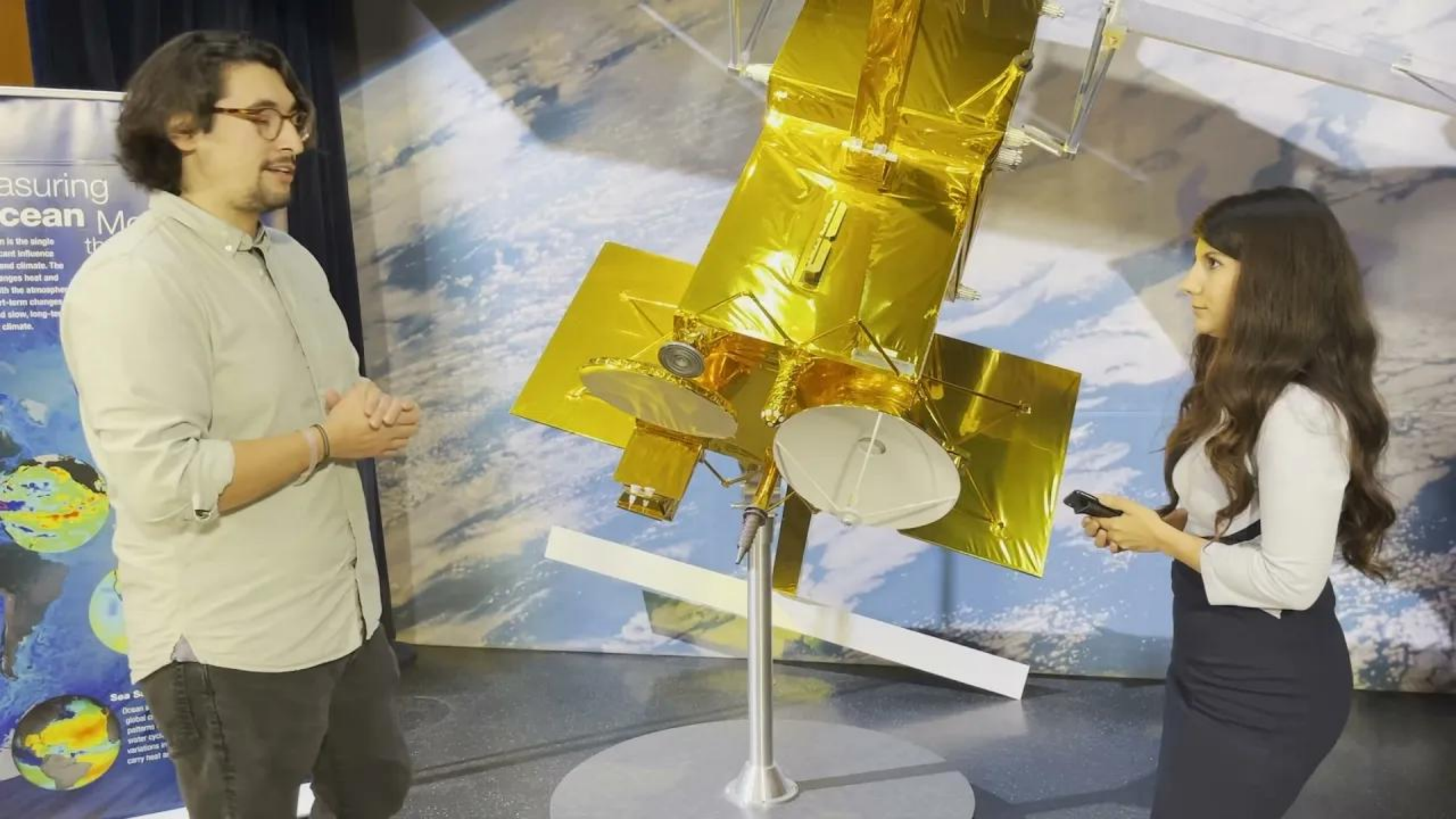
asuring
cean

1
00:00:04,710 --> 00:00:02,389
hi welcome to nasa's jet propulsion

2
00:00:06,950 --> 00:00:04,720
laboratory in southern california i'm

3
00:00:08,549 --> 00:00:06,960
raquel villanueva here with engineer

4
00:00:10,870 --> 00:00:08,559
chris aceves

5
00:00:12,709 --> 00:00:10,880
and we are actually massless right now

6
00:00:15,030 --> 00:00:12,719
because we are fully vaccinated and took

7
00:00:18,470 --> 00:00:15,040
it off for this live specifically

8
00:00:21,269 --> 00:00:18,480
exactly and behind us is the model

9
00:00:23,750 --> 00:00:21,279
surface water ocean topography satellite

10
00:00:25,830 --> 00:00:23,760
known as swat yep that's correct and it

11
00:00:27,189 --> 00:00:25,840
is set to launch about a year from now

12
00:00:28,230 --> 00:00:27,199
and chris is here to answer any

13
00:00:30,710 --> 00:00:28,240

questions you might have about the

14
00:00:32,150 --> 00:00:30,720
spacecraft definitely and if you have a

15
00:00:35,110 --> 00:00:32,160
question you'd like to ask use the

16
00:00:37,830 --> 00:00:35,120
hashtag trackingworldwater

17
00:00:39,750 --> 00:00:37,840
or leave your comments in the chat box

18
00:00:41,510 --> 00:00:39,760
chris thanks for joining us today oh

19
00:00:43,670 --> 00:00:41,520
yeah i'm excited about this yeah and can

20
00:00:45,350 --> 00:00:43,680
you tell us what is the purpose of the

21
00:00:47,270 --> 00:00:45,360
swamp mission yeah as you mentioned uh

22
00:00:50,310 --> 00:00:47,280
swat stands for surface water and ocean

23
00:00:51,750 --> 00:00:50,320
topography it measures all visible water

24
00:00:54,389 --> 00:00:51,760
it's going to be helping all researchers

25
00:00:56,069 --> 00:00:54,399
and scientists to track volume of water

26
00:00:58,549 --> 00:00:56,079
understand the effects of weather

27
00:00:59,670 --> 00:00:58,559
climate and ocean lakes and rivers uh

28
00:01:02,310 --> 00:00:59,680
some additional data is going to be

29
00:01:03,830 --> 00:01:02,320
collecting is some small scale currents

30
00:01:05,910 --> 00:01:03,840
which will be supporting our real-time

31
00:01:07,670 --> 00:01:05,920
marine operations and you mentioned

32
00:01:09,750 --> 00:01:07,680
before there's other uses for the data

33
00:01:11,270 --> 00:01:09,760
too yeah definitely i'm super excited

34
00:01:14,630 --> 00:01:11,280
for what society's gonna be using this

35
00:01:17,670 --> 00:01:14,640
for improving computer models in

36
00:01:19,990 --> 00:01:17,680
monitoring drought conditions but also

37
00:01:21,749 --> 00:01:20,000
an improved floor

38
00:01:23,990 --> 00:01:21,759

flood forecast

39
00:01:27,109 --> 00:01:24,000
and i have a question about your role so

40
00:01:29,270 --> 00:01:27,119
you are a systems integration and launch

41
00:01:30,469 --> 00:01:29,280
engineer can you explain what you do for

42
00:01:31,749 --> 00:01:30,479
the mission yeah definitely so i'm

43
00:01:33,510 --> 00:01:31,759
currently i've been with the project for

44
00:01:35,990 --> 00:01:33,520
over four years now i'm currently the

45
00:01:37,590 --> 00:01:36,000
lead electrical engineer uh what that

46
00:01:39,429 --> 00:01:37,600
means is currently as during our test

47
00:01:41,590 --> 00:01:39,439
