
NASA
SPACESTATION
LIVE

1
00:00:08,870 --> 00:00:06,789
the international space station is an

2
00:00:11,509 --> 00:00:08,880
orbiting science laboratory and it's

3
00:00:13,669 --> 00:00:11,519
also an orbiting technology test site

4
00:00:15,509 --> 00:00:13,679
place where new concepts and hardware

5
00:00:17,510 --> 00:00:15,519
designed to improve our ability to

6
00:00:19,750 --> 00:00:17,520
travel in space can be tested in a

7
00:00:22,230 --> 00:00:19,760
weightless environment one successful

8
00:00:25,029 --> 00:00:22,240
example is the apparatus called the

9
00:00:26,870 --> 00:00:25,039
amine swingbed a system to filter and

10
00:00:29,509 --> 00:00:26,880
renew the air for the crew members to

11
00:00:31,589 --> 00:00:29,519
breathe inside their spacecraft recently

12
00:00:33,830 --> 00:00:31,599
my colleague pat ryan had a chance to

13
00:00:36,630 --> 00:00:33,840

talk with the amine swingbed principal

14
00:00:38,709 --> 00:00:36,640
investigator dr jeffrey sweterlick of

15
00:00:41,030 --> 00:00:38,719
the crew and thermal systems division

16
00:00:43,350 --> 00:00:41,040
here at nasa johnson space center and

17
00:00:45,510 --> 00:00:43,360
asked how this system works to clean the

18
00:00:47,990 --> 00:00:45,520
air on the station

19
00:00:50,389 --> 00:00:48,000
the way that the swing bag works is

20
00:00:53,350 --> 00:00:50,399
there is sorbent media contained in this

21
00:00:55,990 --> 00:00:53,360
basically a bed of rocks absorbent media

22
00:00:58,389 --> 00:00:56,000
that absorbs carbon dioxide and humidity

23
00:00:59,830 --> 00:00:58,399
and one bed is exposed to the cabin

24
00:01:03,029 --> 00:00:59,840
atmosphere and the other is exposed to

25
00:01:04,869 --> 00:01:03,039
vacuum the way that it's similar to the

26
00:01:06,789 --> 00:01:04,879
carbon dioxide removal assembly on

27
00:01:08,630 --> 00:01:06,799
station in a sense that you have two

28
00:01:09,910 --> 00:01:08,640
beds that go back and forth

29
00:01:11,990 --> 00:01:09,920
the difference is we don't have to do

30
00:01:13,750 --> 00:01:12,000
any heating with our system and it's a

31
00:01:15,190 --> 00:01:13,760
different tech different sorbent media

32
00:01:17,030 --> 00:01:15,200
that's being used

33
00:01:18,550 --> 00:01:17,040
we don't save our carbon dioxide this

34
00:01:20,550 --> 00:01:18,560
carbon dioxide that we absorb we went

35
00:01:21,910 --> 00:01:20,560
out to space

36
00:01:24,630 --> 00:01:21,920
so those are some of the differences

37
00:01:26,789 --> 00:01:24,640
that are between our system and the

38
00:01:28,789 --> 00:01:26,799

primary carbon dioxide removal system

39
00:01:30,870 --> 00:01:28,799
when you say you don't have to heat it i

40
00:01:33,030 --> 00:01:30,880
take it the other system does what is

41
00:01:35,350 --> 00:01:33,040
that to activate the that's how they

42
00:01:37,350 --> 00:01:35,360
regenerate their sorbent media our beds

43
00:01:39,749 --> 00:01:37,360
are designed so that the heat from

44
00:01:42,069 --> 00:01:39,759
adsorption transfers to the other bed

45
00:01:44,469 --> 00:01:42,079
doing the desorption so it's basically

46
00:01:45,510 --> 00:01:44,479
isothermal constant temperature process

47
00:01:47,749 --> 00:01:45,520
for us

48
00:01:49,429 --> 00:01:47,759
it reduces the energy demands

49
00:01:52,149 --> 00:01:49,439
which is also which is always a good

