Jet Propulsion Laboratory
California Institute of Technology

Designing for Additive Manufacturing in the Space Industry

Raul Polit-Casillas - Jet Propulsion Laboratory, California Institute of Technology

2016 Converge Americas

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5. Integration of Functions (4D)
6. Improvement of structures
7. All of the above…
8. In-Situ Resource Utilization

Image courtesy of NASA

Design Methods Enabler

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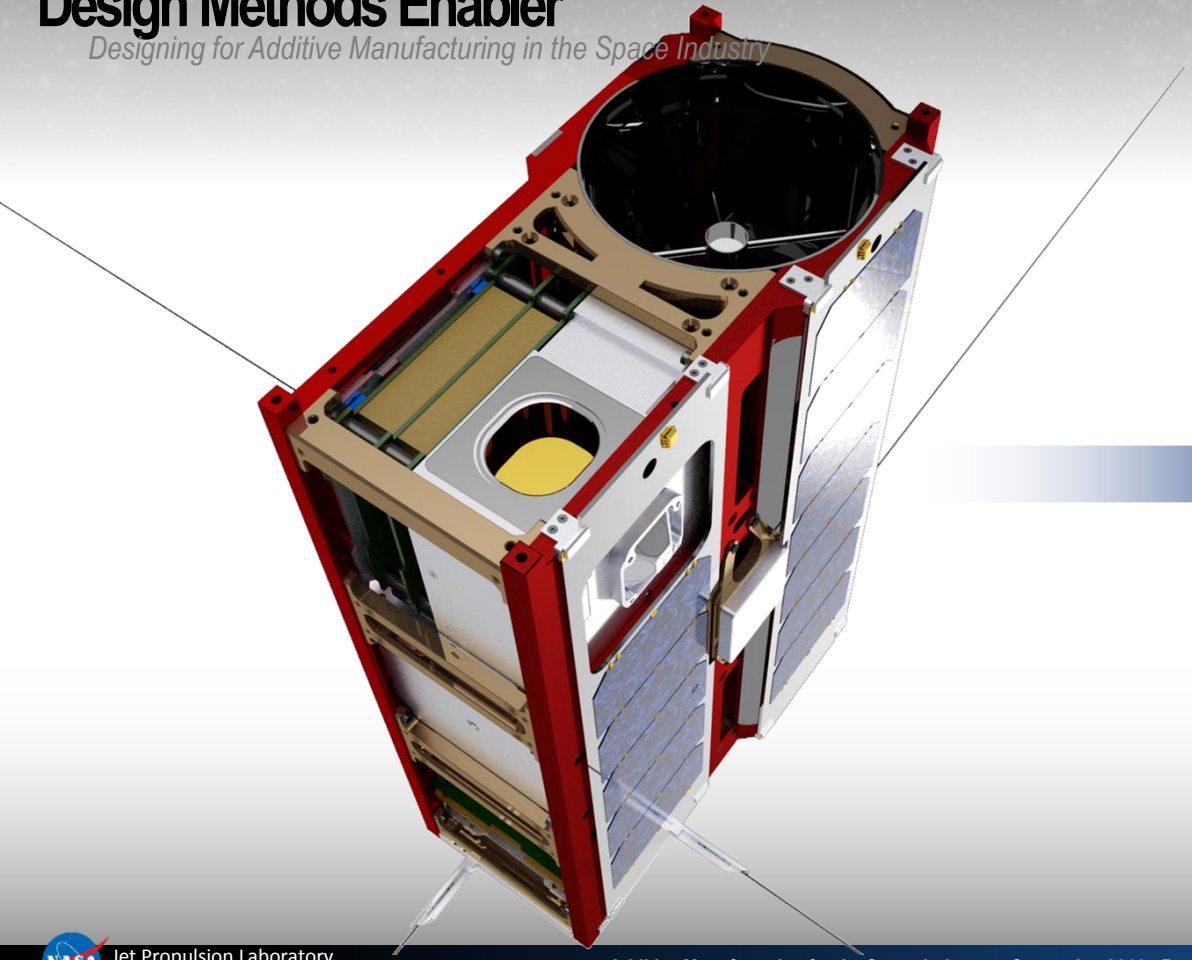

