
NASA
Robbie Schingler
Co-Founder of PlanetLabs

1
00:00:07,590 --> 00:00:05,190
today

2
00:00:09,110 --> 00:00:07,600
on the science and technology cargo

3
00:00:11,669 --> 00:00:09,120
headed to the international space

4
00:00:14,310 --> 00:00:11,679
station aboard orbital sciences cygnus

5
00:00:16,470 --> 00:00:14,320
cargo spacecraft orbitals in terry's

6
00:00:18,390 --> 00:00:16,480
rocket is scheduled to lift off sunday

7
00:00:20,150 --> 00:00:18,400
at 12 52 pm

8
00:00:23,189 --> 00:00:20,160
eastern time from the mid-atlantic

9
00:00:25,029 --> 00:00:23,199
regional spaceport's launch pad 0a

10
00:00:26,470 --> 00:00:25,039
here at nasa's wallops flight facility

11
00:00:27,589 --> 00:00:26,480
in virginia

12
00:00:29,349 --> 00:00:27,599
to talk a little bit about the

13
00:00:30,950 --> 00:00:29,359

investigations that will expand the

14
00:00:32,470 --> 00:00:30,960
research capabilities of the space

15
00:00:34,310 --> 00:00:32,480
station crew

16
00:00:36,229 --> 00:00:34,320
are kirk costello assistant

17
00:00:39,030 --> 00:00:36,239
international space station program

18
00:00:42,869 --> 00:00:40,470
jeff goldstein

19
00:00:45,910 --> 00:00:42,879
student space flight experiments program

20
00:00:50,470 --> 00:00:48,310
robbie shingler co-founder of planet

21
00:00:52,950 --> 00:00:50,480
labs

22
00:00:55,189 --> 00:00:52,960
and joining us by video from nasa's ames

23
00:00:57,270 --> 00:00:55,199
research center in california

24
00:01:00,709 --> 00:00:57,280
mark murbach who's the principal

25
00:01:03,110 --> 00:01:00,719
investigator for tech edsat 4

26
00:01:04,710 --> 00:01:03,120
for those of you joining us through tv

27
00:01:07,270 --> 00:01:04,720
or the web today we'll be taking

28
00:01:09,750 --> 00:01:07,280
questions uh through social media

29
00:01:11,270 --> 00:01:09,760
you can get those questions to us using

30
00:01:12,630 --> 00:01:11,280
the hashtag

31
00:01:14,230 --> 00:01:12,640
nasa

32
00:01:15,910 --> 00:01:14,240
and we'll start with a few opening

33
00:01:17,830 --> 00:01:15,920
remarks kirk would you like to start

34
00:01:19,910 --> 00:01:17,840
okay thank you rachel

35
00:01:22,070 --> 00:01:19,920
tomorrow's really an exciting day for us

36
00:01:25,030 --> 00:01:22,080
onboard space station it marks a

37
00:01:28,149 --> 00:01:25,040
milestone event in our operations on

38
00:01:30,950 --> 00:01:28,159

board it marks the 5 000th day of

39
00:01:33,910 --> 00:01:30,960
continuous crude operations onboard the

40
00:01:35,990 --> 00:01:33,920
space station and in those 5 000 days

41
00:01:38,710 --> 00:01:36,000
not only have we managed to assemble

42
00:01:41,590 --> 00:01:38,720
this unique laboratory that we have

43
00:01:44,789 --> 00:01:41,600
but we've been able to conduct 1600

44
00:01:46,710 --> 00:01:44,799
experiments to date and that involves

45
00:01:48,469 --> 00:01:46,720
over 1500

46
00:01:50,069 --> 00:01:48,479
scientific researchers that we've had

47
00:01:53,510 --> 00:01:50,079
involved in the program

48
00:01:54,630 --> 00:01:53,520
from 82 countries so really it's an

49
00:01:56,630 --> 00:01:54,640
amazing

50
00:01:59,270 --> 00:01:56,640
feat to be able to already have

51
00:02:01,109 --> 00:01:59,280
completed so much science the truth of

52
00:02:04,149 --> 00:02:01,119
the matter is though with station

53
00:02:06,630 --> 00:02:04,159
assembly complete just finishing up two

54
00:02:08,790 --> 00:02:06,640
two or three years ago we are now into

55
00:02:11,430 --> 00:02:08,800
the period where utilization

56
00:02:13,589 --> 00:02:11,440
is really the prime goal of the space

57
00:02:16,070 --> 00:02:13,599
station activities and we have more

58
00:02:18,070 --> 00:02:16,080
wonderful discoveries to come

59
00:02:21,030 --> 00:02:18,080
so onboard the space station we do

60
00:02:23,589 --> 00:02:21,040
science in a number of different fields

61
00:02:26,470 --> 00:02:23,599
we do science in human research

62
00:02:28,710 --> 00:02:26,480
in physical sciences and biological life

63
00:02:30,070 --> 00:02:28,720

sciences we perform

64
00:02:32,229 --> 00:02:30,080
technology

65
00:02:34,710 --> 00:02:32,239
demonstration and development

66
00:02:38,390 --> 00:02:34,720
we participate in earth observation

67
00:02:41,270 --> 00:02:38,400
sciences and also educational sciences

68
00:02:44,470 --> 00:02:41,280
today we'll talk about the payloads on

69
00:02:47,509 --> 00:02:44,480
board the orb 2 and the cygnus module we

70
00:02:48,790 --> 00:02:47,519
have over 350 kilograms of science going

71
00:02:51,910 --> 00:02:48,800
to station

72
00:02:53,910 --> 00:02:51,920
with this mission and it covers areas in

73
00:02:54,710 --> 00:02:53,920
all of those fields that i just talked

74
00:02:56,470 --> 00:02:54,720
about

75
00:02:58,470 --> 00:02:56,480
we'll be talking to some of the experts

76
00:03:00,710 --> 00:02:58,480
and the payload developers and invested

77
00:03:02,869 --> 00:03:00,720
principal investigators for those and

78
00:03:04,630 --> 00:03:02,879
we'll also be sharing some examples from

79
00:03:06,869 --> 00:03:04,640
the other fields

80
00:03:09,430 --> 00:03:06,879
for instance in human research

81
00:03:11,509 --> 00:03:09,440
we are flying equipment to help with the

82
00:03:13,509 --> 00:03:11,519
force shoes investigation

83
00:03:15,190 --> 00:03:13,519
force shoes is an investigation that

84
00:03:17,190 --> 00:03:15,200
helps us determine the forces on

85
00:03:20,470 --> 00:03:17,200
astronauts muscles and bones as they

86
00:03:23,430 --> 00:03:20,480
work out and this will help us in in the

87
00:03:27,190 --> 00:03:23,440
end to determine the right prescription

88
00:03:29,190 --> 00:03:27,200

of exercise and dietary needs for the

89
00:03:30,830 --> 00:03:29,200
astronaut to maintain their bones and

90
00:03:34,229 --> 00:03:30,840
muscles on

91
00:03:36,789 --> 00:03:34,239
orbit we also have tech demos flying to

92
00:03:40,149 --> 00:03:36,799
the space station in the field of

93
00:03:42,550 --> 00:03:40,159
intervehicular activity clothing studies

94
00:03:45,509 --> 00:03:42,560
we're testing new types of clothing for

95
00:03:48,869 --> 00:03:45,519
the astronauts that are more resistant

96
00:03:50,550 --> 00:03:48,879
to bacterial and odor buildup

97
00:03:53,589 --> 00:03:50,560
that will allow the astronauts to

98
00:03:55,270 --> 00:03:53,599
exercise and require fewer clothing

99
00:03:58,229 --> 00:03:55,280
changes overall

100
00:04:01,190 --> 00:03:58,239
so we're testing that out

101
00:04:03,670 --> 00:04:01,200
the cygnus mission itself brings

102
00:04:05,670 --> 00:04:03,680
to the station this time payloads that

103
00:04:08,550 --> 00:04:05,680
are particularly useful in the

104
00:04:11,429 --> 00:04:08,560
technology demonstration category and

105
00:04:13,589 --> 00:04:11,439
also in the commercial and educational

106
00:04:16,390 --> 00:04:13,599
categories and we have some of the

107
00:04:18,870 --> 00:04:16,400
experts here we have over 32

108
00:04:21,509 --> 00:04:18,880
cubesats launching on this mission and

109
00:04:23,350 --> 00:04:21,519
those cubesats include 28 from the

110
00:04:24,230 --> 00:04:23,360
doveflock 1b

111
00:04:26,830 --> 00:04:24,240
and

112
00:04:29,350 --> 00:04:26,840
four additional cubesats which include

113
00:04:32,390 --> 00:04:29,360

uh micro

114
00:04:35,430 --> 00:04:32,400
microwave radio radar

115
00:04:38,230 --> 00:04:35,440
