NGen Next Generation Manufacturing Canada

Additive Manufacturing Ecosystem (developments, application and regulatory differences) Round Table

Join us **Thursday March 4th at 11am EST** for a round table discussion on Additive Manufacturing in Canada.

We'll be discussing several of the key points and ideas from our presentation today, sharing best practices and strategies to ensure the long-term resilience of manufacturing in Canada.

This will be a facilitated discussion, and is open to senior manufacturing leaders.

Watch your email for further details, and to register!



NGen Next Generation Manufacturing Canada

Additive Manufacturing in Canada

Thursday Feb 25th, 11am ET

An overview of the additive manufacturing ecosystem in Canada, from an industry, research and training perspective.



$6.8Bn 20%

$14Tn 1%


YUKON TERRITORY
NORTHWEST TERRITORIES
Nuuk
Hudson Bay
CANADA
Labrador Sea
ALBERTA
MANITOBA
BRITISH COLUMBIA
SASKATCHEWAN
ONTARIO
QUEBEC
NEWFOUNDLAND AND LABRADOR
WASHINGTON
MONTANA
NORTH DAKOTA
MINNESOTA
PRINCE EDWARD ISLAND
NB
St-Pierre
MAINE
Ottawa
VT.
N.H.
OREGON
IDAHO
WYOMING
SOUTH DAKOTA
WISCONSIN
MICHIGAN
N.Y.
MASS.
R.I.
IOWA
NEBRASKA
NEVADA
UTAH
ILLINOIS
OHIO
PA
INDIANA
WEST
MD.
N.J.
UNITED STATES
Bing
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QC
Plastic
M...
ON
Plastic
Metal
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AB
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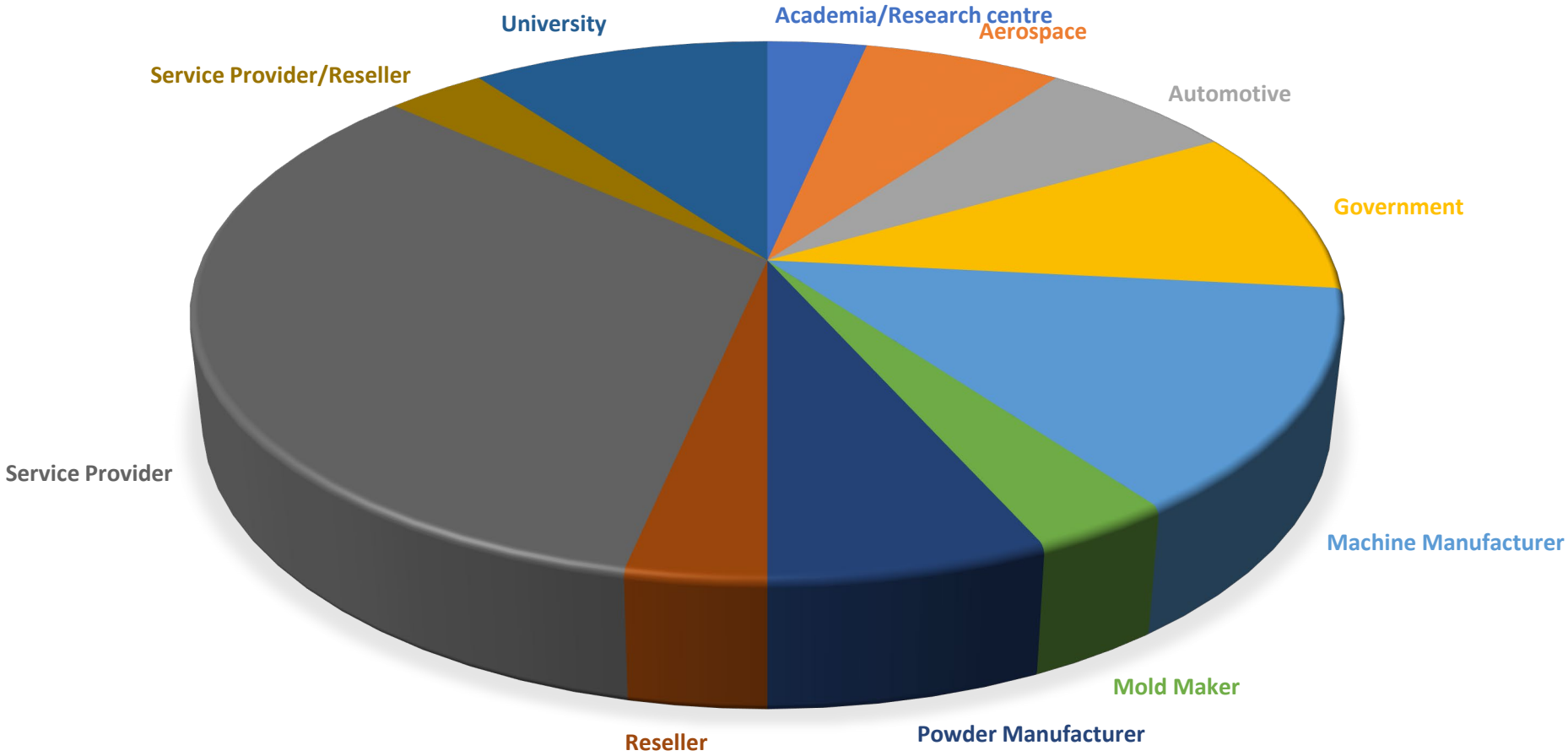
SK

NGen AM Survey



https://www.ngen.ca/blog/ngen-whitepaper-canadas-additive-manufacturing-landscape

Expert opinions – voices from AMAB survey

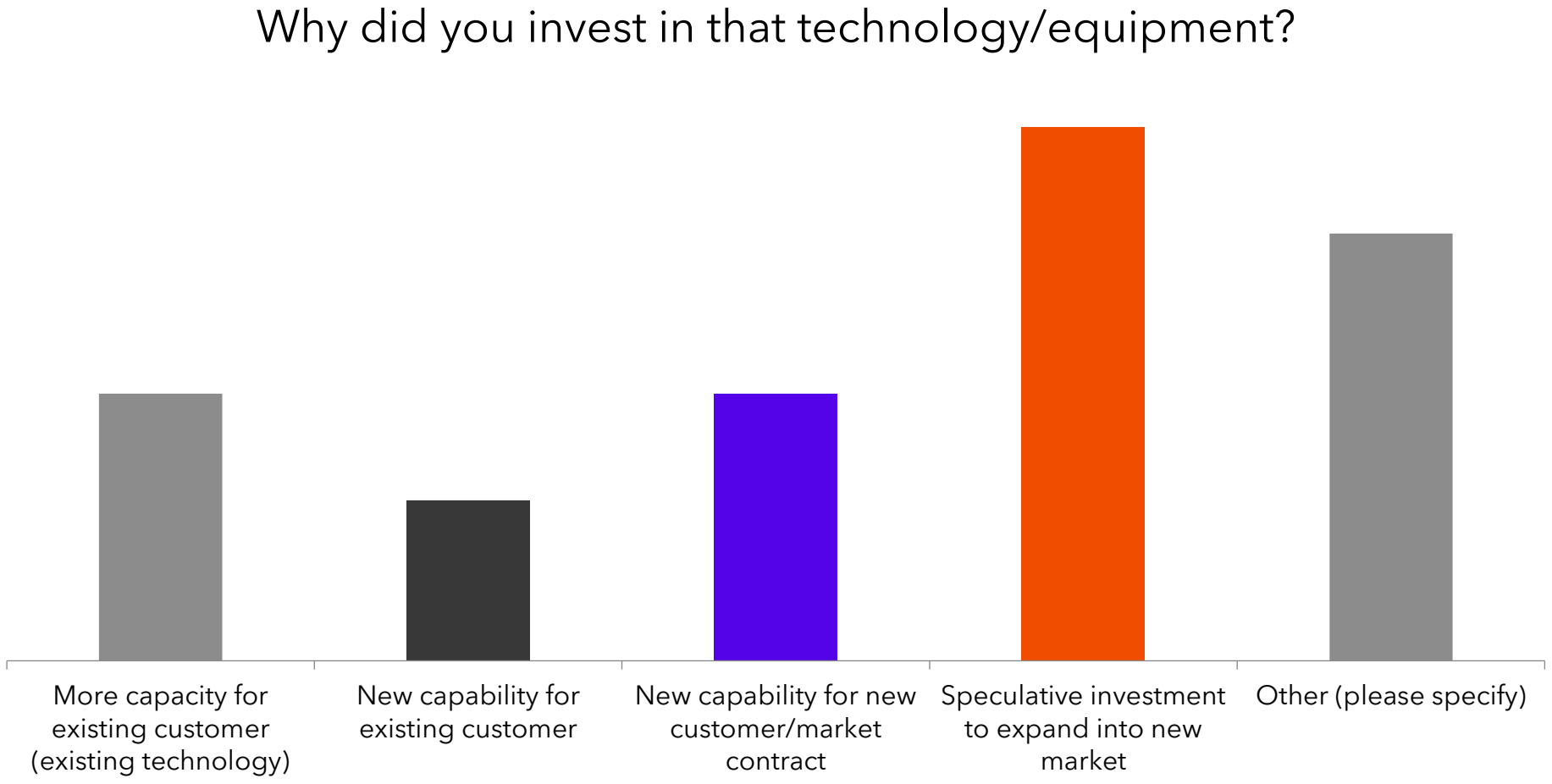
“One of the core problems is everyone is obsessed with additive, and the need for an AM strategy. But really what is needed is a manufacturing strategy.
Absolutely nobody wants to buy an AM part - what they want is a solution.”