now and in future tests we have going on

48
00:01:43,510 --> 00:01:41,600
before launch i need to make sure that

49
00:01:45,830 --> 00:01:43,520
all hardware all science instruments are

50
00:01:47,830 --> 00:01:45,840
working properly i work closely with the

51
00:01:49,670 --> 00:01:47,840
system engineers and making sure that

52
00:01:50,870 --> 00:01:49,680
we're meeting all the requirements but

53
00:01:52,389 --> 00:01:50,880
also working with our scientists and

54
00:01:54,550 --> 00:01:52,399
verifying that our science data being

55
00:01:55,990 --> 00:01:54,560
collected is uh it's all healthy so a

56
00:01:58,870 --> 00:01:56,000
lot of testing yeah a lot of us are

57
00:02:00,789 --> 00:01:58,880
coming up and it's exciting and can can

58
00:02:03,109 --> 00:02:00,799
you kind of walk us through the swap

59
00:02:05,270 --> 00:02:03,119
model and kind of explain how it all

60
00:02:07,749 --> 00:02:05,280
works like is this to scale yeah no it's

61
00:02:09,910 --> 00:02:07,759
not to scale this is a one-third scale

62
00:02:12,390 --> 00:02:09,920
model so it's definitely much larger

63
00:02:13,910 --> 00:02:12,400

uh there's two main parts uh that's

64
00:02:15,830 --> 00:02:13,920
important here we have the bus which is

65
00:02:18,630 --> 00:02:15,840
this top box here and then we have this

66
00:02:20,790 --> 00:02:18,640
payload box the box is uh it's really

67
00:02:22,949 --> 00:02:20,800
the brain of this satellite it does all

68
00:02:25,190 --> 00:02:22,959
the commanding it records all the health

69
00:02:27,589 --> 00:02:25,200
uh data of this satellite which tells us

70
00:02:29,350 --> 00:02:27,599
if the if the satellite's healthy uh it

71
00:02:32,309 --> 00:02:29,360
also has proportion keeping it in its

72
00:02:33,750 --> 00:02:32,319
orbit uh and also is really the battery

73
00:02:35,270 --> 00:02:33,760
that powers up all of our science

74
00:02:37,910 --> 00:02:35,280
instruments so it's definitely a huge

75
00:02:41,110 --> 00:02:37,920
part of the satellite uh then we then we

76
00:02:44,550 --> 00:02:42,390
that carries all of our science

77
00:02:45,990 --> 00:02:44,560
instruments um yeah can you tell us a

78
00:02:48,390 --> 00:02:46,000
little bit more about the instruments

79
00:02:50,070 --> 00:02:48,400
right here definitely so here we have uh

80
00:02:52,229 --> 00:02:50,080
this cooler reflector here it's uh it's

81
00:02:54,229 --> 00:02:52,239
an amr which stands for the advanced

82
00:02:56,070 --> 00:02:54,239
microwave radiometer

83
00:02:57,750 --> 00:02:56,080
uh and what this does is it measures all

84
00:03:00,550 --> 00:02:57,760
the water vapor between this satellite

85
00:03:02,149 --> 00:03:00,560
and earth uh then we have the x-men

86
00:03:04,309 --> 00:03:02,159
antenna here which i think is the

87
00:03:05,830 --> 00:03:04,319
coolest antenna and the reason one of

88
00:03:07,990 --> 00:03:05,840

the reasons why i'm the i'm the

89
00:03:09,830 --> 00:03:08,000
cognizant engineer of this uh satellite

90
00:03:11,350 --> 00:03:09,840
and what that means is i need to know

91
00:03:13,350 --> 00:03:11,360
the ins and outs of the satellite so

92
00:03:15,670 --> 00:03:13,360
usually anyone has any questions on this

93
00:03:17,750 --> 00:03:15,680
they come to me first

