1
00:00:42,470 --> 00:00:40,229
kathy thornton continues to ignite fuels

2
00:00:46,950 --> 00:00:42,480
that are

3
00:00:46,960 --> 00:00:52,869
got the latch to rope shape

4
00:00:56,950 --> 00:00:54,790
that's affirmative valve this is a real

5
00:00:58,869 --> 00:00:56,960
nice drop and we'd like to continue on

6
00:01:03,990 --> 00:00:58,879
at step

7
00:01:04,000 --> 00:01:09,910
copy that

8
00:01:14,870 --> 00:01:12,550
once again we are able to see

9
00:01:16,710 --> 00:01:14,880
experiment video from three of the

10
00:01:45,270 --> 00:01:16,720
experiments that are being processed

11
00:01:51,510 --> 00:01:46,789
stand by rommel and kathy can you

12
00:01:54,630 --> 00:01:53,350
it just extinguished and there's a

13
00:01:55,910 --> 00:01:54,640

little bit of clouding in the chamber

14
00:02:03,190 --> 00:01:55,920
this time that was really strange

15
00:02:08,309 --> 00:02:05,429
in space lab huntsville for kathy we are

16
00:02:10,070 --> 00:02:08,319
going to run with the fsdc fan on for

17
00:02:11,430 --> 00:02:10,080
this next three millimeter run and when

18
00:02:15,750 --> 00:02:11,440
you're ready to copy the setting i've

19
00:02:30,949 --> 00:02:17,589
kathy thornton has just released another

20
00:02:35,509 --> 00:02:33,509
the fuel has just been ignited

21
00:02:37,350 --> 00:02:35,519
you can see the combustion products or

22
00:03:00,949 --> 00:02:37,360
soot that are being released by the

23
00:03:04,790 --> 00:03:03,110
hello worcester mass

24
00:03:07,190 --> 00:03:04,800
my name is al sacco and i'm from

25
00:03:09,430 --> 00:03:07,200
worcester mass i'm a ps on this flight

26
00:03:11,110 --> 00:03:09,440
united states microgravity lab number

27
00:03:12,630 --> 00:03:11,120
two we're doing a lot of science

28
00:03:14,869 --> 00:03:12,640
experiments on a whole variety of

29
00:03:16,710 --> 00:03:14,879
different fields biotechnology material

30
00:03:19,190 --> 00:03:16,720
science crystal growth fluid dynamics

31
00:03:20,470 --> 00:03:19,200
fluid physics and combustion

32
00:03:22,390 --> 00:03:20,480
and we're going to talk a little bit

33
00:03:24,149 --> 00:03:22,400
about all of these things with you guys

34
00:03:25,990 --> 00:03:24,159
today before we do

35
00:03:28,149 --> 00:03:26,000
let me introduce or let them introduce

36
00:03:32,869 --> 00:03:28,159
themselves the redshift first we'll go

37
00:03:36,789 --> 00:03:35,030
hi i'm ken bowersox i'm from bedford

38
00:03:41,830 --> 00:03:36,799

indiana and i'm the mission commander on

39
00:03:47,110 --> 00:03:43,509
i'm kathy thornton and i'm the payload

40
00:03:48,630 --> 00:03:47,120
commander on this flight

41
00:03:50,070 --> 00:03:48,640
and i'm kent romer you're from delaware

42
00:03:55,910 --> 00:03:50,080
colorado and i'm the pilot on this

43
00:03:55,920 --> 00:04:03,589
and that's the redshift

44
00:04:07,589 --> 00:04:05,670
can we have the first question please

45
00:04:09,429 --> 00:04:07,599
okay for questions regarding fluid

46
00:04:11,030 --> 00:04:09,439
experiments worcester south high please

47
00:04:12,630 --> 00:04:11,040
go ahead

48
00:04:14,710 --> 00:04:12,640
this is hosanna

49
00:04:18,870 --> 00:04:14,720
my question is what is the purpose of

50
00:04:21,909 --> 00:04:20,310
well in order to understand the purpose

51
00:04:24,150 --> 00:04:21,919
of the contact angle experiment you

52
00:04:25,670 --> 00:04:24,160
first have to understand two variables

53
00:04:27,030 --> 00:04:25,680
that are involved with it one is called

54
00:04:28,629 --> 00:04:27,040
surface tension

55
00:04:29,990 --> 00:04:28,639
and the other is contact angle and

56
00:04:31,990 --> 00:04:30,000
they're related

57
00:04:34,070 --> 00:04:32,000
surface tension really can be simply

58
00:04:35,749 --> 00:04:34,080
thought of as how molecules like each

59
00:04:37,909 --> 00:04:35,759
other that they like each other a lot

60
00:04:39,749 --> 00:04:37,919