“Some knowledge is earned not learned.
It would take a lifetime to learn all that needs to be known in each discipline, and nobody has 3 lifetimes.”

“Do I care about AM in Canada? No. Do I care about competitiveness in Canada? Yes!”

“Students do not ask why enough.
In industry new hires are even less likely to challenge a senior engineer.”

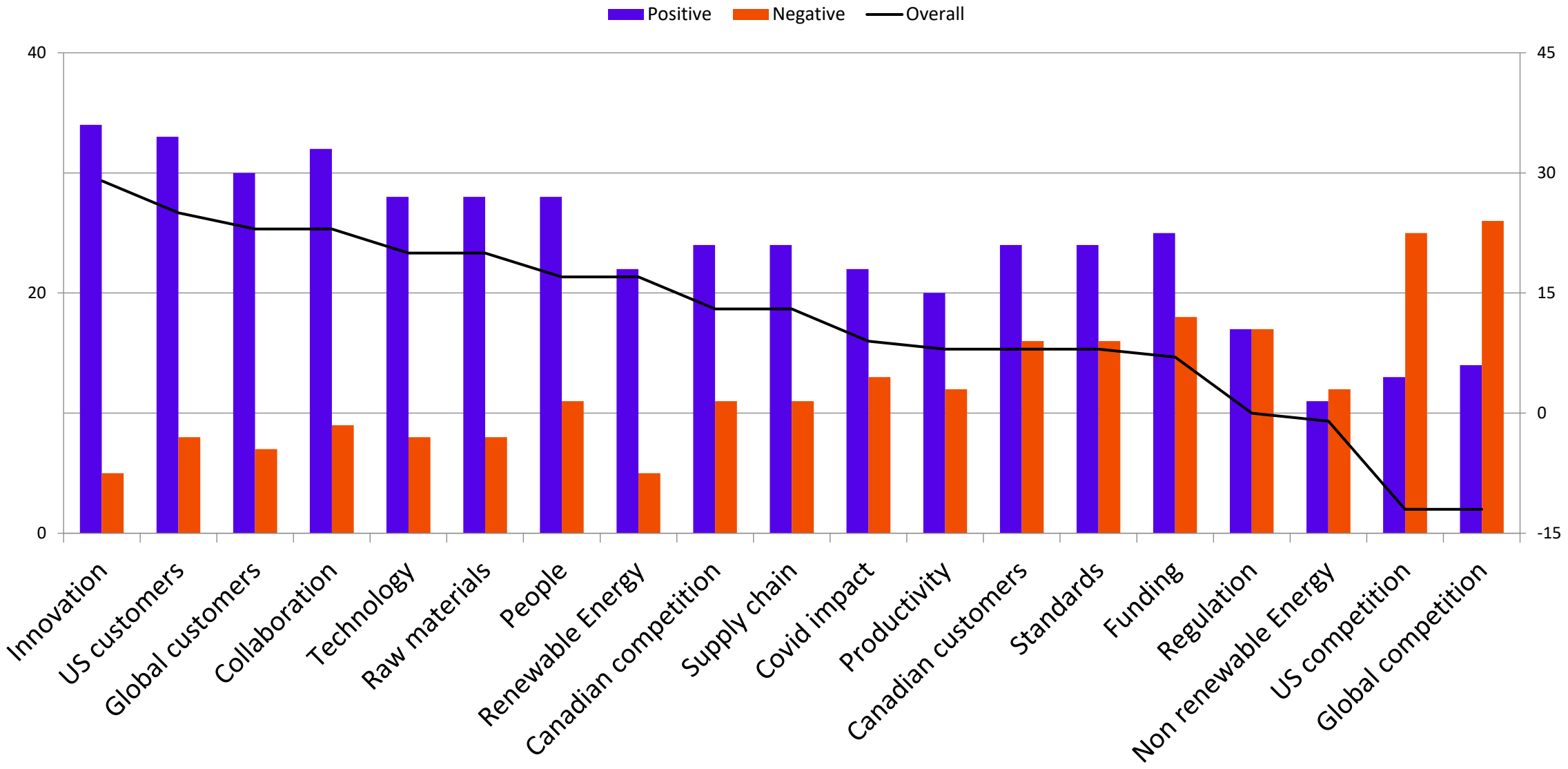
NGen AM Survey



NGen AM Survey

SWOT Analysis

Please categorize the most important issues for your organisation and the AM industry in Canada



Agility In A Covid Crisis



(Photo credit: Exergy Solutions)



(Photo credit: Renishaw)



