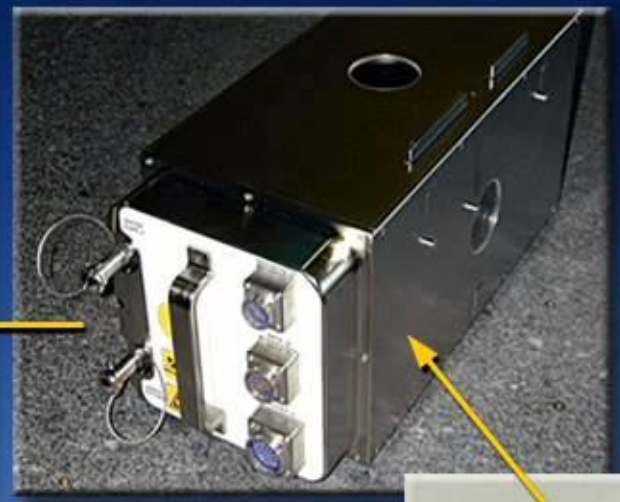
DECLIC Facility

DEVICE FOR THE STUDY OF CRITICAL LIQUIDS AND CRYSTALLIZATION

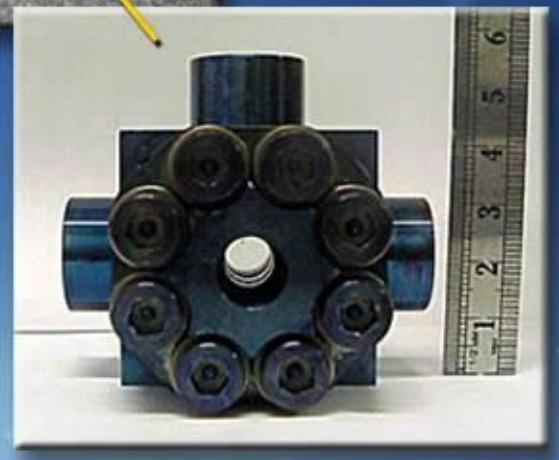
Experiment Locker

Electronic Locker



High Temperature Insert Reflight

Sample Cell Unit contains aqueous salt solution



1
00:00:06,789 --> 00:00:04,550
this is mission control houston

2
00:00:09,030 --> 00:00:06,799
the space station itself has hundreds of

3
00:00:10,950 --> 00:00:09,040
experiments going on on board

4
00:00:12,150 --> 00:00:10,960
at any one point in time during these

5
00:00:13,430 --> 00:00:12,160
expeditions but did you know that

6
00:00:14,789 --> 00:00:13,440
there's an experiment on board that

7
00:00:16,470 --> 00:00:14,799
takes a look at

8
00:00:18,230 --> 00:00:16,480
a special classification of water

9
00:00:21,510 --> 00:00:18,240
because water sometimes

10
00:00:24,790 --> 00:00:21,520
sometimes can be neither a solid liquid

11
00:00:26,790 --> 00:00:24,800
or a gas here to explain this way better

12
00:00:28,550 --> 00:00:26,800
than i can is michael hicks who's from

13
00:00:29,830 --> 00:00:28,560

nasa's glenn research center he's the

14
00:00:31,750 --> 00:00:29,840
principal investigator for what's called

15
00:00:33,830 --> 00:00:31,760
the supercritical water mixture

16
00:00:35,190 --> 00:00:33,840
experiment mr hicks thank you very much

17
00:00:37,750 --> 00:00:35,200
for joining us first of all let's talk

18
00:00:39,670 --> 00:00:37,760
about what supercritical water actually

19
00:00:45,110 --> 00:00:39,680
is

20
00:00:47,190 --> 00:00:45,120
let me just uh first start with uh maybe

21
00:00:48,630 --> 00:00:47,200
somewhat of an unsatisfying answer but

22
00:00:51,189 --> 00:00:48,640
uh simple

23
00:00:53,750 --> 00:00:51,199
and that uh supercritical water is uh

24
00:00:55,830 --> 00:00:53,760
simply uh water that's taking past its

25
00:00:59,430 --> 00:00:55,840
uh critical point and and for water the

26
00:01:02,069 --> 00:00:59,440
critical point is 374 degrees celsius or

27
00:01:04,869 --> 00:01:02,079
uh 705 degrees fahrenheit

28
00:01:07,990 --> 00:01:04,879
and its pressure is

29
00:01:10,070 --> 00:01:08,000
218 atmosphere uh which would be a

30
00:01:12,950 --> 00:01:10,080
little over 3000

31
00:01:16,630 --> 00:01:12,960
psi absolute so so that's super critical

32
00:01:17,830 --> 00:01:16,640
water um when it's taken past its uh

33
00:01:19,190 --> 00:01:17,840
um

34
00:01:21,910 --> 00:01:19,200
critical point

35
00:01:24,950 --> 00:01:21,920
and um probably uh to give you a little

36
00:01:28,390 --> 00:01:24,960
more insight into the experiment itself

37
00:01:30,069 --> 00:01:28,400
might be good if i if i created a visual

38
00:01:31,030 --> 00:01:30,079

if you could imagine taking a pot of

39
00:01:33,429 --> 00:01:31,040
water

40
00:01:35,830 --> 00:01:33,439
and we put that uh

41
00:01:37,429 --> 00:01:35,840
we fill that pot of water with maybe

42
00:01:38,950 --> 00:01:37,439
about

43
00:01:42,950 --> 00:01:38,960
a quarter full

