1
00:00:05,990 --> 00:00:03,909
so in a typical office setting you may

2
00:00:08,070 --> 00:00:06,000
think about the installation and the

3
00:00:09,990 --> 00:00:08,080
setup of a new printer not really always

4
00:00:12,390 --> 00:00:10,000
cause for celebration sometimes cause

5
00:00:15,190 --> 00:00:12,400
for consternation but when your office

6
00:00:17,670 --> 00:00:15,200
is like wilmore's orbiting more than 200

7
00:00:20,310 --> 00:00:17,680
miles above the ground the scientists

8
00:00:23,189 --> 00:00:20,320
around the world will take notice so

9
00:00:24,790 --> 00:00:23,199
today we are joined by bill hubshere out

10
00:00:26,550 --> 00:00:24,800
at the payload operations and

11
00:00:28,550 --> 00:00:26,560
integration center at the marshall space

12
00:00:30,150 --> 00:00:28,560
flight center in huntsville alabama

13
00:00:31,990 --> 00:00:30,160

who's going to tell us a little bit more

14
00:00:33,910 --> 00:00:32,000
on the installation of this first 3d

15
00:00:36,069 --> 00:00:33,920
printer in space bill

16
00:00:37,910 --> 00:00:36,079
thanks a lot dan as we go about science

17
00:00:39,190 --> 00:00:37,920
activities on the space station as you

18
00:00:40,869 --> 00:00:39,200
mentioned there's very little that we

19
00:00:42,630 --> 00:00:40,879
can call routine there are many

20
00:00:45,670 --> 00:00:42,640
challenges about living and working in

21
00:00:48,229 --> 00:00:45,680
space including when a part or a tool is

22
00:00:50,310 --> 00:00:48,239
broken or simply is is not working

23
00:00:52,310 --> 00:00:50,320
correctly and the spare part is 200

24
00:00:54,709 --> 00:00:52,320
miles away here on the surface of the

25
00:00:56,950 --> 00:00:54,719
earth while explorers traveling mars or

26
00:00:58,310 --> 00:00:56,960
or traveling to mars or to asteroids

27
00:01:00,549 --> 00:00:58,320
will face these same challenges but they

28
00:01:02,790 --> 00:01:00,559
won't be able to get any supplies from a

29
00:01:04,469 --> 00:01:02,800
from a supply ship the station as you

30
00:01:06,230 --> 00:01:04,479
mentioned is the ideal laboratory to

31
00:01:08,550 --> 00:01:06,240
test these technologies to help us live

32
00:01:10,310 --> 00:01:08,560
and work off the earth well this morning

33
00:01:12,230 --> 00:01:10,320
on the space station commander butch

34
00:01:14,230 --> 00:01:12,240
wilmore is installing a brand new device

35
00:01:16,390 --> 00:01:14,240
that once installed could change the way

36
00:01:19,270 --> 00:01:16,400
we handle fixing problems in space a

37
00:01:20,390 --> 00:01:19,280
brand new 3d printer here to talk a

38
00:01:22,149 --> 00:01:20,400

little bit about it this morning is

39
00:01:23,590 --> 00:01:22,159
project manager for the 3d printing

40
00:01:25,270 --> 00:01:23,600
project here in marshall nikki

41
00:01:27,350 --> 00:01:25,280
workheiser thanks for making the time

42
00:01:29,190 --> 00:01:27,360
this morning my pleasure it's a busy and

43
00:01:30,630 --> 00:01:29,200
exciting morning for you and your team

44
00:01:32,310 --> 00:01:30,640
tell us a little bit about what butch is

45
00:01:34,550 --> 00:01:32,320
doing first thing this morning so today

46
00:01:35,990 --> 00:01:34,560
is a very big day for us this morning

47
00:01:37,910 --> 00:01:36,000
first thing what they did is they took

48
00:01:39,429 --> 00:01:37,920
the 3d printer out of the stowage

49
00:01:41,350 --> 00:01:39,439
location where it has been since the

50
00:01:43,030 --> 00:01:41,360
spacex 4 launch

51
00:01:44,870 --> 00:01:43,040
and they've actually installed it into

52
00:01:46,230 --> 00:01:44,880
the micro gravity science laboratory

53
00:01:47,510 --> 00:01:46,240
glove box

54
00:01:48,789 --> 00:01:47,520
there it's really important obviously

55
00:01:50,230 --> 00:01:48,799
we're getting all the electronics hooked

56
00:01:52,710 --> 00:01:50,240
up making sure everything's functional

57
00:01:55,030 --> 00:01:52,720
testing the commanding also actually the

58
00:01:57,350 --> 00:01:55,040
printer has two windows

59
00:01:58,950 --> 00:01:57,360
and we're placing the msg cameras very

60
00:02:01,350 --> 00:01:58,960
closely to those windows so we can

61
00:02:02,310 --> 00:02:01,360
monitor the actual extrusion extrusion

62
00:02:03,749 --> 00:02:02,320
process

63
00:02:05,270 --> 00:02:03,759

as the prints and the layers are being

