
NASA
SPACESTATION
LIVE

1
00:00:09,350 --> 00:00:06,869
the international space station is

2
00:00:11,190 --> 00:00:09,360
world-class laboratory that is doing a

3
00:00:13,830 --> 00:00:11,200
lot of different kinds of science on

4
00:00:16,870 --> 00:00:13,840
orbit some of it is using the human crew

5
00:00:18,870 --> 00:00:16,880
members as a test subjects but some of

6
00:00:20,230 --> 00:00:18,880
it is a very different kind of science

7
00:00:22,310 --> 00:00:20,240
it's done as well

8
00:00:24,710 --> 00:00:22,320
for example there is a new experiment

9
00:00:27,269 --> 00:00:24,720
that arrived on the cygnus cargo vehicle

10
00:00:29,910 --> 00:00:27,279
last weekend that is has a goal of

11
00:00:31,669 --> 00:00:29,920
supporting future exploration by looking

12
00:00:35,190 --> 00:00:31,679
into the behavior

13
00:00:37,270 --> 00:00:35,200

of soils that is found on airless bodies

14
00:00:39,670 --> 00:00:37,280
in space and this morning we're going to

15
00:00:41,350 --> 00:00:39,680
learn more about that from dr mark

16
00:00:42,069 --> 00:00:41,360
freeze he is the

17
00:00:44,549 --> 00:00:42,079
uh

18
00:00:46,950 --> 00:00:44,559
a planetary scientist with the astro

19
00:00:48,869 --> 00:00:46,960
materials acquisition and curation

20
00:00:50,709 --> 00:00:48,879
office here at the johnson space center

21
00:00:53,189 --> 00:00:50,719
and the principal investigator of the

22
00:00:56,069 --> 00:00:53,199
experiment known as strato1

23
00:00:58,470 --> 00:00:56,079
uh tell me where did the idea for this

24
00:01:00,950 --> 00:00:58,480
experiment come from okay

25
00:01:03,189 --> 00:01:00,960
strata one is kind of the outgrowth of a

26
00:01:05,270 --> 00:01:03,199
long series of experiments uh there's a

27
00:01:07,190 --> 00:01:05,280
community of scientists interested in

28
00:01:09,830 --> 00:01:07,200
the behavior of regolith that's kind of

29
00:01:11,350 --> 00:01:09,840
like the soil on airless bodies there's

30
00:01:12,630 --> 00:01:11,360
this community of scientists are

31
00:01:14,390 --> 00:01:12,640
interested in the behavior and

32
00:01:16,550 --> 00:01:14,400
properties and characteristics of

33
00:01:19,270 --> 00:01:16,560
regolith on these bodies like

34
00:01:22,070 --> 00:01:19,280
for example the moon mercury comets

35
00:01:23,510 --> 00:01:22,080
asteroids and you know these scientists

36
00:01:25,190 --> 00:01:23,520
have been studying

37
00:01:27,109 --> 00:01:25,200
studying the behavior and properties of

38
00:01:29,670 --> 00:01:27,119

regolith since the apollo days it goes

39
00:01:30,950 --> 00:01:29,680
back to then

40
00:01:32,950 --> 00:01:30,960
there have actually been previous

41
00:01:36,069 --> 00:01:32,960
experiments to try to understand

42
00:01:38,069 --> 00:01:36,079
the behavior of regolith on small bodies

43
00:01:39,670 --> 00:01:38,079
see we have apollo samples we have

44
00:01:41,830 --> 00:01:39,680
samples of regolith from they were

45
00:01:43,270 --> 00:01:41,840
returned by apollo astronauts we have a

46
00:01:45,990 --> 00:01:43,280
pretty good understanding the way

47
00:01:48,550 --> 00:01:46,000
regolith behaves on the moon on larger

48
00:01:49,990 --> 00:01:48,560
bodies like that like moon and mercury

49
00:01:53,109 --> 00:01:50,000
where you have impacts that throw

50
00:01:54,710 --> 00:01:53,119
material up and it comes back down right

51
00:01:56,630 --> 00:01:54,720
um but on

52
00:01:57,990 --> 00:01:56,640
small bodies little small asteroids you

53
00:01:59,910 --> 00:01:58,000
have impacts that will just throw

54
00:02:01,990 --> 00:01:59,920
material clean off the body and these

55