they have a very high surface tension on

61
00:04:41,270 --> 00:04:39,759
the other hand what you also have to

62
00:04:42,950 --> 00:04:41,280
balance is how they like the materials

63
00:04:44,710 --> 00:04:42,960

they contact

64
00:04:47,030 --> 00:04:44,720
and those are called adhesive forces

65
00:04:49,189 --> 00:04:47,040
adhesive forces how the liquids

66
00:04:51,189 --> 00:04:49,199
like the solid so what you have when the

67
00:04:53,110 --> 00:04:51,199
contact angle experiment is a balance

68
00:04:54,550 --> 00:04:53,120
between what they call cohesive forces

69
00:04:56,550 --> 00:04:54,560
or surface tension

70
00:04:59,830 --> 00:04:56,560
and adhesive forces so how it likes the

71
00:05:01,270 --> 00:04:59,840
wall and when those two balance

72
00:05:04,469 --> 00:05:01,280
and they're balanced by gravity that's

73
00:05:06,310 --> 00:05:04,479
really how far up the liquid goes

74
00:05:08,230 --> 00:05:06,320
now in in space the reason we come to

75
00:05:09,830 --> 00:05:08,240
space to study surface tension is

76
00:05:28,469 --> 00:05:09,840
primarily because it dominates and let

77
00:05:31,909 --> 00:05:30,150
you see in space the orange juice the

78
00:05:33,990 --> 00:05:31,919
molecules like each other and they form

79
00:05:36,070 --> 00:05:34,000
a sphere if you were to do that on the

80
00:05:38,150 --> 00:05:36,080
ground of course it would cling to the

81
00:05:39,830 --> 00:05:38,160
sides of the vessel and these are called

82
00:05:42,710 --> 00:05:39,840
again surface tension is something

83
00:05:44,310 --> 00:05:42,720
called a cohesive force

84
00:05:46,150 --> 00:05:44,320
steven bellick from the accelerated

85
00:05:47,510 --> 00:05:46,160
learning laboratory

86
00:05:48,790 --> 00:05:47,520
hi i'm nick piquette from north high

87
00:05:50,469 --> 00:05:48,800
school

88
00:05:51,749 --> 00:05:50,479

hi i'm beth quinadamo from north high

89
00:05:53,029 --> 00:05:51,759
school

90
00:05:53,909 --> 00:05:53,039
hi i'm reggie hill from north high

91
00:05:55,430 --> 00:05:53,919
school

92
00:05:56,469 --> 00:05:55,440
hi i'm josh robert from dardy high

93
00:05:58,230 --> 00:05:56,479
school

94
00:05:59,909 --> 00:05:58,240
hi i'm tanisha westa from north high

95
00:06:02,070 --> 00:05:59,919
school and our question is

96
00:06:04,150 --> 00:06:02,080
how does the surface tension and contact

97
00:06:08,870 --> 00:06:04,160
angle react in space when soap is added

98
00:06:12,790 --> 00:06:11,110
soap is a what we call a surfactant and

99
00:06:14,629 --> 00:06:12,800
what that does is reduce the surface

100
00:06:16,390 --> 00:06:14,639
tension

101
00:06:17,990 --> 00:06:16,400
and in space it reduces the surface

102
00:06:21,110 --> 00:06:18,000
tension by the same amount it doesn't

103
00:06:22,790 --> 00:06:21,120
change at all in space but again what

104
00:06:25,189 --> 00:06:22,800
you can see is you can see the effect of

105
00:06:27,430 --> 00:06:25,199
that so factor a lot more in space

106
00:06:29,749 --> 00:06:27,440
because you have a one-sixth gravity

107
00:06:31,590 --> 00:06:29,759
component and therefore surface tension

108
00:06:33,110 --> 00:06:31,600
dominates over gravity and we can

109
00:06:34,710 --> 00:06:33,120
explore that but it really doesn't

110
00:06:36,710 --> 00:06:34,720
change

111
00:06:38,230 --> 00:06:36,720
anything more than it does on the ground

112
00:06:48,070 --> 00:06:38,240
the ground and space are very similar

113
00:06:50,710 --> 00:06:49,350

i'm katie already from doing another

114
00:06:53,189 --> 00:06:50,720
question please

115
00:06:55,189 --> 00:06:53,199
i am igor vishwandority high school

116
00:06:57,189 --> 00:06:55,199
and i'm tom davao from doherty high and

117
00:06:58,950 --> 00:06:57,199
our question is in the contact angle

118
00:07:00,550 --> 00:06:58,960
experiment what would happen if the

119
00:07:02,550 --> 00:07:00,560