50
00:01:54,469 --> 00:01:52,159
thing on the spacecraft now i understand

51
00:01:56,230 --> 00:01:54,479
that this apparatus was originally

52
00:01:57,910 --> 00:01:56,240
designed to be used on the orion

53
00:02:00,550 --> 00:01:57,920
spacecraft

54
00:02:02,630 --> 00:02:00,560
so how does it come to be up in space on

55
00:02:04,389 --> 00:02:02,640
the international space station so it's

56
00:02:07,830 --> 00:02:04,399
an interesting story we were doing a lot

57
00:02:09,589 --> 00:02:07,840
of testing in our facilities here at jsc

58
00:02:10,869 --> 00:02:09,599
and people knew that we were doing some

59
00:02:11,910 --> 00:02:10,879
of this work

60
00:02:13,350 --> 00:02:11,920
and so

61
00:02:15,589 --> 00:02:13,360
management came to us and said we'd like

62
00:02:17,350 --> 00:02:15,599
to see how this would work in a real

63
00:02:18,949 --> 00:02:17,360

space flight environment

64
00:02:21,350 --> 00:02:18,959
and would you like an opportunity to try

65
00:02:22,790 --> 00:02:21,360
it out make sure exactly so we've done a

66
00:02:25,190 --> 00:02:22,800
lot of ground testing we even did some

67
00:02:26,949 --> 00:02:25,200
testing with some humans back in in the

68
00:02:28,630 --> 00:02:26,959
2008 time frame

69
00:02:30,070 --> 00:02:28,640
but then we started saying okay how are

70
00:02:31,750 --> 00:02:30,080
we going to get this on orbit because

71
00:02:33,670 --> 00:02:31,760
there are different demands

72
00:02:36,070 --> 00:02:33,680
for running this type of equipment on

73
00:02:37,670 --> 00:02:36,080
space station than you would in orion

74
00:02:40,070 --> 00:02:37,680
the orion missions they are shorter

75
00:02:41,910 --> 00:02:40,080
duration they're typically not going to

76
00:02:44,070 --> 00:02:41,920
be um

77
00:02:45,509 --> 00:02:44,080
they're going to be 20 days 30 day

78
00:02:47,509 --> 00:02:45,519
missions where stations up there for

79
00:02:48,550 --> 00:02:47,519
months and months and months at a time

80
00:02:50,070 --> 00:02:48,560
and so

81
00:02:52,150 --> 00:02:50,080
um the main thing is you want to make

82
00:02:53,350 --> 00:02:52,160
sure you save your resources as you go

83
00:02:54,949 --> 00:02:53,360
over and over

84
00:02:57,110 --> 00:02:54,959
rather than

85
00:02:58,869 --> 00:02:57,120
venting continuously which is what orion

86
00:03:00,470 --> 00:02:58,879
will be doing so we had to add

87
00:03:02,630 --> 00:03:00,480
additional hardware

88
00:03:04,149 --> 00:03:02,640

to see how to reduce our water losses

89
00:03:06,149 --> 00:03:04,159
and our air losses which are less of a

90
00:03:08,149 --> 00:03:06,159
concern for short mission but are very

91
00:03:09,270 --> 00:03:08,159
important to know about for long-term

92
00:03:11,030 --> 00:03:09,280
missions on stations so there's

93
00:03:12,390 --> 00:03:11,040
additional equipment that we added to

94
00:03:14,149 --> 00:03:12,400
the system

95
00:03:15,509 --> 00:03:14,159
to make it more compatible to the space

96
00:03:18,229 --> 00:03:15,519
station environment

97
00:03:20,790 --> 00:03:18,239
and it's been up there since uh may of

98
00:03:22,550 --> 00:03:20,800
2013. right we started operating in may

99
00:03:24,710 --> 00:03:22,560
of 2013. we had about a year and a half

100
00:03:26,070 --> 00:03:24,720
worth of troubleshooting to go on so

101
00:03:28,390 --> 00:03:26,080