00:02:04,310 --> 00:02:02,000
are and a lot of these are what's called

56
00:02:05,510 --> 00:02:04,320
rubble piles or they're loosely

57
00:02:07,270 --> 00:02:05,520
aggregated

58
00:02:09,749 --> 00:02:07,280
collections of material that's kind of

59
00:02:12,229 --> 00:02:09,759
free to flow and move as the bot as the

60
00:02:15,110 --> 00:02:12,239
asteroid orbits the sun so we don't know

61
00:02:17,190 --> 00:02:15,120
a whole lot about the way that regolith

62
00:02:19,670 --> 00:02:17,200
behaves on those bodies and that's

63
00:02:21,589 --> 00:02:19,680

that's that's the point of experiments

64
00:02:23,750 --> 00:02:21,599
like this do we have a reason to believe

65
00:02:26,710 --> 00:02:23,760
that it behaves differently than dirt

66
00:02:29,030 --> 00:02:26,720
here on earth yes uh dirt on earth is

67
00:02:30,710 --> 00:02:29,040
composed of the factors that produce

68
00:02:32,949 --> 00:02:30,720
dirt on earth you have

69
00:02:35,990 --> 00:02:32,959
living material you have a large amount

70
00:02:37,910 --> 00:02:36,000
of microbes and and you know dirt and

71
00:02:40,070 --> 00:02:37,920
plants and such or plants and roots and

72
00:02:41,910 --> 00:02:40,080
such there's all the minerals in there

73
00:02:44,949 --> 00:02:41,920
have been rounded off usually by some

74
00:02:46,949 --> 00:02:44,959
process uh weathering winds water that

75
00:02:48,309 --> 00:02:46,959
sort of thing and there's a lot of clays

76
00:02:49,990 --> 00:02:48,319
none of those things are true for

77
00:02:51,990 --> 00:02:50,000
regolith okay there's no weathering

78
00:02:54,309 --> 00:02:52,000
there's no overflowing water there's no

79
00:02:55,830 --> 00:02:54,319
living microbes and so what you what the

80
00:02:59,830 --> 00:02:55,840
regolith on these small bodies is

81
00:03:02,630 --> 00:02:59,840
composed of is more like uh impact

82
00:03:04,949 --> 00:03:02,640
gardened fragmented shocked shattered

83
00:03:06,869 --> 00:03:04,959
pieces of rock and they behave it it

84
00:03:08,550 --> 00:03:06,879
behaves very differently than material

85
00:03:10,390 --> 00:03:08,560
here on earth it's actually fairly

86
00:03:12,790 --> 00:03:10,400
difficult to study on earth for that

87
00:03:14,470 --> 00:03:12,800
reason so you're you've decided to study

88
00:03:16,790 --> 00:03:14,480

it in the weightless environment

89
00:03:19,110 --> 00:03:16,800
describe how the experiment operates

90
00:03:20,470 --> 00:03:19,120
what kind of control system do you have

91
00:03:22,550 --> 00:03:20,480
so that you can

92
00:03:24,630 --> 00:03:22,560
take out the chance factors and really

93
00:03:26,630 --> 00:03:24,640
find out how it behaves

94
00:03:28,470 --> 00:03:26,640
sure the uh

95
00:03:30,789 --> 00:03:28,480
the point of strata of the strata 1

96
00:03:33,110 --> 00:03:30,799
experiment is to test our current models

97
00:03:35,190 --> 00:03:33,120
of regolith on these bodies and and you

98
00:03:37,270 --> 00:03:35,200
know see where the discrepancies lie if

99
00:03:40,630 --> 00:03:37,280
if they if they're there at all

100
00:03:43,350 --> 00:03:40,640
strata is composed of has four tubes

101
00:03:44,949 --> 00:03:43,360
filled with regolith simulants on board

102
00:03:47,270 --> 00:03:44,959
and the reason why we have four is

103
00:03:49,350 --> 00:03:47,280
there's varying degrees of simplicity

104
00:03:51,430 --> 00:03:49,360
we've tried to break out the various

105
00:03:53,270 --> 00:03:51,440
factors that that go into the behavior

106
00:03:54,949 --> 00:03:53,280
of this material and separate them out

107
00:03:57,750 --> 00:03:54,959
so we can we can understand them one at

