1
00:00:00,076 --> 00:00:03,006
>> This is Mission Control
Houston, let's go down now

2
00:00:03,006 --> 00:00:05,316
to the Marshall Space Flight
Center in Huntsville, Alabama

3
00:00:05,316 --> 00:00:06,506
and talk with Lori Meggs.

4
00:00:06,506 --> 00:00:09,856
Lori, typically we wouldn't be
talking about a printer heading

5
00:00:09,856 --> 00:00:11,526
up to the Space Station
but we hear

6
00:00:11,526 --> 00:00:16,916
that this one may be a little
bit different and special.

7
00:00:17,066 --> 00:00:17,586
>> Lori Meggs: That'
right, Josh.

8
00:00:17,586 --> 00:00:18,846
It's not your average printer.

9
00:00:19,106 --> 00:00:22,586
This is a 3-D printer that
could be used on Space Station

10
00:00:22,586 --> 00:00:24,596
where NASA astronauts
might not have to wait

11
00:00:24,596 --> 00:00:27,466

on resupply space craft
to their supplies.

12
00:00:27,506 --> 00:00:30,686
They may be actually able to
build something right there.

13
00:00:30,686 --> 00:00:32,256
Joining me now is
Niki Werkheiser

14
00:00:32,256 --> 00:00:35,126
and she is the 3-D print project
manager here at Marshall.

15
00:00:35,406 --> 00:00:37,806
Niki, first of all, tell us
what 3-D printing is all about.

16
00:00:37,906 --> 00:00:38,636
>> Niki Werkheiser:
Hi Lori, happy to.

17
00:00:38,636 --> 00:00:40,286
Thank you for having me.

18
00:00:40,326 --> 00:00:43,776
3-D printing, a 3-D printer
will extrude plastic,

19
00:00:43,776 --> 00:00:47,726
metals or other materials to
build layer on top of layer

20
00:00:47,726 --> 00:00:49,646
to create a three
dimensional object.

21
00:00:49,966 --> 00:00:52,846
So you might be able to

print all sorts of tools,

22
00:00:53,336 --> 00:00:54,626
spare parts, things like that.

23
00:00:55,496 --> 00:00:56,286
>> Lori Meggs: So
it kind of sounds

24
00:00:56,286 --> 00:00:58,356
like the Star Trek
replicator, right?

25
00:00:58,776 --> 00:00:59,406
>> Niki Werkheiser: Absolutely.

26
00:00:59,406 --> 00:01:01,456
We get that a lot and it
is the first step toward.

27
00:01:03,106 --> 00:01:03,956
>> Lori Meggs: Tell
us how it all works.

28
00:01:04,326 --> 00:01:04,676
>> Niki Werkhesier: Okay.

29
00:01:04,676 --> 00:01:06,106
The 3-D printer that
we're going to fly

30
00:01:06,106 --> 00:01:08,946
in Space Station will actually
be the first ever 3-D printer

31
00:01:08,946 --> 00:01:10,256
in space.

32
00:01:10,256 --> 00:01:11,526

There are tons of printers.

33
00:01:11,526 --> 00:01:12,756
Many people have heard
about on the ground.

34
00:01:12,756 --> 00:01:15,266
As a matter of fact, my 9 and
11-year-old daughters are asking

35
00:01:15,266 --> 00:01:16,246
for one for Christmas.

36
00:01:16,276 --> 00:01:18,436
And they have them at
Staples and places like that.

37
00:01:18,436 --> 00:01:20,696
And you can create all kinds
of things with them but the one

38
00:01:20,696 --> 00:01:22,636
that we're looking at for
microgravity, of course.

39
00:01:22,686 --> 00:01:23,896
We want to build space parts.

40
00:01:24,306 --> 00:01:26,646
So the design optimization
is very important.

41
00:01:26,996 --> 00:01:29,536
As we all know in space,
you have to wait for,

42
00:01:29,536 --> 00:01:30,876
as you mentioned,
the resupply ships.

43
00:01:30,966 --> 00:01:34,446
If you need a spare part or
you have to fly a lot of spares

44
00:01:34,446 --> 00:01:38,756
up which take considerable
mass and which cost money.

45
00:01:38,816 --> 00:01:41,746
Also things break and
things do actually get lost.

46
00:01:41,876 --> 00:01:43,406
We've been on Space
Station for quite a while

47
00:01:43,406 --> 00:01:45,516
and things get sucked
into corners and crevices.

48
00:01:45,516 --> 00:01:45,966
>> Lori Meggs: No.

49
00:01:45,966 --> 00:01:47,116
>> Niki Werkheiser:
Yes it happened.