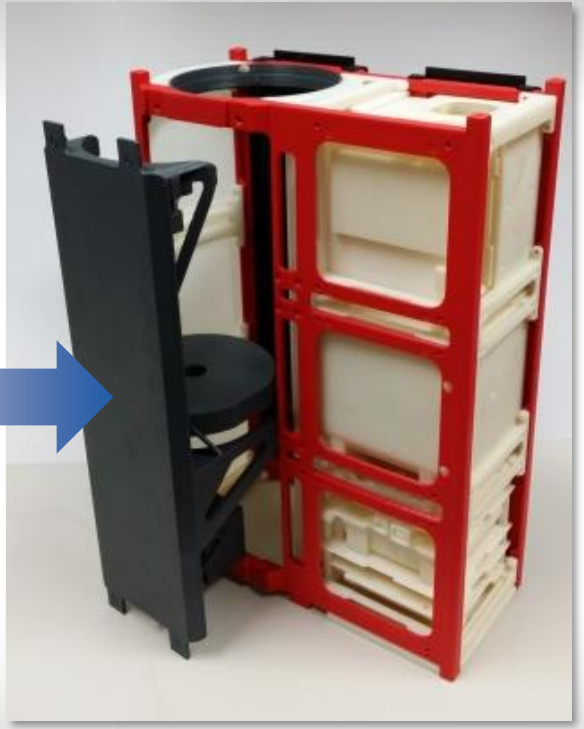

Rapid Prototyping and Engineering

Image courtesy of JPL NASA Caltech

Design Methods Enabler

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Generative Design

And Topology optimization

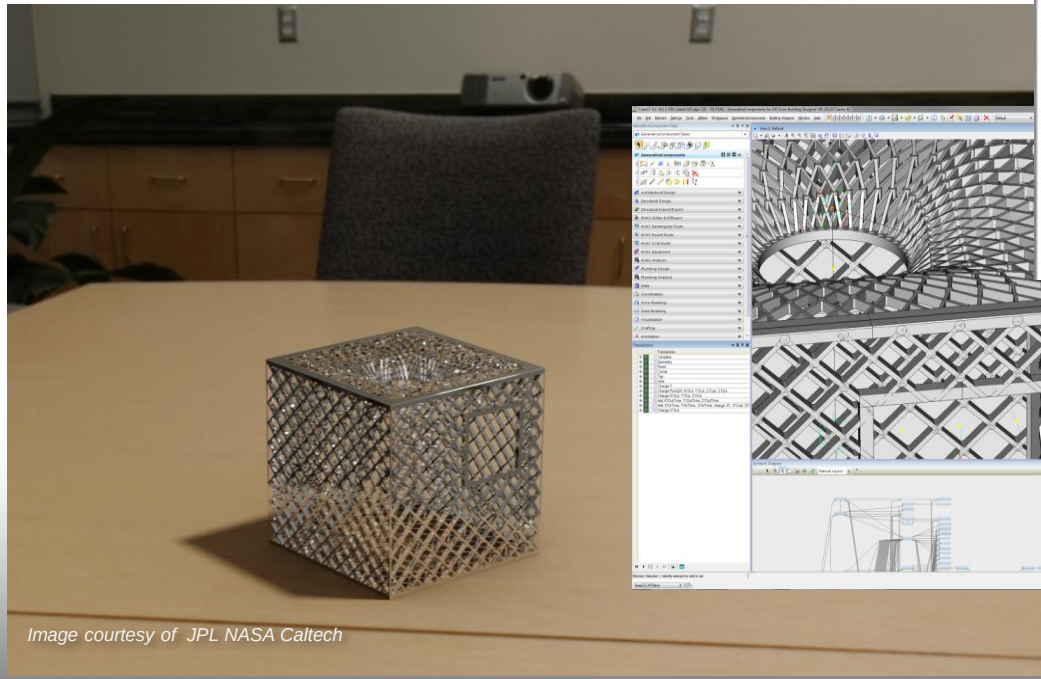
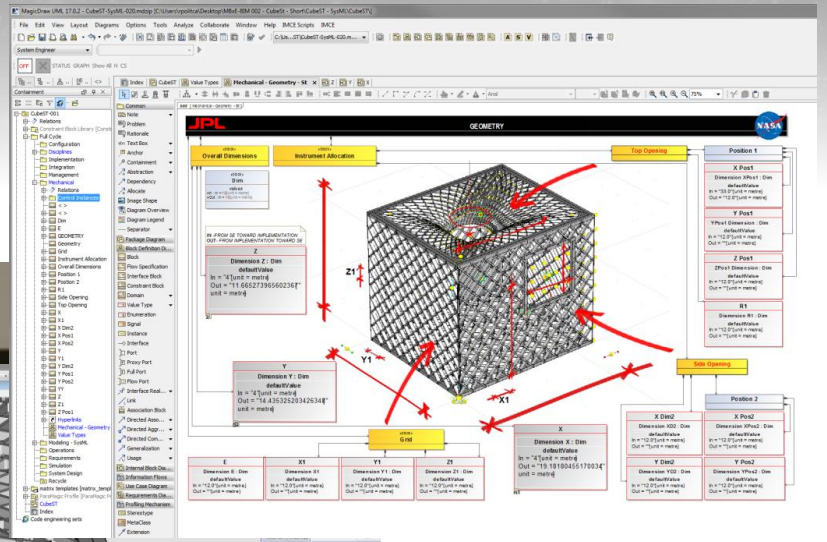