44
00:01:45,350 --> 00:01:42,960
and the and we put a lid on it and we uh

45
00:01:46,950 --> 00:01:45,360
heated it up uh the pressure would build

46
00:01:48,469 --> 00:01:46,960
up and the pressure would not build up

47
00:01:50,950 --> 00:01:48,479
as fast as the temperature would and

48
00:01:53,749 --> 00:01:50,960
eventually you develop a vapor which

49
00:01:56,149 --> 00:01:53,759
would then uh turn to a gas once you

50
00:01:58,550 --> 00:01:56,159
pass the the critical point

51
00:02:00,789 --> 00:01:58,560
and then when you compress that gas

52
00:02:03,270 --> 00:02:00,799
further it would uh go into the

53
00:02:04,709 --> 00:02:03,280
supercritical range and we we have the

54
00:02:06,069 --> 00:02:04,719
same thing on the other side if we

55
00:02:07,510 --> 00:02:06,079
filled up the pot

56
00:02:08,710 --> 00:02:07,520
with um

57
00:02:10,469 --> 00:02:08,720
let's say

58
00:02:11,670 --> 00:02:10,479
50 water

59
00:02:13,670 --> 00:02:11,680
then

60
00:02:15,670 --> 00:02:13,680
you would um

61
00:02:17,750 --> 00:02:15,680
increase the you would if you heated it

62
00:02:20,470 --> 00:02:17,760
up and increase the pressure the the

63
00:02:22,550 --> 00:02:20,480

pressure would uh build up uh eventually

64
00:02:23,510 --> 00:02:22,560
the pot would fill with water

65
00:02:24,869 --> 00:02:23,520
and

66
00:02:26,790 --> 00:02:24,879
because the pressure would condense

67
00:02:29,030 --> 00:02:26,800
whatever vapor was in there

68
00:02:30,869 --> 00:02:29,040
and you would then cross over into the

69
00:02:32,710 --> 00:02:30,879
super critical range

70
00:02:34,550 --> 00:02:32,720
but uh the problem with that is that you

71
00:02:36,550 --> 00:02:34,560
really wouldn't be able to see exactly

72
00:02:40,229 --> 00:02:36,560
when you crossed over to the

73
00:02:41,830 --> 00:02:40,239
supercritical regime because the

74
00:02:44,869 --> 00:02:41,840
um

75
00:02:46,949 --> 00:02:44,879
the the pot in those instances would be

76
00:02:48,869 --> 00:02:46,959
filled either completely with vapor or

77
00:02:51,430 --> 00:02:48,879
completely with uh with liquid just

78
00:02:53,190 --> 00:02:51,440
because of the nature of where we are

79
00:02:53,910 --> 00:02:53,200
where we started at

80
00:02:55,990 --> 00:02:53,920
but

81
00:02:57,350 --> 00:02:56,000
with our experiment what we try to do is

82
00:03:00,710 --> 00:02:57,360
we try to

83
00:03:03,350 --> 00:03:00,720
maintain the uh vapor in the presence of

84
00:03:05,830 --> 00:03:03,360
of liquid throughout the heat up period

85
00:03:07,990 --> 00:03:05,840
so as we're heating up this this pot of

86
00:03:09,830 --> 00:03:08,000
water

87
00:03:12,309 --> 00:03:09,840
we

88
00:03:14,149 --> 00:03:12,319

actually have two uh

89
00:03:15,830 --> 00:03:14,159
two phases the vapor phase and the

90
00:03:17,270 --> 00:03:15,840
liquid phase all the way up through the

91
00:03:18,630 --> 00:03:17,280
critical point and in order to do that

92
00:03:21,910 --> 00:03:18,640
you have to fill