64
00:02:06,550 --> 00:02:05,280
deposited we'll be able to see that in

65
00:02:08,550 --> 00:02:06,560
detail

66
00:02:10,869 --> 00:02:08,560
and then later on today once all of that

67
00:02:13,589 --> 00:02:10,879
is is set up and we'll actually print

68
00:02:15,510 --> 00:02:13,599
our first calibration coupon we'll

69
00:02:17,110 --> 00:02:15,520
probably print a couple of these

70
00:02:19,190 --> 00:02:17,120
and this is part of the functional

71
00:02:20,470 --> 00:02:19,200
checkout for the printer itself just to

72
00:02:22,949 --> 00:02:20,480
make sure everything is functioning

73
00:02:25,510 --> 00:02:22,959
correctly and that we get uh the machine

74
00:02:27,110 --> 00:02:25,520
itself calibrated before we go into the

75
00:02:28,869 --> 00:02:27,120
full operation so that's about the size

76
00:02:30,630 --> 00:02:28,879
of a poacher stamp turn it on edge so we

77
00:02:31,750 --> 00:02:30,640
can see how thin that is

78
00:02:33,750 --> 00:02:31,760
this is how many layers do you think

79
00:02:34,949 --> 00:02:33,760
that is oh goodness um

80
00:02:37,509 --> 00:02:34,959
probably

81
00:02:39,110 --> 00:02:37,519
about 25 or 30. and this is a standard

82
00:02:41,190 --> 00:02:39,120
kind of calibration coupon that we would

83
00:02:42,790 --> 00:02:41,200
use on the ground as well so once the

84
00:02:44,630 --> 00:02:42,800
printer is installed and calibrated what

85
00:02:46,949 --> 00:02:44,640
happens next so next we'll actually

86
00:02:49,509 --> 00:02:46,959
start our full suite of printing

87
00:02:51,509 --> 00:02:49,519
engineering test coupons you'll start

88
00:02:54,869 --> 00:02:51,519

seeing things like

89
00:02:57,910 --> 00:02:54,879
this and and this which are standard

90
00:03:01,350 --> 00:02:57,920
tinsel coupons that we use on the ground

91
00:03:04,229 --> 00:03:01,360
things like a tinsel coupon for testing

92
00:03:06,309 --> 00:03:04,239
strength of in-space printing and the

93
00:03:08,070 --> 00:03:06,319
range coupon to see the tolerances that

94
00:03:10,550 --> 00:03:08,080
we can print um

95
00:03:12,149 --> 00:03:10,560
on orbit and a variety of sizes of whole

96
00:03:13,509 --> 00:03:12,159
variety of sizes to see how small and

97
00:03:15,910 --> 00:03:13,519
how large we can go yes within a

98
00:03:17,110 --> 00:03:15,920
tolerance all right so um what do you

99
00:03:18,309 --> 00:03:17,120
think the team will learn from from

100
00:03:20,229 --> 00:03:18,319
these variety of prints that you've been

101
00:03:21,589 --> 00:03:20,239
showing us the real objective of this

102
00:03:24,149 --> 00:03:21,599
first phase of the technology

103
00:03:26,390 --> 00:03:24,159
demonstration is just to verify that the

104
00:03:28,949 --> 00:03:26,400
process works in microgravity the same

105
00:03:31,270 --> 00:03:28,959
way it does on the ground

106
00:03:33,190 --> 00:03:31,280
nasa and main space have flown parabolic

107
00:03:35,430 --> 00:03:33,200
flights and tested this but you only get

108
00:03:37,910 --> 00:03:35,440
the short spurts of microgravity so

109
00:03:39,110 --> 00:03:37,920
being able to test this on space station

110
00:03:41,110 --> 00:03:39,120
and print complete parts and

111
00:03:42,869 --> 00:03:41,120
microgravity as you mentioned

112
00:03:44,550 --> 00:03:42,879
space station is the actually the only

113
00:03:46,630 --> 00:03:44,560

platform where we're able to test this

114
00:03:48,789 --> 00:03:46,640
technology before we use it in further

115
00:03:50,869 --> 00:03:48,799
out exploration missions now these

116
00:03:52,229 --> 00:03:50,879
objects and some of these others were

117
00:03:54,869 --> 00:03:52,239
built right here in marshall's additive

118
00:03:57,270 --> 00:03:54,879
manufacturing area uh in the printer

119
00:03:59,350 --> 00:03:57,280
that is actually on station right yes

120
00:04:01,110 --> 00:03:59,360
actually uh so after we finish the

121
00:04:03,190 --> 00:04:01,120
flight certification testing and the

122
00:04:04,949 --> 00:04:03,200
integration testing at marshall in the

123
00:04:07,190 --> 00:04:04,959
flight unit before it flew we printed

124
00:04:09,350 --> 00:04:07,200
the full suite of samples just like

125
00:04:11,509 --> 00:04:09,360
we're printing on orbit so that we have

126
00:04:12,789 --> 00:04:11,519
those ground control samples then when