Image courtesy of JPL NASA Caltech



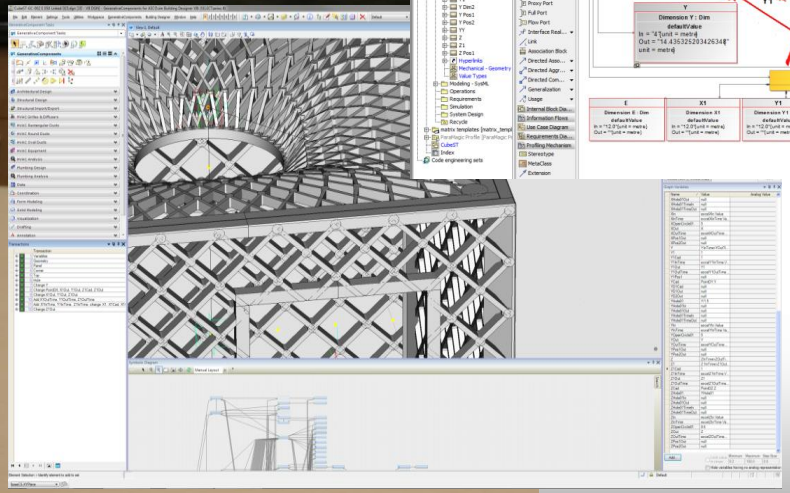


Image courtesy of Autodesk

Enabler of New Material and Structures

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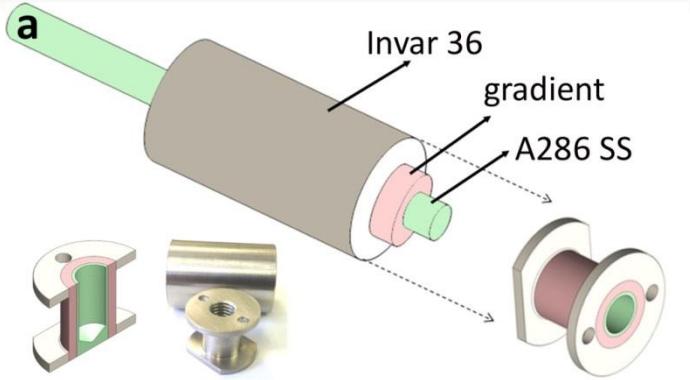
Metal Gradient Alloys Using AM



Doug Hofmann, Scott Roberts, John Paul Borgonia
NASA-Jet Propulsion Laboratory

JPL was just granted US Patent Number US20150044084, Methods for fabricating gradient alloy articles with multi-functional properties, which covers: Multifunctional AM parts, using phase diagrams as maps, gradient alloys, applications for gradient and multifunctional parts.