slides were of different materials and

120
00:07:06,870 --> 00:07:02,560
sizes and would other liquids change the

121
00:07:10,790 --> 00:07:09,029
well i hope uh with what i've explained

122
00:07:13,029 --> 00:07:10,800
to you so far that surface tension and

123
00:07:15,510 --> 00:07:13,039
contact angle are basic properties of a

124
00:07:16,629 --> 00:07:15,520
liquid and its interaction with the

125
00:07:18,309 --> 00:07:16,639
solid

126
00:07:21,270 --> 00:07:18,319
so those aren't affected by space

127
00:07:23,029 --> 00:07:21,280
however every time you change the liquid

128
00:07:25,270 --> 00:07:23,039
or you change the solid that it's in

129
00:07:27,350 --> 00:07:25,280
contact with that is the material then

130
00:07:30,309 --> 00:07:27,360
you in fact will affect the contact

131
00:07:32,469 --> 00:07:30,319
angle experiment how high it rises but

132
00:07:34,950 --> 00:07:32,479
the size that is the size of the

133
00:07:36,550 --> 00:07:34,960
materials or even the amount of liquid

134
00:07:38,790 --> 00:07:36,560
that you put in really doesn't have a

135
00:07:42,790 --> 00:07:38,800
major effect on that either in space or

136
00:07:46,230 --> 00:07:44,629
next question please we have five

137
00:07:48,710 --> 00:07:46,240
minutes remaining in worcester please go

138
00:07:50,950 --> 00:07:48,720

ahead with the next question

139
00:07:53,029 --> 00:07:50,960
hi my name is hong tran from north high

140
00:07:59,270 --> 00:07:53,039
and i was wondering if the mass of an

141
00:08:02,150 --> 00:08:00,629
you know that's that's another very

142
00:08:03,670 --> 00:08:02,160
interesting question and you got to

143
00:08:05,430 --> 00:08:03,680
think about it a little bit surface

144
00:08:06,710 --> 00:08:05,440
tension again is a basic property of a

145
00:08:08,629 --> 00:08:06,720
fluid

146
00:08:10,710 --> 00:08:08,639
and it really doesn't

147
00:08:12,790 --> 00:08:10,720
change whether we have whether we have a

148
00:08:14,390 --> 00:08:12,800
large mass on it or a small mass on it

149
00:08:15,589 --> 00:08:14,400
the surface tension is the same however

150
00:08:17,990 --> 00:08:15,599
what you see

151
00:08:19,749 --> 00:08:18,000
is if i look at an eye dropper and i

152
00:08:22,150 --> 00:08:19,759
squeeze out a little bit of liquid on

153
00:08:23,830 --> 00:08:22,160
the ground as that liquid grows it gets

154
00:08:25,510 --> 00:08:23,840
very heavy and as it gets heavy it

155
00:08:27,909 --> 00:08:25,520
elongates the drop and eventually it

156
00:08:29,589 --> 00:08:27,919
falls off now the surface engine

157
00:08:32,149 --> 00:08:29,599
surface tension of that material didn't

158
00:08:34,469 --> 00:08:32,159
change it just became so heavy

159
00:08:36,949 --> 00:08:34,479
that the adhesive forces were overcome

160
00:08:39,670 --> 00:08:36,959
by the cohesive forces excuse me the

161
00:08:41,269 --> 00:08:39,680
cohesive forces were overcome hello the

162
00:08:42,790 --> 00:08:41,279
cohesive and adhesive forces were

163
00:08:45,350 --> 00:08:42,800

overcome by gravity is what i'm trying

164
00:08:46,710 --> 00:08:45,360
to say hope here up here that wouldn't

165
00:08:48,310 --> 00:08:46,720
happen of course and you saw that with

166
00:08:50,070 --> 00:08:48,320
the straw when i squeezed out the orange

167
00:08:51,350 --> 00:08:50,080
juice it just sort of hung there as a

168
00:08:53,190 --> 00:08:51,360
sphere

169
00:08:55,030 --> 00:08:53,200
so surface tension really doesn't change

170
00:08:56,870 --> 00:08:55,040
it's not broken by mass

171
00:08:58,949 --> 00:08:56,880
but you see it looks that way and it

172
00:09:00,310 --> 00:08:58,959
seems that way uh because of your

173
00:09:01,990 --> 00:09:00,320
observation in the one gravity

174
00:09:03,269 --> 00:09:02,000
environment

175
00:09:05,110 --> 00:09:03,279
please

176
00:09:07,030 --> 00:09:05,120
hi my name is joella tafani from south

177
