
MISSION CONTROL CENTER

1
00:00:06,630 --> 00:00:04,630
welcome to mission control houston i'm

2
00:00:08,150 --> 00:00:06,640
here with dr peter voorhees the

3
00:00:09,830 --> 00:00:08,160
principal investigator of one of the

4
00:00:12,390 --> 00:00:09,840
experiments on the international space

5
00:00:14,390 --> 00:00:12,400
station uh this is a rather special run

6
00:00:16,630 --> 00:00:14,400
for this experiment because

7
00:00:19,349 --> 00:00:16,640
it's one where we brought the samples up

8
00:00:21,349 --> 00:00:19,359
on the spacex dragon vehicle and we'll

9
00:00:23,990 --> 00:00:21,359
be returning them home when the spacex

10
00:00:26,390 --> 00:00:24,000
dragon comes back on may the 25th so

11
00:00:27,670 --> 00:00:26,400
it's a very quick run and dr voorhees

12
00:00:30,310 --> 00:00:27,680
will tell us a little bit more about his

13
00:00:32,549 --> 00:00:30,320

experiment and why it's important for it

14
00:00:33,670 --> 00:00:32,559
to come back so quickly welcome to

15
00:00:35,830 --> 00:00:33,680
mission control thank you it's a

16
00:00:37,990 --> 00:00:35,840
pleasure to be here now you are here for

17
00:00:40,069 --> 00:00:38,000
some regular space station program

18
00:00:41,350 --> 00:00:40,079
science meetings about uh how we

19
00:00:43,270 --> 00:00:41,360
coordinate all the research on the

20
00:00:44,869 --> 00:00:43,280
station right that's exactly right that

21
00:00:46,709 --> 00:00:44,879
meeting starts in a little bit all right

22
00:00:48,869 --> 00:00:46,719
well we appreciate you taking time to

23
00:00:50,709 --> 00:00:48,879
join us today tell us a little bit about

24
00:00:52,630 --> 00:00:50,719
your experiment what do you call it yeah

25
00:00:54,630 --> 00:00:52,640
so uh what we're interested is in

26
00:00:56,470 --> 00:00:54,640
studying how the how these structures

27
00:00:58,470 --> 00:00:56,480
called dendrites evolve

28
00:01:00,310 --> 00:00:58,480
and dendrites everyone has experience so

29
00:01:02,549 --> 00:01:00,320
if you go out in the you look at your

30
00:01:05,189 --> 00:01:02,559
windshield in the winter and you'll see

31
00:01:07,830 --> 00:01:05,199
frost on your on on the windshield those

32
00:01:09,750 --> 00:01:07,840
little things are dendrites ice crystals

33
00:01:11,990 --> 00:01:09,760
are dendrites snow

34
00:01:13,990 --> 00:01:12,000
and what happens when you make materials

35
00:01:16,550 --> 00:01:14,000
is they're solidified from a liquid and

36
00:01:18,870 --> 00:01:16,560
when they solidify they form dendrites

37
00:01:21,190 --> 00:01:18,880
and the properties of the material are

38
00:01:22,789 --> 00:01:21,200

inherently linked to the way what these

39
00:01:24,630 --> 00:01:22,799
dendrites look like

40
00:01:26,710 --> 00:01:24,640
and what we're studying in space is how

41
00:01:29,109 --> 00:01:26,720
they evolve so that we can understand

42
00:01:31,109 --> 00:01:29,119
better how to control these dendritic

43
00:01:33,109 --> 00:01:31,119
structures on the ground and improve the

44
00:01:34,550 --> 00:01:33,119
properties of materials

45
00:01:36,069 --> 00:01:34,560
okay and how long have you been working

46
00:01:38,550 --> 00:01:36,079
on this kind of research

47
00:01:40,870 --> 00:01:38,560
oh my first experiment for nasa was

48
00:01:42,069 --> 00:01:40,880
proposed in 1985.

