
INSIDE THE CLEAN ROOM: EARTH SATELLITE NEARS LAUNCH
NASA
Jet Propulsion Laboratory
California Institute of Technology
MASSE A VIDE
DIM 6834 X 2 500 X 908 STOCKAGE

1
00:00:01,790 --> 00:00:00,589
[Music]

2
00:00:03,889 --> 00:00:01,800
because

3
00:00:05,930 --> 00:00:03,899
we are less than a month away from

4
00:00:08,930 --> 00:00:05,940
launching NASA's next Earth observing

5
00:00:11,150 --> 00:00:08,940
satellite I'm Raquel vinueva and today

6
00:00:13,009 --> 00:00:11,160
we're at Vandenberg space Force Base

7
00:00:16,070 --> 00:00:13,019
where the surface water and ocean

8
00:00:18,590 --> 00:00:16,080
topography spacecraft also known as SWAT

9
00:00:21,349 --> 00:00:18,600
is undergoing its final preparations

10
00:00:23,750 --> 00:00:21,359
before launch this is the mission

11
00:00:26,150 --> 00:00:23,760
director Center where just a few weeks

12
00:00:29,330 --> 00:00:26,160
from now teams will be monitoring SWOT

13
00:00:31,550 --> 00:00:29,340

launch operations but to get a closer

14
00:00:33,950 --> 00:00:31,560
look at the spacecraft and to hear more

15
00:00:37,130 --> 00:00:33,960
about its Mission let's get suited up

16
00:00:40,490 --> 00:00:37,140
and head into the clean room

17
00:00:43,549 --> 00:00:40,500
and here it is you are looking at SWAT

18
00:00:46,430 --> 00:00:43,559
inside the astrotech clean room and I am

19
00:00:49,850 --> 00:00:46,440
joined today by Phoebe Rhodes Wicket she

20
00:00:51,290 --> 00:00:49,860
is leading mechanical activities here

21
00:00:53,389 --> 00:00:51,300
inside the clean room thank you for

22
00:00:55,369 --> 00:00:53,399
joining us today thank you for having me

23
00:00:58,250 --> 00:00:55,379
so Phoebe can you tell us a little bit

24
00:01:01,069 --> 00:00:58,260
more about SWAT yeah so this is our baby

25
00:01:03,470 --> 00:01:01,079
SWAT uh it stands for surface water

26
00:01:05,690 --> 00:01:03,480
ocean topography and that's this mission

27
00:01:08,630 --> 00:01:05,700
is going to help us understand the water

28
00:01:10,609 --> 00:01:08,640
on our planet better so as we know water

29
00:01:12,710 --> 00:01:10,619
is a finite resource that we have and

30
00:01:15,469 --> 00:01:12,720
it's really important to know where it

31
00:01:17,210 --> 00:01:15,479
was where it is and where it's going and

32
00:01:19,609 --> 00:01:17,220
SWAT is going to help us with that it

33
00:01:21,950 --> 00:01:19,619
uses advanced technology to take

34
00:01:23,990 --> 00:01:21,960
snapshots of the water on our planet so

35
00:01:26,270 --> 00:01:24,000
that we can better plan for things like

36
00:01:27,590 --> 00:01:26,280
droughts and floods and just better help

37
00:01:29,690 --> 00:01:27,600
prepare our communities for what's

38
00:01:31,429 --> 00:01:29,700

coming and how long have you been

39
00:01:33,710 --> 00:01:31,439
working on the mission I have been

40
00:01:36,350 --> 00:01:33,720
working on this mission for eight years

41
00:01:40,190 --> 00:01:36,360
which is exactly a quarter of my life

42
00:01:43,190 --> 00:01:40,200
Wow and so I started working on at the

43
00:01:46,429 --> 00:01:43,200
mechanism level and then built up into

44
00:01:49,370 --> 00:01:46,439
where I was part of the Deployable team

45
00:01:50,990 --> 00:01:49,380
for all the Deployable structure on this

46
00:01:53,929 --> 00:01:51,000
spacecraft which is basically everything

47
00:01:57,050 --> 00:01:53,939
that unfolds once we're in space on the

48
00:02:00,590 --> 00:01:57,060
payload side which is what JPL delivered

49
00:02:02,330 --> 00:02:00,600
and so uh that basically once we're in

50
00:02:04,730 --> 00:02:02,340
space we go through a three-phase

51
00:02:06,770 --> 00:02:04,740
deployment so we start all tucked up

52
00:02:09,109 --> 00:02:06,780
like you see here today and then we go

53
00:02:11,089 --> 00:02:09,119
up through stage one out through stage

54
00:02:14,570 --> 00:02:11,099
two and then the third stage deploys the

55
00:02:16,850 --> 00:02:14,580
antennas until we're out to about half a

56
00:02:18,890 --> 00:02:16,860
tennis court size is 10 meters

57
00:02:21,410 --> 00:02:18,900
hold that that's a great description of

58
00:02:23,150 --> 00:02:21,420
it and can you tell us what is going on

59
00:02:25,729 --> 00:02:23,160
in the clean room right now how long has

60
00:02:28,369 --> 00:02:25,739
swap been here too yeah so we've been

61
00:02:30,350 --> 00:02:28,379
here for a few weeks we came over from

62
00:02:33,410 --> 00:02:30,360
France after being there for a little

63
00:02:34,910 --> 00:02:33,420

over a year and we've now been in the

64
00:02:37,729 --> 00:02:34,920
clean room we're going through the final

65
00:02:40,309 --> 00:02:37,739
activities before launch so we're making

66
00:02:42,770 --> 00:02:40,319
sure everything is cleaned and ready to

67
00:02:44,809 --> 00:02:42,780
go we're removing all the flight all the

68
00:02:46,790 --> 00:02:44,819
items that we don't want to fly with the

69
00:02:49,130 --> 00:02:46,800
spacecraft we're installing our last

70
00:02:51,170 --> 00:02:49,140
little touches we have some ground

71
00:02:52,910 --> 00:02:51,180
supportment that's on here for the test

72
00:02:54,949 --> 00:02:52,920
that has to come off and then we can

73
00:02:56,930 --> 00:02:54,959
close up all the blankets which keep the

74
00:03:00,110 --> 00:02:56,940
spacecraft nice and warm in the cold

75
00:03:01,309 --> 00:03:00,120
space environment and can you tell us a

76
00:03:02,750 --> 00:03:01,319
little bit more about this gear we're

77
00:03:05,270 --> 00:03:02,760
wearing and why we have to wear it

78
00:03:06,949 --> 00:03:05,280
inside this room specifically yeah so

79
00:03:09,410 --> 00:03:06,959
it's important to keep our spacecraft

80
00:03:11,270 --> 00:03:09,420
clean I was just talking about our the

81
00:03:13,970 --> 00:03:11,280
hardware I care the most about the

82
00:03:15,649 --> 00:03:13,980
Deployable structure and for that it's

83
00:03:17,030 --> 00:03:15,659
important that

84
00:03:18,589 --> 00:03:17,040
um you know there could be contaminants

85
00:03:20,570 --> 00:03:18,599
on surfaces and then when we go through

86
00:03:22,790 --> 00:03:20,580
launch you can just picture if you had

87
00:03:25,910 --> 00:03:22,800
dust it will spread out to probably

88
00:03:28,250 --> 00:03:25,920

places you don't want it to go and so we

89
00:03:31,309 --> 00:03:28,260
don't want that contamination to get

90
00:03:34,490 --> 00:03:31,319
inside the mechanisms and keep us from

91
00:03:36,530 --> 00:03:34,500
being able to successfully deploy once

92
00:03:39,350 --> 00:03:36,540
they're in space or to get on any of

93
00:03:43,070 --> 00:03:39,360
those surfaces where you know it's very

94
00:03:44,570 --> 00:03:43,080
important that we come together in our

95
00:03:46,369 --> 00:03:44,580
final deployment and everything is where

96