50
00:01:47,116 --> 00:01:50,156
And on top of that, there
are unique types of things

51
00:01:50,156 --> 00:01:52,326
that we could do if we had a
capability to build in space.

52
00:01:52,386 --> 00:01:53,586
For example, cube
sats [phonetic].

53

00:01:53,706 --> 00:01:55,486
Many people have about
these small cube sats

54
00:01:55,616 --> 00:01:58,626
and with the onset of nano-sat
technologies that we have,

55
00:01:58,896 --> 00:02:02,356
these are used for all sorts of
things in academia, commercial,

56
00:02:02,356 --> 00:02:05,026
and you actually can deploy
them from the Space Station.

57
00:02:05,326 --> 00:02:07,436
If we were able to
print these on orbit,

58
00:02:07,436 --> 00:02:09,896
the crew could assembly them
and deploy them from Station.

59
00:02:10,086 --> 00:02:13,876
You can do all sorts of unique
structures and just an abundance

60
00:02:13,876 --> 00:02:15,266
of different types
of experiments.

61
00:02:15,266 --> 00:02:17,496
>> Lori Meggs: So this one
was built here at Marshall.

62
00:02:17,546 --> 00:02:18,556
>> Niki Werkheiser: Yeah,
this one was printed here.

63

00:02:18,556 --> 00:02:19,936
And this is just kind
of a case of one.

64
00:02:19,936 --> 00:02:21,406
It's got some electronics
that go inside

65
00:02:21,406 --> 00:02:22,726
and you deploy it from Station.

66
00:02:22,966 --> 00:02:23,636
>> Lori Meggs: So
how long does it take

67
00:02:23,756 --> 00:02:24,586
to build something like that?

68
00:02:24,586 --> 00:02:24,976
>> Niki Werkheiser: Something

69
00:02:24,976 --> 00:02:27,346
like this would actually
only probably take an hour,

70
00:02:27,346 --> 00:02:28,196
hour and a half.

71
00:02:28,296 --> 00:02:31,056
And then you also
have things like this.

72
00:02:31,056 --> 00:02:32,166
It looks pretty nonassuming.

73
00:02:32,166 --> 00:02:33,096
It looks pretty simple.

74
00:02:33,096 --> 00:02:35,136

You could print this
probably in 15 to 20 minutes

75
00:02:35,136 --> 00:02:37,326
and we would just
upload a CAD drawing

76
00:02:37,486 --> 00:02:39,006
to the printer on station.

77
00:02:39,356 --> 00:02:42,466
But what this is actually
is MSG, an extraction tool

78
00:02:42,836 --> 00:02:44,276
that they did not have on orbit.

79
00:02:44,656 --> 00:02:47,516
And actually MSGG was down
for around 6 months waiting

80
00:02:47,516 --> 00:02:48,806
on a resupply ship
to bring this up.

81
00:02:49,386 --> 00:02:51,456
This is something with the
3-D printer capabilitiy

82
00:02:51,456 --> 00:02:54,606
that we could've actually
printed, had in orbit within 30,

83
00:02:54,646 --> 00:02:56,376
45 minutes able to go.

84
00:02:56,636 --> 00:02:58,056
>> Lori Meggs: Wow, what else
do we see here [inaudible] the

85
00:02:58,056 --> 00:02:58,216
machine --

86
00:02:58,216 --> 00:02:59,536
>> Niki Werkheiser: We've got
some other just fun things.

87
00:02:59,656 --> 00:03:01,946
Of course, people think of
crew tools and wrenches.

88
00:03:02,076 --> 00:03:06,036
We've got a metal one here too
and we're starting with plastics

89
00:03:06,036 --> 00:03:06,866
for the first printer.

90
00:03:07,186 --> 00:03:09,776
But we will be moving to metals
and other types of materials.

91
00:03:10,646 --> 00:03:11,786
We've got things like that --

92
00:03:11,786 --> 00:03:13,886
you can imagine different
size sample containers.

93
00:03:14,106 --> 00:03:16,686
You can also do interactive
-- oop, sorry.

94
00:03:16,856 --> 00:03:19,106
[Laughter] That wouldn't
happen in space.

95
00:03:19,246 --> 00:03:20,176
It would float away.

96
00:03:20,176 --> 00:03:23,816
So you have interactive parts
like this that can move.

97
00:03:23,816 --> 00:03:26,566
You can do complex parts as
well with unique structures.

98
00:03:28,136 --> 00:03:28,986
>> Lori Meggs: So
tell us about the unit

99
00:03:28,986 --> 00:03:30,746
that is actually
going to station.

100
00:03:30,866 --> 00:03:31,366
>> Niki Werkheiser:
So we're working

101
00:03:31,366 --> 00:03:32,756
with the company MAIDENSPACE.