49
00:01:43,749 --> 00:01:42,079
and so you did some space shuttle

50
00:01:45,749 --> 00:01:43,759
experiments too right some space shuttle

51
00:01:47,109 --> 00:01:45,759
experiments as well so i've transitioned

52
00:01:49,910 --> 00:01:47,119
from the shuttle now into the space

53
00:01:51,590 --> 00:01:49,920
station era okay great and tell us the

54
00:01:53,270 --> 00:01:51,600
name of this particular experiment this

55
00:01:54,389 --> 00:01:53,280
is called coarsening and solid liquid

56
00:01:56,789 --> 00:01:54,399
mixtures

57
00:01:58,950 --> 00:01:56,799
okay and uh what are the

58
00:02:01,109 --> 00:01:58,960
advantages of learning how these

59
00:02:03,270 --> 00:02:01,119
dendrites work and solidify in

60
00:02:05,270 --> 00:02:03,280
microgravity yeah microgravity is really

61
00:02:06,709 --> 00:02:05,280
essential because what happens is when

62
00:02:09,669 --> 00:02:06,719
we do the experiments on the ground it's

63
00:02:11,589 --> 00:02:09,679

just like ice cubes in a drink the ice

64
00:02:13,110 --> 00:02:11,599
cubes settle to the top

65
00:02:15,270 --> 00:02:13,120
and so when we do the experiments on the

66
00:02:17,430 --> 00:02:15,280
ground the dendrites settle to the top

67
00:02:19,430 --> 00:02:17,440
and that's exactly not what we want we

68
00:02:20,390 --> 00:02:19,440
want them to be uniformly distributed in

69
00:02:22,790 --> 00:02:20,400
the liquid

70
00:02:24,630 --> 00:02:22,800
and so in space there's the absence of

71
00:02:26,390 --> 00:02:24,640
gravity and they stay approximately

72
00:02:27,510 --> 00:02:26,400
fixed in space and we can watch these

73
00:02:29,110 --> 00:02:27,520
things evolve

74
00:02:31,270 --> 00:02:29,120
in in during the experiment without

75
00:02:33,830 --> 00:02:31,280
having them settle okay now what

76
00:02:36,550 --> 00:02:33,840
material are you working with

77
00:02:38,550 --> 00:02:36,560
the material we're using is lead tin

78
00:02:39,990 --> 00:02:38,560
this is commonly called solder

79
00:02:41,509 --> 00:02:40,000
but the nice thing about lead tin is

80
00:02:44,309 --> 00:02:41,519
that it melted a very low temperature

81
00:02:46,710 --> 00:02:44,319
it's only 185 degrees centigrade so it's

82
00:02:49,030 --> 00:02:46,720
easy to do the experiments in space

83
00:02:51,670 --> 00:02:49,040
okay great the furnace only takes 11

84
00:02:52,630 --> 00:02:51,680
watts of power all right and so

85
00:02:54,630 --> 00:02:52,640
again

86
00:02:57,110 --> 00:02:54,640
you've got a number of these uh

87
00:02:59,030 --> 00:02:57,120
experiments and samples that have been

88
00:03:00,390 --> 00:02:59,040

worked on the space station already

89
00:03:02,390 --> 00:03:00,400
that's right this is a little bit

90
00:03:03,910 --> 00:03:02,400
different because it went up and it's

91
00:03:06,070 --> 00:03:03,920
coming back very quickly why is that

92
00:03:07,830 --> 00:03:06,080
important that this this is one of the i

93
00:03:09,910 --> 00:03:07,840
think the real highlights of this

94
00:03:12,149 --> 00:03:09,920
particular mission in the sense that we

95
00:03:14,550 --> 00:03:12,159
can send the experiments up have them

96
00:03:16,630 --> 00:03:14,560
done and returned quickly because what

97
00:03:17,830 --> 00:03:16,640
happens is that the samples degrade once

98
00:03:19,110 --> 00:03:17,840
they're solidified after they're

99
00:03:21,190 --> 00:03:19,120
solidified

100
00:03:23,030 --> 00:03:21,200
and it makes the analysis of the samples

101
00:03:24,630 --> 00:03:23,040
that much more difficult if we have to

102