00:03:48,470 --> 00:03:46,379
we need it to be our alignment

97
00:03:51,289 --> 00:03:48,480
requirements are within the thousandth

98
00:03:52,670 --> 00:03:51,299
degree and so it's really tight and we

99
00:03:54,289 --> 00:03:52,680
need to make sure it's successful and

100
00:03:56,149 --> 00:03:54,299
keeping everything clean as part of how

101
00:03:58,130 --> 00:03:56,159
we do that that makes sense and why we

102
00:04:01,130 --> 00:03:58,140
have to wear these hair nets with us now

103
00:04:03,890 --> 00:04:01,140
they are cute it's a look I like it I'm

104
00:04:08,809 --> 00:04:03,900
digging it and with less than a month

105
00:04:11,570 --> 00:04:08,819
left to launch uh how does SWAT get over

106
00:04:13,490 --> 00:04:11,580
to the launch pad yeah so we have a

107
00:04:16,189 --> 00:04:13,500
massive shipping container that was used

108
00:04:18,890 --> 00:04:16,199
to bring it here from France so we use

109
00:04:20,750 --> 00:04:18,900
the crane to lift it off of this dolly

110
00:04:22,909 --> 00:04:20,760
onto another one that then rolls into

111
00:04:24,409 --> 00:04:22,919
the shipping container and then that

112
00:04:27,590 --> 00:04:24,419
shipping container is transported over

113
00:04:30,710 --> 00:04:27,600

to SpaceX where it's removed and it's

114
00:04:32,510 --> 00:04:30,720
integrated with the long the rocket and

115
00:04:35,090 --> 00:04:32,520
then smooth to the launch pad ready to

116
00:04:38,210 --> 00:04:35,100
look and where will you be for launch I

117
00:04:41,210 --> 00:04:38,220
will be in Toulouse France I'm part of

118
00:04:43,070 --> 00:04:41,220
the deployment operations team so we

119
00:04:46,189 --> 00:04:43,080
will be at kness which is the French

120
00:04:48,170 --> 00:04:46,199
space agency and we will be going

121
00:04:50,390 --> 00:04:48,180
through the deployment process just

122
00:04:53,870 --> 00:04:50,400
shortly after launch a couple days and

123
00:04:55,969 --> 00:04:53,880
we'll get our baby off deployed and

124
00:04:57,890 --> 00:04:55,979
ready to complete a successful Mission

125
00:05:00,890 --> 00:04:57,900
and what will be like for you when you

126
00:05:03,770 --> 00:05:00,900
see those solar arrays open up for the

127
00:05:06,170 --> 00:05:03,780
first time I'm probably gonna cry we'll

128
00:05:09,050 --> 00:05:06,180
see but it's a long time in the making

129
00:05:10,850 --> 00:05:09,060
I've there's already been so much sweat

130
00:05:13,430 --> 00:05:10,860
and tears and love poured into this

131
00:05:15,710 --> 00:05:13,440
spacecraft and so it's it's gonna be a

132
00:05:17,570 --> 00:05:15,720
really special moment for sure that's so

133
00:05:20,629 --> 00:05:17,580
I'm so happy for you thank you Phoebe

134
00:05:23,029 --> 00:05:20,639
for talking to us today now we are going

135
00:05:25,129 --> 00:05:23,039
to head over back to NASA's jet

136
00:05:28,129 --> 00:05:25,139
propulsion laboratory where our social

137
00:05:29,810 --> 00:05:28,139
media lead Emily Richardson is going to

138
00:05:31,969 --> 00:05:29,820

be with two other Mission members

139
00:05:33,650 --> 00:05:31,979
answering your questions today so if you

140
00:05:36,230 --> 00:05:33,660
have a question you'd like to ask use

141
00:05:53,770 --> 00:05:36,240
the hashtag tracking worldwater or leave

142
00:05:57,590 --> 00:05:55,610
really soon it's going to be

143
00:05:59,570 --> 00:05:57,600
encapsulated and loaded up onto the

144
00:06:01,370 --> 00:05:59,580
rocket for launch for those of you who

145
00:06:03,469 --> 00:06:01,380
are just joining us we're talking about

146
00:06:06,170 --> 00:06:03,479
SWAT the surface water and ocean

147
00:06:08,810 --> 00:06:06,180
topography Mission it's led by NASA and

148
00:06:10,310 --> 00:06:08,820
the French space agency kness and it

149
00:06:12,890 --> 00:06:10,320
recently returned from its integration

150
00:06:15,409 --> 00:06:12,900
at the taliselania space facility in

151
00:06:16,490 --> 00:06:15,419
France scheduled for launch on December

152
00:06:18,230 --> 00:06:16,500
12th

153
00:06:19,790 --> 00:06:18,240
for those of you who have questions you

154
00:06:22,610 --> 00:06:19,800
can drop them in the chat or use the

155
00:06:25,189 --> 00:06:22,620
hashtag trackingworldwater but first

156
00:06:27,710 --> 00:06:25,199
let's meet our subject matter experts

157
00:06:29,629 --> 00:06:27,720
I'm joined today by Ava peral SWAT

158
00:06:33,469 --> 00:06:29,639
Mission performance engineer and

159
00:06:35,210 --> 00:06:33,479
oceanographer Matt Archer hi Matt Leo

160
00:06:37,610 --> 00:06:35,220
thanks welcome everybody thanks for

161
00:06:39,409 --> 00:06:37,620
joining us Matt uh you're part of the

162
00:06:41,270 --> 00:06:39,419
mission science team so I can imagine

163
00:06:43,309 --> 00:06:41,280

that you're really really excited to get

164
00:06:44,450 --> 00:06:43,319
the data back from this Mission can you

165
00:06:45,590 --> 00:06:44,460
tell us a little bit more about what

166
00:06:48,650 --> 00:06:45,600
swat's going to help us learn about

167
00:06:49,850 --> 00:06:48,660
Earth's water sure yeah so soy is a

168
00:06:51,650 --> 00:06:49,860
Pathfinder Mission which means it's

169
00:06:53,749 --> 00:06:51,660
putting new technology into space for

170
00:06:55,070 --> 00:06:53,759
the first time so you know our

171
00:06:56,629 --> 00:06:55,080
scientists are very excited we're going

172
00:06:58,309 --> 00:06:56,639
to have a new data set that's going to

173
00:07:00,189 --> 00:06:58,319
give us you know a brand new view of the

174
00:07:02,930 --> 00:07:00,199
global ocean water

175
00:07:05,210 --> 00:07:02,940
and so you know SWAT has two main

176
00:07:07,430 --> 00:07:05,220
branches I'm a nationographer so you

177
00:07:10,430 --> 00:07:07,440
know I know most about the ocean side of

178
00:07:12,290 --> 00:07:10,440
this Mission and we've been lucky for

179
00:07:15,110 --> 00:07:12,300
the last 30 years to have satellite

180
00:07:17,570 --> 00:07:15,120
measurements of the ocean which you know

181
00:07:20,029 --> 00:07:17,580
started decades ago and

182
00:07:21,350 --> 00:07:20,039
it really satellite imagery changed

183
00:07:23,510 --> 00:07:21,360
their whole view because For the First

184
00:07:24,890 --> 00:07:23,520
time we're able to see how you know the

185
00:07:26,749 --> 00:07:24,900
ocean's changing not just in small

186
00:07:29,330 --> 00:07:26,759
locations or off ships but over the

187
00:07:31,189 --> 00:07:29,340
entire planet and

188
00:07:33,230 --> 00:07:31,199

SWOT is going to be extending this

189
00:07:34,249 --> 00:07:33,240
30-year period out longer and so the

190
00:07:36,230 --> 00:07:34,259
first thing it's going to be doing is

191
00:07:37,730 --> 00:07:36,240
helping us to maintain that unbroken

192
00:07:39,589 --> 00:07:37,740
record for understanding long-term

193