Mass and Assembly Parts Reduction

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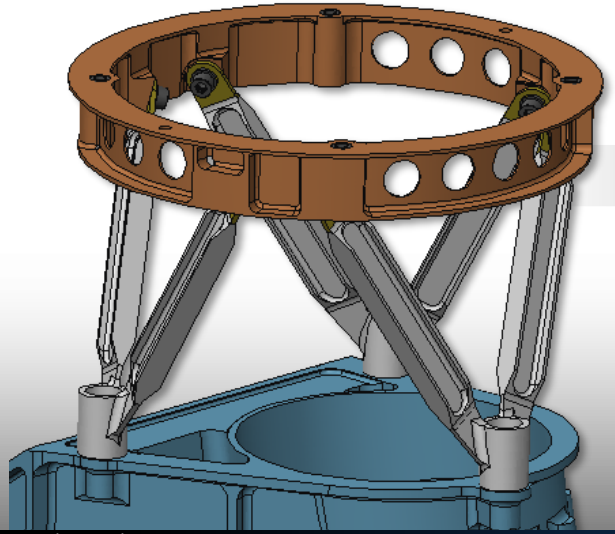
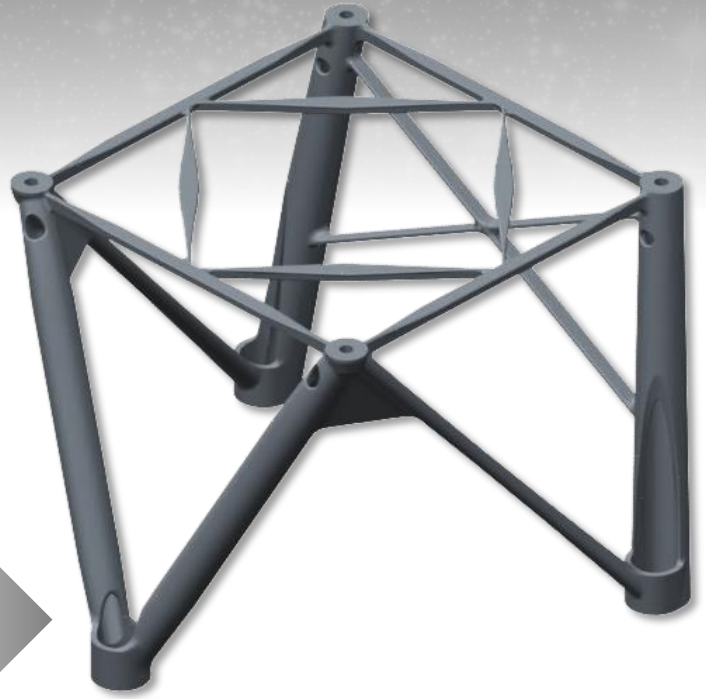
JPL – Andrew Shapiro-Scharlotta
SSL – Jason Croom





Mars Science Laboratory UHF Antenna Assembly
Initial state (below left): 4-piece assembly with 6 bolted joints
Final state (above right): 1-piece assembly
19% reduction in mass, as well as part count reduction