00:09:08,790 --> 00:09:07,040
high my question is is there a

178
00:09:14,630 --> 00:09:08,800
difference in velocity of the spreading

179
00:09:17,430 --> 00:09:15,990
well to be honest with you we didn't

180
00:09:19,430 --> 00:09:17,440
spread any pepper in space on this

181
00:09:20,310 --> 00:09:19,440
flight at least we haven't yet

182
00:09:22,070 --> 00:09:20,320
but

183
00:09:23,670 --> 00:09:22,080
i would expect that there may be a

184
00:09:24,949 --> 00:09:23,680
difference in in velocity and the

185
00:09:27,110 --> 00:09:24,959
difference in velocity wouldn't be

186
00:09:28,310 --> 00:09:27,120
because of the surface tension effect

187
00:09:30,230 --> 00:09:28,320
but

188
00:09:32,230 --> 00:09:30,240

because of convective effects

189
00:09:33,990 --> 00:09:32,240
temperature differences and that's

190
00:09:35,670 --> 00:09:34,000
additive so you'd get not only the

191
00:09:37,190 --> 00:09:35,680
surface tension effect but in addition

192
00:09:39,670 --> 00:09:37,200
to that you may get some convective

193
00:09:41,670 --> 00:09:39,680
effect so you probably see a difference

194
00:09:46,310 --> 00:09:41,680
in the velocity of the pepper itself

195
00:09:49,750 --> 00:09:48,150
can i have another question please we

196
00:09:51,990 --> 00:09:49,760
have one minute left in worcester time

197
00:09:53,990 --> 00:09:52,000
for one last question my reaction

198
00:10:01,430 --> 00:09:54,000
there's a reaction would a ball of water

199
00:10:04,230 --> 00:10:02,949
well we haven't run that experiment

200
00:10:05,030 --> 00:10:04,240
either but i can tell you the answer to

201
00:10:06,630 --> 00:10:05,040
that

202
00:10:08,470 --> 00:10:06,640
just like sprinkling

203
00:10:10,630 --> 00:10:08,480
pepper on a liquid surface what you'd

204
00:10:12,630 --> 00:10:10,640
see up here is you'd see the pepper just

205
00:10:13,750 --> 00:10:12,640
form around the outside of the sphere of

206
00:10:16,150 --> 00:10:13,760
liquid

207
00:10:17,430 --> 00:10:16,160
and for every action there is a reaction

208
00:10:19,110 --> 00:10:17,440
as the pepper touch the surface of the

209
00:10:21,269 --> 00:10:19,120
liquid the liquid would touch back with

210
00:10:24,230 --> 00:10:21,279
exactly the same force but what you'd

211
00:10:26,389 --> 00:10:24,240
see is because of surface tension that

212
00:10:27,990 --> 00:10:26,399
pepper would just adhere to the outside

213
00:10:29,590 --> 00:10:28,000

of the drop

214
00:10:31,430 --> 00:10:29,600
and it would form all the way around the

215
00:10:34,389 --> 00:10:31,440
drop you'd see a uniform distribution of

216
00:10:37,030 --> 00:10:34,399
pepper all the way around the drop

217
00:10:39,269 --> 00:10:37,040
hi my name is prubali chakraborty and

218
00:10:41,030 --> 00:10:39,279
can fiber supported drop combustion be

219
00:10:43,430 --> 00:10:41,040
used in the shuttle's engines to make

220
00:10:47,590 --> 00:10:43,440
maneuvering simpler and are there any

221
00:10:51,829 --> 00:10:49,110
yeah that's a good question too and i

222
00:10:53,350 --> 00:10:51,839
have a navy aviator here and a fighter

223
00:10:55,269 --> 00:10:53,360
pilot that's going to answer that for us

224
00:10:58,389 --> 00:10:55,279
and also the pilot of the shuttle so

225
00:11:01,829 --> 00:10:59,990
thanks sally that's a great question and

226
00:11:04,389 --> 00:11:01,839
the answer is maybe that can help us

227
00:11:06,310 --> 00:11:04,399
maneuver the shuttle

228
00:11:08,389 --> 00:11:06,320
the uh and also in real line

229
00:11:09,910 --> 00:11:08,399
applications there are many i'll start

230
00:11:11,750 --> 00:11:09,920
out by saying as well as the shuttle

231
00:11:13,670 --> 00:11:11,760
from having better combustion and the

232
00:11:15,350 --> 00:11:13,680
f-14 i used to fly as well as the car

233
00:11:17,269 --> 00:11:15,360
that people drive even the heater and

234
00:11:19,190 --> 00:11:17,279