00:07:41,629 --> 00:07:39,599
changes but the thing that's really

194
00:07:43,790 --> 00:07:41,639
exciting about SWAT is that with this

195
00:07:45,529 --> 00:07:43,800
new instrument that's going on going out

196
00:07:46,850 --> 00:07:45,539
into space where we're going to have a

197
00:07:48,650 --> 00:07:46,860
brand new view of the ocean so it's

198
00:07:50,390 --> 00:07:48,660
going to kind of be like putting a pair

199
00:07:52,249 --> 00:07:50,400
of Spectacles on the older satellites

200
00:07:55,070 --> 00:07:52,259
you know everything that we saw that was

201
00:07:57,170 --> 00:07:55,080
slightly blurry or fuzzy will now be you

202
00:07:58,370 --> 00:07:57,180
know high definition Clarity and so

203
00:08:00,050 --> 00:07:58,380
that's going to help us to answer a lot

204
00:08:02,689 --> 00:08:00,060
of questions that we have about how the

205
00:08:05,390 --> 00:08:02,699
ocean works and then swat's other branch

206
00:08:08,689 --> 00:08:05,400
is land-based fresh water supply and

207
00:08:10,249 --> 00:08:08,699
storage changes and that might even be

208
00:08:12,409 --> 00:08:10,259
more exciting than the ocean component

209
00:08:14,150 --> 00:08:12,419
for the hydrologist because this will be

210
00:08:15,650 --> 00:08:14,160
the first satellite that is launched

211
00:08:17,570 --> 00:08:15,660
that can actually study the global

212
00:08:19,309 --> 00:08:17,580
land-based Water

213
00:08:21,469 --> 00:08:19,319

um across the you know the entire planet

214
00:08:24,409 --> 00:08:21,479
and so that includes you know reservoirs

215
00:08:26,930 --> 00:08:24,419
and lakes but also Rivers

216
00:08:28,850 --> 00:08:26,940
um and so you know before SWOT launches

217
00:08:31,790 --> 00:08:28,860
our ability to understand fresh water

218
00:08:33,110 --> 00:08:31,800
changes really requires a lot of work it

219
00:08:34,670 --> 00:08:33,120
requires a lot of comp you know

220
00:08:36,290 --> 00:08:34,680
computational models but also you know

221
00:08:38,209 --> 00:08:36,300
going out to Rivers going out to Lakes

222
00:08:40,550 --> 00:08:38,219
taking measurements so it's what it's

223
00:08:42,110 --> 00:08:40,560
going to enable us to basically not have

224
00:08:44,209 --> 00:08:42,120
to do that as much and actually stand

225
00:08:45,769 --> 00:08:44,219
back and see everything at once and so

226
00:08:48,949 --> 00:08:45,779
it's really going to like revolutionize

227
00:08:49,910 --> 00:08:48,959
the study of fresh water hydrology and

228
00:08:52,910 --> 00:08:49,920
of course that's going to have huge

229
00:08:54,829 --> 00:08:52,920
implications for uh how we make changes

230
00:08:57,110 --> 00:08:54,839
at the community level so Water Resource

231
00:08:58,490 --> 00:08:57,120
engineers and managers can make changes

232
00:09:00,110 --> 00:08:58,500
on the ground based on what we

233
00:09:02,090 --> 00:09:00,120
understand about you know how much water

234
00:09:04,670 --> 00:09:02,100
is going in or coming out of specific

235
00:09:06,230 --> 00:09:04,680
locations yeah it's true water is so

236
00:09:08,990 --> 00:09:06,240
essential to everything on this planet

237
00:09:10,610 --> 00:09:09,000
so as an oceanographer what particularly

238
00:09:12,470 --> 00:09:10,620

are you looking forward to learning

239
00:09:14,870 --> 00:09:12,480
about the ocean from slime

240
00:09:17,630 --> 00:09:14,880
all right so I'm an oceanographer that

241
00:09:19,730 --> 00:09:17,640
specializes in small-scale oceanography

242
00:09:21,410 --> 00:09:19,740
and so during throughout my career

243
00:09:23,389 --> 00:09:21,420
that's required that I

244
00:09:25,430 --> 00:09:23,399
kind of work on instruments that give us

245
00:09:27,410 --> 00:09:25,440
this high definition View and that

246
00:09:29,150 --> 00:09:27,420
usually means instruments that give us a

247
00:09:31,190 --> 00:09:29,160
very limited view in space even though

248
00:09:32,810 --> 00:09:31,200
it's high resolution so for example when

249
00:09:34,550 --> 00:09:32,820
I was in Australia I was working on a

250
00:09:36,650 --> 00:09:34,560
high frequency radar that was deployed

251
00:09:38,570 --> 00:09:36,660
along the coastline and that allowed us

252
00:09:41,150 --> 00:09:38,580
to look at the ocean over about 60 miles

253
00:09:43,130 --> 00:09:41,160
squared area uh

254
00:09:46,009 --> 00:09:43,140
what's going to do is basically let us

255
00:09:48,410 --> 00:09:46,019
do that for the entire Globe so it's you

256
00:09:49,850 --> 00:09:48,420
can't really understand my excitement

257
00:09:52,550 --> 00:09:49,860
because it's going to be able to see

258
00:09:55,430 --> 00:09:52,560
suddenly everything all at once yeah

259
00:09:56,509 --> 00:09:55,440
excited that's awesome and Ava I

260
00:09:59,030 --> 00:09:56,519
understand if you've been on the mission

261
00:10:00,769 --> 00:09:59,040
for 13 years what's it been like seeing

262
00:10:02,690 --> 00:10:00,779
the spacecraft come together

263
00:10:06,170 --> 00:10:02,700

so yes you're right I've been on sport

264
00:10:09,050 --> 00:10:06,180
for 13 years in fact my whole life at

265
00:10:11,990 --> 00:10:09,060
JPL I've been working on soar and when I

266
00:10:15,290 --> 00:10:12,000
came to JPL my expertise was fiber

267
00:10:18,550 --> 00:10:15,300
optics but I joined the radar team the

268
00:10:22,190 --> 00:10:18,560
Raider is the main instrument on SWAT

269
00:10:23,870 --> 00:10:22,200
over the years I became the lead system

270
00:10:26,810 --> 00:10:23,880
engineer for this instrument which is

271
00:10:28,730 --> 00:10:26,820
called Kern and then after that I became

272
00:10:31,850 --> 00:10:28,740
the soil Mission performance

273
00:10:34,610 --> 00:10:31,860
so for me it's been a tremendous growth

274
00:10:36,949 --> 00:10:34,620
opportunity professionally I've been

275
00:10:40,250 --> 00:10:36,959
very fortunate to work alongside very

276
00:10:42,170 --> 00:10:40,260
very talented Engineers young Engineers

277
00:10:44,630 --> 00:10:42,180
for experienced Engineers we have all

278
00:10:47,990 --> 00:10:44,640
learned from each other so now I'm super

279
00:10:50,449 --> 00:10:48,000
excited to be able to deliver this data

280
00:10:53,210 --> 00:10:50,459
to scientists like like Matt they're

281
00:10:55,190 --> 00:10:53,220
going to be answering very important

282
00:10:57,530 --> 00:10:55,200
questions about how Earth Works and

283
00:11:00,530 --> 00:10:57,540
about how the water cycle works

284
00:11:02,449 --> 00:11:00,540
amazing and you mentioned Karen briefly

285
00:11:04,190 --> 00:11:02,459
and Karen is an instrument that's really

286
00:11:05,930 --> 00:11:04,200
unique to swat and will set it apart

287
00:11:07,310 --> 00:11:05,940
from other Earth observing satellites

288
00:11:09,410 --> 00:11:07,320

can you tell us a little bit more about

289
00:11:12,050 --> 00:11:09,420