94
00:03:19,270 --> 00:03:17,760
and then we have

95
00:03:21,750 --> 00:03:19,280
these other two satellites here are part

96
00:03:23,670 --> 00:03:21,760
of our french our partnership around the

97
00:03:26,070 --> 00:03:23,680
world they are from the french space

98
00:03:28,070 --> 00:03:26,080
agency canvas so we have this cool

99
00:03:29,270 --> 00:03:28,080
looking laser beam looking satellite

100
00:03:32,070 --> 00:03:29,280
it's called the

101
00:03:34,630 --> 00:03:32,080
doris and what doris stands for and it's

102
00:03:37,350 --> 00:03:34,640
extremely long name uh door uh doppler

103
00:03:39,509 --> 00:03:37,360
orbital graphe radio position integrated

104
00:03:40,789 --> 00:03:39,519
satellite that's a mouthful yeah i know

105
00:03:42,710 --> 00:03:40,799
it's uh that's something we say every

106
00:03:44,630 --> 00:03:42,720
day we just call it doris i like doris

107
00:03:46,550 --> 00:03:44,640
all right yeah and what this does is

108
00:03:49,589 --> 00:03:46,560
actually gives us the positioning of the

109
00:03:50,949 --> 00:03:49,599
satellite while it's in orbit so we at

110
00:03:52,630 --> 00:03:50,959
all times know exactly where the

111
00:03:53,910 --> 00:03:52,640
satellite is now what about this

112
00:03:55,589 --> 00:03:53,920
instrument yeah so this is the nader

113
00:03:57,750 --> 00:03:55,599

altimeter and what this does is measures

114
00:03:59,030 --> 00:03:57,760
the height of the sorry it measures the

115
00:04:01,270 --> 00:03:59,040
height of the water

116
00:04:03,429 --> 00:04:01,280
and uh something i do want to bring up

117
00:04:05,750 --> 00:04:03,439
is that all these instruments do work uh

118
00:04:07,110 --> 00:04:05,760
work together for example

119
00:04:08,550 --> 00:04:07,120
this nato altimeter dish will measure

120
00:04:09,910 --> 00:04:08,560
the height of the water but there is

121
00:04:11,750 --> 00:04:09,920
there is interference sometimes with the

122
00:04:13,910 --> 00:04:11,760
water vapor in between the satellite and

123
00:04:15,509 --> 00:04:13,920
the water and that's where the amr comes

124
00:04:17,990 --> 00:04:15,519
in we have those we have those

125
00:04:20,310 --> 00:04:18,000
measurements already so we're able to

126
00:04:23,030 --> 00:04:20,320
extract that data to get a better uh

127
00:04:24,629 --> 00:04:23,040
measurement of the water height

128
00:04:26,950 --> 00:04:24,639
and that covers all the instruments that

129
00:04:28,629 --> 00:04:26,960
you see here what about these beams then

130
00:04:30,390 --> 00:04:28,639
up here yeah

131
00:04:33,430 --> 00:04:30,400
so this is where it gets real exciting

132
00:04:36,310 --> 00:04:33,440
um this is really the care module and

133
00:04:38,950 --> 00:04:36,320
karen stands for is a k-band radar

134
00:04:41,670 --> 00:04:38,960
inferometer and um that karen endorsed

135
00:04:43,270 --> 00:04:41,680
them yeah we have karen and doris

136
00:04:46,390 --> 00:04:43,280
they get along pretty well

137
00:04:48,469 --> 00:04:46,400
uh so we have these two booms and these

138
00:04:50,390 --> 00:04:48,479

are reflectors and right here you can

139
00:04:52,150 --> 00:04:50,400
see on the other end are

140
00:04:54,390 --> 00:04:52,160
the feed horns and these actually shoot