108
00:03:59,509 --> 00:03:57,760
a time there's the simplest model is

109
00:04:02,149 --> 00:03:59,519
just three different sizes of glass

110
00:04:03,589 --> 00:04:02,159
beads okay it's all spherical all of

111
00:04:04,710 --> 00:04:03,599
them are smooth all of them are the same

112
00:04:06,630 --> 00:04:04,720
material

113
00:04:08,149 --> 00:04:06,640

we go up a step in complexity to the

114
00:04:10,630 --> 00:04:08,159
next one which is

115
00:04:13,270 --> 00:04:10,640
three sizes of broken glass fragments so

116
00:04:14,630 --> 00:04:13,280
now we've got same material but angular

117
00:04:16,390 --> 00:04:14,640
fragments something more like you'd

118
00:04:18,870 --> 00:04:16,400
actually see in regolith and then the

119
00:04:21,270 --> 00:04:18,880
third one is crushed meteorite that's

120
00:04:23,350 --> 00:04:21,280
the stuff that

121
00:04:25,189 --> 00:04:23,360
the regolith on small bodies is actually

122
00:04:26,310 --> 00:04:25,199
composed of and you have angular

123
00:04:28,070 --> 00:04:26,320
fragments

124
00:04:29,749 --> 00:04:28,080
varying density because this stuff has

125
00:04:31,430 --> 00:04:29,759
metal and sulfides and other things in

126
00:04:34,790 --> 00:04:31,440
it and then the fourth is a carbonaceous

127
00:04:37,590 --> 00:04:34,800
chondrite to uh to support uh nasa

128
00:04:39,110 --> 00:04:37,600
emissions such as the osiris-rex mission

129
00:04:41,350 --> 00:04:39,120
which is going to go collect material

130
00:04:44,710 --> 00:04:41,360
from it from the regolith of a small

131
00:04:47,110 --> 00:04:44,720
carbon-rich body and do you just

132
00:04:48,950 --> 00:04:47,120
let it be and see how it reacts when

133
00:04:51,670 --> 00:04:48,960
there's no gravity to to work on it or

134
00:04:53,830 --> 00:04:51,680
are you doing something else to it

135
00:04:55,510 --> 00:04:53,840
it turns out the vibration environment

136
00:04:57,030 --> 00:04:55,520
on the international space station is

137
00:04:58,629 --> 00:04:57,040
fairly similar to what we'd expect to

138
00:05:00,790 --> 00:04:58,639

see on these small bodies you have the

139
00:05:02,950 --> 00:05:00,800
occasional thump you know

140
00:05:04,150 --> 00:05:02,960
in a kind of a low level background of

141
00:05:05,990 --> 00:05:04,160
movement

142
00:05:08,550 --> 00:05:06,000
previous experiments by university of

143
00:05:10,629 --> 00:05:08,560
central florida on short-lived parabolic

144
00:05:12,070 --> 00:05:10,639
flight short duration parabolic flight

145
00:05:14,390 --> 00:05:12,080
experiments have shown that we need to

146
00:05:16,230 --> 00:05:14,400
do this over do these types of

147
00:05:17,990 --> 00:05:16,240
experiments over spans of months and

148
00:05:19,430 --> 00:05:18,000
years to really understand the behavior

149
00:05:20,629 --> 00:05:19,440
of this material so what's going to

150
00:05:22,790 --> 00:05:20,639
happen is

151
00:05:25,029 --> 00:05:22,800
each of these tubes is the material has

152
00:05:28,310 --> 00:05:25,039
been sorted and it's held in place by a

153
00:05:30,469 --> 00:05:28,320
device we call the entrapulator and

154
00:05:32,790 --> 00:05:30,479
when the instrument is activated here

155
00:05:34,790 --> 00:05:32,800
shortly within next days or weeks the

156
00:05:36,710 --> 00:05:34,800
entrapulator will retract and allow the

157
00:05:38,870 --> 00:05:36,720
material to flow free and it's just

158
00:05:41,430 --> 00:05:38,880
going to be exposed to the ambient

159
00:05:43,270 --> 00:05:41,440
vibration environment on iss which will

160
00:05:45,430 --> 00:05:43,280
be carefully monitored with

161