Karen yeah so there are multiple

290
00:11:14,090 --> 00:11:12,060
instrumental

291
00:11:17,150 --> 00:11:14,100
several of them have been flown before

292
00:11:19,370 --> 00:11:17,160
and the exception is really caring which

293
00:11:21,530 --> 00:11:19,380
is a very unique instrument which we

294
00:11:25,069 --> 00:11:21,540
have never ever done before so current

295
00:11:28,730 --> 00:11:25,079
stands for a cabin radar interferometer

296
00:11:31,910 --> 00:11:28,740
so it is a radar and Raiders transmit a

297
00:11:33,710 --> 00:11:31,920
signal that passes off the Earth and it

298
00:11:36,050 --> 00:11:33,720
measures what we call the time of flight

299
00:11:38,030 --> 00:11:36,060
is the time it takes from the signal to

300
00:11:41,269 --> 00:11:38,040
go to the Earth and back to the

301
00:11:42,889 --> 00:11:41,279
satellite and but current is an

302
00:11:45,170 --> 00:11:42,899
interferometer as well it has two

303
00:11:47,810 --> 00:11:45,180
antennas you can see those in this model

304
00:11:50,810 --> 00:11:47,820
are this is one of the antennas and this

305
00:11:53,509 --> 00:11:50,820
is the other antenna and so when the

306
00:11:56,090 --> 00:11:53,519
signal buses back is received by these

307
00:11:58,490 --> 00:11:56,100
two antennas so what we measure in

308
00:12:00,889 --> 00:11:58,500
addition of this time of flight is the

309
00:12:04,250 --> 00:12:00,899
relative phase of the signal that comes

310
00:12:06,949 --> 00:12:04,260
to these two antennas and these 10 this

311
00:12:10,190 --> 00:12:06,959
antennas as you can see are separated by

312
00:12:12,470 --> 00:12:10,200
this distance which is about 10 meters

313
00:12:14,810 --> 00:12:12,480

and that's about the height of a

314
00:12:17,449 --> 00:12:14,820
two-story building and that allows us to

315
00:12:18,949 --> 00:12:17,459
get this very very high Precision but in

316
00:12:21,650 --> 00:12:18,959
addition to that the third aspect of

317
00:12:25,009 --> 00:12:21,660
that is the key partner so this is a

318
00:12:28,130 --> 00:12:25,019
high frequency Raider K1 is 35 around 35

319
00:12:30,170 --> 00:12:28,140
gigahertz that means a wavelength of

320
00:12:33,110 --> 00:12:30,180
eight millimeters about the size of your

321
00:12:36,470 --> 00:12:33,120
fingernail which means that the

322
00:12:38,150 --> 00:12:36,480
measurements that we make have that type

323
00:12:40,190 --> 00:12:38,160
of accuracy the accuracy of about

324
00:12:43,129 --> 00:12:40,200
centimeter level so what we're doing

325
00:12:46,430 --> 00:12:43,139
with current is we have the ability to

326
00:12:50,030 --> 00:12:46,440
measure the height of the water on the

327
00:12:53,509 --> 00:12:50,040
earth to centimeter level accuracy

328
00:12:55,009 --> 00:12:53,519
wow that's so cool it's time to take

329
00:12:56,449 --> 00:12:55,019
some social media questions because I

330
00:12:58,850 --> 00:12:56,459
have lots but there are tons of great

331
00:13:00,590 --> 00:12:58,860
questions coming in from social media so

332
00:13:02,690 --> 00:13:00,600
reminder if you do have questions go

333
00:13:05,150 --> 00:13:02,700
ahead and drop them in the chats or use

334
00:13:07,430 --> 00:13:05,160
the hashtag tracking worldwater

335
00:13:08,449 --> 00:13:07,440
all right let's get started

336
00:13:11,090 --> 00:13:08,459
um

337
00:13:12,350 --> 00:13:11,100
let's go with since you were just

338
00:13:15,470 --> 00:13:12,360

talking about measuring different

339
00:13:17,930 --> 00:13:15,480
elements of the water breadny on

340
00:13:19,910 --> 00:13:17,940
Instagram wants to know how does SWAT

341
00:13:21,350 --> 00:13:19,920
radar differentiate water bodies from

342
00:13:24,710 --> 00:13:21,360
the surrounding Earth

343
00:13:27,470 --> 00:13:24,720
yeah so the signal that bounces back

344
00:13:31,190 --> 00:13:27,480
from Earth has different strength if

345
00:13:34,129 --> 00:13:31,200
it's water or land the signal from the

346
00:13:37,790 --> 00:13:34,139
water is about 10 10 times stronger than

347
00:13:40,210 --> 00:13:37,800
the signal from land so we use a image

348
00:13:42,069 --> 00:13:40,220
processing algorithms

349
00:13:44,690 --> 00:13:42,079
to

350
00:13:46,730 --> 00:13:44,700
differentiate between these two signal

351
00:13:49,550 --> 00:13:46,740
strengths and with that we're going to

352
00:13:51,710 --> 00:13:49,560
be able to determine not just the height

353
00:13:54,769 --> 00:13:51,720
of these water bodies but also the

354
00:13:56,629 --> 00:13:54,779
extent the area that they occupy

355
00:13:58,490 --> 00:13:56,639
wonderful

356
00:14:01,250 --> 00:13:58,500
um and for Matt what type of information

357
00:14:03,350 --> 00:14:01,260
on water is the satellite collecting for

358
00:14:06,290 --> 00:14:03,360
you and the science team right yeah so

359
00:14:09,170 --> 00:14:06,300
over the ocean is is collecting water

360
00:14:11,629 --> 00:14:09,180
elevation and this has been a key

361
00:14:13,910 --> 00:14:11,639
measurement for us over those 30 years I

362
00:14:15,590 --> 00:14:13,920
was talking about what it allows us to

363
00:14:17,629 --> 00:14:15,600

look at is sea level changes around the

364
00:14:19,670 --> 00:14:17,639
world and it also lets us to infer ocean

365
00:14:21,230 --> 00:14:19,680
currents and therefore it allows us to

366
00:14:22,790 --> 00:14:21,240
understand how the ocean's moving which

367
00:14:25,370 --> 00:14:22,800
plays a really important role of course

368
00:14:29,449 --> 00:14:25,380
in the whole climate system and you know

369
00:14:31,370 --> 00:14:29,459
as a whole yeah for that awesome

370
00:14:33,410 --> 00:14:31,380
um another one for you Matt Danny on

371
00:14:36,889 --> 00:14:33,420
Instagram asks what conditions could

372
00:14:39,290 --> 00:14:36,899
affect swats measurements right yeah um

373
00:14:41,449 --> 00:14:39,300
again for the ocean at least the uh one

374
00:14:44,750 --> 00:14:41,459
of the Key conditions is waves ocean

375
00:14:46,670 --> 00:14:44,760
waves when you have very stormy waves

376
00:14:48,290 --> 00:14:46,680
um that creates noise for the instrument

377
00:14:50,870 --> 00:14:48,300
we you know we're interested in the

378
00:14:53,210 --> 00:14:50,880
ocean sea surface height uh and not so

379
00:14:55,730 --> 00:14:53,220
much the surface waves and so when we

380
00:14:59,150 --> 00:14:55,740
have like big stormy seas that's gonna

381
00:15:02,930 --> 00:14:59,160
degrade the um the quality of the

382
00:15:09,110 --> 00:15:05,829
uh Eva melophilic Athlete on Instagram

383
00:15:11,689 --> 00:15:09,120
asks which wavelength Spectrum does it

384
00:15:14,090 --> 00:15:11,699
use to scan water and how does it how is

385
00:15:17,030 --> 00:15:14,100
it different from other satellites that

386
00:15:19,509 --> 00:15:17,040
like Karen uses higher frequency than