102
00:03:32,826 --> 00:03:34,986
They're actually located
at Aimes Research Center

103
00:03:34,986 --> 00:03:38,226
and the project is led here out
of Marshall Space Flight Center.

104
00:03:38,226 --> 00:03:39,206
It's a really good interaction

105
00:03:39,206 --> 00:03:42,056
between this commercial
company whose business model is

106

00:03:42,056 --> 00:03:45,056
to create a commercial additive
manufacturing 3-D printing

107
00:03:45,056 --> 00:03:46,416
facility on Space Station.

108
00:03:46,806 --> 00:03:48,476
This is the first step.

109
00:03:48,476 --> 00:03:50,046
It is a technology
demonstration.

110
00:03:50,426 --> 00:03:53,066
We'll operate in the
microgravity science Glovebox

111
00:03:53,446 --> 00:03:56,956
and NASA has been providing
the discipline expertise

112
00:03:56,956 --> 00:04:00,326
and the expertise in
terms of taking a printer

113
00:04:00,326 --> 00:04:01,626
that you would use on the ground

114
00:04:01,896 --> 00:04:04,346
which MAIDENSPACE are absolutely
experts on that as well

115
00:04:04,346 --> 00:04:05,406
as designing for space.

116
00:04:05,916 --> 00:04:08,996
And making sure that we can
verify that for microgravity,

117
00:04:08,996 --> 00:04:11,696
the physics of microgravity
as well as the safety

118
00:04:11,696 --> 00:04:12,926
and operational constraints

119
00:04:12,986 --> 00:04:14,706
in the controlled
environment of space station.

120
00:04:14,916 --> 00:04:17,376
>> Lori Meggs: And this is
also critical being able

121
00:04:17,376 --> 00:04:19,446
to replace parts
like this on orbit

122
00:04:19,686 --> 00:04:21,946
for future long duration trips.

123
00:04:21,946 --> 00:04:22,376
>> Niki Werkheiser: Absolutely.

124
00:04:22,376 --> 00:04:23,606
The big thing about this is

125
00:04:23,736 --> 00:04:27,806
for Space Station even it will
decrease risk, decrease cost,

126
00:04:27,806 --> 00:04:30,896
and increase efficiency but
for longer term missions,

127
00:04:30,936 --> 00:04:34,216
for space exploration
this is absolutely a

128
00:04:34,256 --> 00:04:35,386
critical technology.

129
00:04:36,316 --> 00:04:38,196
>> Lori Meggs: And talk about
the ones that we have here

130
00:04:38,196 --> 00:04:42,296
on Earth that -- will this
technology make them better?

131
00:04:42,296 --> 00:04:42,856
>> Niki Werkheiser: Absolutely.

132
00:04:42,856 --> 00:04:43,676
There's a lot of applications.

133
00:04:43,676 --> 00:04:46,476
We talked to several of our
industry partners as well

134
00:04:46,476 --> 00:04:50,056
as academia even international
partners on the ground here.

135
00:04:50,056 --> 00:04:53,046
This is an area that has
exploded in the last few years.

136
00:04:53,046 --> 00:04:54,556
It's been being used
in an abundance.

137
00:04:54,556 --> 00:04:56,136
So there are lessons learned

138
00:04:56,136 --> 00:04:57,436
from the microgravity

application.

139
00:04:57,436 --> 00:04:59,536
It could actually apply to the
things on the Earth especially

140
00:04:59,536 --> 00:05:02,446
when you think of things
such as maybe the Army.

141
00:05:02,446 --> 00:05:06,096
Maybe you have folks out in
the field in a remote area

142
00:05:06,176 --> 00:05:08,506
and they've had the same
type of problems we have

143
00:05:08,506 --> 00:05:09,596
in space, things break.

144
00:05:09,596 --> 00:05:11,956
And you're remote -- you
can also think of things

145
00:05:11,956 --> 00:05:14,706
like submarines or even
just remote regions.

146
00:05:15,126 --> 00:05:19,506
Also commercial growth, so
in this smaller size and form

147
00:05:19,506 --> 00:05:21,556
and function that you
get from the printer,

148
00:05:21,736 --> 00:05:24,136
you could absolutely apply
that to Earth applications.

149
00:05:24,346 --> 00:05:27,286
>> Lori Meggs: So we've seen the
video of the printer and work

150
00:05:27,326 --> 00:05:28,826
with that but how
big is this unit?

151
00:05:28,826 --> 00:05:28,976
I mean -

152
00:05:28,976 --> 00:05:30,146
>> Niki Werkheiser:
So this is actually --

153
00:05:30,146 --> 00:05:31,076
this is kind of cool.