satellite that will be placed into orbit

116
00:04:41,510 --> 00:04:38,240
and take pictures of storms tropical

117
00:04:44,710 --> 00:04:41,520
weather events and so forth

118
00:04:47,350 --> 00:04:44,720
we also have a number of nanoracks cube

119
00:04:49,909 --> 00:04:47,360
modules going on board and those modules

120
00:04:51,590 --> 00:04:49,919
contain many student experiments some of

121
00:04:54,070 --> 00:04:51,600
those student experiments are hailing

122
00:04:56,550 --> 00:04:54,080
from the great state of hawaii and the

123
00:04:58,790 --> 00:04:56,560
girl scout troupe in hawaii they are

124
00:05:01,670 --> 00:04:58,800
testing the capability to grow arugula

125
00:05:03,830 --> 00:05:01,680
plants in zero g

126
00:05:06,629 --> 00:05:03,840
many other uh of the nanoracks

127
00:05:08,950 --> 00:05:06,639
experiments come from the national

128
00:05:11,189 --> 00:05:08,960
center national center for earth and

129
00:05:13,350 --> 00:05:11,199
space sciences education

130
00:05:15,670 --> 00:05:13,360
and

131
00:05:17,909 --> 00:05:15,680
sorry jeff we'll talk more about that

132
00:05:20,230 --> 00:05:17,919
thank you

133
00:05:21,830 --> 00:05:20,240
well um i'm here to talk about the

134
00:05:23,510 --> 00:05:21,840
seventh flight opportunity for the

135
00:05:25,990 --> 00:05:23,520
student space flight experiments program

136
00:05:28,070 --> 00:05:26,000
or ssep it's mission 5 to the

137
00:05:30,710 --> 00:05:28,080
international space station and we've

138
00:05:33,189 --> 00:05:30,720

got 15 student experiments launching on

139
00:05:34,710 --> 00:05:33,199
orb 2 hopefully on sunday

140
00:05:37,189 --> 00:05:34,720
thought i would give you a very quick

141
00:05:39,110 --> 00:05:37,199
overview of the program and

142
00:05:40,629 --> 00:05:39,120
what its

143
00:05:42,469 --> 00:05:40,639
goals might be

144
00:05:45,670 --> 00:05:42,479
we launched this program back in 2010 so

145
00:05:47,270 --> 00:05:45,680
it's only four years old um it is um

146
00:05:49,430 --> 00:05:47,280
done in conjunction in strategic

147
00:05:52,870 --> 00:05:49,440
partnership with nanoracks which is our

148
00:05:54,870 --> 00:05:52,880
launch services provider and nanoracks

149
00:05:56,469 --> 00:05:54,880
works with nasa through a space act

150
00:05:58,469 --> 00:05:56,479
agreement to fly commercial payloads

151
00:06:00,469 --> 00:05:58,479
we're also working in concert with the

152
00:06:01,990 --> 00:06:00,479
center for the advancement of science

153
00:06:04,070 --> 00:06:02,000
and space or cases which is the

154
00:06:07,189 --> 00:06:04,080
nonprofit that oversees the us national

155
00:06:09,909 --> 00:06:07,199
lab on iss when we designed this program

156
00:06:11,270 --> 00:06:09,919
the idea was to provide a community at

157
00:06:13,029 --> 00:06:11,280
the local level

158
00:06:15,110 --> 00:06:13,039
the ability to immerse hundreds of

159
00:06:18,070 --> 00:06:15,120
students in every facet of real research

160
00:06:21,350 --> 00:06:18,080
to see research for themselves

161
00:06:22,469 --> 00:06:21,360
so it's absolutely authentic

162
00:06:24,150 --> 00:06:22,479
and

163
00:06:26,309 --> 00:06:24,160

a typical community has a school

164
00:06:29,029 --> 00:06:26,319
district engaged through an

165
00:06:31,510 --> 00:06:29,039
implementation plan that has

166
00:06:33,029 --> 00:06:31,520
at least 300 students immersed in

167
00:06:35,670 --> 00:06:33,039
microgravity experiment design and

168
00:06:37,909 --> 00:06:35,680
proposal writing we typically see 60 to

169
00:06:40,390 --> 00:06:37,919
100 flight experiment proposals from

170
00:06:41,990 --> 00:06:40,400
each community all those proposals go

171
00:06:44,710 --> 00:06:42,000
through a formal two-step proposal

172
00:06:46,950 --> 00:06:44,720
review process and at the smithsonian we

173
00:06:48,550 --> 00:06:46,960
select the flight experiment for each

174
00:06:50,790 --> 00:06:48,560
community so no community

175
00:06:52,230 --> 00:06:50,800
is competing with any other

176
00:06:54,390 --> 00:06:52,240
each community is getting essentially

177
00:06:55,510 --> 00:06:54,400
their own real space program

178
00:06:57,430 --> 00:06:55,520
and

179
00:07:00,070 --> 00:06:57,440
we've had i think 30

180
00:07:02,070 --> 00:07:00,080
35 200 students

181
00:07:05,350 --> 00:07:02,080
engaged since program inception just

182
00:07:07,830 --> 00:07:05,360
four years ago um today we are flying uh

183
00:07:10,070 --> 00:07:07,840
the charlie brown mission five payload

184
00:07:11,270 --> 00:07:10,080
um with 15 experiments and just to give

185
00:07:14,950 --> 00:07:11,280
you a sense of that that's that

186
00:07:15,430 --> 00:07:14,960
represents 15 communities and

187
00:07:17,830 --> 00:07:15,440
hundred 6

188
00:07:20,550 --> 00:07:17,840

fifty students engaged in experiment

189
00:07:22,230 --> 00:07:20,560
design and proposal writing and from the

190
00:07:24,309 --> 00:07:22,240
one thousand three hundred and forty

191
00:07:27,510 --> 00:07:24,319
four flight experiments submitted by

192
00:07:29,189 --> 00:07:27,520
student teams these fifteen were chosen

193
00:07:31,670 --> 00:07:29,199
so just to give you a sense of the

194
00:07:33,270 --> 00:07:31,680
overarching range in science that's

195
00:07:34,710 --> 00:07:33,280
being undertaken

196
00:07:35,469 --> 00:07:34,720
let me just read

197
00:07:39,350 --> 00:07:35,479
from

198
00:07:41,830 --> 00:07:39,360
a one sheet that is in the press kit

199
00:07:44,629 --> 00:07:41,840
efficacy of sprayed enamel coating onion

200
00:07:46,869 --> 00:07:44,639
root cell division triops as a protein

201
00:07:49,430 --> 00:07:46,879
source micro encapsulation in two

202
00:07:52,070 --> 00:07:49,440
dimensions under microgravity planarian

203
00:07:53,029 --> 00:07:52,080
worm regeneration penicillium growth

204
00:07:58,869 --> 00:07:53,039
rate

205
00:08:00,710 --> 00:07:58,879
these are experiments that have been

206
00:08:02,950 --> 00:08:00,720
designed um

207
00:08:03,990 --> 00:08:02,960
by students in grades five through

208
00:08:06,070 --> 00:08:04,000
twelve

209
00:08:08,390 --> 00:08:06,080
and these represent the next generation

210
00:08:10,230 --> 00:08:08,400
of america's scientists and engineers

211
00:08:12,950 --> 00:08:10,240
and on sunday

212
00:08:15,189 --> 00:08:12,960
nasa has asked us to do a a short

213
00:08:17,749 --> 00:08:15,199

briefing to the media where we've got

214
00:08:18,950 --> 00:08:17,759
five uh delegations five student teams

215
00:08:20,070 --> 00:08:18,960
here that will present on their

216
00:08:21,990 --> 00:08:20,080
experiments

217
00:08:25,189 --> 00:08:22,000
thank you

218
00:08:27,270 --> 00:08:25,199
having us here today i also want to

219
00:08:29,589 --> 00:08:27,280
thank nasa and the international space

220
00:08:31,350 --> 00:08:29,599
station program office for for actually

221
00:08:32,870 --> 00:08:31,360
making this possible and

222
00:08:34,630 --> 00:08:32,880
to take a step back the international

223
00:08:36,469 --> 00:08:34,640
space station while it's now in

224
00:08:38,469 --> 00:08:36,479
utilization is really a marvel of

225
00:08:40,310 --> 00:08:38,479
mankind it is one of the most complex

226
00:08:41,350 --> 00:08:40,320
systems engineering challenges ever

227
00:08:42,790 --> 00:08:41,360
taken

228
00:08:45,190 --> 00:08:42,800
and um

229
00:08:47,670 --> 00:08:45,200
and under utilization it

230