387
00:15:22,610 --> 00:15:19,519
what has been done before most previous

388
00:15:25,069 --> 00:15:22,620

altimeter missions were using Ku band

389
00:15:27,650 --> 00:15:25,079
around like 15 gigahertz there was also

390
00:15:31,189 --> 00:15:27,660
a Ka band altimeter but to my knowledge

391
00:15:33,769 --> 00:15:31,199
this is the first Ka band interfer radar

392
00:15:36,170 --> 00:15:33,779
interferometer that is going to be

393
00:15:38,509 --> 00:15:36,180
launched into space and be able to

394
00:15:41,629 --> 00:15:38,519
measure water from space so that's about

395
00:15:44,210 --> 00:15:41,639
eight millimeter wavelength

396
00:15:45,650 --> 00:15:44,220
very very precise like the spectacles

397
00:15:47,509 --> 00:15:45,660
that you're talking about making it very

398
00:15:49,730 --> 00:15:47,519
clear

399
00:15:53,990 --> 00:15:49,740
um this is really an international

400
00:15:56,930 --> 00:15:54,000
Mission uh kvk space flight on YouTube

401
00:15:58,610 --> 00:15:56,940
asks which countries will swats data

402
00:16:01,430 --> 00:15:58,620
serve

403
00:16:03,889 --> 00:16:01,440
D sure I can take that so

404
00:16:06,050 --> 00:16:03,899
uh SWAT has four major Partners we have

405
00:16:07,790 --> 00:16:06,060
NASA obviously here we have canez which

406
00:16:09,650 --> 00:16:07,800
is the French space agency and then we

407
00:16:12,710 --> 00:16:09,660
have two other partners the UK space

408
00:16:14,030 --> 00:16:12,720
agency and the Canadian space agency and

409
00:16:16,430 --> 00:16:14,040
they've all contribute to make this

410
00:16:19,370 --> 00:16:16,440
satellite a possibility but the data we

411
00:16:20,930 --> 00:16:19,380
collect is a public service so it will

412
00:16:23,030 --> 00:16:20,940
be available to anyone around the world

413
00:16:24,829 --> 00:16:23,040

who wants to access it and that's kind

414
00:16:26,269 --> 00:16:24,839
of one of the exciting things again from

415
00:16:27,949 --> 00:16:26,279
the ocean perspective you know we're

416
00:16:30,170 --> 00:16:27,959
studying these very small scale features

417
00:16:31,610 --> 00:16:30,180
now and so we'll be able to look at

418
00:16:32,990 --> 00:16:31,620
these small scale features you know

419
00:16:35,509 --> 00:16:33,000
anyone will be able to look at them

420
00:16:38,030 --> 00:16:35,519
scientists you know from Argentina to

421
00:16:39,650 --> 00:16:38,040
you know India and everywhere in between

422
00:16:41,210 --> 00:16:39,660
we'll be able to all be able to access

423
00:16:42,050 --> 00:16:41,220
that data and look at their own Regional

424
00:16:46,850 --> 00:16:42,060
ocean

425
00:16:48,110 --> 00:16:46,860
as well rivers lakes and reservoirs you

426
00:16:49,730 --> 00:16:48,120
know all countries will have access to

427
00:16:51,889 --> 00:16:49,740
it and be able to make you know

428
00:16:53,329 --> 00:16:51,899
engineering and water-based research

429
00:16:55,069 --> 00:16:53,339
decisions

430
00:16:56,389 --> 00:16:55,079
on this data

431
00:16:58,490 --> 00:16:56,399
yeah we have several questions about

432
00:17:00,470 --> 00:16:58,500
that because it does like we said it's

433
00:17:01,910 --> 00:17:00,480
really critical to everyone's lives on

434
00:17:04,370 --> 00:17:01,920
on our planet

435
00:17:05,990 --> 00:17:04,380
um and the fact that information is

436
00:17:07,789 --> 00:17:06,000
going to be publicly available is really

437
00:17:09,470 --> 00:17:07,799
great do you know how if it's going to

438
00:17:13,069 --> 00:17:09,480

be available in real time or what the

439
00:17:18,829 --> 00:17:16,669
do you know so um and we were just

440
00:17:21,409 --> 00:17:18,839
actually talking about this before uh

441
00:17:23,569 --> 00:17:21,419
we've had once we launched we're gonna

442
00:17:25,130 --> 00:17:23,579
have about six months in which we're

443
00:17:27,350 --> 00:17:25,140
going to be doing calibration and

444
00:17:29,090 --> 00:17:27,360
validation of the measurement that means

445
00:17:31,549 --> 00:17:29,100
that we're going to be

446
00:17:33,049 --> 00:17:31,559
um comparing the data that we measured

447
00:17:35,029 --> 00:17:33,059
with the instrument with the ground

448
00:17:36,710 --> 00:17:35,039
truth and making sure that the

449
00:17:39,169 --> 00:17:36,720
measurement has the meets the

450
00:17:40,610 --> 00:17:39,179
requirements as we expect after that

451
00:17:43,250 --> 00:17:40,620
we're actually moving to a different

452
00:17:45,250 --> 00:17:43,260
orbit and it's going to take months

453
00:17:47,690 --> 00:17:45,260
after that for that data to be available

454
00:17:49,669 --> 00:17:47,700
and even after that we might need to

455
00:17:52,310 --> 00:17:49,679
reprocess the data as we learn more

456
00:17:55,490 --> 00:17:52,320
about the measurement and about the type

457
00:17:57,409 --> 00:17:55,500
of signal that we are receiving so it

458
00:17:59,750 --> 00:17:57,419
will not be real time for the current

459
00:18:03,470 --> 00:17:59,760
data some of the other instruments are

460
00:18:05,690 --> 00:18:03,480
part of SWOT that have a lot of Legacy

461
00:18:07,789 --> 00:18:05,700
they've been out in other missions

462
00:18:09,770 --> 00:18:07,799
before the data of those is going to be

463
00:18:11,810 --> 00:18:09,780

available in real time

464
00:18:14,210 --> 00:18:11,820
wow yeah and I can actually add to that

465
00:18:15,409 --> 00:18:14,220
the the the the interferometer the

466
00:18:16,909 --> 00:18:15,419
character in this instrument is

467
00:18:18,770 --> 00:18:16,919
producing so much data it's

468
00:18:20,390 --> 00:18:18,780
unprecedented for a satellite and so

469
00:18:22,490 --> 00:18:20,400
there's people that are having to work

470
00:18:24,169 --> 00:18:22,500
on how to actually you know reduce that

471
00:18:26,150 --> 00:18:24,179
data to something manageable and also

472
00:18:28,310 --> 00:18:26,160
how to make it available to people and

473
00:18:31,130 --> 00:18:28,320
so we've moved from you know storing it

474
00:18:31,850 --> 00:18:31,140
in data servers and accessing it you

475
00:18:32,690 --> 00:18:31,860
know

476
00:18:34,010 --> 00:18:32,700
um

477
00:18:36,590 --> 00:18:34,020
uh

478
00:18:38,510 --> 00:18:36,600
you know locally to putting into a

479
00:18:40,909 --> 00:18:38,520
cloud-based service so that there's more

480
00:18:42,289 --> 00:18:40,919
accessibility and easier data storage so

481
00:18:43,669 --> 00:18:42,299
you don't have to download and store any

482
00:18:45,770 --> 00:18:43,679
data to your computer you can actually

483
00:18:46,850 --> 00:18:45,780
go and access it in the clouds so that's

484
00:18:49,010 --> 00:18:46,860
something that's quite important with

485
00:18:50,690 --> 00:18:49,020
this Mission and that this Mission has

486
00:18:53,930 --> 00:18:50,700
stimulated this kind of computational