water heater in your home it can help

235
00:11:20,310 --> 00:11:19,200
them be much more efficient and the

236
00:11:22,389 --> 00:11:20,320
reason we study that up here in

237
00:11:25,350 --> 00:11:22,399
microgravity is without the influence of

238
00:11:27,350 --> 00:11:25,360

gravity and without convection

239
00:11:29,829 --> 00:11:27,360
the burning is much more even in a

240
00:11:32,069 --> 00:11:29,839
sphere and it burns more slowly so we

241
00:11:33,990 --> 00:11:32,079
can control it and much better analyze

242
00:11:36,870 --> 00:11:34,000
it and hopefully come up with more

243
00:11:38,470 --> 00:11:36,880
efficient combustion processes and fuels

244
00:11:40,630 --> 00:11:38,480
and additionally that would also result

245
00:11:42,550 --> 00:11:40,640
in less pollutants so it would help the

246
00:11:44,710 --> 00:11:42,560
environment also

247
00:11:46,870 --> 00:11:44,720
next question

248
00:11:48,550 --> 00:11:46,880
hello my name is jill feckler

249
00:11:50,069 --> 00:11:48,560
do different flammable liquids form

250
00:11:51,509 --> 00:11:50,079
different shapes when they burn and are

251
00:12:02,629 --> 00:11:51,519
the materials you're using different

252
00:12:06,389 --> 00:12:04,310
that's a good question as i understand

253
00:12:08,069 --> 00:12:06,399
the materials that you are using are

254
00:12:09,509 --> 00:12:08,079
petroleum distillate which is a mixture

255
00:12:12,310 --> 00:12:09,519
of all different kinds of petroleum

256
00:12:14,550 --> 00:12:12,320
products we're trying some pure

257
00:12:16,550 --> 00:12:14,560
fuels up here or very simple mixtures

258
00:12:18,470 --> 00:12:16,560
we're using some methanol and water and

259
00:12:20,310 --> 00:12:18,480
a few other mixtures and

260
00:12:21,269 --> 00:12:20,320
because they are liquids they form a

261
00:12:22,710 --> 00:12:21,279
sphere

262
00:12:23,829 --> 00:12:22,720
here in space

263
00:12:26,310 --> 00:12:23,839

just like the orange juice you saw

264
00:12:27,750 --> 00:12:26,320
floating around but we don't want these

265
00:12:29,750 --> 00:12:27,760
burning droplets floating around the

266
00:12:31,190 --> 00:12:29,760
space lab so we can find them by putting

267
00:12:33,990 --> 00:12:31,200
them on a fiber

268
00:12:35,750 --> 00:12:34,000
so there are spherical drops on a fiber

269
00:12:38,389 --> 00:12:35,760
the different materials often the same

270
00:12:39,990 --> 00:12:38,399
shape however the the combustion of the

271
00:12:41,910 --> 00:12:40,000
different materials is significantly

272
00:12:44,870 --> 00:12:41,920
different the methanol was burning with

273
00:12:46,069 --> 00:12:44,880
a very very faint blue shell of flame

274
00:12:48,470 --> 00:12:46,079
and some of the other products were

275
00:12:50,829 --> 00:12:48,480
burning with yellow or several or blue

276
00:12:53,990 --> 00:12:50,839
and yellow alternating kind of

277
00:12:56,069 --> 00:12:54,000
flames you have another question

278
00:12:58,069 --> 00:12:56,079
yes my name is jessica huddy

279
00:13:00,069 --> 00:12:58,079
did your flames move around or vary in

280
00:13:01,590 --> 00:13:00,079
size and shape due to air currents and

281
00:13:13,269 --> 00:13:01,600
do the flames produce any visible

282
00:13:16,069 --> 00:13:14,470
that's a very good question that some of

283
00:13:18,069 --> 00:13:16,079
the things that we're trying to explore

284
00:13:19,590 --> 00:13:18,079
up here we have done some of the burns

285
00:13:22,150 --> 00:13:19,600
without air currents and we get a

286
00:13:23,590 --> 00:13:22,160
completely spherical shell of flame

287
00:13:25,910 --> 00:13:23,600
and others we have done with air

288
00:13:28,389 --> 00:13:25,920

currents and we get a teardrop shape

289
00:13:30,550 --> 00:13:28,399
where the the combustion products and

290
00:13:32,470 --> 00:13:30,560
the vapors that are burning are moving

291
00:13:34,310 --> 00:13:32,480