00:08:49,350 --> 00:08:47,680
it requires a lot of access to space and

231
00:08:51,829 --> 00:08:49,360
that's that's why we're here right for a

232
00:08:54,230 --> 00:08:51,839
cargo resupply mission so about 15 of

233
00:08:55,750 --> 00:08:54,240
the global launch capacity is there to

234
00:08:57,030 --> 00:08:55,760
service the international space station

235
00:08:58,710 --> 00:08:57,040
to have humans work and live

236
00:09:01,829 --> 00:08:58,720
productively in space

237
00:09:04,790 --> 00:09:01,839
and as a result that gives the ability

238
00:09:06,710 --> 00:09:04,800

for there to be reliable access to space

239
00:09:08,310 --> 00:09:06,720
and so we as a company planet labs are

240
00:09:09,990 --> 00:09:08,320
beginning to take advantage of that to

241
00:09:12,230 --> 00:09:10,000
utilize the international space station

242
00:09:14,070 --> 00:09:12,240
as a platform in order to launch and

243
00:09:15,269 --> 00:09:14,080
test future technologies for our

244
00:09:16,470 --> 00:09:15,279
spacecraft

245
00:09:18,310 --> 00:09:16,480
so

246
00:09:20,150 --> 00:09:18,320
in i want to tell you guys a little bit

247
00:09:22,310 --> 00:09:20,160
about planet labs

248
00:09:24,230 --> 00:09:22,320
and in doing so um i will tell you about

249
00:09:26,550 --> 00:09:24,240
our capabilities through antares because

250
00:09:28,630 --> 00:09:26,560
in fact we've been on every single

251
00:09:31,269 --> 00:09:28,640
launch of the antares rocket

252
00:09:33,670 --> 00:09:31,279
um we were on their first demo launch

253
00:09:36,470 --> 00:09:33,680
the first cygnus orb one and then now

254
00:09:37,829 --> 00:09:36,480
this one this weekend for orb two so

255
00:09:39,509 --> 00:09:37,839
planet labs

256
00:09:41,670 --> 00:09:39,519
we're a san francisco company and our

257
00:09:42,630 --> 00:09:41,680
goal is to image the whole earth every

258
00:09:46,389 --> 00:09:42,640
day

259
00:09:48,630 --> 00:09:46,399
and this is to make the planet visible

260
00:09:50,550 --> 00:09:48,640
actionable and accessible

261
00:09:51,910 --> 00:09:50,560
and the way in which we do this is by

262
00:09:54,230 --> 00:09:51,920
operating the world's largest

263
00:09:56,949 --> 00:09:54,240

constellation of imaging satellites to

264
00:09:58,790 --> 00:09:56,959
autonomously operate the spacecraft and

265
00:10:01,030 --> 00:09:58,800
process the imagery and then put it

266
00:10:03,509 --> 00:10:01,040
online for people to get access to it

267
00:10:05,269 --> 00:10:03,519
and so our product is is building earth

268
00:10:07,030 --> 00:10:05,279
observation imagery as a service or

269
00:10:08,550 --> 00:10:07,040
imaging on demand so that we actually

270
00:10:09,990 --> 00:10:08,560
understand the state of the world as it

271
00:10:11,350 --> 00:10:10,000
is today

272
00:10:14,069 --> 00:10:11,360
so

273
00:10:16,150 --> 00:10:14,079
what underpins this is actually building

274
00:10:17,430 --> 00:10:16,160
a highly compact capable imaging

275
00:10:23,509 --> 00:10:17,440
spacecraft

276
00:10:25,990 --> 00:10:23,519
actually an engineering model as part of

277
00:10:27,509 --> 00:10:26,000
flock one internally we call it build

278
00:10:29,350 --> 00:10:27,519
seven

279
00:10:32,870 --> 00:10:29,360
and on the first chart here you could

280
00:10:33,990 --> 00:10:32,880
actually see an image of our team

281
00:10:35,350 --> 00:10:34,000
with

282
00:10:37,030 --> 00:10:35,360
build four

283
00:10:39,590 --> 00:10:37,040
this was actually one of our first tech

284
00:10:41,670 --> 00:10:39,600
demo satellites that went up into space

285
00:10:44,710 --> 00:10:41,680
in april of last year and this went up

286
00:10:46,550 --> 00:10:44,720
on the on the antares first launch

287
00:10:48,949 --> 00:10:46,560
and you can see the size of our team at

288
00:10:50,630 --> 00:10:48,959

that point in time and this the the goal

289
00:10:51,509 --> 00:10:50,640
of this mission was to see if we can

290
00:10:53,750 --> 00:10:51,519
build

291
00:10:56,230 --> 00:10:53,760
um an ultra compact state-of-the-art

292
00:10:58,150 --> 00:10:56,240
imaging spacecraft and on the next slide

293
00:11:01,190 --> 00:10:58,160
you can see in this six day mission we

294
00:11:03,590 --> 00:11:01,200
were able to take an image of a forest

295
00:11:05,910 --> 00:11:03,600
here in oregon so this is first light of

296
00:11:07,750 --> 00:11:05,920
dove one which proved the underlying

297
00:11:09,190 --> 00:11:07,760
hypothesis of our company that we could

298
00:11:10,949 --> 00:11:09,200
build an ultra compact imaging

299
00:11:12,550 --> 00:11:10,959
spacecraft and that was actually made

300
00:11:14,230 --> 00:11:12,560
possible by going up as secondary

301
00:11:15,750 --> 00:11:14,240
payloads

302
00:11:17,990 --> 00:11:15,760
next thing that we had to do was learn

303
00:11:20,470 --> 00:11:18,000
how to mass manufacture these spacecraft

304
00:11:21,750 --> 00:11:20,480
so on the next chart you could see 28

305
00:11:24,069 --> 00:11:21,760
satellites

306
00:11:25,990 --> 00:11:24,079
this is known as build seven so this is

307
00:11:28,230 --> 00:11:26,000
actually an extra one from that that

308
00:11:30,870 --> 00:11:28,240
production run and we wanted to learn if

309
00:11:33,030 --> 00:11:30,880
we can mass manufacture these spacecraft

310
00:11:34,630 --> 00:11:33,040
but then launch them into space and and

311
00:11:36,310 --> 00:11:34,640
and operate them

312
00:11:38,790 --> 00:11:36,320
and so i'm going to describe a little

313
00:11:41,590 --> 00:11:38,800

bit about what we did with

314
00:11:43,269 --> 00:11:41,600
the flock one um as so that you can

315
00:11:44,790 --> 00:11:43,279
understand what's about to happen with

316
00:11:47,910 --> 00:11:44,800
flock 1b

317
00:11:51,350 --> 00:11:47,920
so on the next image these go up as as

318
00:11:53,990 --> 00:11:51,360
pressurized cargo on the cygnus capsule

319
00:11:55,990 --> 00:11:54,000
and they are going up inside the

320
00:11:58,389 --> 00:11:56,000
nanoracks capsules so two of these

321
00:11:59,509 --> 00:11:58,399
spacecraft fit inside each one of these

322
00:12:00,470 --> 00:11:59,519
sleeves

323
00:12:05,990 --> 00:12:00,480
and

324
00:12:08,310 --> 00:12:06,000
eight sleeves or 16 spacecraft that are

325
00:12:10,550 --> 00:12:08,320
mounted on a rack and the astronauts

326
00:12:13,590 --> 00:12:10,560
take out these sleeves and put this on

327
00:12:15,350 --> 00:12:13,600
this rack through the japanese airlock

328
00:12:18,310 --> 00:12:15,360
through the gem module

329
00:12:20,150 --> 00:12:18,320
and then they attach it to a robotic arm

330
00:12:22,069 --> 00:12:20,160
and move the robotic arm away from the

331
00:12:23,910 --> 00:12:22,079
international space station then they

332
00:12:26,230 --> 00:12:23,920
release them two at a time and in the

333
00:12:28,069 --> 00:12:26,240
next image here you could see actually

334
00:12:31,990 --> 00:12:28,079
what that looks like

335
00:12:33,350 --> 00:12:32,000
so this is a a beautiful image it shows

336
00:12:34,870 --> 00:12:33,360
the most

337
00:12:37,030 --> 00:12:34,880
complex

338
00:12:38,870 --> 00:12:37,040

engineering spacecraft ever built by

339
00:12:40,150 --> 00:12:38,880
humanity the international space station

340
00:12:42,310 --> 00:12:40,160
and it's launching some of the world's

341
00:12:44,470 --> 00:12:42,320
smallest most ultra compact satellites

342
00:12:46,389 --> 00:12:44,480