High Complexity / Adaptable Parts

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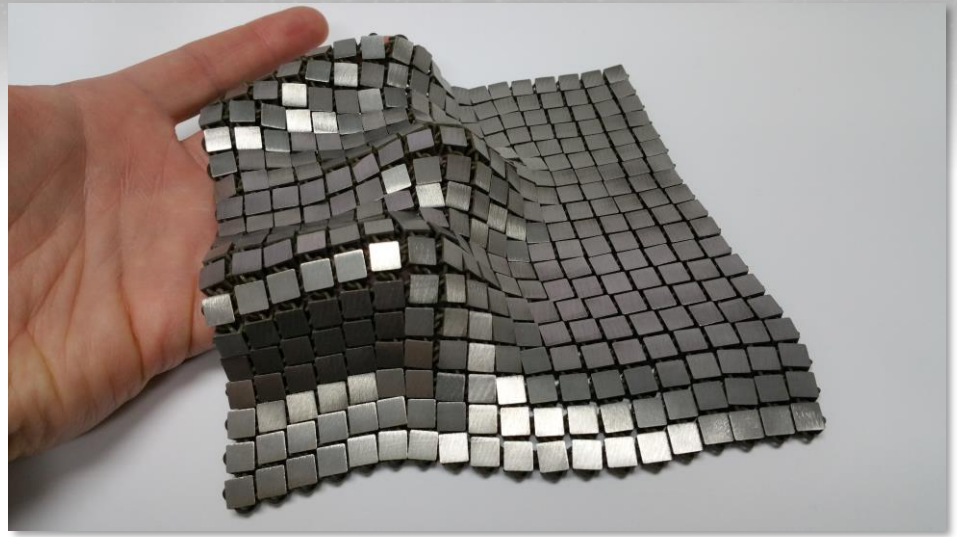

Multifunction 3-D Printed Space Fabrics

Raul Polit-Casillas, Andrew Shapiro-Scharlotta, Bryan Mcenerney, John Paul Borgonia
NASA-Jet Propulsion Laboratory

NASA NTR 49925 – US Temporary Patent CIT 7252-P

Integration of Functions (4D)

Additive Manufacturing for Space Architecture and Hardware

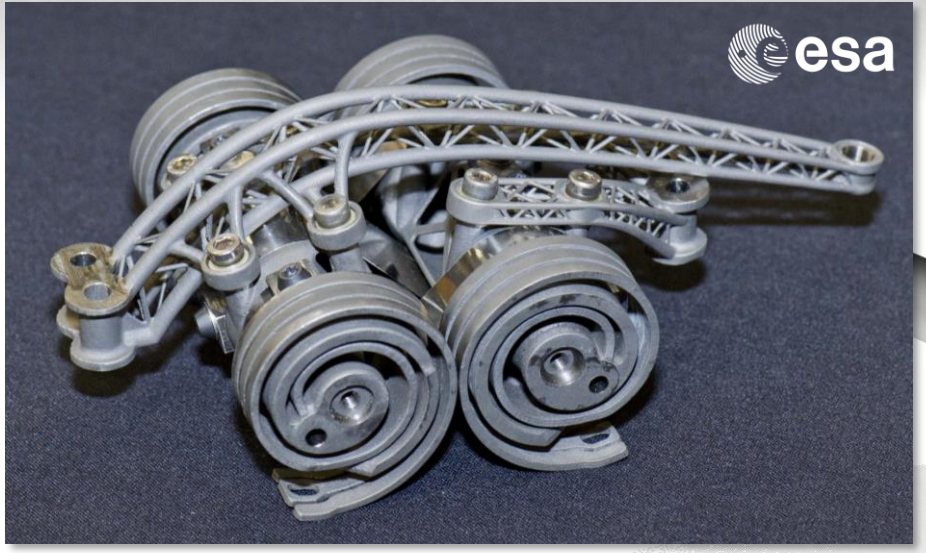

Image Courtesy of ESA

Artist's Concept

Image courtesy of JPL NASA Caltech

SENTINEL KISS CUBESAT CONFIGURATION

Raul Polit Casillas

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Integration of Functions (4D)