along with the air currents it also

292
00:13:35,829 --> 00:13:34,320
changes the color of the flame because

293
00:13:37,110 --> 00:13:35,839
with air currents we're feeding more

294
00:13:38,150 --> 00:13:37,120
oxygen

295
00:13:40,470 --> 00:13:38,160
to the

296
00:13:42,310 --> 00:13:40,480
ball of fire

297
00:13:45,189 --> 00:13:42,320
and uh other when we're not having air

298
00:13:46,870 --> 00:13:45,199
flow it's uh the oxygen has to diffuse

299
00:13:48,790 --> 00:13:46,880
into the combustion zone so it's a

300
00:13:51,269 --> 00:13:48,800
little bit slower burning process

301
00:13:55,350 --> 00:13:51,279
also burns bluer whereas we have airflow

302
00:13:59,189 --> 00:13:57,430
my name is ray marquette

303
00:14:01,590 --> 00:13:59,199
what percentage of times did you get a

304
00:14:06,230 --> 00:14:01,600
good flame and how long on average did

305
00:14:09,750 --> 00:14:07,430
we've had a little bit of trouble

306
00:14:12,150 --> 00:14:09,760
getting the droplets deployed on the

307
00:14:15,509 --> 00:14:12,160
fiber but once we get them on the fiber

308
00:14:17,910 --> 00:14:15,519
we get ignition every time

309
00:14:19,430 --> 00:14:17,920
and uh we it burns from uh on the

310
00:14:21,350 --> 00:14:19,440
average of five or six seconds for a

311
00:14:23,509 --> 00:14:21,360
small drop to a five millimeter drop was

312
00:14:25,189 --> 00:14:23,519
going as long as 25 or 30 seconds which

313
00:14:26,150 --> 00:14:25,199

is a lot longer burn time than you're

314
00:14:29,670 --> 00:14:26,160
getting on the ground with your

315
00:14:34,470 --> 00:14:32,310
hi my name is geralyn waters

316
00:14:36,230 --> 00:14:34,480
and my question is do you think anything

317
00:14:45,990 --> 00:14:36,240
besides the difference in graphic

318
00:14:50,629 --> 00:14:48,069
gravity has a lot of effects on the

319
00:14:52,310 --> 00:14:50,639
on this experiment and yours

320
00:14:54,629 --> 00:14:52,320
in your experiment you're burning a tear

321
00:14:56,949 --> 00:14:54,639
drape teardrop shaped

322
00:14:59,189 --> 00:14:56,959
fuel because gravity is pulling it down

323
00:15:02,550 --> 00:14:59,199
here we start out with a spherical drop

324
00:15:04,710 --> 00:15:02,560
of fuel and also because of convection

325
00:15:06,230 --> 00:15:04,720
which is another effect of gravity the

326
00:15:07,990 --> 00:15:06,240
combustion products and actually the

327
00:15:09,910 --> 00:15:08,000
vapors that are burning are rising in

328
00:15:11,829 --> 00:15:09,920
your experiment and oxygen continues to

329
00:15:13,750 --> 00:15:11,839
be supplied from the bottom here we

330
00:15:16,310 --> 00:15:13,760
don't have that so we're looking at

331
00:15:18,790 --> 00:15:16,320
diffusion of oxygen into the flame front

332
00:15:20,069 --> 00:15:18,800
to continue to feed it which is a little

333
00:15:21,750 --> 00:15:20,079
bit different than what you're doing so

334
00:15:23,430 --> 00:15:21,760
gravity is certainly the major effect up

335
00:15:24,710 --> 00:15:23,440
here the lack of gravity is the

336
00:15:27,430 --> 00:15:24,720
difference in what we're doing and what

337
00:15:29,430 --> 00:15:27,440
you're doing down there

338
00:15:30,949 --> 00:15:29,440

my name is jared shooter

339
00:15:41,350 --> 00:15:30,959
do you have to replace the filament

340
00:15:45,030 --> 00:15:43,509
you know another good question that's uh

341
00:15:47,430 --> 00:15:45,040
we didn't replace the filament every

342
00:15:48,790 --> 00:15:47,440
time but we do replace it periodically

343
00:15:51,269 --> 00:15:48,800
and one of the reasons for that is we

344
00:15:53,269 --> 00:15:51,279
get foot deposits we had carbon deposits

345
00:15:55,110 --> 00:15:53,279
high molecular weight carbon materials

346
00:15:56,710 --> 00:15:55,120
and what do they do they change the

347
00:15:58,790 --> 00:15:56,720
surface tension of the liquid and how it

348
00:16:00,710 --> 00:15:58,800