and and this is uh you know we're really

343
00:12:47,990 --> 00:12:46,399
grateful for nasa for unbelievable

344
00:12:49,670 --> 00:12:48,000
imagery that came from this mission

345
00:12:51,110 --> 00:12:49,680
ultimately you don't really get to see

346
00:12:52,629 --> 00:12:51,120
your spacecraft once you bolt it to a

347
00:12:54,310 --> 00:12:52,639
launch vehicle and here you get to see a

348
00:12:55,829 --> 00:12:54,320
very very beautiful image

349
00:12:57,990 --> 00:12:55,839
so with

350
00:12:59,910 --> 00:12:58,000
flock one we learned how to

351
00:13:01,829 --> 00:12:59,920
operate the spacecraft commission these

352
00:13:02,949 --> 00:13:01,839
spacecraft and get them going and again

353
00:13:04,710 --> 00:13:02,959
this is the world's largest

354
00:13:06,150 --> 00:13:04,720
constellation of imaging spacecraft and

355
00:13:08,230 --> 00:13:06,160
in fact the largest constellation of

356
00:13:10,310 --> 00:13:08,240
spacecraft to be commissioned at once

357
00:13:11,910 --> 00:13:10,320
on the next image here you can see first

358
00:13:14,629 --> 00:13:11,920
light of

359
00:13:16,150 --> 00:13:14,639
flock one this is of davis

360
00:13:18,949 --> 00:13:16,160
california

361
00:13:20,870 --> 00:13:18,959
and um and then on the next image here

362
00:13:23,509 --> 00:13:20,880
you'll be able to see a sneak preview of

363
00:13:25,110 --> 00:13:23,519

first light from flock 1c so this went

364
00:13:27,509 --> 00:13:25,120
up on a

365
00:13:29,670 --> 00:13:27,519
on a rocket about two weeks ago 11

366
00:13:31,110 --> 00:13:29,680
satellites in a sun synchronous orbit

367
00:13:33,269 --> 00:13:31,120
and we'll be releasing much more of

368
00:13:35,190 --> 00:13:33,279
these imagery as

369
00:13:37,509 --> 00:13:35,200
as the weeks go on

370
00:13:40,389 --> 00:13:37,519
um but in summary what i wanted to do is

371
00:13:41,269 --> 00:13:40,399
with with flock 1b launched on sunday we

372
00:13:45,030 --> 00:13:41,279
would

373
00:13:46,389 --> 00:13:45,040
launch our 71st satellite in 15 months

374
00:13:48,629 --> 00:13:46,399
and that's really quite quite

375
00:13:50,230 --> 00:13:48,639
extraordinary so that's 71 satellites

376
00:13:52,470 --> 00:13:50,240
going through nine builds of a

377
00:13:54,870 --> 00:13:52,480
spacecraft so every two to three months

378
00:13:56,230 --> 00:13:54,880
we learn from building spacecraft

379
00:13:58,069 --> 00:13:56,240
putting them in space and actually

380
00:13:59,189 --> 00:13:58,079
testing them in in the laboratory of

381
00:14:00,949 --> 00:13:59,199
space

382
00:14:03,189 --> 00:14:00,959
and on monday of this this week we

383
00:14:06,150 --> 00:14:03,199
welcomed three more people to our team

384
00:14:09,189 --> 00:14:06,160
to make up 71 employees so 71 satellites

385
00:14:10,949 --> 00:14:09,199
with 71 employees going up on sunday and

386
00:14:13,590 --> 00:14:10,959
i'd really like to to thank our team to

387
00:14:15,350 --> 00:14:13,600
actually um really make this possible

388
00:14:17,269 --> 00:14:15,360

we've done an amazing amount

389
00:14:19,189 --> 00:14:17,279
taking this from an idea in a garage and

390
00:14:22,710 --> 00:14:19,199
actually out into space

391
00:14:24,150 --> 00:14:22,720
so this is agile aerospace this is uh

392
00:14:26,470 --> 00:14:24,160
it's about more launches and more

393
00:14:27,990 --> 00:14:26,480
satellites but it's really about getting

394
00:14:30,710 --> 00:14:28,000
rich data

395
00:14:32,949 --> 00:14:30,720
data is our product and to make it

396
00:14:35,910 --> 00:14:32,959
actionable and accessible for people so

397
00:14:36,710 --> 00:14:35,920
go antares and uh and let's go three for

398
00:14:38,150 --> 00:14:36,720
three

399
00:14:41,189 --> 00:14:38,160
thanks robbie

400
00:14:45,269 --> 00:14:42,870
great uh good afternoon everybody it's

401
00:14:46,949 --> 00:14:45,279
um it's a real pleasure to be here um

402
00:14:48,870 --> 00:14:46,959
i've worked at wallops for a number of

403
00:14:50,710 --> 00:14:48,880
years and a very comfortable in the

404
00:14:52,710 --> 00:14:50,720
environment over there it's been very

405
00:14:54,790 --> 00:14:52,720
productive also i

406
00:14:56,949 --> 00:14:54,800
um also very appreciative to the iss

407
00:14:58,790 --> 00:14:56,959
program my esteemed colleagues at

408
00:15:01,110 --> 00:14:58,800
nanoracks who we've worked very close

409
00:15:03,590 --> 00:15:01,120
with for the past couple of years and uh

410
00:15:05,430 --> 00:15:03,600
our our uh our co-writers our rideshare

411
00:15:08,069 --> 00:15:05,440
people uh um

412
00:15:10,069 --> 00:15:08,079
um the planet labs who also were our our

413
00:15:13,350 --> 00:15:10,079

former uh some of which were our former

414
00:15:15,590 --> 00:15:13,360
interns from nasa ames um so if i could

415
00:15:16,870 --> 00:15:15,600
have you show the first slide please

416
00:15:19,430 --> 00:15:16,880
i'd like to talk a little bit about what

417
00:15:21,590 --> 00:15:19,440
uh tech ed sat is it's a tech education

418
00:15:24,310 --> 00:15:21,600
satellite it's a series of satellites

419
00:15:25,670 --> 00:15:24,320
that we've built we're launching uh

420
00:15:27,509 --> 00:15:25,680
on sunday is the fourth one in the

421
00:15:29,910 --> 00:15:27,519
series uh also combined with some

422
00:15:31,509 --> 00:15:29,920
suborbital launches from wallops

423
00:15:33,829 --> 00:15:31,519
so in that satellite actually you see uh

424
00:15:36,550 --> 00:15:33,839
we go back two years um so our small

425
00:15:38,710 --> 00:15:36,560
team uh comprised of

426
00:15:40,389 --> 00:15:38,720
young professionals and interns uh from

427
00:15:42,310 --> 00:15:40,399
various universities including san jose

428
00:15:43,749 --> 00:15:42,320
state university of california

429
00:15:45,430 --> 00:15:43,759
university of idaho

430
00:15:47,509 --> 00:15:45,440
uh we got together and actually in a

431
00:15:49,509 --> 00:15:47,519
short time we produced the first

432
00:15:50,790 --> 00:15:49,519
1u cubesat that was deployed from the

433
00:15:51,910 --> 00:15:50,800
space station

434
00:15:53,509 --> 00:15:51,920
and that's what you see on the first

435
00:15:58,310 --> 00:15:53,519
slide

436
00:16:00,470 --> 00:15:58,320
if you please you see a 3u satellite

437
00:16:04,150 --> 00:16:00,480
meaning it's three times the size

438
00:16:06,230 --> 00:16:04,160

uh also being uh jettisoned and in this

439
00:16:07,350 --> 00:16:06,240
case we were advancing um experiments

440
00:16:09,590 --> 00:16:07,360
and uh

441
00:16:11,350 --> 00:16:09,600
cubesat communication and also

442
00:16:13,509 --> 00:16:11,360
deorbit techniques that are of a

443
00:16:15,110 --> 00:16:13,519
particular interest

444
00:16:19,350 --> 00:16:15,120
if i could have you show the third slide

445
00:16:20,949 --> 00:16:19,360
this is now a a depiction of what the um

446
00:16:22,470 --> 00:16:20,959
of what this experiment looks like so

447
00:16:24,550 --> 00:16:22,480
it's a 3u satellite

448
00:16:26,949 --> 00:16:24,560
you see one of the forward antennas and

449
00:16:29,189 --> 00:16:26,959
off the back end is a peculiar looking

450
00:16:31,749 --> 00:16:29,199
object which is a an exo break an

451
00:16:34,710 --> 00:16:31,759
exo-atmospheric drag device that allows

452
00:16:37,350 --> 00:16:34,720
us to deorbit fairly rapidly

453
00:16:39,430 --> 00:16:37,360
something from an orbital platform

454
00:16:41,749 --> 00:16:39,440
