MOON 3 missions

<u>3D Printing in Space:</u> Enabling New Markets and Accelerating the Growth of Orbital Infrastructure

VENUS 1 mission

Jason Dunn Made in Space, Inc.

MOON 2 missions

SUN missions

2 mission

Key Points

1) Its time for terrestrial 3D printing technology to be put in space

2) It will revolutionize the space industry

3) We're doing it

























Its time to put 3D printing technology in space.

Additive Manufacturing Comparison

3D Printing	Plastic or Metal	Zero G Capability	Vacuum Compatibil
EBF3	Metal	Under– development	Required
Fab @ Home	Metal & Plastic	Not Tested	Material Dependent
SLS	Metal & Plastic	No	Yes
FDM	Plastic	Yes	Material Dependent

Over 25 Materials Printed

3D Printing	Breadth of Materials	Finest Resolution	Space Rated
EBF3	Steel, Copper, Aluminum,	2.54 mm	Yes
Fab @ Home	Plastics and Stainless	.4 mm	Yes (Stainless Steel)
SLS	Metals, Alloys, Plastics,	70 microns	Yes (Metals and Alloys)
FDM	ABS, ABSi, Polycarbonat e, Ultem 9085, and	40 microns	Yes (PC–ABS)

Estimated Flight Development Cost Comparison For Printers



Here's how it will revolutionize the space industry.

Current Manufacturing	In-Space Manufacturing
Space is isolated yet dependent on earth	Missions have a back up plan building in space
Plan for every "what if" scenario	Build what is needed on demand
"Jerry rig" a solution with parts	Print needed part immediately
Many repairs have no immediate solution	Immediately repair what is broken
Must survive extreme forces of	Build for main use in space, not
Conform to fairing of launch vehicle	Build large structures that can only be built in space
Requires a large workforce	Less hands-on work needed

Solving Three Key Problems

1. Fundamental Size Limits

2. Excess Waste

3. Time Delays



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Fundamental Size Limit SOLVED

- Spacecraft not dependent on launch vehicle fairing
- Launch stresses not a problem
- Build large structures



Excess Waste SOLVED

- Estimated 30% structural mass removed
- Less spare parts- print on demand
- Recycle feedstock material



Time Delay SOLVED

- Spare parts replaced immediately
- Less lead time to build spacecraft
- Efficient large-scale production

Markets Enabled













What we're doing right now.

Immediate Objectives

- Micro-gravity research flights
- Adapt 3D printing for space based application
- Fly on space stations

SUN missione

2 mission

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Size and Cost

3D Printin g	Mass	Volume	Printing dimensio ns	Cost
EBF3	818 kg	1.5m ³	15x15x15 cm	\$250k
Fab @ Home	40 kg	0.5 m ³	10x10x10 cm	\$7k
SLS	1125 kg	2 m ³	25x25x35 cm	\$100-3 00k
FDM	35 kg	0.42 m ³	25x25x25 cm	\$10-50 k