interacts with the solid itself that can

349
00:16:02,870 --> 00:16:00,720
result in a variety of different things

350
00:16:05,110 --> 00:16:02,880
not the least of which is the drop

351
00:16:06,949 --> 00:16:05,120
moving along the filament itself in

352
00:16:09,189 --> 00:16:06,959
addition to that it can change the heat

353
00:16:11,030 --> 00:16:09,199
transfer rate how heat is leaving the

354
00:16:12,230 --> 00:16:11,040
filament which affects the studies that

355
00:16:13,829 --> 00:16:12,240
we're looking at

356
00:16:15,189 --> 00:16:13,839
so we don't replace it all the time but

357
00:16:18,389 --> 00:16:15,199
if it looks like it's getting a little

358
00:16:20,710 --> 00:16:18,399
then we do in fact replace it

359
00:16:22,470 --> 00:16:20,720
my name is kate gehart does the type of

360
00:16:30,069 --> 00:16:22,480
filament have an effect on the result of

361
00:16:33,990 --> 00:16:32,310
yeah very much and that's another

362
00:16:36,150 --> 00:16:34,000
very interesting question because one of

363
00:16:37,829 --> 00:16:36,160

the things that we're looking at is is

364
00:16:39,910 --> 00:16:37,839
all the different heat transfer and mass

365
00:16:41,990 --> 00:16:39,920
transfer effects how oxygen comes into

366
00:16:43,509 --> 00:16:42,000
the flame and that light blue flame that

367
00:16:46,069 --> 00:16:43,519
we see as a result of what we call a

368
00:16:47,670 --> 00:16:46,079
diffusive flame oxygen is not convecting

369
00:16:49,990 --> 00:16:47,680
ends not being brought in by other

370
00:16:52,389 --> 00:16:50,000
molecules as a group but coming in

371
00:16:53,829 --> 00:16:52,399
individually it's a diffusive flame

372
00:16:55,910 --> 00:16:53,839
how the heat is taken out of the

373
00:16:57,509 --> 00:16:55,920
filament is very important because some

374
00:16:59,509 --> 00:16:57,519
of the heat is being conducted down the

375
00:17:01,110 --> 00:16:59,519
filament so if we change that material

376
00:17:02,550 --> 00:17:01,120
we can change it from a metal which is

377
00:17:04,309 --> 00:17:02,560
very conductive

378
00:17:06,069 --> 00:17:04,319
to a ceramic which we're using up here

379
00:17:08,470 --> 00:17:06,079
which is a little bit less conductive

380
00:17:09,990 --> 00:17:08,480
and that changes the entire burning rate

381
00:17:11,990 --> 00:17:10,000
of the film

382
00:17:14,710 --> 00:17:12,000
of the flame excuse me

383
00:17:16,949 --> 00:17:14,720
and changes what we see in the dynamics

384
00:17:19,510 --> 00:17:16,959
of the flame itself so the material the

385
00:17:21,350 --> 00:17:19,520
thickness of that material are very very

386
00:17:23,750 --> 00:17:21,360
important it's also important in

387
00:17:25,669 --> 00:17:23,760
microgravity to make sure again the

388
00:17:28,390 --> 00:17:25,679

liquid and the solid are compatible in

389
00:17:31,669 --> 00:17:28,400
the sense that the liquid to a certain

390
00:17:33,110 --> 00:17:31,679
extent but not too much what's the solid

391
00:17:34,789 --> 00:17:33,120
in other words we don't want it to like

392
00:17:36,870 --> 00:17:34,799
to solid too much so it won't maintain

393
00:17:38,710 --> 00:17:36,880
its sphericity but we'll spread along

394
00:17:40,630 --> 00:17:38,720
the filament but we do want it to

395
00:17:42,150 --> 00:17:40,640
maintain its contact with the filament

396
00:17:44,390 --> 00:17:42,160
we need to light the filament a little

397
00:17:49,350 --> 00:17:47,029
hello my name is ann johnsy my question

398
00:17:51,350 --> 00:17:49,360
is is the flame isolated to the coil of

399
00:17:53,110 --> 00:17:51,360
the filament or does it move away from

400
00:18:05,270 --> 00:17:53,120
the filament so just the fluid is

401
00:18:09,830 --> 00:18:07,110
well first again we're not using a coil

402
00:18:11,990 --> 00:18:09,840
up here we're using a uh filament just a

403
00:18:14,630 --> 00:18:12,000
straight line