487
00:18:58,430 --> 00:18:56,390
Nicholas on LinkedIn asks does the

488
00:19:01,430 --> 00:18:58,440

spacecraft have the ability to change

489
00:19:03,590 --> 00:19:01,440
its orbit once it's in orbit

490
00:19:05,330 --> 00:19:03,600
so we are going in fact to do that as I

491
00:19:08,210 --> 00:19:05,340
said it's going to be first in what we

492
00:19:10,789 --> 00:19:08,220
call the cowboy orbit which has a

493
00:19:12,770 --> 00:19:10,799
repetition of one day and then we're

494
00:19:15,350 --> 00:19:12,780
gonna move it to a different orbit which

495
00:19:17,990 --> 00:19:15,360
is a 21-day orbit which is what we call

496
00:19:19,669 --> 00:19:18,000
the science phase so after that we're

497
00:19:22,190 --> 00:19:19,679
not planning to change the orbit anymore

498
00:19:23,690 --> 00:19:22,200
okay and yeah there was an animation

499
00:19:25,730 --> 00:19:23,700
right at the front that I think showed

500
00:19:29,150 --> 00:19:25,740
how that orbit looks and how it scans

501
00:19:31,610 --> 00:19:29,160
the entire Earth or most of the Earth

502
00:19:33,110 --> 00:19:31,620
um combustion on YouTube asks how does

503
00:19:34,690 --> 00:19:33,120
it know the difference between water and

504
00:19:37,430 --> 00:19:34,700
ice

505
00:19:41,150 --> 00:19:37,440
do you think that it's also about back

506
00:19:43,850 --> 00:19:41,160
scattering so it is the difference

507
00:19:46,010 --> 00:19:43,860
between the the strength of the signal

508
00:19:48,289 --> 00:19:46,020
that comes from the water and the land

509
00:19:50,510 --> 00:19:48,299
the difference is higher than the

510
00:19:52,370 --> 00:19:50,520
difference between water and ice so it's

511
00:19:56,029 --> 00:19:52,380
going to be more difficult to

512
00:19:59,270 --> 00:19:56,039
distinguish them and we don't have any

513
00:20:00,710 --> 00:19:59,280

science requirements to measure ice but

514
00:20:03,169 --> 00:20:00,720
it's certainly one of our goals we're

515
00:20:06,650 --> 00:20:03,179
gonna try to do our best to also get

516
00:20:09,049 --> 00:20:06,660
some science on ice

517
00:20:11,270 --> 00:20:09,059
all right

518
00:20:13,370 --> 00:20:11,280
um Roxanna on Instagram

519
00:20:14,930 --> 00:20:13,380
how do what do we hope to get from this

520
00:20:16,190 --> 00:20:14,940
mission in the long term so we're

521
00:20:17,210 --> 00:20:16,200
talking about the next couple of weeks

522
00:20:18,650 --> 00:20:17,220
and months with getting this thing

523
00:20:19,970 --> 00:20:18,660
launched and up in space and its

524
00:20:21,289 --> 00:20:19,980
measurements collected but what about

525
00:20:23,270 --> 00:20:21,299
the long term what are we hoping to

526
00:20:24,710 --> 00:20:23,280
learn

527
00:20:27,049 --> 00:20:24,720
that's a great question

528
00:20:35,390 --> 00:20:27,059
so

529
00:20:38,330 --> 00:20:35,400
measuring the water

530
00:20:40,730 --> 00:20:38,340
we have these open questions in the

531
00:20:42,830 --> 00:20:40,740
oceanographic community about how energy

532
00:20:44,690 --> 00:20:42,840
transfers between scales and what I mean

533
00:20:46,490 --> 00:20:44,700
by that is you know the energy is forced

534
00:20:47,990 --> 00:20:46,500
at large scales you have the sun heating

535
00:20:50,029 --> 00:20:48,000
the surface of the ocean you have the

536
00:20:51,770 --> 00:20:50,039
winds blowing over the ocean

537
00:20:53,510 --> 00:20:51,780
um but the energy is dissipated or it

538
00:20:55,250 --> 00:20:53,520

gets destroyed at small scales you know

539
00:20:56,930 --> 00:20:55,260
in turbulence and all the mixture you

540
00:20:58,730 --> 00:20:56,940
know when you think of uh you know

541
00:21:02,990 --> 00:20:58,740
mixing a cup of coffee and all that's

542
00:21:04,610 --> 00:21:03,000
the stirring and and turbulence and so

543
00:21:05,870 --> 00:21:04,620
one of the kind of gaps in our

544
00:21:07,970 --> 00:21:05,880
understanding is what happens between

545
00:21:10,130 --> 00:21:07,980
the big scales and the tiny scales

546
00:21:11,570 --> 00:21:10,140
there's this middle scale and so sweat

547
00:21:14,029 --> 00:21:11,580
is going to be providing a lot of

548
00:21:15,950 --> 00:21:14,039
hopeful you know insight into into these

549
00:21:17,090 --> 00:21:15,960
Dynamics and to how this works and

550
00:21:18,890 --> 00:21:17,100
that's going to give us that piece of

551
00:21:21,409 --> 00:21:18,900
the puzzle to understand better how the

552
00:21:22,810 --> 00:21:21,419
ocean works as a whole system and also

553
00:21:25,730 --> 00:21:22,820
you know how it

554
00:21:27,830 --> 00:21:25,740
interacts with the atmosphere and so for

555
00:21:29,149 --> 00:21:27,840
us the basic understanding of like

556
00:21:31,190 --> 00:21:29,159
understanding from a scientific like

557
00:21:32,990 --> 00:21:31,200
basic research perspective is is going

558
00:21:34,430 --> 00:21:33,000
to change is going to improve on our

559
00:21:37,130 --> 00:21:34,440
understanding of how the Earth system

560
00:21:39,350 --> 00:21:37,140
works from a forecasting or predictive

561
00:21:41,630 --> 00:21:39,360
Viewpoint this data will be fed into

562
00:21:42,950 --> 00:21:41,640
computer models both for the atmospheric

563
00:21:44,330 --> 00:21:42,960

for weather for understanding how

564
00:21:45,590 --> 00:21:44,340
weather's changing but also for the

565
00:21:47,690 --> 00:21:45,600
ocean as well and how the ocean's

566
00:21:49,730 --> 00:21:47,700
changing and so over the long run we're

567
00:21:51,529 --> 00:21:49,740
just going to be improving you know as

568
00:21:52,549 --> 00:21:51,539
this data is collected longer and longer

569
00:21:56,930 --> 00:21:52,559
it's going to be improving our

570
00:22:01,730 --> 00:21:59,570
there's so much that just is really

571
00:22:02,990 --> 00:22:01,740
important as we talk about climate

572
00:22:04,730 --> 00:22:03,000
change and the effect that it has on

573
00:22:07,370 --> 00:22:04,740
communities on the coastlines but also

574
00:22:09,289 --> 00:22:07,380
with droughts and floods which feeds

575
00:22:11,750 --> 00:22:09,299
into this question from Invincible on

576
00:22:13,730 --> 00:22:11,760
Instagram can it predict the future of

577
00:22:20,390 --> 00:22:13,740
land regions that might be covered by

578
00:22:23,870 --> 00:22:22,010
so one thing I haven't talked about so

579
00:22:26,149 --> 00:22:23,880
far is that interface of land and ocean

580
00:22:28,190 --> 00:22:26,159
so not only are we going to have the

581
00:22:29,750 --> 00:22:28,200
hydrologists studying rivers lakes and

582
00:22:32,029 --> 00:22:29,760
reservoirs and the oceanographers

583
00:22:33,950 --> 00:22:32,039
studying the ocean we have Coastal

584
00:22:35,690 --> 00:22:33,960
oceanographers and Estuary scientists

585
00:22:38,810 --> 00:22:35,700
and Delta scientists that are studying

586