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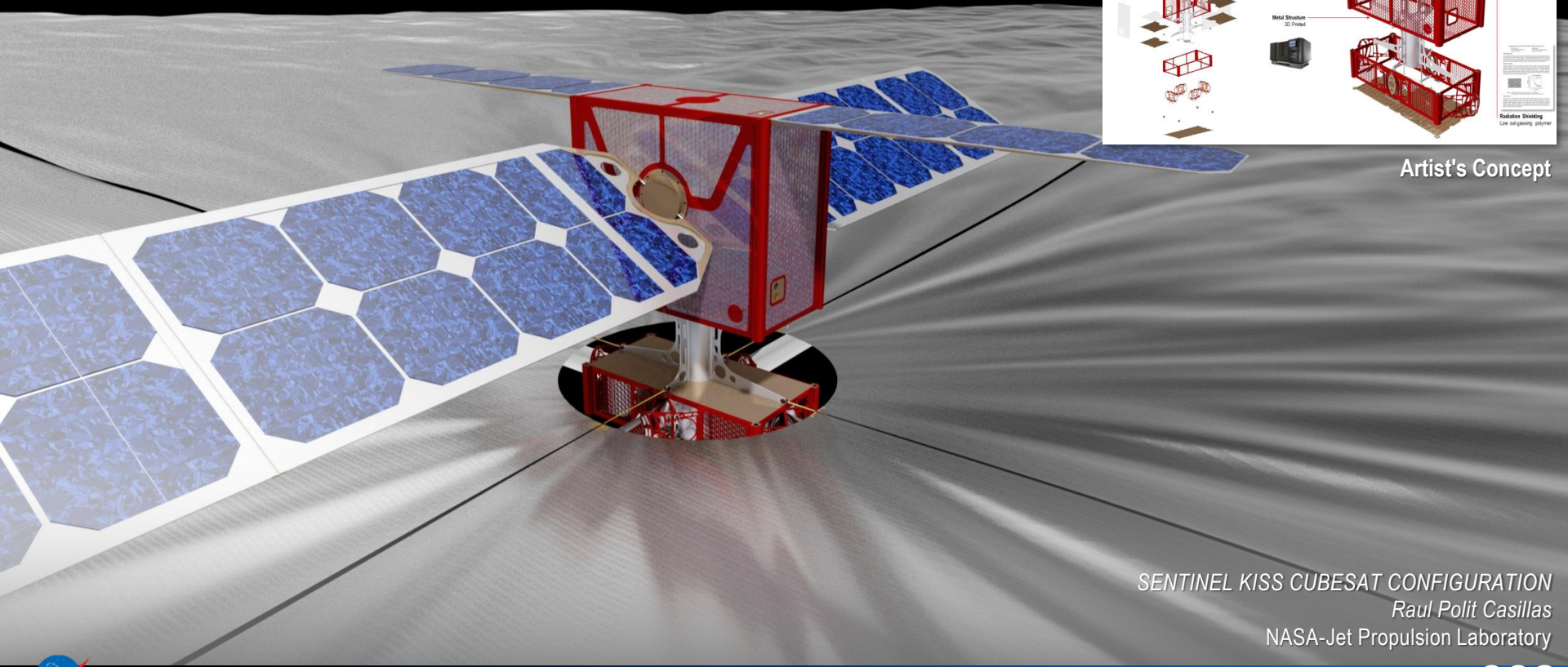