93
00:03:22,790 --> 00:03:21,920
this uh pot of water with exactly the

94
00:03:25,830 --> 00:03:22,800
proper

95
00:03:28,710 --> 00:03:25,840
amount of vapor and and liquid and so

96
00:03:30,710 --> 00:03:28,720
that's uh roughly about one-third liquid

97
00:03:32,710 --> 00:03:30,720
and two-thirds vapor

98
00:03:34,070 --> 00:03:32,720
and at that point then you cross right

99
00:03:35,830 --> 00:03:34,080
to the critical point and you can

100
00:03:37,190 --> 00:03:35,840
actually visually determine when you get

101
00:03:39,190 --> 00:03:37,200
to the critical point

102
00:03:40,070 --> 00:03:39,200
uh by looking at

103
00:03:51,030 --> 00:03:40,080
the

104
00:03:52,070 --> 00:03:51,040
that was performed about four years ago

105
00:03:54,390 --> 00:03:52,080
by the

106
00:03:55,350 --> 00:03:54,400
uh by our french colleagues

107
00:03:57,670 --> 00:03:55,360
and

108
00:03:59,509 --> 00:03:57,680
what we are doing now with the super

109
00:04:00,550 --> 00:03:59,519
critical water mixture experiment is we

110
00:04:03,429 --> 00:04:00,560
put

111
00:04:05,750 --> 00:04:03,439
a small pinch of salt in this water

112
00:04:08,869 --> 00:04:05,760
we're actually using sodium sulfate and

113
00:04:10,710 --> 00:04:08,879

we put that in solution and we

114
00:04:12,390 --> 00:04:10,720
then

115
00:04:14,949 --> 00:04:12,400
heat it up

116
00:04:16,870 --> 00:04:14,959
we then look at uh we then cross the

117
00:04:18,469 --> 00:04:16,880
critical point and we're looking at uh

118
00:04:19,830 --> 00:04:18,479
when this critical point shifts because

119
00:04:22,150 --> 00:04:19,840
our critical point will change a little

120
00:04:23,749 --> 00:04:22,160
bit because of the presence of the uh

121
00:04:25,189 --> 00:04:23,759
the salt and the water

122
00:04:27,030 --> 00:04:25,199
so that in essence

123
00:04:29,430 --> 00:04:27,040
in a nutshell is the experiment that

124
00:04:31,510 --> 00:04:29,440
we're performing

125
00:04:32,870 --> 00:04:31,520
okay let's talk about real world

126
00:04:34,629 --> 00:04:32,880
applications for this the way i

127
00:04:36,710 --> 00:04:34,639
understand it is that there's actually

128
00:04:38,550 --> 00:04:36,720
some cities and some also some navy

129
00:04:41,110 --> 00:04:38,560
ships that are kind of using

130
00:04:43,110 --> 00:04:41,120
the supercritical water to sort of you

131
00:04:45,189 --> 00:04:43,120
know clean waste and things like that

132
00:04:46,629 --> 00:04:45,199
talk about you know real world examples

133
00:04:48,390 --> 00:04:46,639
of how what this you know what this does

134
00:04:50,870 --> 00:04:48,400
for people on earth

135
00:04:52,950 --> 00:04:50,880
yeah one of the one of the great uh

136
00:04:56,469 --> 00:04:52,960
advantages of super cool water is that

137
00:04:59,430 --> 00:04:56,479
it becomes a terrific solvent for uh

138
00:05:02,310 --> 00:04:59,440

organic material organic waste

139
00:05:04,469 --> 00:05:02,320
and this is because of this change in

140