00:22:40,549 --> 00:22:38,820
this kind of this interface and because

587
00:22:42,110 --> 00:22:40,559
what has a much smaller footprint it has

588
00:22:44,090 --> 00:22:42,120

a much higher resolution it's able to

589
00:22:45,649 --> 00:22:44,100
measure you know really much closer to

590
00:22:47,510 --> 00:22:45,659
the coast than the previous satellites

591
00:22:49,610 --> 00:22:47,520
were and so we will be able to

592
00:22:51,350 --> 00:22:49,620
understand and we're going to gain a lot

593
00:22:53,570 --> 00:22:51,360
of information about sea level changes

594
00:22:55,310 --> 00:22:53,580
along the coast and how it's changing

595
00:22:58,070 --> 00:22:55,320
between countries and even you know

596
00:23:00,110 --> 00:22:58,080
along countries coastlines and so it's

597
00:23:02,570 --> 00:23:00,120
going to help us to understand how this

598
00:23:05,090 --> 00:23:02,580
ocean is changing how the sea levels are

599
00:23:06,470 --> 00:23:05,100
rising or dropping in some places and

600
00:23:09,350 --> 00:23:06,480
yeah so that would help us with

601
00:23:11,630 --> 00:23:09,360
understanding where land will be lost

602
00:23:15,409 --> 00:23:11,640
exactly

603
00:23:20,029 --> 00:23:17,570
this one I know we get a we often get

604
00:23:21,710 --> 00:23:20,039
questions about this so just putting it

605
00:23:24,590 --> 00:23:21,720
out there so we can kind of establish

606
00:23:27,169 --> 00:23:24,600
what SWAT does and what it doesn't uh

607
00:23:29,029 --> 00:23:27,179
on YouTube we have a question about does

608
00:23:31,730 --> 00:23:29,039
the cape does SWAT have the capability

609
00:23:35,810 --> 00:23:31,740
to measure subsurface water

610
00:23:37,789 --> 00:23:35,820
no it does not because the the SWAT rate

611
00:23:40,549 --> 00:23:37,799
their signal doesn't penetrate the water

612
00:23:42,710 --> 00:23:40,559
it just bounces off the surface so it

613
00:23:45,710 --> 00:23:42,720

will not be able to measure the depth of

614
00:23:48,770 --> 00:23:45,720
the water or in hydrology they're going

615
00:23:50,409 --> 00:23:48,780
to use models try to estimate that it's

616
00:23:53,810 --> 00:23:50,419
part of the information that they need

617
00:23:56,690 --> 00:23:53,820
to measure what they call this chart of

618
00:23:59,049 --> 00:23:56,700
the river but it's not something that is

619
00:24:03,130 --> 00:23:59,059
what is going to give

620
00:24:06,470 --> 00:24:03,140
as a measurement it's going to be

621
00:24:09,590 --> 00:24:06,480
deduced using some additional algorithms

622
00:24:11,270 --> 00:24:09,600
and predictions on on a ground truth

623
00:24:13,010 --> 00:24:11,280
and I can actually add to that one of

624
00:24:15,289 --> 00:24:13,020
the exciting things in the ocean is that

625
00:24:17,750 --> 00:24:15,299
some things that happen at depth have a

626
00:24:20,690 --> 00:24:17,760
signature at the surface and so SWOT

627
00:24:21,890 --> 00:24:20,700
will be able to actually give us a kind

628
00:24:23,210 --> 00:24:21,900
of an insight into what's happening

629
00:24:25,250 --> 00:24:23,220
below the surface even though we can't

630
00:24:27,049 --> 00:24:25,260
see it we can infer it from the from the

631
00:24:28,730 --> 00:24:27,059
surface signal and that's one of the

632
00:24:30,529 --> 00:24:28,740
really exciting Parts is can we

633
00:24:32,510 --> 00:24:30,539
understand vertical movement in the

634
00:24:33,710 --> 00:24:32,520
ocean how the ocean is taking heat from

635
00:24:36,409 --> 00:24:33,720
the atmosphere and putting it down

636
00:24:38,090 --> 00:24:36,419
deeper and vice versa and so that's

637
00:24:39,950 --> 00:24:38,100
actually something we can infer even if

638
00:24:42,230 --> 00:24:39,960

we can't do it directly

639
00:24:43,669 --> 00:24:42,240
great thank you and thanks to our social

640
00:24:45,110 --> 00:24:43,679
media audience for all of these great

641
00:24:46,430 --> 00:24:45,120
questions there's just so many and

642
00:24:48,169 --> 00:24:46,440
they're really putting you to the test

643
00:24:50,630 --> 00:24:48,179
here

644
00:24:52,970 --> 00:24:50,640
we have time for just a few more before

645
00:24:55,850 --> 00:24:52,980
we wrap up for today

646
00:24:57,649 --> 00:24:55,860
um Kingdom kale on YouTube asks the

647
00:25:00,470 --> 00:24:57,659
Prime mission is gathering data about

648
00:25:02,450 --> 00:25:00,480
water are there other smaller similar

649
00:25:05,750 --> 00:25:02,460
functions that you hope to learn as well

650
00:25:07,430 --> 00:25:05,760
if so what they would they record

651
00:25:10,549 --> 00:25:07,440
any bonus science that we're gonna get

652
00:25:12,289 --> 00:25:10,559
from SWAT as I said I know that um and

653
00:25:15,169 --> 00:25:12,299
we don't have people representing that

654
00:25:18,590 --> 00:25:15,179
here but I know that there's going to be

655
00:25:22,070 --> 00:25:18,600
also ice science Coastal science Asmara

656
00:25:25,070 --> 00:25:22,080
was saying and that we might be able to

657
00:25:26,330 --> 00:25:25,080
use sword for and of course once we

658
00:25:28,970 --> 00:25:26,340
launch the data is going to be available

659
00:25:31,789 --> 00:25:28,980
it's going to be globally available so

660
00:25:34,250 --> 00:25:31,799
who knows there might be things that

661
00:25:36,409 --> 00:25:34,260
we're going to be learning as we work on

662
00:25:39,350 --> 00:25:36,419
this as on this data on this measurement

663
00:25:41,690 --> 00:25:39,360

and um this might be helping other

664
00:25:44,450 --> 00:25:41,700
communities as well

665
00:25:46,250 --> 00:25:44,460
and I can add to that there's um

666
00:25:48,230 --> 00:25:46,260
something that's kind of cool is the

667
00:25:51,230 --> 00:25:48,240
surface of the ocean changes depending

668
00:25:53,570 --> 00:25:51,240
on the bathymetry of the sea floor and

669
00:25:55,730 --> 00:25:53,580
so when you take a measure of the sea

670
00:25:57,169 --> 00:25:55,740
surface High over long periods you can

671
00:25:59,570 --> 00:25:57,179
actually extract the information of the

672
00:26:02,149 --> 00:25:59,580
sea floor changes and so it's what is

673
00:26:03,950 --> 00:26:02,159
going to be giving us way more coverage

674
00:26:05,930 --> 00:26:03,960
way more measurements at higher

675
00:26:07,549 --> 00:26:05,940
resolution over a long period we'll

676
00:26:10,310 --> 00:26:07,559
actually be able to not me but other

677
00:26:11,570 --> 00:26:10,320
scientists will be able to extract

678
00:26:14,750 --> 00:26:11,580
um how the shape of the sea floor in

679
00:26:17,930 --> 00:26:14,760
much higher resolution over the globe

680
00:26:20,090 --> 00:26:17,940
yeah thanks for adding that

681
00:26:22,130 --> 00:26:20,100
um okay let me see we do have a few more

682
00:26:24,169 --> 00:26:22,140
questions here

683
00:26:26,090 --> 00:26:24,179