00:03:25,589 --> 00:03:24,640
wait a long period of time before they

103
00:03:27,509 --> 00:03:25,599
come back

104
00:03:29,430 --> 00:03:27,519
so the ability to retrieve the samples

105
00:03:31,830 --> 00:03:29,440
very very quickly is really a really

106
00:03:34,390 --> 00:03:31,840
real uh plus for us okay and so these

107
00:03:36,789 --> 00:03:34,400
samples are going to come back on uh may

108
00:03:39,350 --> 00:03:36,799
the march the 25th when do you expect to

109
00:03:41,670 --> 00:03:39,360
have them in your hands march the 28th

110
00:03:44,309 --> 00:03:41,680
wow that's pretty quick return yes after

111
00:03:45,670 --> 00:03:44,319
a splash down the pacific ocean and then

112
00:03:47,670 --> 00:03:45,680
they go to the total

113
00:03:49,350 --> 00:03:47,680

long beach and they take them out out of

114
00:03:52,070 --> 00:03:49,360
the out of the furnaces at long beach

115
00:03:54,309 --> 00:03:52,080
and put them into dry ice and send them

116
00:03:56,710 --> 00:03:54,319
uh to northwestern great and what kind

117
00:03:58,070 --> 00:03:56,720
of analysis do you do on these yeah what

118
00:03:59,910 --> 00:03:58,080
what we do when we get them back in the

119
00:04:02,229 --> 00:03:59,920
laboratory is that my students and

120
00:04:02,949 --> 00:04:02,239
postdocs will be working on cutting them

121
00:04:04,309 --> 00:04:02,959
up

122
00:04:05,750 --> 00:04:04,319
and looking at the insides of the

123
00:04:07,270 --> 00:04:05,760
samples to look at the dendrite

124
00:04:09,429 --> 00:04:07,280
structures

125
00:04:11,670 --> 00:04:09,439
and tell us a little bit more about the

126
00:04:13,110 --> 00:04:11,680
potential benefits to

127
00:04:14,390 --> 00:04:13,120
people here on earth from what we

128
00:04:15,830 --> 00:04:14,400
learned about this

129
00:04:17,270 --> 00:04:15,840
yeah it turns out that the the

130
00:04:18,949 --> 00:04:17,280
properties of materials let's say

131
00:04:22,150 --> 00:04:18,959
aluminum alloys that are used in

132
00:04:24,710 --> 00:04:22,160
bicycles or used in engine blocks are

133
00:04:26,790 --> 00:04:24,720
inherently linked to how the what these

134
00:04:28,230 --> 00:04:26,800
dendrite structures look like in other

135
00:04:30,870 --> 00:04:28,240
words what these christmas christmas

136
00:04:32,070 --> 00:04:30,880
tree-like structures uh look like

137
00:04:35,270 --> 00:04:32,080
and

138
00:04:37,110 --> 00:04:35,280

them

139
00:04:38,790 --> 00:04:37,120
then you would understand how to

140
00:04:40,870 --> 00:04:38,800
improve their strength improve their

141
00:04:42,550 --> 00:04:40,880
ability to withstand vibrations over

142
00:04:44,070 --> 00:04:42,560
long periods of time

143
00:04:45,270 --> 00:04:44,080
and so what we'll do is we'll take this

144
00:04:48,390 --> 00:04:45,280
information that we get from these

145
00:04:50,070 --> 00:04:48,400
experiments and use that in in codes

146
00:04:51,670 --> 00:04:50,080
that that will predict the properties of

147
00:04:53,189 --> 00:04:51,680
materials so i'm guessing this would

148
00:04:55,030 --> 00:04:53,199
apply to just about anything that's an

149
00:04:56,710 --> 00:04:55,040
alloy a mixture of metals absolutely

150
00:04:57,749 --> 00:04:56,720
that's right that's right there are

151
00:04:58,790 --> 00:04:57,759
about

152
00:05:00,950 --> 00:04:58,800
uh

153
00:05:03,510 --> 00:05:00,960
a billion trillion dendrites produced

154
00:05:06,230 --> 00:05:03,520
every day in the casting of steels and

155
00:05:08,230 --> 00:05:06,240
and and aluminum alloys that are used in

156