(Photo credit: StarFish Medical)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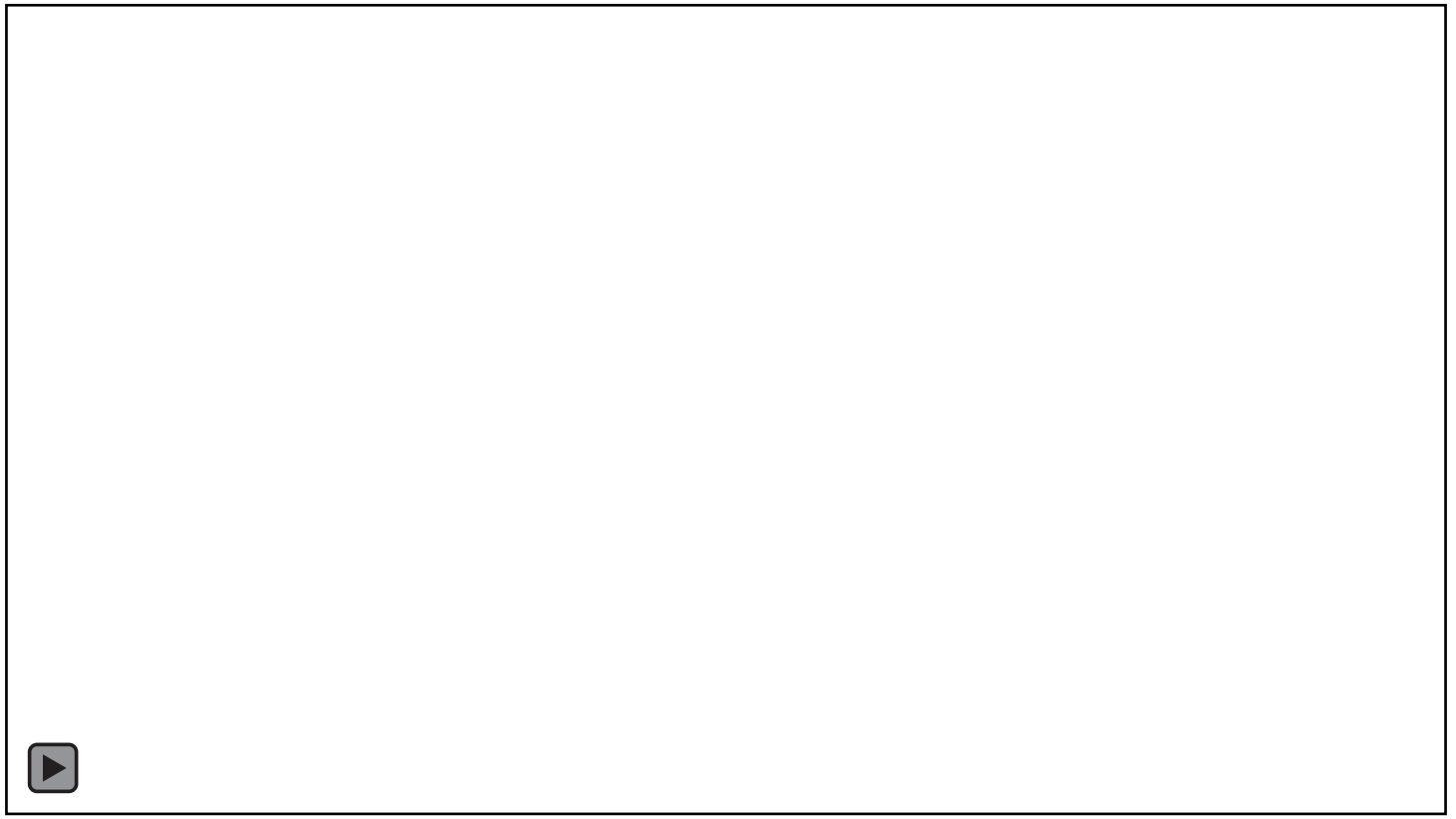
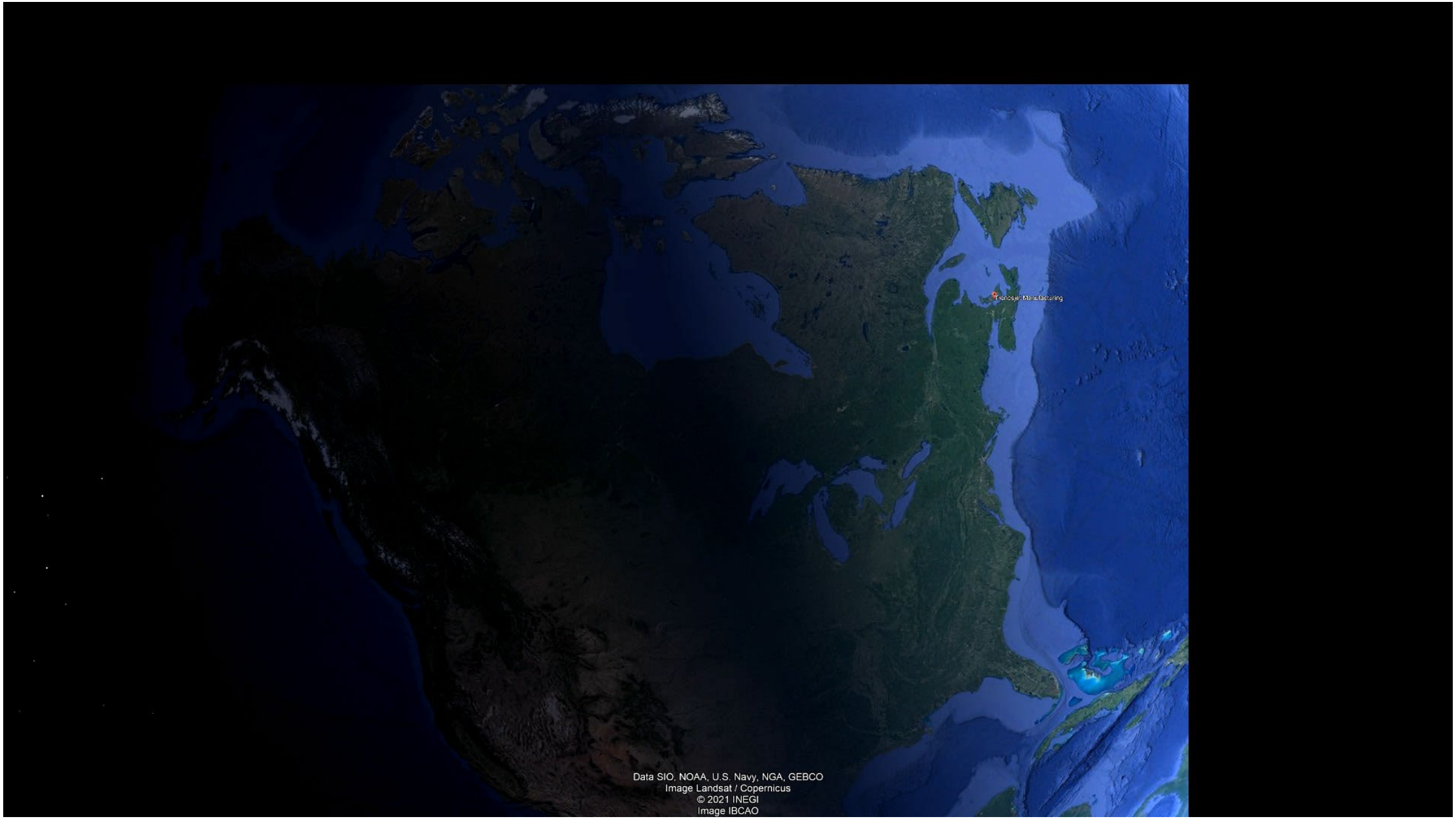
Data SIO, NOAA, U.S. Navy, NGA, GEBCO




Transjet Manufacturing
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat / Copernicus
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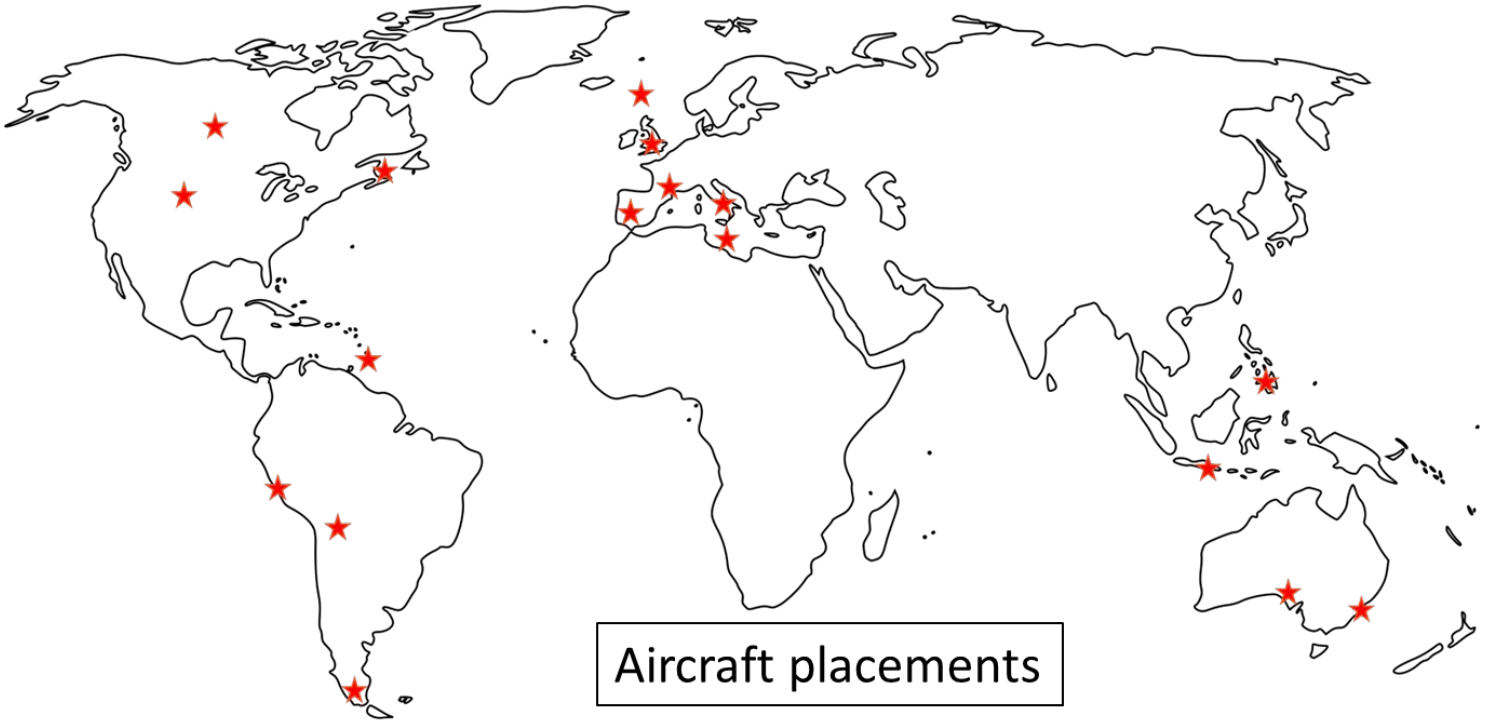
TRONOS