00:05:05,990 --> 00:05:04,479
material properties or thermal physical

141
00:05:07,590 --> 00:05:06,000
properties when it goes into its

142
00:05:10,230 --> 00:05:07,600
supercritical regime

143
00:05:12,070 --> 00:05:10,240
and so there's a

144
00:05:13,029 --> 00:05:12,080
there's a facility on

145
00:05:14,950 --> 00:05:13,039
that's

146
00:05:16,710 --> 00:05:14,960
in orlando florida that was just put

147
00:05:18,469 --> 00:05:16,720
online not too long ago the city of

148
00:05:20,310 --> 00:05:18,479
orlando uses supercritical water

149
00:05:22,629 --> 00:05:20,320
oxidation technology

150
00:05:26,710 --> 00:05:25,670
basically convert all their waste to

151
00:05:27,909 --> 00:05:26,720
uh

152
00:05:30,310 --> 00:05:27,919
either

153
00:05:32,870 --> 00:05:30,320
they essentially burn their waste in in

154
00:05:36,150 --> 00:05:32,880
a supercritical water reactor and the

155
00:05:38,710 --> 00:05:36,160
byproducts are then carbon dioxide and

156
00:05:42,710 --> 00:05:38,720
water so it's a relatively benign

157
00:05:50,469 --> 00:05:45,029
take this uh the super critical water

158
00:05:53,749 --> 00:05:51,990
so what's uh what's next i hear that you

159
00:05:55,670 --> 00:05:53,759
guys have another run of this experiment

160
00:05:56,790 --> 00:05:55,680
coming up i think in march maybe or

161
00:05:58,230 --> 00:05:56,800
whenever it's going to be so what are

162
00:06:00,390 --> 00:05:58,240
what are the next steps

163
00:06:01,350 --> 00:06:00,400

well the next step would be to

164
00:06:03,270 --> 00:06:01,360
um

165
00:06:05,270 --> 00:06:03,280
basically repeat the the test that we

166
00:06:07,990 --> 00:06:05,280
had already done in july and that that's

167
00:06:11,749 --> 00:06:08,000
coming up in march and so march 3rd

168
00:06:13,029 --> 00:06:11,759
we're scheduled for an 18-day uh

169
00:06:14,790 --> 00:06:13,039
test sequence

170
00:06:17,430 --> 00:06:14,800
and we'll um we'll have another test

171
00:06:19,189 --> 00:06:17,440
sequence after that uh probably in april

172
00:06:21,749 --> 00:06:19,199
so starting in march we'll we'll become

173
00:06:23,350 --> 00:06:21,759
busy again with this experiment

174
00:06:24,469 --> 00:06:23,360
all right michael hicks from nasa's glen

175
00:06:26,309 --> 00:06:24,479
research center thank you very much for

176
00:06:27,670 --> 00:06:26,319
joining us here on space station live

177
00:06:29,510 --> 00:06:27,680
you're welcome thank you for your

178
00:06:31,670 --> 00:06:29,520
interest thank you again that is the

179
00:06:33,029 --> 00:06:31,680
supercritical water mixture experiment

180
00:06:34,390 --> 00:06:33,039
of course you can read more about that

181
00:06:36,309 --> 00:06:34,400
on nasa.gov

182
00:06:38,309 --> 00:06:36,319
station just take a look at research and

183
00:06:39,990 --> 00:06:38,319
technology there on the left hand side

184
00:06:41,430 --> 00:06:40,000
and you can look up pretty much anything

185
00:06:43,749 --> 00:06:41,440
that these expedition crews are working