00:05:10,150 --> 00:05:08,240
virtually every material that you that

157
00:05:11,510 --> 00:05:10,160
every application you can think of and

158
00:05:13,189 --> 00:05:11,520
so it's inherently linked to a lot of

159
00:05:14,950 --> 00:05:13,199
the properties of these materials and of

160
00:05:16,230 --> 00:05:14,960
course launching things to space is

161
00:05:17,830 --> 00:05:16,240
pretty expensive and so we're not

162
00:05:20,629 --> 00:05:17,840
talking about making a factory to do

163
00:05:22,629 --> 00:05:20,639

these in microgravity but can you

164
00:05:24,469 --> 00:05:22,639
translate what you learn into improved

165
00:05:25,909 --> 00:05:24,479
processes for manufacturing

166
00:05:27,670 --> 00:05:25,919
that's precisely the whole idea we're

167
00:05:29,909 --> 00:05:27,680
not manufacturing in space but we're

168
00:05:31,749 --> 00:05:29,919
using the information to improve what we

169
00:05:33,749 --> 00:05:31,759
know about the processes and hence

170
00:05:35,590 --> 00:05:33,759
impact things that we do on the ground

171
00:05:37,510 --> 00:05:35,600
here in earth okay tell us a little bit

172
00:05:39,430 --> 00:05:37,520
about you i did you always know you were

173
00:05:41,670 --> 00:05:39,440
going to be doing research in space um

174
00:05:43,670 --> 00:05:41,680
no i didn't know when i when i did my

175
00:05:45,110 --> 00:05:43,680
phd of course i never thought i'd ever

176
00:05:47,749 --> 00:05:45,120
ever have the opportunity to do

177
00:05:49,749 --> 00:05:47,759
experiments in space it's just that uh

178
00:05:52,070 --> 00:05:49,759
the the microgravity environment

179
00:05:53,990 --> 00:05:52,080
provided by the iss or the shuttle is

180
00:05:55,990 --> 00:05:54,000
such a unique platform to do these

181
00:05:57,830 --> 00:05:56,000
experiments and you can act really focus

182
00:06:00,230 --> 00:05:57,840
on the important issues associated with

183
00:06:02,469 --> 00:06:00,240
material science in many cases by doing

184
00:06:05,590 --> 00:06:02,479
experiments in space so we know you're

185
00:06:07,350 --> 00:06:05,600
at northwestern in the chicago area now

186
00:06:09,189 --> 00:06:07,360
where are you from originally i grew up

187
00:06:10,950 --> 00:06:09,199
on stat in staten island new york it's a

188
00:06:13,270 --> 00:06:10,960

borough of new york city

189
00:06:15,270 --> 00:06:13,280
and spent some time at

190
00:06:16,629 --> 00:06:15,280
nist national institute of standards and

191
00:06:18,309 --> 00:06:16,639
technology in gaithersburg and then

192
00:06:20,710 --> 00:06:18,319
moved to northwestern

193
00:06:22,070 --> 00:06:20,720
now almost 20 years 25 years ago so i've

194
00:06:23,510 --> 00:06:22,080
been there ever since are you missing

195
00:06:25,350 --> 00:06:23,520
the cold weather yet oh i couldn't

196
00:06:28,309 --> 00:06:25,360
believe how warm it was when i arrived

197
00:06:30,629 --> 00:06:28,319
yesterday it's like 88 degrees

198
00:06:31,990 --> 00:06:30,639
all right well dr peter voorhees thank

199
00:06:33,350 --> 00:06:32,000
you so much for joining us here in

200
00:06:35,590 --> 00:06:33,360
mission control today explain a little

201
00:06:37,430 --> 00:06:35,600
bit about your experiment uh good luck

202
00:06:39,350 --> 00:06:37,440
in your meetings here and on your

203
00:06:41,909 --> 00:06:39,360
travels back home and we look forward to

204
00:06:43,350 --> 00:06:41,919
hearing the results of uh how this

205
00:06:45,749 --> 00:06:43,360
unique opportunity to get your

206
00:06:47,189 --> 00:06:45,759
experiment up and down quickly works out