Conversion of BAe146 to Waterbomber



Aircraft placements



Airframe heavy maintenance

TRONOS







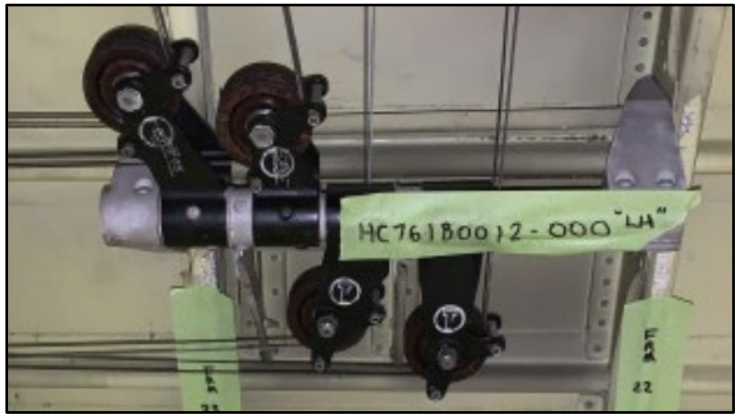
FAA PMA Certification in Process

Engine control bracket

(directs throttle control cable from cockpit to engine)

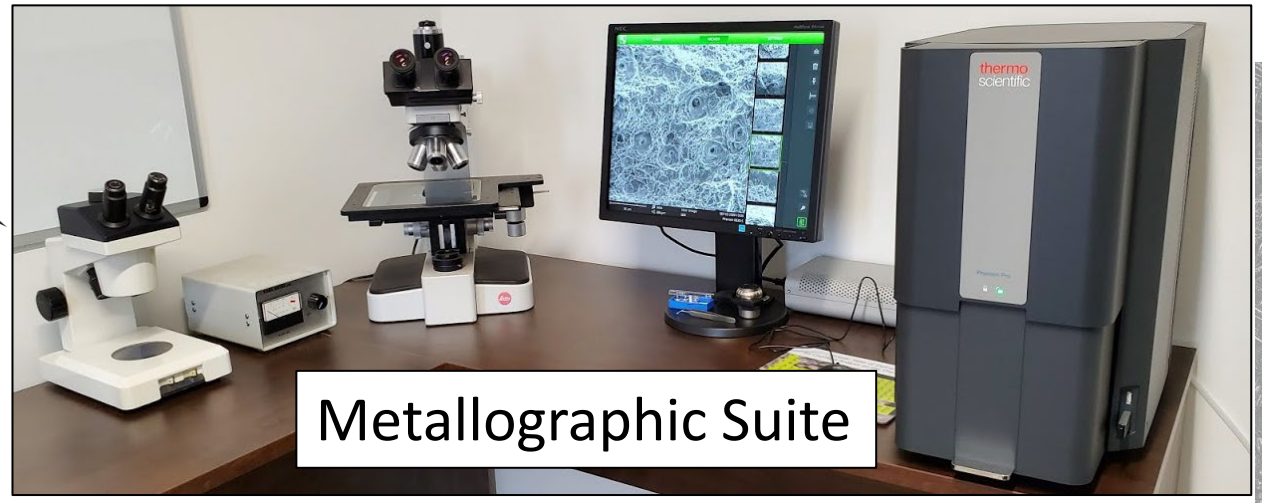
- Critical Component
- Static/Continuous low load
- Traditional: Cast Magnesium
- AM: Titanium (Ti-6Al-4V)