141
00:04:56,710 --> 00:04:54,400
out a beam to these reflectors and they

142
00:04:59,110 --> 00:04:56,720
reflect down into the earth hitting the

143
00:05:01,189 --> 00:04:59,120
ocean or hitting anything that it sees

144
00:05:03,510 --> 00:05:01,199
and then it bounces back to the opposite

145
00:05:05,510 --> 00:05:03,520
reflectors and then collecting that data

146
00:05:07,189 --> 00:05:05,520
and that data is then stored and then

147
00:05:09,189 --> 00:05:07,199
transferred over to the x-men antenna

148
00:05:10,790 --> 00:05:09,199
and then transferred over to our ground

149
00:05:12,550 --> 00:05:10,800
stations for our scientists to review

150
00:05:14,390 --> 00:05:12,560
and you were saying that the french

151
00:05:16,150 --> 00:05:14,400
space agency canes

152
00:05:18,070 --> 00:05:16,160
is helping is there any other

153
00:05:20,469 --> 00:05:18,080
international collaborators there's a

154
00:05:22,790 --> 00:05:20,479
canadian space agency and the uk space

155
00:05:25,029 --> 00:05:22,800
agency and they are there are boxes that

156
00:05:27,110 --> 00:05:25,039
you not you're not able to see them but

157
00:05:30,230 --> 00:05:27,120
they there are boxes that supports our

158
00:05:30,870 --> 00:05:30,240
karen uh instrument that they're inside

159
00:05:32,790 --> 00:05:30,880
um

160
00:05:34,469 --> 00:05:32,800
so it's really an international effort

161
00:05:36,469 --> 00:05:34,479
yeah no it's world yeah and working with

162
00:05:38,230 --> 00:05:36,479
all these partnerships uh it's exciting

163
00:05:39,990 --> 00:05:38,240

to have all these engineers and we're

164
00:05:42,469 --> 00:05:40,000
all here for the same cause that's great

165
00:05:44,710 --> 00:05:42,479
big global team effort now those are all

166
00:05:46,150 --> 00:05:44,720
the questions i had for you i'm gonna go

167
00:05:47,749 --> 00:05:46,160
online and get some questions if you

168
00:05:50,710 --> 00:05:47,759
have a question you'd like to ask use

169
00:05:53,189 --> 00:05:50,720
the hashtag trackingworldwater

170
00:05:54,629 --> 00:05:53,199
and first up we have

171
00:05:58,710 --> 00:05:54,639
let's see

172
00:06:01,189 --> 00:05:58,720
astro kv 812 on instagram asks

173
00:06:02,710 --> 00:06:01,199
what is new about swat and that's

174
00:06:04,469 --> 00:06:02,720
different from earlier missions we had

175
00:06:07,990 --> 00:06:04,479
for the ocean it's going to be the high

176
00:06:09,590 --> 00:06:08,000
definition we're measuring to a scale

177
00:06:11,749 --> 00:06:09,600
that hasn't been done before which is

178
00:06:14,950 --> 00:06:11,759
going to help help as i mentioned before

179
00:06:16,870 --> 00:06:14,960
society get a better

180
00:06:18,710 --> 00:06:16,880
measurements to improve

181
00:06:20,629 --> 00:06:18,720
the computer modeling for

182
00:06:23,830 --> 00:06:20,639
drug conditions but also improve flood

183
00:06:24,550 --> 00:06:23,840
forecasting uh but the the fine tuning

184
00:06:25,830 --> 00:06:24,560
of

185
00:06:28,390 --> 00:06:25,840
high quality we're gonna be getting

186
00:06:30,309 --> 00:06:28,400
that's that's what this brings that that

187
00:06:33,270 --> 00:06:30,319
definition like quality that quality

188
00:06:35,670 --> 00:06:33,280