that took some time to get that going

102
00:03:30,630 --> 00:03:28,400
but when we finally got it operational

103
00:03:32,229 --> 00:03:30,640
um we started operating it doing our

104
00:03:34,070 --> 00:03:32,239
science test we had about a thousand

105
00:03:35,350 --> 00:03:34,080
hours of planned test runs that we

106
00:03:38,229 --> 00:03:35,360
wanted to do

107
00:03:41,110 --> 00:03:38,239
and um we finished that up back in

108
00:03:43,270 --> 00:03:41,120
february time frame of last year

109
00:03:45,270 --> 00:03:43,280
how did it do it worked right it worked

110
00:03:47,190 --> 00:03:45,280
very nice it compared we had a couple of

111
00:03:49,750 --> 00:03:47,200
software things that we had to adjust as

112
00:03:50,869 --> 00:03:49,760
we were uh moving along but what we

113
00:03:51,830 --> 00:03:50,879

found was

114
00:03:53,670 --> 00:03:51,840
um

115
00:03:55,750 --> 00:03:53,680
it behaved very similar to how we tested

116
00:03:57,830 --> 00:03:55,760
on the ground which is

117
00:04:00,710 --> 00:03:57,840
produces a big boost of confidence yeah

118
00:04:02,789 --> 00:04:00,720
that the design is good and uh that also

119
00:04:04,789 --> 00:04:02,799
provides confidence to orion

120
00:04:06,789 --> 00:04:04,799
because their system is looking very

121
00:04:09,030 --> 00:04:06,799
similar to what we do in terms of the

122
00:04:10,630 --> 00:04:09,040
carbon dioxide removal function

123
00:04:12,390 --> 00:04:10,640
so it gives them a lot of confidence as

124
00:04:14,630 --> 00:04:12,400
well hey we've operated this in a real

125
00:04:16,229 --> 00:04:14,640
spacecraft environment that's good news

126
00:04:18,310 --> 00:04:16,239
for the orion program

127
00:04:21,270 --> 00:04:18,320
did you learn anything from the actual

128
00:04:23,189 --> 00:04:21,280
operation that you can apply back into

129
00:04:25,030 --> 00:04:23,199
the orion version there was a very

130
00:04:26,629 --> 00:04:25,040
unique technical issue that came up the

131
00:04:28,469 --> 00:04:26,639
swing bed the way that it works is

132
00:04:30,710 --> 00:04:28,479
there's basically two beds as i said

133
00:04:33,189 --> 00:04:30,720
earlier but there's a valve that rotates

134
00:04:34,390 --> 00:04:33,199
between bed a and bed b to direct the

135
00:04:36,950 --> 00:04:34,400
air flow

136
00:04:39,590 --> 00:04:36,960
and there was a feature with that valve

137
00:04:40,790 --> 00:04:39,600
that we found out during our testing

138
00:04:42,710 --> 00:04:40,800

that if you

139
00:04:43,990 --> 00:04:42,720
that could result in an over rotation

140
00:04:46,230 --> 00:04:44,000
and the problem with that is you could

141
00:04:48,310 --> 00:04:46,240
now have a direct path from cabin

142
00:04:50,790 --> 00:04:48,320
atmosphere to space vacuum which would

143
00:04:52,950 --> 00:04:50,800
be a bad thing yes so

144
00:04:54,629 --> 00:04:52,960
they when we learned about this

145
00:04:55,990 --> 00:04:54,639
uh situation

146
00:04:58,390 --> 00:04:56,000
that was information we were able to

147
00:05:00,230 --> 00:04:58,400
provide to the orion program and they've

148
00:05:02,550 --> 00:05:00,240
made some design changes because of that

149
00:05:04,230 --> 00:05:02,560
thing that we found out so

150
00:05:06,150 --> 00:05:04,240
the version we have on orbit won't

151
00:05:07,990 --> 00:05:06,160
suffer that issue this was a ground test