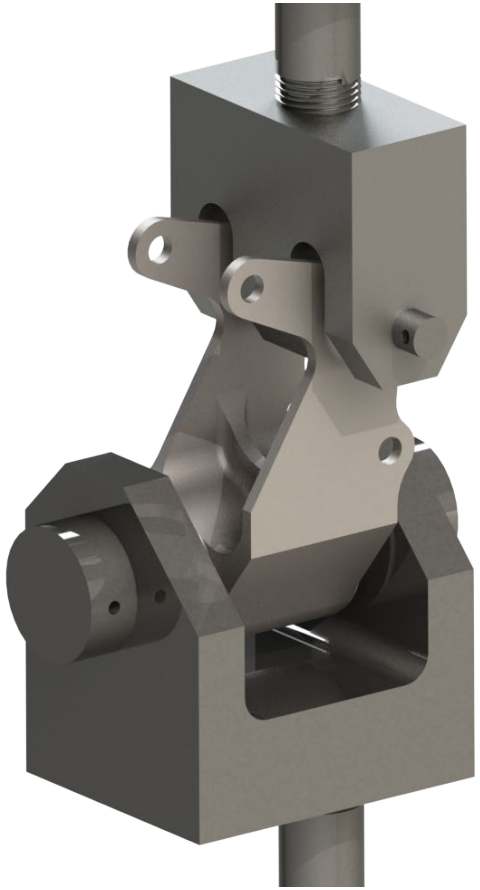


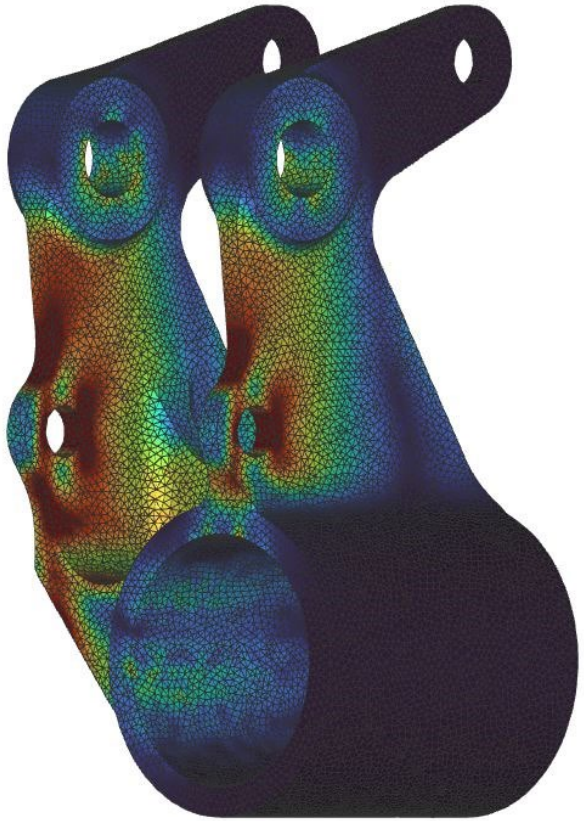


TRONOS

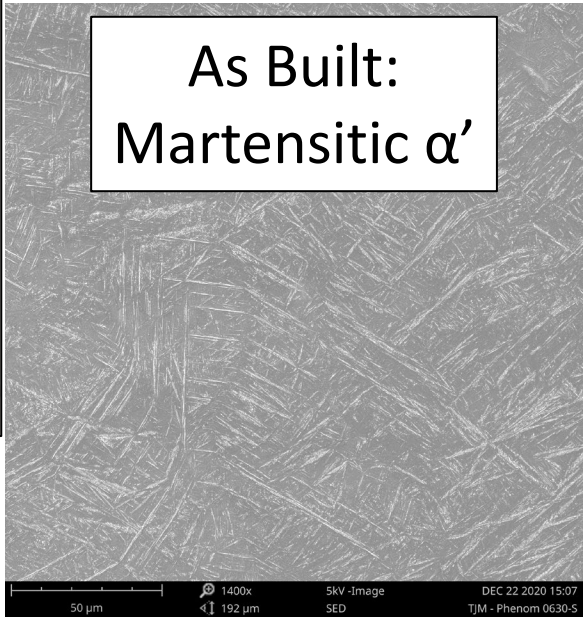


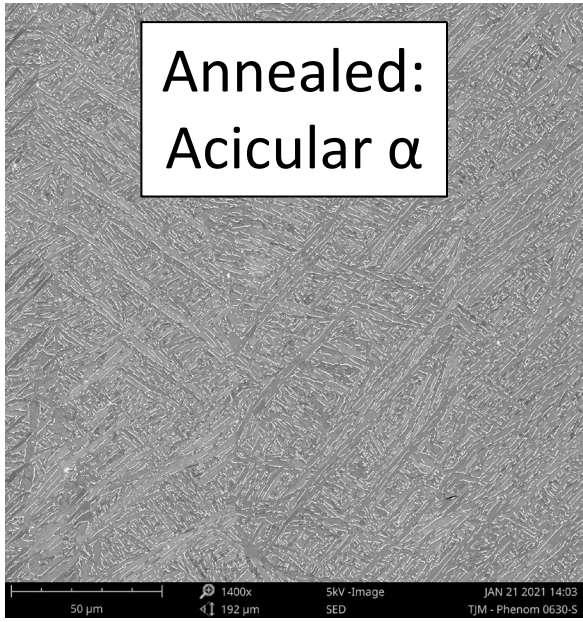
Metallographic Suite






250kN Load Frame





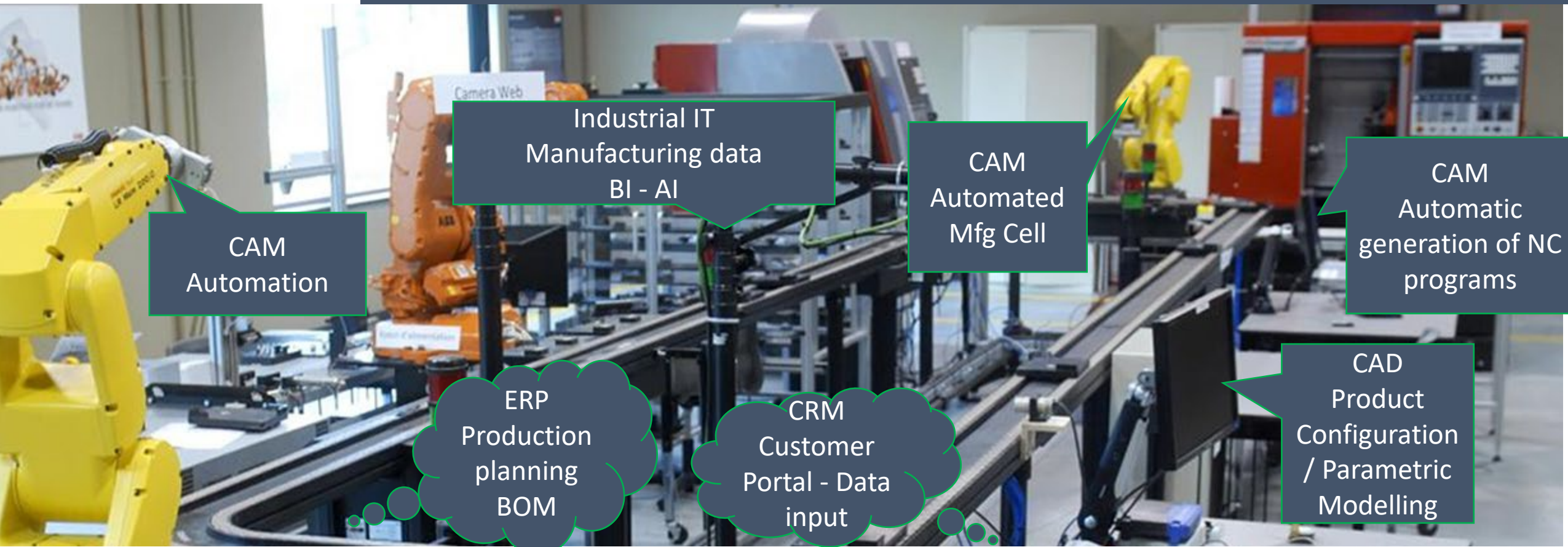
PRODUCTIQUE QUÉBEC

INTELLIGENCE MANUFACTURIÈRE

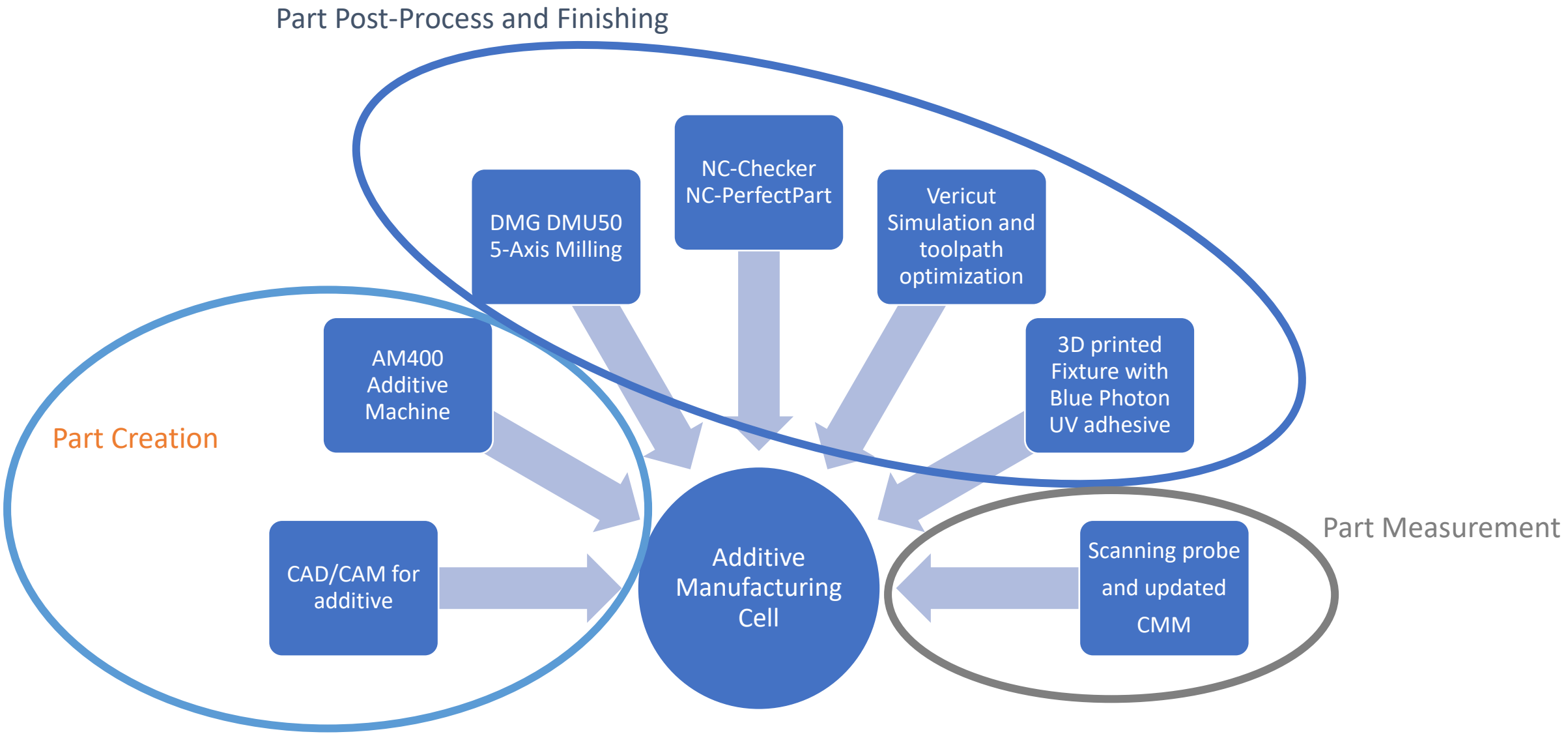
Our facility: Tailored for manufacturing technology demos.