there and hugo on facebook asks how

189
00:06:38,230 --> 00:06:35,680
small of body can this measure

190
00:06:39,990 --> 00:06:38,240
uh so as mentioned just right earlier

191
00:06:42,390 --> 00:06:40,000
the the high division of this it's going

192
00:06:44,469 --> 00:06:42,400
to be small it's able to measure ponds

193
00:06:46,070 --> 00:06:44,479
uh small lakes um

194
00:06:48,390 --> 00:06:46,080
not i wouldn't say to measure the water

195
00:06:49,749 --> 00:06:48,400
in your backyard not a little puddle no

196
00:06:51,029 --> 00:06:49,759
okay that's not what we're trying to

197
00:06:52,790 --> 00:06:51,039
measure but it's supposed to measure all

198
00:06:55,830 --> 00:06:52,800
the little small river streams that are

199
00:06:57,909 --> 00:06:55,840
around the world and divia on instagram

200
00:07:00,870 --> 00:06:57,919
asks how would you be measuring water

201
00:07:02,469 --> 00:07:00,880
through the distance from space

202
00:07:04,150 --> 00:07:02,479
sorry can you repeat this sure like how

203
00:07:05,749 --> 00:07:04,160
would you measure water through the

204
00:07:07,670 --> 00:07:05,759
distance from space so how does this

205
00:07:09,350 --> 00:07:07,680
kind of be down and work so as i

206
00:07:11,430 --> 00:07:09,360
mentioned the karen it stands for it's a

207
00:07:13,430 --> 00:07:11,440
decay bad frequency there's a reason why

208
00:07:15,749 --> 00:07:13,440
we chose that type of frequency and once

209
00:07:17,909 --> 00:07:15,759
it interacts and hits water that

210
00:07:19,830 --> 00:07:17,919
frequency that the speed of that wave

211
00:07:21,830 --> 00:07:19,840
changes and once it reflects back and we

212
00:07:22,950 --> 00:07:21,840
see that change of wave that tells us

213
00:07:25,189 --> 00:07:22,960

exactly

214
00:07:27,430 --> 00:07:25,199
um the dense of how much water there is

215
00:07:29,270 --> 00:07:27,440
so that information of that frequency is

216
00:07:31,589 --> 00:07:29,280
what is providing us that

217
00:07:34,629 --> 00:07:31,599
information from from earth okay well

218
00:07:35,990 --> 00:07:34,639
thanks for that question now uh sorry on

219
00:07:39,350 --> 00:07:36,000
facebook

220
00:07:41,589 --> 00:07:39,360
uh how does this measure the water that

221
00:07:43,350 --> 00:07:41,599
you know it's active

222
00:07:46,629 --> 00:07:43,360
i'm just making water in the way of yeah

223
00:07:48,469 --> 00:07:46,639
yeah uh again with the k-man v that

224
00:07:52,390 --> 00:07:48,479
frequency uh if you don't know if it

225
00:07:53,749 --> 00:07:52,400
hits demand uh water any type of soil uh

226
00:07:56,550 --> 00:07:53,759
it's gonna know the difference between

227
00:07:59,589 --> 00:07:56,560
water and soil and once we see that

228
00:08:04,869 --> 00:07:59,599
different data to know exactly what the

229
00:08:09,350 --> 00:08:06,950
yeah it needs to be real detail

230
00:08:10,950 --> 00:08:09,360
and then um how much time will it take

231
00:08:13,270 --> 00:08:10,960
to complete the whole mission this is a

232
00:08:15,110 --> 00:08:13,280
gtp unknown on its example

233
00:08:17,029 --> 00:08:15,120
yes commission it's uh it's a three-year

234
00:08:18,390 --> 00:08:17,039
mission uh but from the previous mission

235
00:08:21,029 --> 00:08:18,400