um one that I personally am curious

684
00:26:27,649 --> 00:26:26,100
about is I know Phoebe talked a little

685
00:26:28,970 --> 00:26:27,659
bit about what the next couple of weeks

686
00:26:31,010 --> 00:26:28,980
are going to look like and you mentioned

687
00:26:33,590 --> 00:26:31,020
a little bit about deployment Ava can

688
00:26:35,570 --> 00:26:33,600

you tell us a little bit more about what

689
00:26:36,769 --> 00:26:35,580
those steps leading up to and following

690
00:26:40,190 --> 00:26:36,779
launch are going to look like for the

691
00:26:41,570 --> 00:26:40,200
spacecraft so uh we are now preparing

692
00:26:45,350 --> 00:26:41,580
for lunch which is going to happen in

693
00:26:46,370 --> 00:26:45,360
about a month and after that uh the

694
00:26:48,830 --> 00:26:46,380
first thing that we're going to do is

695
00:26:51,230 --> 00:26:48,840
deploy the antennas here you can see

696
00:26:53,390 --> 00:26:51,240
them in the deployed State all of these

697
00:26:56,690 --> 00:26:53,400
is folded into as you saw in the video

698
00:26:58,610 --> 00:26:56,700
in inside here next to the next to the

699
00:27:00,890 --> 00:26:58,620
next to the spacecraft so the first

700
00:27:02,690 --> 00:27:00,900
thing that we do is to open this up this

701
00:27:06,110 --> 00:27:02,700
has to be done with extremely high

702
00:27:07,730 --> 00:27:06,120
accuracy and in order in order to get

703
00:27:09,649 --> 00:27:07,740
the accuracy that we need for the

704
00:27:11,990 --> 00:27:09,659
measurement that has to be a fraction of

705
00:27:14,810 --> 00:27:12,000
the wavelength remember that the wavelet

706
00:27:16,370 --> 00:27:14,820
is about a fingernail length and that

707
00:27:18,110 --> 00:27:16,380
has to be a small fraction of that so

708
00:27:20,990 --> 00:27:18,120
now we're talking about really microbes

709
00:27:24,049 --> 00:27:21,000
like the width of a hair so that's going

710
00:27:26,390 --> 00:27:24,059
to be the first the first step which is

711
00:27:29,149 --> 00:27:26,400
has a lot of technological challenges

712
00:27:31,610 --> 00:27:29,159
and but we need to be successful at that

713
00:27:33,230 --> 00:27:31,620

to be able to proceed after that the

714
00:27:35,690 --> 00:27:33,240
next thing that we do is turn on the

715
00:27:37,610 --> 00:27:35,700
instruments and then because we don't

716
00:27:40,430 --> 00:27:37,620
expect the deployment to be perfect we

717
00:27:42,830 --> 00:27:40,440
actually have a an alignment mechanism

718
00:27:45,350 --> 00:27:42,840
to co-align these two antennas to have

719
00:27:47,450 --> 00:27:45,360
them even more precisely aligned and in

720
00:27:50,269 --> 00:27:47,460
order to do that we're going to be using

721
00:27:52,730 --> 00:27:50,279
actual radar data to determine the

722
00:27:55,010 --> 00:27:52,740
alignment and we're gonna have we have a

723
00:27:57,350 --> 00:27:55,020
mechanism that slightly rotates the

724
00:27:59,750 --> 00:27:57,360
antenna to improve on that and then

725
00:28:02,810 --> 00:27:59,760
after that we call into what we call the

726
00:28:04,070 --> 00:28:02,820
calibration and validation phase first

727
00:28:05,810 --> 00:28:04,080
for the instrument we're going to do

728
00:28:07,430 --> 00:28:05,820
some calibration but then for the whole

729
00:28:11,930 --> 00:28:07,440
measurement we're going to be

730
00:28:14,690 --> 00:28:11,940
calibrating a measuring some constants

731
00:28:16,789 --> 00:28:14,700
biases offsets that we need to add to

732
00:28:18,470 --> 00:28:16,799
the data and then validating that

733
00:28:21,049 --> 00:28:18,480
measurement comparing that data that

734
00:28:23,990 --> 00:28:21,059
measure data with the ground truth and

735
00:28:28,010 --> 00:28:24,000
making sure that the data that we obtain

736
00:28:29,870 --> 00:28:28,020
pain is has the Precision that we expect

737
00:28:31,850 --> 00:28:29,880
incredible it's going to be so amazing

738
00:28:33,649 --> 00:28:31,860

to watch that and to see all of those

739
00:28:35,769 --> 00:28:33,659
Milestones get checked off I bet you're

740
00:28:38,330 --> 00:28:35,779
pretty excited for it yes

741
00:28:41,149 --> 00:28:38,340
so we're just coming up on the end here

742
00:28:43,190 --> 00:28:41,159
one question I wanted to ask you both is

743
00:28:46,070 --> 00:28:43,200
where are you going to be for launch

744
00:28:48,430 --> 00:28:46,080
oh Thunderbird I will be there you'll

745
00:28:51,470 --> 00:28:48,440
both be up at Vandenberg yes all right

746
00:28:55,070 --> 00:28:51,480
and last question coming in from

747
00:28:57,110 --> 00:28:55,080
LinkedIn uh dupanna on LinkedIn

748
00:28:59,269 --> 00:28:57,120
this is kind of zooming back a bit big

749
00:29:01,010 --> 00:28:59,279
level high level SWAT what's unique

750
00:29:03,289 --> 00:29:01,020
about this Mission compared to other

751
00:29:04,730 --> 00:29:03,299
Earth observing missions

752
00:29:07,669 --> 00:29:04,740
so I think we've been talking a lot

753
00:29:09,710 --> 00:29:07,679
about that the most unique instrument is

754
00:29:12,409 --> 00:29:09,720
caring the the K band radio enter

755
00:29:15,049 --> 00:29:12,419
parameter is going to give us accuracy

756
00:29:16,970 --> 00:29:15,059
in this measurement that is over and

757
00:29:19,250 --> 00:29:16,980
over magnitude better than anything that

758
00:29:22,190 --> 00:29:19,260
has been done before both for the oceans

759
00:29:24,590 --> 00:29:22,200
and for hydrology and it's going to give

760
00:29:26,570 --> 00:29:24,600
us this global view that asmada was

761
00:29:29,630 --> 00:29:26,580
saying is unprecedented and it's gonna

762
00:29:31,549 --> 00:29:29,640
be able to answer uh scientific

763
00:29:33,529 --> 00:29:31,559

questions and also open up new questions

764
00:29:35,750 --> 00:29:33,539
that we hadn't even never thought about

765
00:29:39,049 --> 00:29:35,760
before

766
00:29:40,370 --> 00:29:39,059
all right wonderful well thank you so

767
00:29:42,049 --> 00:29:40,380
much that's all the time that we have

768
00:29:43,370 --> 00:29:42,059
for questions today thanks to our social

769
00:29:45,649 --> 00:29:43,380
media audience for the wonderful

770
00:29:47,450 --> 00:29:45,659
questions thanks to Matt and Ava for

771
00:29:49,370 --> 00:29:47,460
answering them and thanks to Raquel and

772
00:29:52,310 --> 00:29:49,380
Phoebe up at Vandenberg space for space

773
00:29:54,169 --> 00:29:52,320
SWAT is scheduled for launch on December

774
00:29:57,250 --> 00:29:54,179
12th if you want to learn more about the

775
00:29:59,389 --> 00:29:57,260
mission you can go to

776
00:30:01,970 --> 00:29:59,399
swat.jpl.nasa.gov or you can follow us

777
00:30:04,010 --> 00:30:01,980
on social media at Nasa Earth or NASA

778
00:30:05,930 --> 00:30:04,020
JPL you can also follow the hashtag

779
00:30:08,090 --> 00:30:05,940
tracking worldwater