Integration of manufacturing software – manufacturing equipment

- 2 CNC: 3-axis milling and 2 axis lathe.
- 3 robots (1 collaborative)
- Laser cutting/engraving machine
- Conveyor and automated sorting/storage
- Inspection Camera and Connected tools

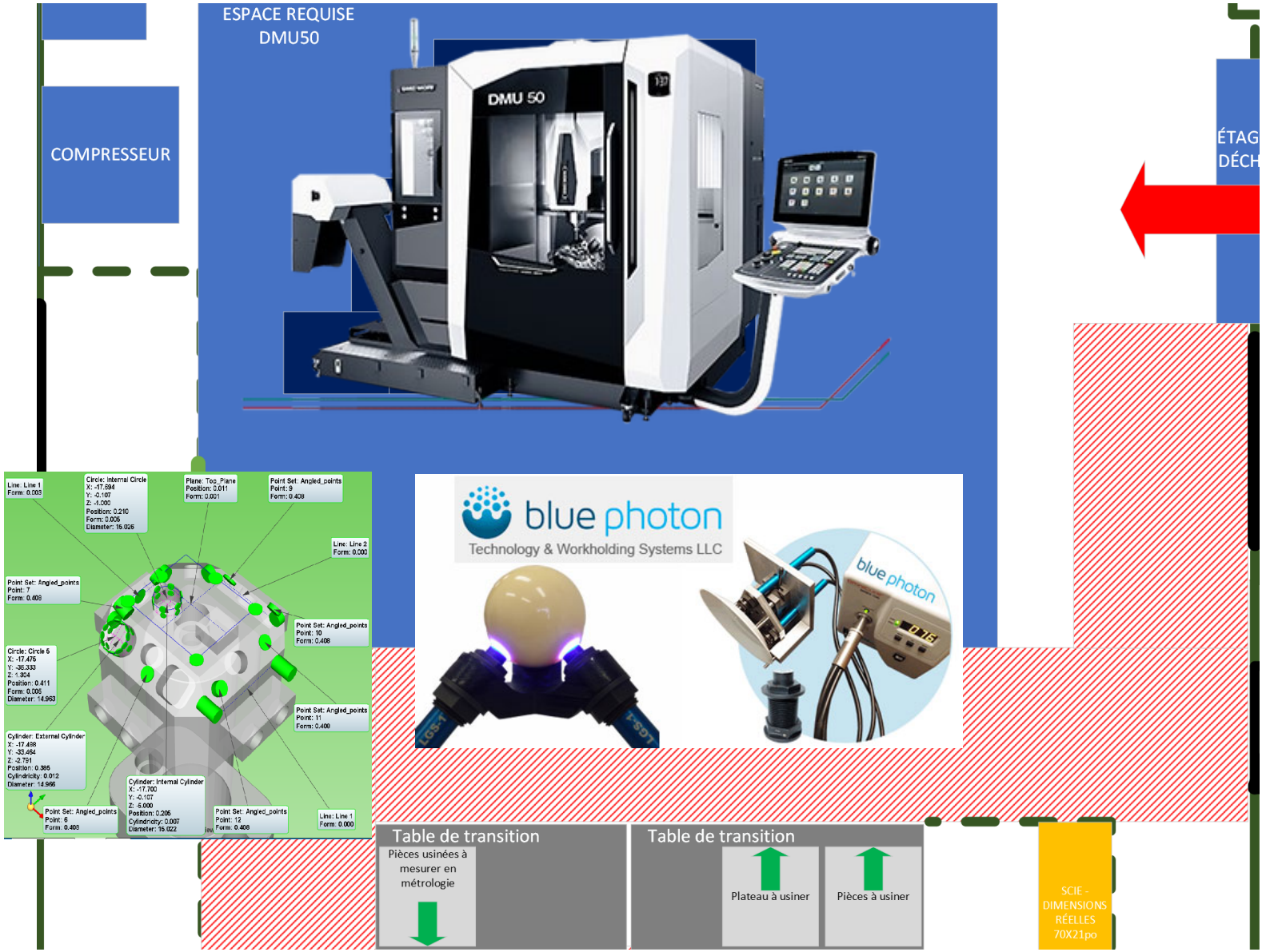


Additive Manufacturing Cell concept and technologies

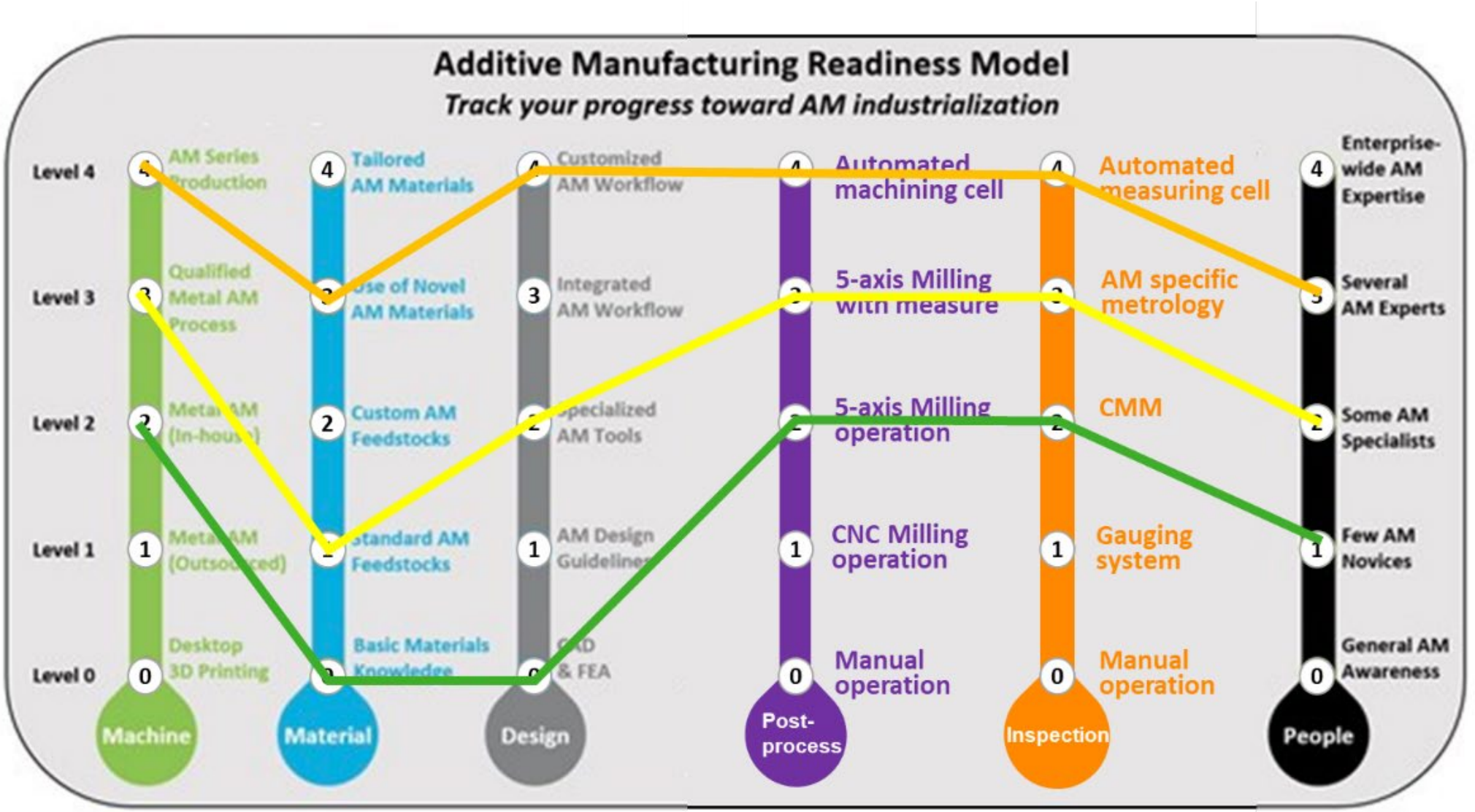


Part Finishing

- Part and tool probes
- Plastic 3D printer for conformal jaws.
- Blue Photon grippers to hold the part
- NC-PerfectPart to position the machining work offset
- Vericut to simulate the machining process and optimize cutting conditions.