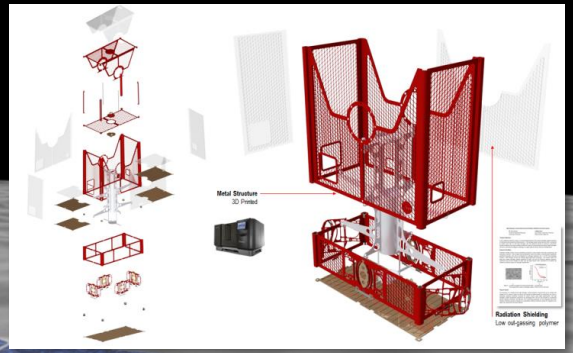

Artist's Concept

SENTINEL KISS CUBESAT CONFIGURATION

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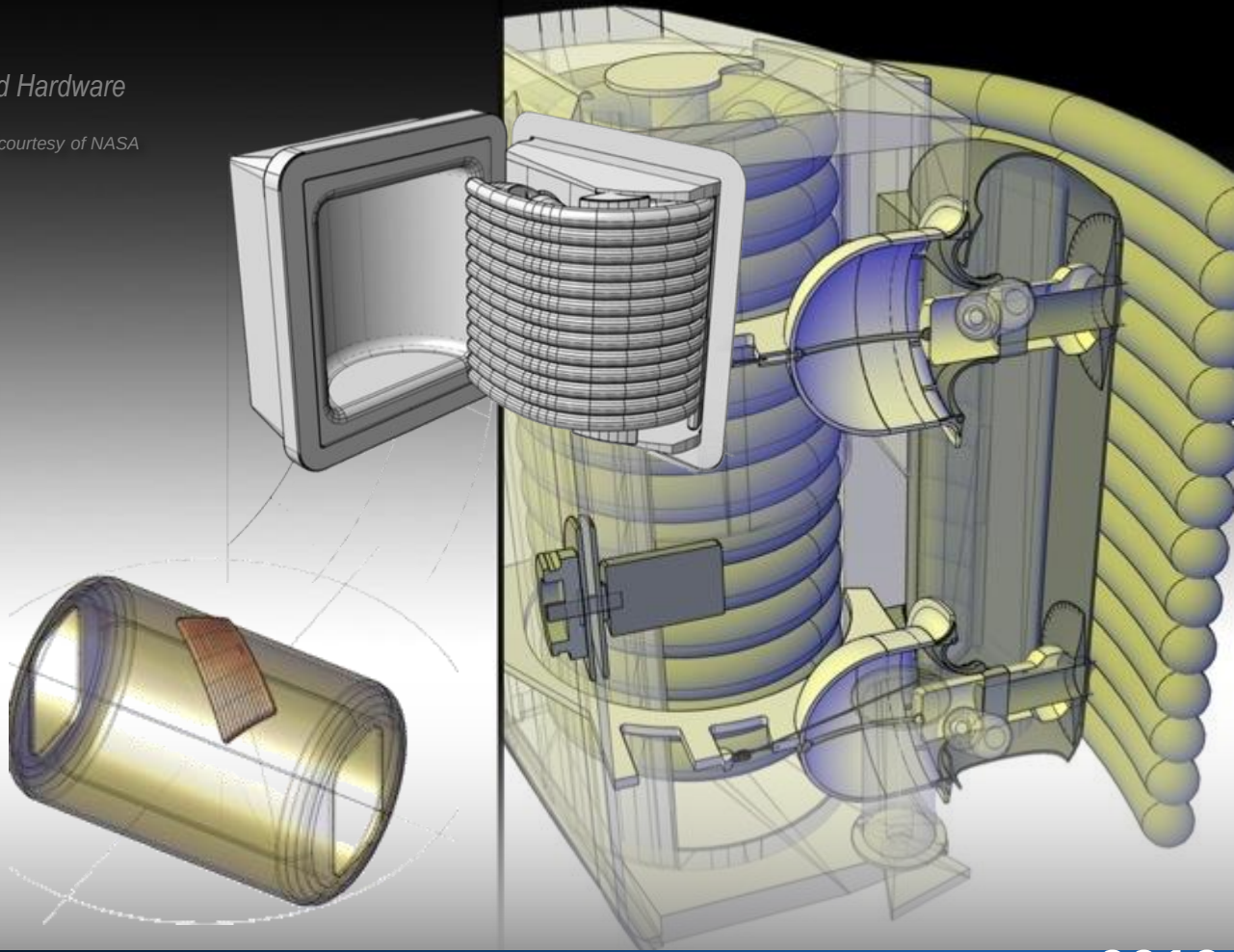
Improvement of structures

Additive Manufacturing for Space Architecture and Hardware

Image courtesy of NASA



Raul Polit-Casillas – Master Thesis
NASA-Jet Propulsion Laboratory

All of the Above – Atelier *Outer Planets Probes*

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JPL Atelier

Polit-Casillas, Karapetian, Hanna, Hirsch, Sauder, Castillo, Aboobaker, Dandino, Le, Ye, Theberge, Dinicola, Darrach