we haven't passed with other projects

236
00:08:22,869 --> 00:08:21,039
here at dpl uh they've always surpassed

237
00:08:35,110 --> 00:08:22,879
their lifespan so we're really hoping

238
00:08:40,070 --> 00:08:36,870

like how big is this mall in new york

239
00:08:41,589 --> 00:08:40,080
city yeah no it's uh imagine a original

240
00:08:43,190 --> 00:08:41,599
yellow school box

241
00:08:44,870 --> 00:08:43,200
it's quite large

242
00:08:46,070 --> 00:08:44,880
and then with the solar ray panels

243
00:08:48,870 --> 00:08:46,080
imagine a

244
00:08:52,630 --> 00:08:48,880
737 boeing plane being span

245
00:08:54,710 --> 00:08:52,640
so it's it's a large spacecraft

246
00:08:56,630 --> 00:08:54,720
and cga on instagram asks what are the

247
00:08:57,670 --> 00:08:56,640
main components that are the most

248
00:08:59,590 --> 00:08:57,680
important

249
00:09:01,509 --> 00:08:59,600
yeah no it's depends what you're asking

250
00:09:03,190 --> 00:09:01,519
well for you what is it uh

251
00:09:05,910 --> 00:09:03,200
i think everyone's gonna agree that it's

252
00:09:07,750 --> 00:09:05,920
really uh karen that's what's uh

253
00:09:10,150 --> 00:09:07,760
the heart of this satellite it's

254
00:09:11,509 --> 00:09:10,160
measuring uh the water it's going to

255
00:09:13,110 --> 00:09:11,519
give us a lot of patterns a lot of

256
00:09:15,350 --> 00:09:13,120
information that we're going to need but

257
00:09:18,070 --> 00:09:15,360
again if you're asking me i'm going to

258
00:09:19,670 --> 00:09:18,080
choose the expand tenant uh again uh

259
00:09:21,430 --> 00:09:19,680
without this we're not we're not going

260
00:09:23,030 --> 00:09:21,440
to be receiving any of this data if this

261
00:09:24,230 --> 00:09:23,040
goes down

262
00:09:25,430 --> 00:09:24,240
it's like we're not going to be able to

263
00:09:27,030 --> 00:09:25,440

collect any of the science data that's

264
00:09:28,630 --> 00:09:27,040
being measured how's doris going to feel

265
00:09:30,710 --> 00:09:28,640
about all this yeah i know doris is not

266
00:09:32,710 --> 00:09:30,720
going to like that but uh karen karen's

267
00:09:34,389 --> 00:09:32,720
the lead lady here she's important too

268
00:09:37,190 --> 00:09:34,399
no she's afforded as well

269
00:09:38,870 --> 00:09:37,200
and then uh we have jessica on facebook

270
00:09:40,389 --> 00:09:38,880
who asks where in the world is the

271
00:09:42,470 --> 00:09:40,399
satellite being built

272
00:09:44,790 --> 00:09:42,480
currently it's in france uh

273
00:09:47,269 --> 00:09:44,800
this payload part started here at jpl

274
00:09:48,630 --> 00:09:47,279
with the instruments uh the french space

275
00:09:51,030 --> 00:09:48,640
agency they came over brought their

276
00:09:52,230 --> 00:09:51,040
instruments got integrated here in jpl

277
00:09:53,430 --> 00:09:52,240
pasadena

278
00:09:55,590 --> 00:09:53,440
uh

279
00:09:57,509 --> 00:09:55,600
this was then sent over to france which

280
00:09:58,870 --> 00:09:57,519
is currently then being integrated into

281
00:10:01,750 --> 00:09:58,880
this bus

282
00:10:03,350 --> 00:10:01,760
and once it's fully built and complete

283
00:10:04,630 --> 00:10:03,360
we then bring it back

284
00:10:06,630 --> 00:10:04,640
towards the end of this year from launch