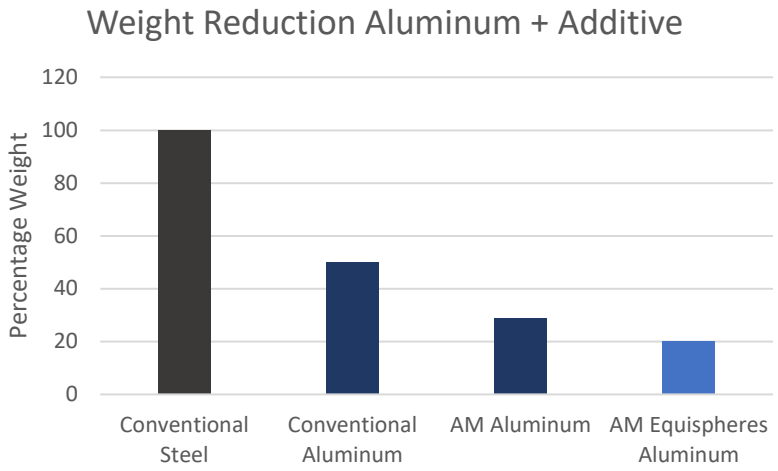
Progression plan.



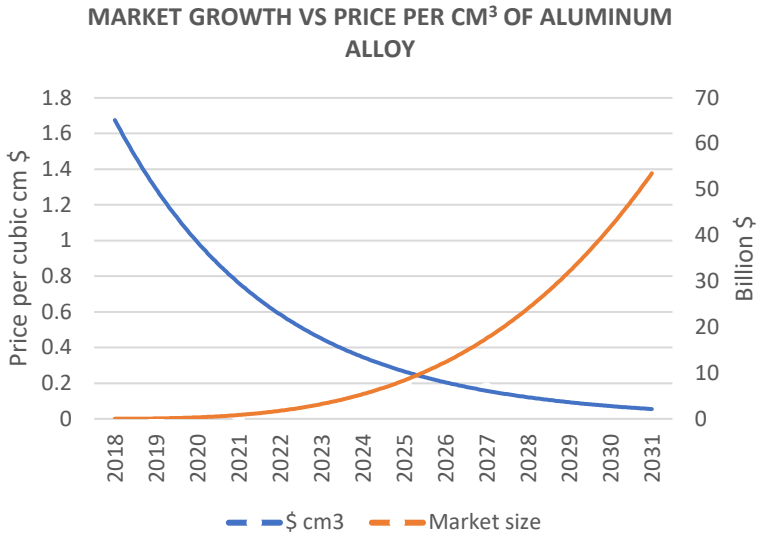
Adapté de l'article de Thimothy W. Simpson « Getting Ready for Additive Manufacturing. »
https://www.additivemanufacturing.media/blog/post/getting-ready-for-additive-manufacturing

ALUMINUM MARKET FOR AM

- Increasing demand for aluminum as transportation sector seeks to lightweight their product to reduce GHG emissions
- Design for AM can reduce the weight of a part by 30 – 40%



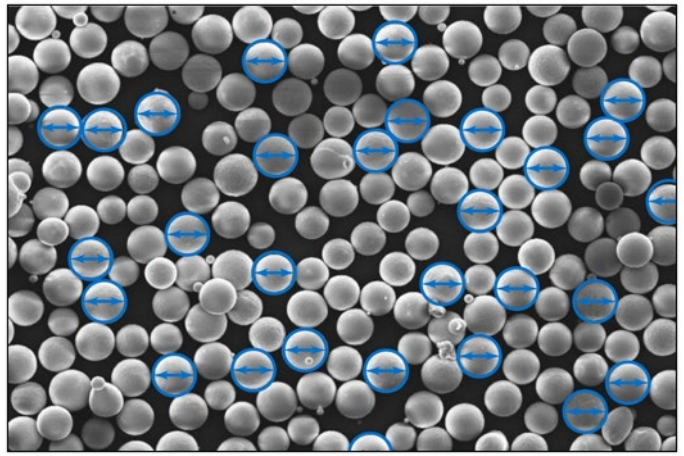
- However, to be economically viable, AM part production costs need to come down by a factor of 10 to compete with casting



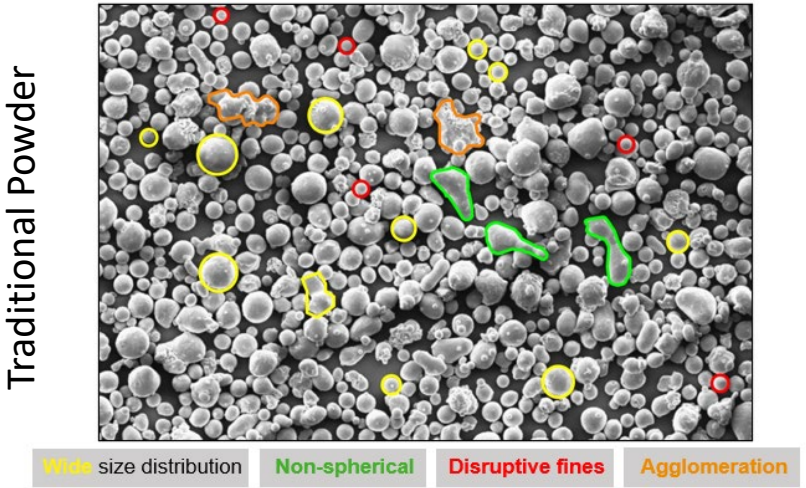
WHO WE ARE

- Equispheres has developed a disruptive and proprietary technology to atomize metal powders for use in Additive Manufacturing (AM)
- Founded in 2015
- Operate 3 reactors out of facility in Ottawa with access to 40,000 square feet – producing Aluminum alloys
- Employ 30 people (including large R&D group with several MSc and PhD research scientists)
- ISO 9001 Registered
- Produce uniform, fine free, spherical powder than enables user to produce stronger parts faster