154
00:05:31,076 --> 00:05:32,236
I don't know if you
can see it here

155
00:05:32,236 --> 00:05:35,336
but this is actually we printed
a model of the 3-D printer.

156
00:05:35,696 --> 00:05:38,286
This first printer will be
a technology demonstration.

157
00:05:38,286 --> 00:05:40,466
So it's a little smaller
because we fit it inside

158
00:05:40,466 --> 00:05:43,156
of the microgravity science
Glovebox on Space Station.

159

00:05:43,156 --> 00:05:45,556
So the crew will actually
put their hands inside

160
00:05:45,556 --> 00:05:47,336
of the glove box to
operate the experiment.

161
00:05:47,686 --> 00:05:49,526
We're getting a lot
of materials data

162
00:05:49,526 --> 00:05:52,806
and ultimately what this will
demonstrate is that the objects

163
00:05:52,806 --> 00:05:55,716
that we print in space are
equitable quality to those

164
00:05:55,716 --> 00:05:56,946
that we print on the ground.

165
00:05:56,946 --> 00:05:58,196
That there are no
difference in the way

166
00:05:58,196 --> 00:06:00,826
that the printing takes
place in the physics

167
00:06:00,826 --> 00:06:02,076
and the material quality.

168
00:06:02,436 --> 00:06:04,116
Maidenspace [assumed spelling]
has already done a series

169
00:06:04,296 --> 00:06:05,266
of parabolic flights

170
00:06:05,266 --> 00:06:07,956
on the KC-135 affectionately
known as the Vomit Comet.

171
00:06:08,496 --> 00:06:10,156
And they've had excellent
results.

172
00:06:10,156 --> 00:06:12,166
Everything has shown that
it is equitable Earth

173
00:06:12,226 --> 00:06:14,366
but you get the short spurts
in microgravity and we want

174
00:06:14,366 --> 00:06:17,936
to be able to generate
full products on orbit.

175
00:06:18,066 --> 00:06:19,196
>> Lori Meggs: I'm sure
astronauts are excited

176
00:06:19,196 --> 00:06:20,126
about this.

177
00:06:20,126 --> 00:06:21,576
So tell me when we'll
see this on station.

178
00:06:21,576 --> 00:06:23,086
>> Niki Werkheiser: We
will see this next fall.

179
00:06:23,276 --> 00:06:26,106
It'll be launching on Space X
5 [phonetic] and we're actually

180
00:06:26,106 --> 00:06:27,196
with the astronaut office.

181
00:06:27,236 --> 00:06:30,346
We already have a set of tools
and things that they've picked

182
00:06:30,346 --> 00:06:32,836
out and said hey, can
you provide this for us?

183
00:06:32,836 --> 00:06:34,046
And we're working
toward that now.

184
00:06:34,546 --> 00:06:35,576
>> Lori Meggs: Very
exciting stuff.

185
00:06:35,576 --> 00:06:36,336
Can't wait to see it.

186
00:06:36,336 --> 00:06:38,926
I'm -- maybe you can build me
something a little bit later

187
00:06:38,926 --> 00:06:39,236
on today.

188
00:06:39,236 --> 00:06:39,303
>> Niki Werkheiser: Yeah,

189
00:06:39,303 --> 00:06:41,016
we absolutely could
have fun with this.

190
00:06:41,016 --> 00:06:41,646
Thank you, Lori.

191
00:06:41,646 --> 00:06:42,866
>> Lori Meggs: Thank
you, Niki, so much

192
00:06:42,866 --> 00:06:43,866
and let's take a live look

193
00:06:43,866 --> 00:06:45,816
into the Payload Operations
Integration Center.

194
00:06:45,816 --> 00:06:48,616
Busy at work today
setting up experiments.

195
00:06:48,996 --> 00:06:51,836
Slam D [phonetic], they're
working with the crew on station

196
00:06:51,836 --> 00:06:55,496
to get that working and
they'll be busy all day long

197
00:06:55,496 --> 00:06:56,286
and all week long.

198
00:06:56,656 --> 00:06:58,046
That'll do it for us here

199
00:06:58,046 --> 00:06:59,746
in the POaylod Operations
Integration Center.

200
00:07:00,246 --> 00:07:02,696
Now back to you, Josh, at
Mission Control in Houston.

201
00:07:02,916 --> 00:07:04,206
>> Josh: All right,

thank you Lori.

202
00:07:04,206 --> 00:07:07,426
That 3-D printer could change
the way we do business onboard

203
00:07:07,426 --> 00:07:08,486
here the International
Space Station.

204
00:07:08,486 --> 00:07:09,766
Make it quite a bit easier

205
00:07:09,896 --> 00:07:12,116
for the crews onboard the
Space Station and us here