so we did that in tickets at three and

455
00:16:44,150 --> 00:16:41,759
four and um and what we're doing is

456
00:16:46,230 --> 00:16:44,160
advancing the techniques such that

457
00:16:49,430 --> 00:16:46,240
in the future that we could modulate or

458
00:16:51,590 --> 00:16:49,440
change the shape of that uh drag device

459
00:16:53,269 --> 00:16:51,600
such that we can steer

460
00:16:55,829 --> 00:16:53,279
the satellite to

461
00:16:57,670 --> 00:16:55,839
the top of the atmosphere

462
00:16:59,350 --> 00:16:57,680
why do we want to do this if we look at

463
00:17:01,749 --> 00:16:59,360

slide number four

464
00:17:02,629 --> 00:17:01,759
we have a series of

465
00:17:04,390 --> 00:17:02,639
of

466
00:17:06,710 --> 00:17:04,400
re-entries a three-step process by which

467
00:17:08,309 --> 00:17:06,720
we would now take a larger device that

468
00:17:10,870 --> 00:17:08,319
would uh also come from the space

469
00:17:13,350 --> 00:17:10,880
station carrying valuable um samples

470
00:17:15,429 --> 00:17:13,360
this is a sample return concept in fact

471
00:17:17,510 --> 00:17:15,439
we would go through a de-orbit process

472
00:17:19,750 --> 00:17:17,520
using a exo break that we're developing

473
00:17:22,150 --> 00:17:19,760
small scale and then it would go through

474
00:17:23,750 --> 00:17:22,160
a process of having a self-stabilizing

475
00:17:25,669 --> 00:17:23,760
hot reentry vehicle that you see in the

476
00:17:27,829 --> 00:17:25,679
middle part of the slide

477
00:17:31,430 --> 00:17:27,839
final finally the terminal reentry you

478
00:17:33,430 --> 00:17:31,440
see the back with a gps guided parafoil

479
00:17:34,789 --> 00:17:33,440
so slowly we're practicing all this as

480
00:17:37,350 --> 00:17:34,799
you can see we're we're doing the

481
00:17:38,789 --> 00:17:37,360
deorbit stage and in idaho and

482
00:17:40,230 --> 00:17:38,799
washington state with our university

483
00:17:42,150 --> 00:17:40,240
colleagues we're developing the gps

484
00:17:44,710 --> 00:17:42,160
guided parafoil

485
00:17:47,750 --> 00:17:44,720
from nasa wallops we've actually flown

486
00:17:49,270 --> 00:17:47,760
the tdrv the self-stabilizing reentry

487
00:17:50,549 --> 00:17:49,280
probe

488
00:17:53,590 --> 00:17:50,559

another application that we're very

489
00:17:55,830 --> 00:17:53,600
interested in is then taking the idea of

490
00:17:58,789 --> 00:17:55,840
compartmentalizing a small satellite and

491
00:18:01,669 --> 00:17:58,799
its electronics and carrying it to a

492
00:18:03,990 --> 00:18:01,679
another planet so in slide number four

493
00:18:06,549 --> 00:18:04,000
you see our atromus concept

494
00:18:08,950 --> 00:18:06,559
and again at the uh left the upper left

495
00:18:10,950 --> 00:18:08,960
you see a our self-stabilizing reentry

496
00:18:14,390 --> 00:18:10,960
probe going through a entry descent

497
00:18:17,190 --> 00:18:14,400
landing sequence and finally putting a

498
00:18:19,430 --> 00:18:17,200
cubesat sized device now in cylindrical

499
00:18:21,909 --> 00:18:19,440
format on the surface of mars to

500
00:18:24,789 --> 00:18:21,919
basically uh validate

501
00:18:26,310 --> 00:18:24,799
atmospheric pressure and and actually go

502
00:18:27,830 --> 00:18:26,320
to very interesting places at mars that

503
00:18:30,470 --> 00:18:27,840
are otherwise inaccessible we would do

504
00:18:32,549 --> 00:18:30,480
this in a piggyback fashion

505
00:18:33,990 --> 00:18:32,559
so if i could have the camera pointed

506
00:18:35,830 --> 00:18:34,000
back toward me if you don't mind i will

507
00:18:37,990 --> 00:18:35,840
show you and perhaps many people in the

508
00:18:40,789 --> 00:18:38,000
audience have seen this but what i'm

509
00:18:42,870 --> 00:18:40,799
holding right now is a was one of our

510
00:18:43,750 --> 00:18:42,880
first cubesat models in fact a phone set

511
00:18:47,029 --> 00:18:43,760
um

512
00:18:48,870 --> 00:18:47,039
uh they perhaps were worked on some by

513
00:18:51,190 --> 00:18:48,880

two or three years ago from our our our

514
00:18:53,990 --> 00:18:51,200
colleagues um

515
00:18:56,230 --> 00:18:54,000
uh and now in in various different uh

516
00:18:57,750 --> 00:18:56,240
companies in the aerospace industry so

517
00:18:59,350 --> 00:18:57,760
this is what we started with so this

518
00:19:01,029 --> 00:18:59,360
this was the first thing cast off the

519
00:19:03,270 --> 00:19:01,039
iss

520
00:19:05,029 --> 00:19:03,280
and over time then we grew three times

521
00:19:06,950 --> 00:19:05,039
in size so this is a three-year cubesat

522
00:19:09,590 --> 00:19:06,960
that's representative our of our current

523
00:19:12,310 --> 00:19:09,600
uh payload also of our

524
00:19:13,510 --> 00:19:12,320
our com our companion doves

525
00:19:16,230 --> 00:19:13,520
and um

526
00:19:17,909 --> 00:19:16,240
so what i have in here is also a a small

527
00:19:20,310 --> 00:19:17,919
scale version of a tube deployed

528
00:19:22,150 --> 00:19:20,320
re-entry vehicle

529
00:19:23,350 --> 00:19:22,160
so this would come out the back on that

530
00:19:26,470 --> 00:19:23,360
previous slide that you saw there and

531
00:19:29,510 --> 00:19:26,480
then these uh the uh the drag device the

532
00:19:32,549 --> 00:19:29,520
uh heat shield if you will is oddly put

533
00:19:35,029 --> 00:19:32,559
in the back of the payload giving a lot

534
00:19:37,110 --> 00:19:35,039
of stability so perhaps you can see this

535
00:19:38,789 --> 00:19:37,120
and then at the right time the um a

536
00:19:41,029 --> 00:19:38,799
payload canister would slip out of the

537
00:19:43,669 --> 00:19:41,039
back and this is what we would recover

538
00:19:45,750 --> 00:19:43,679

from a orbital platform or perhaps put

539
00:19:48,549 --> 00:19:45,760
on the surface of mars

540
00:19:50,150 --> 00:19:48,559
it's real size

541
00:19:52,230 --> 00:19:50,160
and if you'll excuse the noise it would

542
00:19:54,230 --> 00:19:52,240
be something like this so this is a

543
00:19:57,270 --> 00:19:54,240
actual sample canister that we developed

544
00:19:59,430 --> 00:19:57,280
for recovering uh samples from the iss

545
00:20:00,789 --> 00:19:59,440
and it would be uh very close to the

546
00:20:02,870 --> 00:20:00,799
same size of an object that we would

547
00:20:04,549 --> 00:20:02,880
like to place on mars with the kind of

548
00:20:09,830 --> 00:20:04,559
technologies that you see uh being

549
00:20:14,230 --> 00:20:12,230
so that in very short form is what we're

550
00:20:17,029 --> 00:20:14,240
trying to develop and i'd like to close

551
00:20:19,350 --> 00:20:17,039
with a one of my favorite quotes from

552
00:20:21,430 --> 00:20:19,360
a luminary in the aerospace

553
00:20:23,990 --> 00:20:21,440
sciences and his name was a theodore von

554
00:20:25,350 --> 00:20:24,000
carmen and i like this i i tell this to

555
00:20:27,750 --> 00:20:25,360
my students

556
00:20:29,590 --> 00:20:27,760
scientists study study the world as it

557
00:20:32,310 --> 00:20:29,600
is engineers

558
00:20:33,990 --> 00:20:32,320
create the world that has never been

559
00:20:36,230 --> 00:20:34,000
and with that i'll pass the baton back

560
00:20:38,549 --> 00:20:36,240
to our esteemed colleagues at wallops

561
00:20:40,870 --> 00:20:38,559
okay thanks mark okay so we'll take some

562
00:20:42,549 --> 00:20:40,880
questions we'll start here and have some

563
00:20:44,789 --> 00:20:42,559

on the phone as well

564