152
00:05:09,430 --> 00:05:08,000
that we tried out

153
00:05:11,430 --> 00:05:09,440
and um

154
00:05:12,629 --> 00:05:11,440
the new version is a lot more robust and

155
00:05:14,790 --> 00:05:12,639
so that

156
00:05:16,469 --> 00:05:14,800
that risk of having a direct path to

157
00:05:18,310 --> 00:05:16,479
space vacuum from the cabin isn't going

158
00:05:20,550 --> 00:05:18,320
to happen now now you mentioned you

159
00:05:22,469 --> 00:05:20,560
completed the testing in february of

160
00:05:24,870 --> 00:05:22,479
2014

161
00:05:27,029 --> 00:05:24,880
what is emming swingbed been doing up

162
00:05:29,749 --> 00:05:27,039
there uh since then what what's what's

163
00:05:31,510 --> 00:05:29,759

it going to keep doing so correct we did

164
00:05:33,510 --> 00:05:31,520
a lot about a thousand hours of test

165
00:05:35,749 --> 00:05:33,520
planning and since then we've done more

166
00:05:37,830 --> 00:05:35,759
than a thousand hours of actually

167
00:05:39,670 --> 00:05:37,840
providing contingency carbon dioxide

168
00:05:41,590 --> 00:05:39,680
removal systems when they take one of

169
00:05:43,670 --> 00:05:41,600
the primary systems down to do some

170
00:05:46,230 --> 00:05:43,680
maintenance they ask us to turn on to

171
00:05:49,189 --> 00:05:46,240
help with some of the co2 and removal

172
00:05:50,870 --> 00:05:49,199
functions going on so basically we are a

173
00:05:52,230 --> 00:05:50,880
backup when there's requests from the

174
00:05:53,909 --> 00:05:52,240
flight director or from some of the

175
00:05:56,070 --> 00:05:53,919
console operators say we need a little

176
00:05:57,350 --> 00:05:56,080
extra co2 removal

177
00:05:59,670 --> 00:05:57,360
they call us up

178
00:06:01,029 --> 00:05:59,680
and we operate it ourselves not in from

179
00:06:02,070 --> 00:06:01,039
the flight control room but from mission

180
00:06:03,749 --> 00:06:02,080
control

181
00:06:07,990 --> 00:06:03,759
and

182
00:06:10,150 --> 00:06:08,000
it's a very simple system to operate

183
00:06:12,150 --> 00:06:10,160
would be uh it'd be great to uh to see

184
00:06:14,390 --> 00:06:12,160
it running in in the future spacecraft

185
00:06:15,830 --> 00:06:14,400
too yes it will it i'm sure it will

186
00:06:18,230 --> 00:06:15,840
definitely be running in the future

187
00:06:19,510 --> 00:06:18,240
spacecraft we are planning we'll keep it

188
00:06:21,350 --> 00:06:19,520

up there as long as the space station

189
00:06:22,550 --> 00:06:21,360
program wants us to operate which could

190
00:06:24,070 --> 00:06:22,560
be

191
00:06:25,749 --> 00:06:24,080
another couple years who know i don't

192
00:06:26,950 --> 00:06:25,759
know exactly how long that will be but

193
00:06:28,150 --> 00:06:26,960
we haven't seen any changes in

194
00:06:30,390 --> 00:06:28,160
performance

195
00:06:32,469 --> 00:06:30,400
over the last two years of operations so

196
00:06:33,990 --> 00:06:32,479
that's also you know

197
00:06:35,830 --> 00:06:34,000
a very good thing for both the orion

198
00:06:37,909 --> 00:06:35,840
program and station program as well

199
00:06:39,670 --> 00:06:37,919
that's great jeff thanks very much for

200
00:06:42,309 --> 00:06:39,680
for bringing us up to date well thank

201
00:06:44,309 --> 00:06:42,319
you dr jeffrey sweterlich is the

202
00:06:46,230 --> 00:06:44,319
principal investigator of the amine