00:05:47,430 --> 00:05:45,440
with the sams instrument package which

162
00:05:49,270 --> 00:05:47,440
is bolted to the front of

163
00:05:51,510 --> 00:05:49,280

strata one right now so we get the

164
00:05:53,510 --> 00:05:51,520
vibration data and we will watch the

165
00:05:55,590 --> 00:05:53,520
behavior of each of these materials

166
00:05:57,270 --> 00:05:55,600
there's a camera for each tube we're

167
00:06:00,469 --> 00:05:57,280
going to take pictures at a regular

168
00:06:02,230 --> 00:06:00,479
cadence and we'll have

169
00:06:04,070 --> 00:06:02,240
time lapse imagery basically over the

170
00:06:06,150 --> 00:06:04,080
course of a year and watch how this

171
00:06:08,070 --> 00:06:06,160
stuff sorts and move and rearranges

172
00:06:10,469 --> 00:06:08,080
itself under the under this vibration

173
00:06:12,629 --> 00:06:10,479
environment in uh in microgravity and

174
00:06:14,950 --> 00:06:12,639
then it comes back to earth we re-engage

175
00:06:16,950 --> 00:06:14,960
the entrapulator so nothing moves again

176
00:06:18,390 --> 00:06:16,960
bring it back to earth and we will core

177
00:06:20,390 --> 00:06:18,400
these things out carefully and look at

178
00:06:22,629 --> 00:06:20,400
the distribution of particles in terms

179
00:06:24,790 --> 00:06:22,639
of size and density where appropriate

180
00:06:26,070 --> 00:06:24,800
and compare the results to the existing

181
00:06:28,469 --> 00:06:26,080
models

182
00:06:30,309 --> 00:06:28,479
very interesting now this experiment is

183
00:06:31,749 --> 00:06:30,319
the product of a of a program here at

184
00:06:34,710 --> 00:06:31,759
the johnson space center that was

185
00:06:36,950 --> 00:06:34,720
designed to to get experiments to flight

186
00:06:38,950 --> 00:06:36,960
faster than what has has been the norm

187
00:06:42,550 --> 00:06:38,960
in the past how did that work out for

188
00:06:44,469 --> 00:06:42,560

you in getting strata 1 to fly yes it's

189
00:06:46,629 --> 00:06:44,479
called the 1e program

190
00:06:48,150 --> 00:06:46,639
historically getting to getting

191
00:06:50,230 --> 00:06:48,160
experiments to the space station has

192
00:06:53,110 --> 00:06:50,240
been a multi-year experiment

193
00:06:55,350 --> 00:06:53,120
experience strata one we got there there

194
00:06:57,830 --> 00:06:55,360
was strata one and several other 1e

195
00:07:00,790 --> 00:06:57,840
pathfinder experiments and we got strata

196
00:07:03,270 --> 00:07:00,800
one from concept to delivered hardware

197
00:07:05,749 --> 00:07:03,280
in 10 months so we took this all this

198
00:07:07,270 --> 00:07:05,759
all the scheduling all everything

199
00:07:09,189 --> 00:07:07,280
that had been set up for these longer

200
00:07:11,350 --> 00:07:09,199
duration development procedures and

201
00:07:13,430 --> 00:07:11,360
condensed it to 10 months it shook the

202
00:07:15,510 --> 00:07:13,440
system pretty pretty well

203
00:07:17,670 --> 00:07:15,520
but it didn't break um you know if it

204
00:07:19,430 --> 00:07:17,680
did then strata wouldn't be on iss right

205
00:07:20,950 --> 00:07:19,440
now we had a lot of good people helping

206
00:07:23,510 --> 00:07:20,960
who put in

207
00:07:25,189 --> 00:07:23,520
time after hours time on holidays and

208
00:07:27,029 --> 00:07:25,199
got this thing done had some good

209
00:07:29,430 --> 00:07:27,039
lessons learned of how to

210
00:07:32,790 --> 00:07:29,440
how to make this work seamlessly for

211
00:07:35,510 --> 00:07:32,800
future 1e experiments and i hope to see

212
00:07:37,110 --> 00:07:35,520
more 1e experiments as we go forward

213
00:07:39,430 --> 00:07:37,120

looking forward to see how