00:20:45,830 --> 00:20:44,799
um as a reminder for those watching from

565
00:20:47,350 --> 00:20:45,840
afar

566
00:20:49,110 --> 00:20:47,360
you can

567
00:20:53,590 --> 00:20:49,120
send your questions to us through social

568
00:20:55,190 --> 00:20:53,600
media using the hashtag asknasa and if

569
00:20:57,110 --> 00:20:55,200
you will please state your name and

570
00:20:59,190 --> 00:20:57,120
affiliation and to whom you're

571
00:21:00,870 --> 00:20:59,200
addressing your question uh that will

572
00:21:03,110 --> 00:21:00,880
help us out a lot

573
00:21:05,430 --> 00:21:03,120
okay go ahead ken

574
00:21:07,750 --> 00:21:05,440
wait for the mic here

575
00:21:09,190 --> 00:21:07,760
hi ken kramer universe today uh i have a

576
00:21:11,029 --> 00:21:09,200
question for the last speaker very

577
00:21:13,590 --> 00:21:11,039
interesting what you talked about mars

578
00:21:16,070 --> 00:21:13,600
uh deployments how how close

579
00:21:18,149 --> 00:21:16,080
um are we to actually sending these

580
00:21:20,149 --> 00:21:18,159
satellites to mars and and talk a little

581
00:21:28,710 --> 00:21:20,159
bit about more about the missions they

582
00:21:32,950 --> 00:21:30,870
mark i think that one might be for you

583
00:21:34,070 --> 00:21:32,960
oh i'm sorry i i did i didn't hear the

584
00:21:35,909 --> 00:21:34,080
question

585
00:21:37,830 --> 00:21:35,919
quite well could you uh repeat it for me

586
00:21:39,430 --> 00:21:37,840
rachel

587
00:21:42,950 --> 00:21:39,440
uh it's very interesting what you talked

588
00:21:44,950 --> 00:21:42,960

about how close are you to actually

589
00:21:46,950 --> 00:21:44,960
deploying sending these satellites to

590
00:21:49,350 --> 00:21:46,960
mars and what kind of missions could you

591
00:21:53,190 --> 00:21:49,360
accomplish

592
00:21:57,430 --> 00:21:55,669
i think we're targeting a 2018 or 2020

593
00:21:59,669 --> 00:21:57,440
the idea would be that it would be a

594
00:22:01,669 --> 00:21:59,679
piggyback mission um aboard either a

595
00:22:03,029 --> 00:22:01,679
european or

596
00:22:04,950 --> 00:22:03,039
american

597
00:22:08,070 --> 00:22:04,960
larger mission to mars and so we would

598
00:22:10,149 --> 00:22:08,080
use excess mass capability and in

599
00:22:12,149 --> 00:22:10,159
independently re-enter the uh the

600
00:22:14,230 --> 00:22:12,159
atmosphere of mars and land and for

601
00:22:16,789 --> 00:22:14,240
example mid-latitude regions

602
00:22:19,110 --> 00:22:16,799
um or other very interesting regions of

603
00:22:21,430 --> 00:22:19,120
mars that we can't access so um our

604
00:22:26,950 --> 00:22:21,440
technology would be ready by you know a

605
00:22:26,960 --> 00:22:35,669
okay next question

606
00:22:39,270 --> 00:22:37,590
thanks jeff space review i think this is

607
00:22:41,590 --> 00:22:39,280
for kurt

608
00:22:43,909 --> 00:22:41,600
as you balance the science experiments

609
00:22:45,430 --> 00:22:43,919
that go up to space station um i

610
00:22:47,190 --> 00:22:45,440
understand they're probably some that

611
00:22:49,669 --> 00:22:47,200
are dragon specific because they have to

612
00:22:51,909 --> 00:22:49,679
come back down are there any that have

613
00:22:54,470 --> 00:22:51,919

that are cygnus specific because of some

614
00:22:56,149 --> 00:22:54,480
capabilities of that spacecraft

615
00:22:59,669 --> 00:22:56,159
or are you able to slip them back and

616
00:23:00,789 --> 00:22:59,679
forth as the the launch schedules go

617
00:23:01,990 --> 00:23:00,799
well this

618
00:23:04,630 --> 00:23:02,000
great question

619
00:23:06,230 --> 00:23:04,640
this probably isn't fair to the tv

620
00:23:08,149 --> 00:23:06,240
audience because they didn't see the

621
00:23:12,950 --> 00:23:08,159
cygnus briefing that occurred just

622
00:23:15,350 --> 00:23:12,960
before this one but because cygnus does

623
00:23:17,669 --> 00:23:15,360
destructively re-enter

624
00:23:20,149 --> 00:23:17,679
there are some examples of fire

625
00:23:23,430 --> 00:23:20,159
investigations notably the sapphire

626
00:23:25,510 --> 00:23:23,440
investigation that make a good fit for

627
00:23:27,830 --> 00:23:25,520
the cygnus vehicle rather than a spacex

628
00:23:29,669 --> 00:23:27,840
which where we which is where we tend to

629
00:23:32,230 --> 00:23:29,679
try and recover all of the science on

630
00:23:33,909 --> 00:23:32,240
board so there are a certain class of

631
00:23:36,470 --> 00:23:33,919
missions particularly those that have to

632
00:23:39,190 --> 00:23:36,480
deal with spacecraft breakup and reentry

633
00:23:41,990 --> 00:23:39,200
and upper atmospherics that and that fit

634
00:23:44,549 --> 00:23:42,000
very well to the cygnus profile

635
00:23:48,870 --> 00:23:44,559
but really wouldn't fit into the return

636
00:23:48,880 --> 00:24:01,750
okay other questions here

637
00:24:05,510 --> 00:24:03,350
thank you

638
00:24:06,789 --> 00:24:05,520

maddox i'm with the social media group

639
00:24:09,669 --> 00:24:06,799
and i was wondering if you could speak

640
00:24:12,470 --> 00:24:09,679
to the technology that is used

641
00:24:15,669 --> 00:24:12,480
to not only coordinate the cameras but

642
00:24:17,590 --> 00:24:15,679
to also keep them from overlapping and

643
00:24:18,789 --> 00:24:17,600
keep them in orbit

644
00:24:20,470 --> 00:24:18,799
sure so

645
00:24:23,510 --> 00:24:20,480
the technology that we have inside the

646
00:24:25,830 --> 00:24:23,520
spacecraft and and here again is uh is

647
00:24:27,590 --> 00:24:25,840
an engineering model from flock one that

648
00:24:30,149 --> 00:24:27,600
went up in in january and deployed in

649
00:24:33,350 --> 00:24:30,159
february um about two-thirds of the

650
00:24:34,710 --> 00:24:33,360
volume is is a telescope um and then the

651
00:24:36,390 --> 00:24:34,720
the thing that's sticking out the back

652
00:24:38,789 --> 00:24:36,400
is the camera and the associated

653
00:24:40,710 --> 00:24:38,799
electronics and if you think about what

654
00:24:42,549 --> 00:24:40,720
you need inside of a spacecraft in order

655
00:24:44,789 --> 00:24:42,559
for it to operate it's very very similar

656
00:24:46,549 --> 00:24:44,799
to to the components and the subsystems

657
00:24:49,029 --> 00:24:46,559
that you have inside your phone

658
00:24:51,830 --> 00:24:49,039
so you need a radio you need batteries

659
00:24:53,750 --> 00:24:51,840
you need to recharge those batteries

660
00:24:55,590 --> 00:24:53,760
a computer fast processor and a whole

661
00:24:58,070 --> 00:24:55,600
bunch of sensors on board like

662
00:25:00,149 --> 00:24:58,080
accelerometers and magnetometers in

663
00:25:01,750 --> 00:25:00,159

order to sense the environment but to

664
00:25:04,390 --> 00:25:01,760
answer your question specifically around

665
00:25:07,110 --> 00:25:04,400
pointing we use two modes for pointing

666
00:25:09,269 --> 00:25:07,120
our spacecraft one of which is utilizing

667
00:25:11,590 --> 00:25:09,279
the earth's magnetic field so we have

668
00:25:14,470 --> 00:25:11,600
three magna torquers on board and what

669
00:25:15,750 --> 00:25:14,480
these are is a tightly wound copper coil

670
00:25:17,029 --> 00:25:15,760
that if you put a little bit of current

671
00:25:17,909 --> 00:25:17,039
through it it creates that magnetic

672
00:25:19,669 --> 00:25:17,919
field

673
00:25:21,990 --> 00:25:19,679
so you have three of these coils on each

674
00:25:23,990 --> 00:25:22,000
one of the three axes of the spacecraft