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Artist's Concept

In-Situ Resource Utilization

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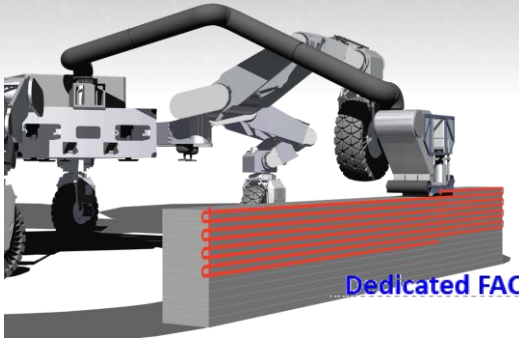
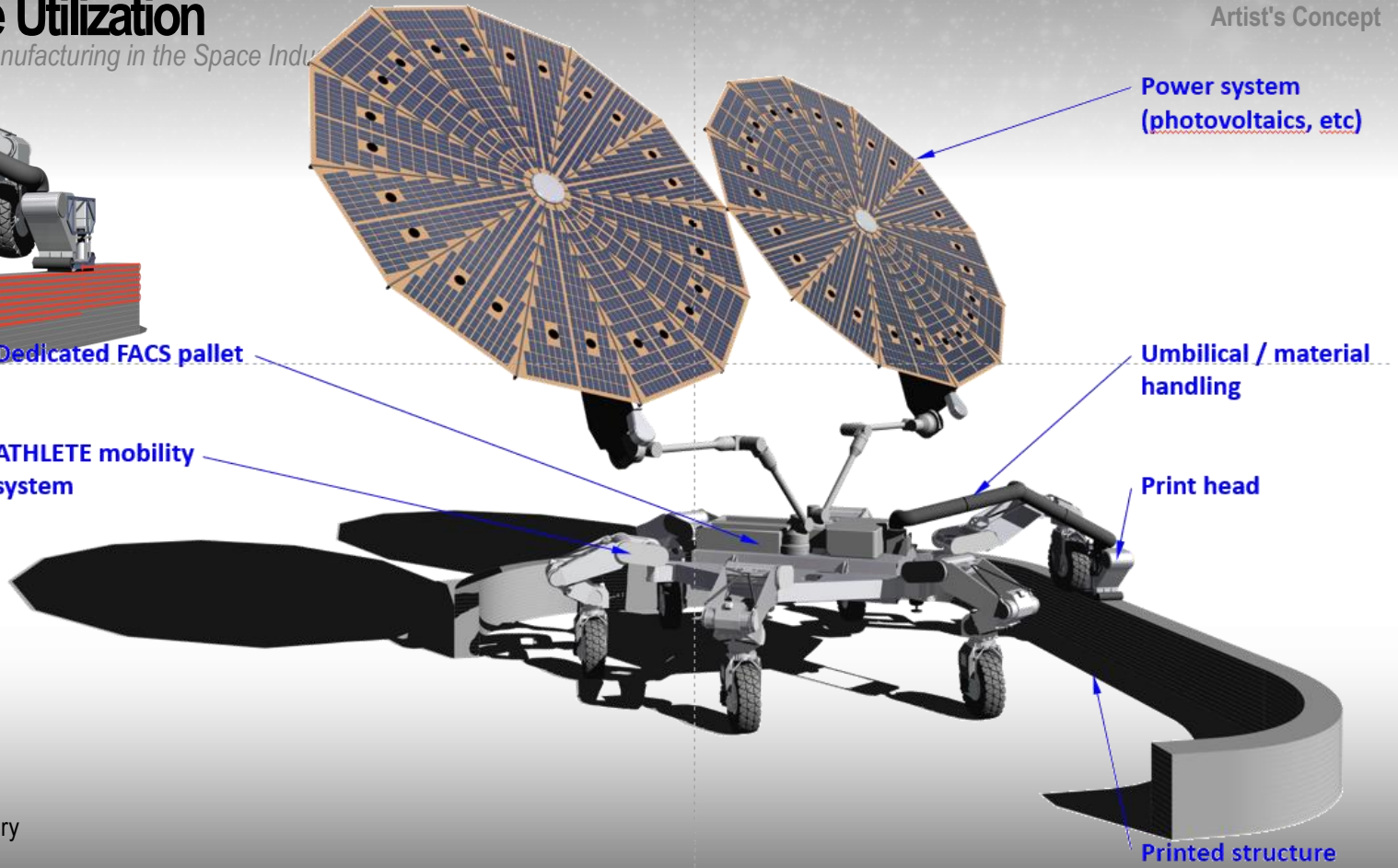
Artist's Concept





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Dr. Scott Howe
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