127
00:04:14,710 --> 00:04:12,799
the parts are returned we'll be able to

128
00:04:16,469 --> 00:04:14,720
do detailed analysis to study those

129
00:04:17,909 --> 00:04:16,479
results and do an apples to apples

130
00:04:20,069 --> 00:04:17,919
comparison all right now this is another

131
00:04:21,509 --> 00:04:20,079
sample you've picked up here um someone

132
00:04:23,510 --> 00:04:21,519
looks like the actual honest to goodness

133
00:04:24,950 --> 00:04:23,520
tools yes so i mentioned the first phase

134
00:04:26,550 --> 00:04:24,960
is really focused around those

135
00:04:28,469 --> 00:04:26,560
engineering samples that we'll be

136
00:04:30,070 --> 00:04:28,479
studying but then the second phase once

137
00:04:32,469 --> 00:04:30,080
we see that the process works in

138
00:04:34,310 --> 00:04:32,479

microgravity the same way and will turn

139
00:04:36,150 --> 00:04:34,320
its focus more toward the parts that we

140
00:04:39,110 --> 00:04:36,160
print and demonstrating their

141
00:04:40,710 --> 00:04:39,120
utilization on space station well i know

142
00:04:42,469 --> 00:04:40,720
nasa worked with a group of young

143
00:04:44,950 --> 00:04:42,479
engineers from the company made in space

144
00:04:46,310 --> 00:04:44,960
to design and test the printer what's

145
00:04:47,909 --> 00:04:46,320
their role in the upcoming printer

146
00:04:50,469 --> 00:04:47,919
operations so made in space has been

147
00:04:52,870 --> 00:04:50,479
fantastic um we this project is actually

148
00:04:55,030 --> 00:04:52,880
made possible through a small business

149
00:04:56,950 --> 00:04:55,040
innovation research contract

150
00:04:58,230 --> 00:04:56,960
where mainspace actually designed and

151
00:05:00,150 --> 00:04:58,240
built the printer

152
00:05:01,670 --> 00:05:00,160
with nasa involved throughout the entire

153
00:05:03,189 --> 00:05:01,680
process through the design and the

154
00:05:05,029 --> 00:05:03,199
certification

155
00:05:06,950 --> 00:05:05,039
to provide insight and guidance on

156
00:05:08,710 --> 00:05:06,960
flight certification and we actually

157
00:05:11,110 --> 00:05:08,720
also performed all of the the testing

158
00:05:13,510 --> 00:05:11,120
here at marshall main space is located

159
00:05:14,870 --> 00:05:13,520
in silicon valley and they are actually

160
00:05:17,430 --> 00:05:14,880
today going to be doing all the

161
00:05:19,350 --> 00:05:17,440
commanding to the printer on orbit so

162
00:05:20,790 --> 00:05:19,360
they'll have direct control then

163
00:05:23,029 --> 00:05:20,800

absolutely from the ground we try to

164
00:05:24,710 --> 00:05:23,039
limit astronaut time as much as possible

165
00:05:27,029 --> 00:05:24,720
now while this is only a technical

166
00:05:28,870 --> 00:05:27,039
demonstration if you will of 3d printing

167
00:05:30,390 --> 00:05:28,880
in space why is this technology so

168
00:05:32,070 --> 00:05:30,400
important to future exploration

169
00:05:34,629 --> 00:05:32,080
absolutely great question so this is

170
00:05:36,310 --> 00:05:34,639
actually truly a historical moment

171
00:05:37,909 --> 00:05:36,320
since the inception of the human space

172
00:05:40,150 --> 00:05:37,919
program we have been completely

173
00:05:42,870 --> 00:05:40,160
dependent on launching every single

174
00:05:45,430 --> 00:05:42,880
thing we need from earth to space

175
00:05:46,950 --> 00:05:45,440
so it's a very constrained supply and

176
00:05:48,310 --> 00:05:46,960
demand chain

177
00:05:49,990 --> 00:05:48,320
for exploration missions you mentioned

178
00:05:51,990 --> 00:05:50,000
earlier that's just not plausible it's

179
00:05:54,070 --> 00:05:52,000
not feasible so i think we're making

180
00:05:55,110 --> 00:05:54,080
history by for the first time ever being

181
00:05:57,189 --> 00:05:55,120
able to

182
00:05:59,270 --> 00:05:57,199
make what we need when we need it in

183
00:06:00,950 --> 00:05:59,280
space and even though it may sound a

184
00:06:02,870 --> 00:06:00,960
little like science fiction

185
00:06:04,629 --> 00:06:02,880
we're actually able to email our

186
00:06:05,350 --> 00:06:04,639
hardware to space instead of launching

187
00:06:08,870 --> 00:06:05,360
it

188
00:06:10,710 --> 00:06:08,880

nikki very much we look forward to

189
00:06:12,070 --> 00:06:10,720
seeing some of these samples come back