675
00:25:25,990 --> 00:25:24,000
and then operating inside a magnetic

676
00:25:28,310 --> 00:25:26,000
field it pushes off of it and that's how

677
00:25:29,990 --> 00:25:28,320
you get very very coarse pointing then

678
00:25:32,230 --> 00:25:30,000
we also have three reaction wheels

679
00:25:35,350 --> 00:25:32,240
inside of this and this is a motor that

680
00:25:36,789 --> 00:25:35,360
spins up again one on each axis and this

681
00:25:38,549 --> 00:25:36,799
allows for

682
00:25:40,070 --> 00:25:38,559
for you to then use the conservation of

683
00:25:42,149 --> 00:25:40,080
angular momentum in order to get fine

684
00:25:44,470 --> 00:25:42,159
pointing so there's actually a lot of

685
00:25:46,149 --> 00:25:44,480
capacity that is built within this

686
00:25:48,070 --> 00:25:46,159
really small spacecraft and the exact

687
00:25:49,909 --> 00:25:48,080
same type of subsystems

688
00:25:53,830 --> 00:25:49,919

that are necessary inside much larger

689
00:25:57,830 --> 00:25:55,830
hi my name is kelly gaul i'm with the

690
00:26:00,230 --> 00:25:57,840
nasa social group and with the american

691
00:26:01,990 --> 00:26:00,240
society for microbiology my question is

692
00:26:03,750 --> 00:26:02,000
for dr goldstein about the student

693
00:26:06,310 --> 00:26:03,760
experiments and what disciplines are

694
00:26:07,909 --> 00:26:06,320
represented and what microbiology might

695
00:26:09,510 --> 00:26:07,919
be on board

696
00:26:11,190 --> 00:26:09,520
well there's

697
00:26:13,590 --> 00:26:11,200
there's a whole variety of disciplines

698
00:26:16,149 --> 00:26:13,600
that are appropriate and the experiments

699
00:26:17,110 --> 00:26:16,159
simply need to be designed to operate

700
00:26:18,789 --> 00:26:17,120
within

701
00:26:21,269 --> 00:26:18,799
a very simple

702
00:26:23,110 --> 00:26:21,279
fluid mixing enclosure which is a volume

703
00:26:24,630 --> 00:26:23,120
that can be divided into three

704
00:26:26,950 --> 00:26:24,640
sub-volumes

705
00:26:28,070 --> 00:26:26,960
and so microbials work very very

706
00:26:30,549 --> 00:26:28,080
effectively here if you have a

707
00:26:33,190 --> 00:26:30,559
freeze-dried microbial in one volume and

708
00:26:35,990 --> 00:26:33,200
a growth medium in a second

709
00:26:38,549 --> 00:26:36,000
an astronaut will unclamp the first

710
00:26:41,590 --> 00:26:38,559
clamp and activate the microbial and at

711
00:26:45,029 --> 00:26:41,600
some point the student team will ask the

712
00:26:47,909 --> 00:26:45,039
um the crew the crew to

713
00:26:49,669 --> 00:26:47,919

introduce a fixative to kill and

714
00:26:51,430 --> 00:26:49,679
preserve the biology so that when it

715
00:26:53,269 --> 00:26:51,440
comes back down

716
00:26:55,029 --> 00:26:53,279
this identical experiment done on the

717
00:26:57,510 --> 00:26:55,039
ground the ground truth can be compared

718
00:27:00,870 --> 00:26:57,520
to the one that flew and see what the

719
00:27:03,430 --> 00:27:00,880
impact of a microgravity environment has

720
00:27:04,870 --> 00:27:03,440
on that system so there are quite a few

721
00:27:07,830 --> 00:27:04,880
microbials

722
00:27:10,070 --> 00:27:07,840
on board right now

723
00:27:11,750 --> 00:27:10,080
planarian worm regeneration

724
00:27:14,230 --> 00:27:11,760
penicillium growth rate mold

725
00:27:20,549 --> 00:27:14,240
reproduction lettuce growth

726
00:27:23,190 --> 00:27:22,230
other questions from the audience here

727
00:27:25,669 --> 00:27:23,200
okay

728
00:27:27,430 --> 00:27:25,679
uh yeah hi bill harwood cbs for uh for

729
00:27:28,710 --> 00:27:27,440
robbie again um

730
00:27:29,990 --> 00:27:28,720
i'm sure this is on the website i just

731
00:27:31,669 --> 00:27:30,000
hadn't had time to look for it what is

732
00:27:34,149 --> 00:27:31,679
the average lifetime of one of these

733
00:27:35,990 --> 00:27:34,159
guys uh before drag brings it down and

734
00:27:37,669 --> 00:27:36,000
how do you what's the long-range plan to

735
00:27:40,310 --> 00:27:37,679
replenish the constellation as it goes

736
00:27:42,070 --> 00:27:40,320
forward yeah as i mentioned in in

737
00:27:44,070 --> 00:27:42,080
my opening remarks we've

738
00:27:45,430 --> 00:27:44,080

with this launch on sunday this will be

739
00:27:47,750 --> 00:27:45,440
our sixth launch

740
00:27:49,110 --> 00:27:47,760
um over over the last 15 months and

741
00:27:51,110 --> 00:27:49,120
three of them have been to a really

742
00:27:52,950 --> 00:27:51,120
really low orbit so to the international

743
00:27:54,950 --> 00:27:52,960
space station orbit and the other three

744
00:27:56,950 --> 00:27:54,960
are much higher and so you're right to

745
00:27:58,710 --> 00:27:56,960
point out that the that the limiting

746
00:28:00,950 --> 00:27:58,720
factor especially in a low orbit

747
00:28:02,789 --> 00:28:00,960
constellation is is drag

748
00:28:05,269 --> 00:28:02,799
and drag has to do with the ballistic

749
00:28:06,789 --> 00:28:05,279
coefficient um but in but really has to

750
00:28:08,310 --> 00:28:06,799
do with the mass of your object and the

751
00:28:10,549 --> 00:28:08,320
surface area in the velocity vector

752
00:28:12,070 --> 00:28:10,559
direction so right now we are in a solar

753
00:28:13,750 --> 00:28:12,080
max

754
00:28:16,549 --> 00:28:13,760
and therefore the atmosphere has

755
00:28:17,990 --> 00:28:16,559
expanded and so at 400 kilometers which

756
00:28:20,310 --> 00:28:18,000
is on average where the international

757
00:28:23,510 --> 00:28:20,320
space station is these satellites last

758
00:28:25,510 --> 00:28:23,520
on the on on on the order of months so

759
00:28:27,750 --> 00:28:25,520
about six months or so but which is

760
00:28:29,430 --> 00:28:27,760
absolutely perfect for us in order to

761
00:28:31,510 --> 00:28:29,440
practice again what we call agile

762
00:28:33,190 --> 00:28:31,520
aerospace which is to test out new

763
00:28:35,029 --> 00:28:33,200

technologies new operations and new

764
00:28:36,710 --> 00:28:35,039
capabilities and then feed that into the

765
00:28:38,950 --> 00:28:36,720
next generation

766
00:28:40,630 --> 00:28:38,960
of our spacecraft that we deploy

767
00:28:42,789 --> 00:28:40,640
for operational constellations for

768
00:28:44,310 --> 00:28:42,799
longer term going up to about 500

769
00:28:46,630 --> 00:28:44,320
kilometers they would last about five

770
00:28:52,230 --> 00:28:48,470
okay and i think we have one question on

771
00:28:56,389 --> 00:28:53,590
you want to take one from the audience

772
00:29:00,630 --> 00:28:58,870
taylor with eight in space it's just a

773
00:29:02,549 --> 00:29:00,640
follow-up to that you said uh we're at

774
00:29:04,470 --> 00:29:02,559
solar max and that's that's decreasing

775
00:29:07,350 --> 00:29:04,480
it down to five months how much longer

776
00:29:08,549 --> 00:29:07,360
would it last if we weren't at solar max

777
00:29:11,590 --> 00:29:08,559
that's a very good question it would

778
00:29:17,110 --> 00:29:11,600
probably be about two times longer so on

779
00:29:25,029 --> 00:29:18,549
okay now i think we have a couple from

780
00:29:28,549 --> 00:29:26,630
wonderful this first question comes from

781
00:29:30,470 --> 00:29:28,559
twitter user scott who asks how long

782
00:29:32,230 --> 00:29:30,480
will the sensors be functional for in

783
00:29:34,310 --> 00:29:32,240
collecting data

784
00:29:36,870 --> 00:29:34,320
for planet labs

785