285
00:10:08,790 --> 00:10:06,640
here in uh in california

286
00:10:10,710 --> 00:10:08,800
and uh will you be going back and forth

287
00:10:12,790 --> 00:10:10,720
to france yeah so i was there this this

288
00:10:13,750 --> 00:10:12,800

year for a few months uh we're currently

289
00:10:15,670 --> 00:10:13,760
in the middle of doing a lot of

290
00:10:17,829 --> 00:10:15,680
environmentals on the mechanical side

291
00:10:20,870 --> 00:10:17,839
and i'll be going back this january to

292
00:10:23,030 --> 00:10:20,880
continue electrical testing and i i'm

293
00:10:25,910 --> 00:10:23,040
one of the lucky few to be part of the

294
00:10:27,990 --> 00:10:25,920
the launch team that will be in uh

295
00:10:30,790 --> 00:10:28,000
in the french space agency in toulouse

296
00:10:32,870 --> 00:10:30,800
france and actually seen uh live live

297
00:10:34,069 --> 00:10:32,880
information live coming down to earth

298
00:10:36,310 --> 00:10:34,079
verifying that our instruments are

299
00:10:37,670 --> 00:10:36,320
working properly and give it the go to

300
00:10:39,030 --> 00:10:37,680
you know begin collecting science data

301
00:10:40,710 --> 00:10:39,040
yeah it'll be a lot of international

302
00:10:41,509 --> 00:10:40,720
travel in your future

303
00:10:46,150 --> 00:10:41,519
so

304
00:10:48,710 --> 00:10:46,160
favorite part of working on this mission

305
00:10:50,710 --> 00:10:48,720
my favorite part is uh the team uh like

306
00:10:53,269 --> 00:10:50,720
as is mentioned this is a worldwide

307
00:10:55,350 --> 00:10:53,279
effort here and being able to

308
00:10:56,470 --> 00:10:55,360
work with all these different engineers

309
00:10:58,389 --> 00:10:56,480
there's always going to be hurdles to

310
00:11:00,230 --> 00:10:58,399
get through and getting all their heads

311
00:11:01,509 --> 00:11:00,240
in this together with the same goal with

312
00:11:04,310 --> 00:11:01,519
the same achievement

313
00:11:06,230 --> 00:11:04,320

uh it's it's amazing how well we work

314
00:11:08,710 --> 00:11:06,240
together to get through these hurdles

315
00:11:10,550 --> 00:11:08,720
yeah great answer and that's kind of all

316
00:11:12,470 --> 00:11:10,560
the time we have for questions today

317
00:11:15,910 --> 00:11:12,480
thank you so much for joining us chris

318
00:11:17,990 --> 00:11:15,920
no problem now swat is being jointly

319
00:11:20,069 --> 00:11:18,000
developed like you said by nasa and the

320
00:11:22,150 --> 00:11:20,079
french space agency canes with

321
00:11:23,910 --> 00:11:22,160
contributions from

322
00:11:26,230 --> 00:11:23,920
the canadian space agency canadian and

323
00:11:28,710 --> 00:11:26,240
the uk space agency they're both a

324
00:11:30,949 --> 00:11:28,720
part and there's uh hardware and boxes

325
00:11:33,350 --> 00:11:30,959
inside the cairn that they support and

326
00:11:35,670 --> 00:11:33,360
uh so yeah so there's total of the four

327
00:11:37,990 --> 00:11:35,680
of us and then it's scheduled to launch

328
00:11:40,069 --> 00:11:38,000
no earlier than november

329
00:11:42,310 --> 00:11:40,079
2022. that is correct it's getting close

330
00:11:44,550 --> 00:11:42,320
here no it's getting real close and for

331
00:11:47,750 --> 00:11:44,560
more information on swot you can visit