404
00:18:15,430 --> 00:18:14,640
material straight string

405
00:18:16,390 --> 00:18:15,440
but

406
00:18:18,070 --> 00:18:16,400
you should

407
00:18:19,830 --> 00:18:18,080
you probably remember from studying this

408
00:18:21,110 --> 00:18:19,840
that in fact the liquid is not burning

409
00:18:23,110 --> 00:18:21,120
but the vapors from the liquid are

410
00:18:25,990 --> 00:18:23,120
burning and that's what we see as well

411
00:18:27,830 --> 00:18:26,000
we see a shallow or a halo of burning

412
00:18:29,830 --> 00:18:27,840
material that's displaced slightly from

413
00:18:33,669 --> 00:18:29,840

the liquid of the fuel

414
00:18:37,270 --> 00:18:35,750
next question please

415
00:18:38,630 --> 00:18:37,280
and this is the last question from

416
00:18:39,590 --> 00:18:38,640
louisville science center please go

417
00:18:41,270 --> 00:18:39,600
ahead

418
00:18:43,190 --> 00:18:41,280
my name is tom fulda

419
00:18:45,270 --> 00:18:43,200
and i was wondering would the amount of

420
00:18:47,590 --> 00:18:45,280
electricity used in the experiment

421
00:19:00,070 --> 00:18:47,600
change the rate of combustion and would

422
00:19:03,110 --> 00:19:01,750
that's another uh interesting question

423
00:19:03,909 --> 00:19:03,120
we have to think on that a little bit

424
00:19:05,029 --> 00:19:03,919
but

425
00:19:06,870 --> 00:19:05,039
certainly when you put in more

426
00:19:08,710 --> 00:19:06,880
electricity into your filaments now

427
00:19:10,789 --> 00:19:08,720
we're not doing it exactly that way

428
00:19:12,710 --> 00:19:10,799
we're igniting it from an external

429
00:19:13,590 --> 00:19:12,720
source we're not putting electricity

430
00:19:15,590 --> 00:19:13,600
through it

431
00:19:18,150 --> 00:19:15,600
i wouldn't expect the electricity to be

432
00:19:20,549 --> 00:19:18,160
affected by the microgravity at all

433
00:19:22,070 --> 00:19:20,559
but by increasing the electricity in the

434
00:19:23,909 --> 00:19:22,080
filament if we were doing it that way

435
00:19:25,830 --> 00:19:23,919
like you're doing it on the ground

436
00:19:28,070 --> 00:19:25,840
increases the rate at which the filament

437
00:19:30,630 --> 00:19:28,080
heats and therefore

438
00:19:32,950 --> 00:19:30,640

impacts the rate at which the vapor is

439
00:19:35,430 --> 00:19:32,960
combust so in fact as you change the

440
00:19:36,950 --> 00:19:35,440
electricity you may see an effect but

441
00:19:39,350 --> 00:19:36,960
that would be again a function of the

442
00:19:41,110 --> 00:19:39,360
material that you make your your coil

443
00:19:42,870 --> 00:19:41,120
out of and the rate at which you put

444
00:19:44,310 --> 00:19:42,880
electricity in it would be a very subtle

445
00:19:46,470 --> 00:19:44,320
and difficult thing to measure for you

446
00:19:48,150 --> 00:19:46,480
but it is measurable on the ground in

447
00:19:49,510 --> 00:19:48,160
microgravity that wouldn't affect us

448
00:19:51,350 --> 00:19:49,520
very much first of all but because of

449
00:19:52,950 --> 00:19:51,360
the way we're doing the experiment but

450
00:19:54,870 --> 00:19:52,960
in addition to that even if we were

451
00:19:56,950 --> 00:19:54,880
using electrical way to heat the

452
00:19:58,950 --> 00:19:56,960
filament i wouldn't expect uh

453
00:20:01,190 --> 00:19:58,960
microgravity to affect

454
00:20:02,789 --> 00:20:01,200
electricity very much up here so that in

455
00:20:04,230 --> 00:20:02,799
and of itself would not be affected by

456
00:20:05,909 --> 00:20:04,240
microgravity the same thing that was

457
00:20:07,510 --> 00:20:05,919
affected on the ground though would be

458
00:20:09,110 --> 00:20:07,520
affected up here in the sense that the

459
00:20:11,510 --> 00:20:09,120
rate at which you put the electricity in

460
00:20:13,430 --> 00:20:11,520
how much the thickness of the material

461
00:20:15,590 --> 00:20:13,440
and what that material it is how much of