00:29:39,510 --> 00:29:36,880
you believe so uh well we will find out

786
00:29:41,190 --> 00:29:39,520
uh we just launched uh two weeks ago to

787
00:29:43,350 --> 00:29:41,200
an orbit that will be up there for about

788
00:29:44,950 --> 00:29:43,360

five years right now they're all they're

789
00:29:47,190 --> 00:29:44,960
operating perfectly but we will see

790
00:29:48,789 --> 00:29:47,200
degradation over time and performance uh

791
00:29:50,870 --> 00:29:48,799
then take that into consideration as we

792
00:29:52,789 --> 00:29:50,880
iterate on our technology moving forward

793
00:29:55,350 --> 00:29:52,799
but for now that the limiting factor has

794
00:29:58,470 --> 00:29:55,360
been uh altitude with respect to build

795
00:30:02,630 --> 00:30:00,389
wonderful then the second question comes

796
00:30:04,950 --> 00:30:02,640
from twitter user dylan who asks will it

797
00:30:06,710 --> 00:30:04,960
help make the iss bigger i believe what

798
00:30:08,470 --> 00:30:06,720
they're referring to is the cargo that's

799
00:30:14,549 --> 00:30:08,480
being carried up the the science

800
00:30:19,350 --> 00:30:17,029
okay um dylan thanks for the question

801
00:30:22,230 --> 00:30:19,360
the cargo would technically make the iss

802
00:30:25,669 --> 00:30:22,240
a little bit heavier but not bigger it

803
00:30:27,990 --> 00:30:25,679
doesn't technically expand the

804
00:30:30,470 --> 00:30:28,000
dimensions of the spacecraft as we know

805
00:30:33,269 --> 00:30:30,480
it now we will be jettising

806
00:30:34,789 --> 00:30:33,279
a number of cubesats and those will go

807
00:30:36,950 --> 00:30:34,799
on to have their own life outside the

808
00:30:38,789 --> 00:30:36,960
space station but we are bringing

809
00:30:41,029 --> 00:30:38,799
valuable science to the space station

810
00:30:42,870 --> 00:30:41,039
and that increases the knowledge that

811
00:30:44,789 --> 00:30:42,880
all of us can gain back here on earth

812
00:30:47,909 --> 00:30:44,799
whether that's developing

813
00:30:51,669 --> 00:30:47,919

new new prescriptions for uh

814
00:30:56,470 --> 00:30:53,830
healthcare or whether it's

815
00:30:59,190 --> 00:30:56,480
developing new technologies that go into

816
00:31:03,590 --> 00:30:59,200
showing how we can commercially utilize

817
00:31:07,590 --> 00:31:05,750
and i think we have one on the phone uh

818
00:31:09,430 --> 00:31:07,600
from frank mooring with aviation week

819
00:31:11,430 --> 00:31:09,440
frank are you on

820
00:31:13,190 --> 00:31:11,440
i'm here thank you can you hear me

821
00:31:16,389 --> 00:31:13,200
we can can

822
00:31:18,710 --> 00:31:16,399
uh this is for robbie and it has to do

823
00:31:21,110 --> 00:31:18,720
with your um

824
00:31:23,110 --> 00:31:21,120
operational constellation

825
00:31:24,789 --> 00:31:23,120
at this point do you know when it will

826
00:31:26,630 --> 00:31:24,799
be fully operational how big that

827
00:31:28,630 --> 00:31:26,640
constellation will be

828
00:31:29,750 --> 00:31:28,640
the altitude and

829
00:31:31,830 --> 00:31:29,760
um i'm

830
00:31:34,070 --> 00:31:31,840
really interested in obsolescence on

831
00:31:36,549 --> 00:31:34,080
your spacecraft how how often you expect

832
00:31:39,669 --> 00:31:36,559
to upgrade and what your launch rate

833
00:31:40,710 --> 00:31:39,679
will be if you know those numbers

834
00:31:43,110 --> 00:31:40,720
thank you

835
00:31:46,070 --> 00:31:43,120
yeah frank frank thanks for the question

836
00:31:49,269 --> 00:31:46,080
um and uh we we aim to operate our

837
00:31:51,909 --> 00:31:49,279
spacecraft around 400 to 600 kilometers

838
00:31:54,149 --> 00:31:51,919

uh so that that's about the the altitude

839
00:31:56,549 --> 00:31:54,159
which we'll go for so it's a useful

840
00:31:58,950 --> 00:31:56,559
lifetime of around about five years when

841
00:32:03,509 --> 00:31:58,960
we get above 500 kilometers

842
00:32:06,070 --> 00:32:03,519
and um and we have a number of of of

843
00:32:08,310 --> 00:32:06,080
of conversations trying to get access to

844
00:32:10,389 --> 00:32:08,320
space and secondary payloads over the

845
00:32:12,310 --> 00:32:10,399
coming 18 months but we anticipate that

846
00:32:14,310 --> 00:32:12,320
we would be able to launch about once a

847
00:32:16,310 --> 00:32:14,320
quarter in order to replenish the

848
00:32:18,950 --> 00:32:16,320
constellation but in addition to that

849
00:32:22,149 --> 00:32:18,960
provide much more robust capability

850
00:32:24,070 --> 00:32:22,159
um as as we get into operations but the

851
00:32:26,230 --> 00:32:24,080
ones in sun synchronous orbit will be up

852
00:32:28,789 --> 00:32:26,240
there for a number of years and already

853
00:32:30,870 --> 00:32:28,799
uh frank with flock 1c we're getting

854
00:32:32,310 --> 00:32:30,880
excellent imagery back and and there

855
00:32:35,430 --> 00:32:32,320
will be a lot more data coming out on

856
00:32:37,029 --> 00:32:35,440
that over the next couple of weeks

857
00:32:38,630 --> 00:32:37,039
okay we have time for a couple more

858
00:32:40,310 --> 00:32:38,640
questions from the audience if there are

859
00:32:46,389 --> 00:32:40,320
any

860
00:32:50,149 --> 00:32:48,549
harvey leifer freelance rider i'm just

861
00:32:52,950 --> 00:32:50,159
curious as to what's going on on the

862
00:32:57,590 --> 00:32:52,960
launch pad the cherry picker has gone up

863
00:33:02,549 --> 00:32:59,509

it looks like uh

864
00:33:04,070 --> 00:33:02,559
normal pad operations hopefully

865
00:33:10,389 --> 00:33:04,080
they continue to

866
00:33:10,399 --> 00:33:13,430
other questions

867
00:33:13,440 --> 00:33:16,549
yep

868
00:33:20,549 --> 00:33:18,310
i'm sorry could serratus and i had a

869
00:33:22,389 --> 00:33:20,559
question for robbie again the those

870
00:33:24,630 --> 00:33:22,399
microsatellites what sort of data rates

871
00:33:26,310 --> 00:33:24,640
do they communicate back to earth with

872
00:33:27,269 --> 00:33:26,320
that's a great question so

873
00:33:32,950 --> 00:33:27,279
we have

874
00:33:35,669 --> 00:33:32,960
megabits a second with uh with our large

875
00:33:38,070 --> 00:33:35,679
ground stations in addition to

876
00:33:39,509 --> 00:33:38,080
what we currently have in in models

877
00:33:41,269 --> 00:33:39,519
build nine

878
00:33:44,070 --> 00:33:41,279
and that will continue to evolve over

879
00:33:46,470 --> 00:33:44,080
time as we add additional power and

880
00:33:49,990 --> 00:33:46,480
upgrade additional uh compression

881
00:33:52,149 --> 00:33:50,000
mechanisms on board our um our radio but

882
00:33:54,389 --> 00:33:52,159
we we started with a very low speed

883
00:33:57,029 --> 00:33:54,399
transmission uhf

884
00:33:59,830 --> 00:33:57,039
transceiver which is very very low speed

885
00:34:04,630 --> 00:33:59,840
but now over time with x-band down

886
00:34:04,640 --> 00:34:08,950
okay any last question

887
00:34:12,710 --> 00:34:11,109
okay well we'll go ahead and wrap up um

888
00:34:15,190 --> 00:34:12,720

i'd like to thank everyone for joining

889
00:34:17,270 --> 00:34:15,200
us today especially our participants

890
00:34:20,470 --> 00:34:17,280
for awareness we'll hold a pre-launch

891
00:34:23,030 --> 00:34:20,480
status briefing tomorrow at 1 pm eastern

892
00:34:24,710 --> 00:34:23,040
from here at wallops flight facility

893
00:34:27,430 --> 00:34:24,720
you can find out more about the space

894
00:34:32,310 --> 00:34:27,440
station and the science payloads headed