fascinating awesome

2249
01:18:55,080 --> 01:18:52,930
yeah well this has been awesome and

2250
01:18:57,390 --> 01:18:55,090
thank you guys for joining us maybe we

2251
01:18:59,250 --> 01:18:57,400
can just about run out of time but thank

2252
01:19:01,170 --> 01:18:59,260
you for being here and thank you to

2253
01:19:03,480 --> 01:19:01,180
everybody who joined us in the chat on

2254
01:19:05,610 --> 01:19:03,490
twitch we'll be back in the new year so

2255
01:19:08,490 --> 01:19:05,620
follow NASA on social media to hear

2256
01:19:10,410 --> 01:19:08,500
about upcoming shows and to see past

2257
01:19:13,920 --> 01:19:10,420
episodes of this show you can check out

2258
01:19:16,860 --> 01:19:13,930
nasa.gov slash Ames slash NASA in