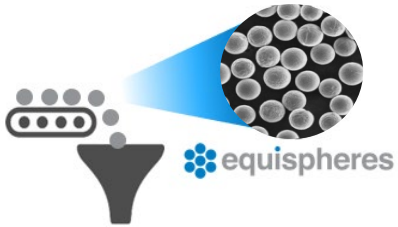
equispheres



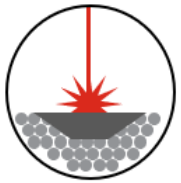
Traditional Powder



EQUISPHERES POWDER



Feedstock Predictability



Process Stability



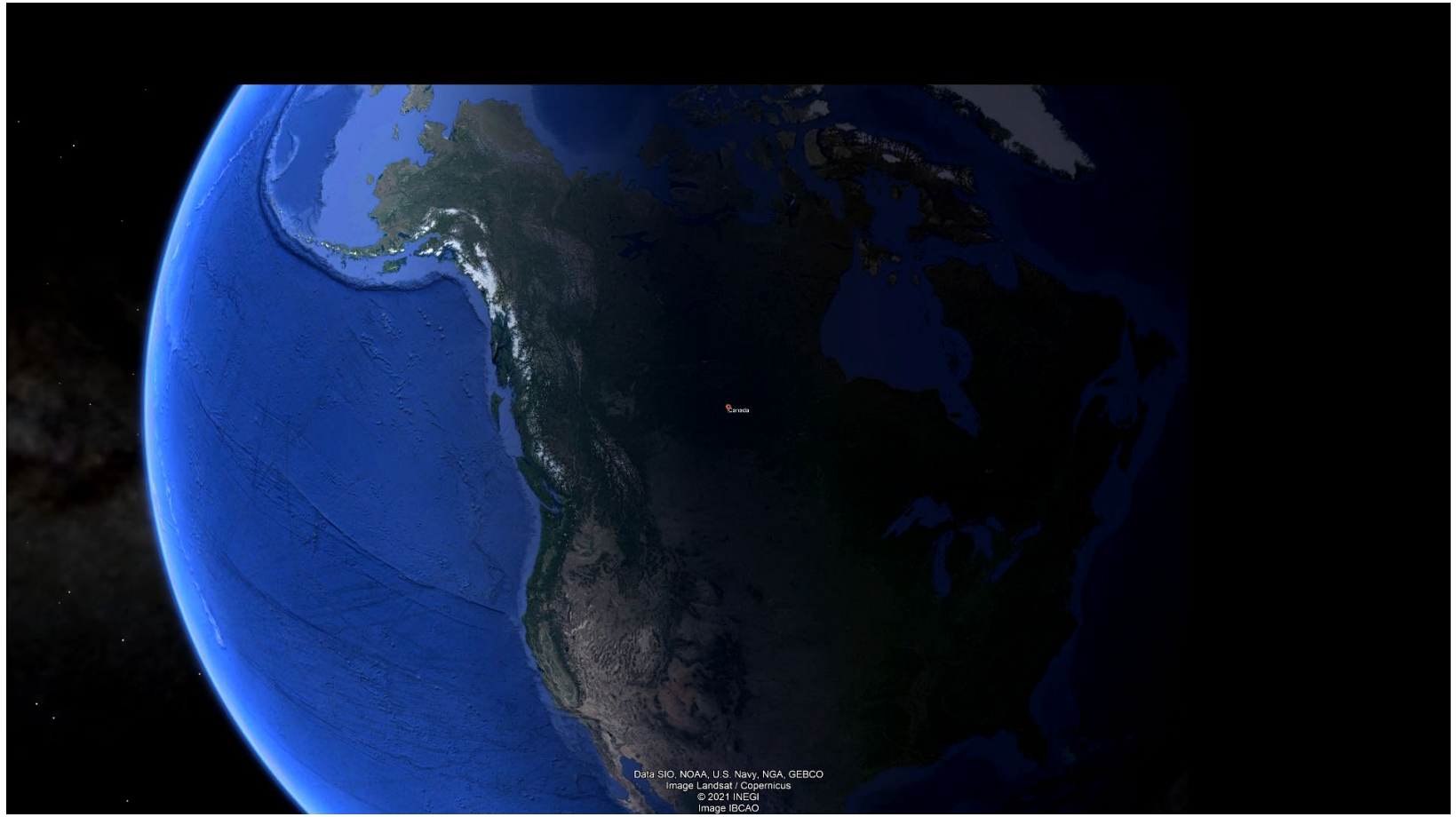
Consistently Superior Mechanical Properties

- **Sphericity** – .99 spherical(1) vs competitor less than 0.5
- **Smooth** – $^{1}/_{10}$ th surface area
- **Uniform size** – ½ size range of particles
- **Fine free** – $^{1}/_{10}$th of fine particles (0 - 10 um range)
- **Oxygen content** – $^{1}/_{3}$rd oxygen content (no inclusions)

- **Flowability** – flows(2) 2.5 x faster
- **Spread density** – packs 30% more densely
- **Adsorption** – ½ the water adsorption – 2 x desorption
- **Chemically Stable –** less than 3% Mg loss vs 30% for competitor

- **Higher design allowable (30%)**
- **3 – 4 x increase in production speed**
- **Lighter, stronger parts built faster and consistently**

(1) Wadell Sphericity test
(2) Carney flow test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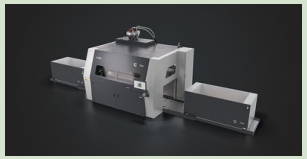
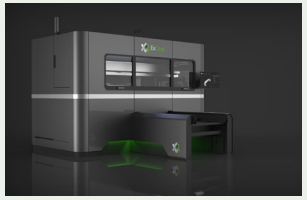
ExOne™

Metal Printing Solutions

	Family	Technology	Material	Build Volume	Layer Thickness	Build Rate
	S-MAX	Binder Jetting (sand mold)	Any sand mold alloy	1.800 X 1.000 X 700 mm	0.26 – 0.38 mm	up to 125* l/h
	Pro & Innovent Series	Binder Jetting (print part-sinter)	Single alloy, composites & ceramics	800 x 500 x 400 mm	30 to 200 µm	More than 10,000+ cc/hour
	Metal Designlab	FDM (print part-sinter)	316L & 17-4PH Stainless Steel	200 x 280 x 150 mm	Nozzle 0.6 and 0.4 mm	40 cc/h (2.4 cu in/hr)

Bound Metal Printing Solutions

- Workflow: CAD → Print → Sinter
- Water based consumable no solvents
- One day print, one day sinter
- Refillable consumable cartridges
- Designed for low maintenance & ease of use
- Dual head MIM paste, polymer support
- Material list expansion roadmap

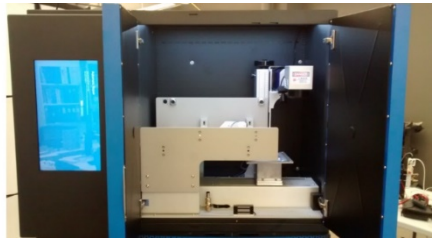


Canada’s AM machines



NANOGRANDE

JUAN SCHNEIDER JUAN.SCHNEIDER@NANOGRANDE.COM MONTREAL, QC



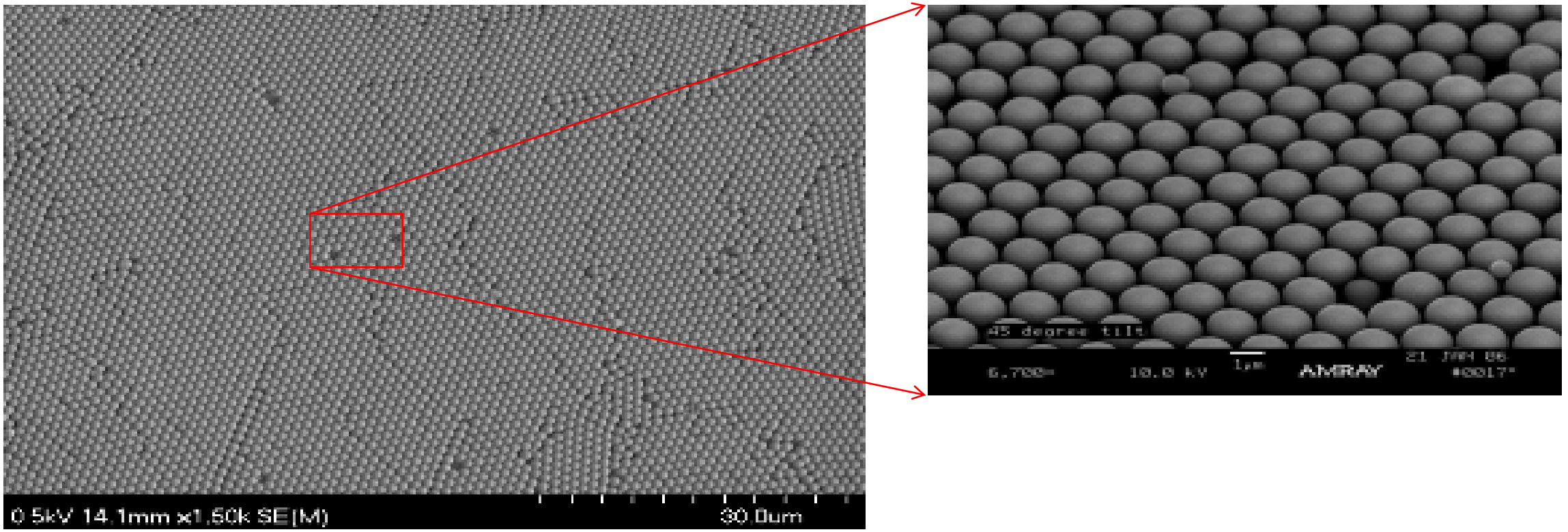


MPL-200 Technical Specifications

GENERAL			
Category	Industrial		
Technology	Binder Jetting, FluidBed		
Materials	Ceramics, Metals, Polymers, Carbon nanotubes		
PERFORMANCE		**EQUIPMENT**	
Max. build size (mm)	100 x 100 x 100	System dimensions (cm)	115 x 59 x 174
Optional extended volume	200 x 200 x 200	Weight	250 kg
XYZ accuracy	3 µm	**JETTING SYSTEM**	
Max. build speed*	480 cm^3/h	Drop volume (8 levels)	6 to 42 pL
Min. layer thickness	0.5 µm	Injector speed	0.83 m/s

*Made with layers of 20 µm thickness

LAYER FORMATION QUALITY



SEM images of layer made with 800 nm particles diameter. System shows hexagonal closed packing density arrangement, the highest packing density possible for a powder with narrow size distribution (**MONODISPERCED POWDER**).

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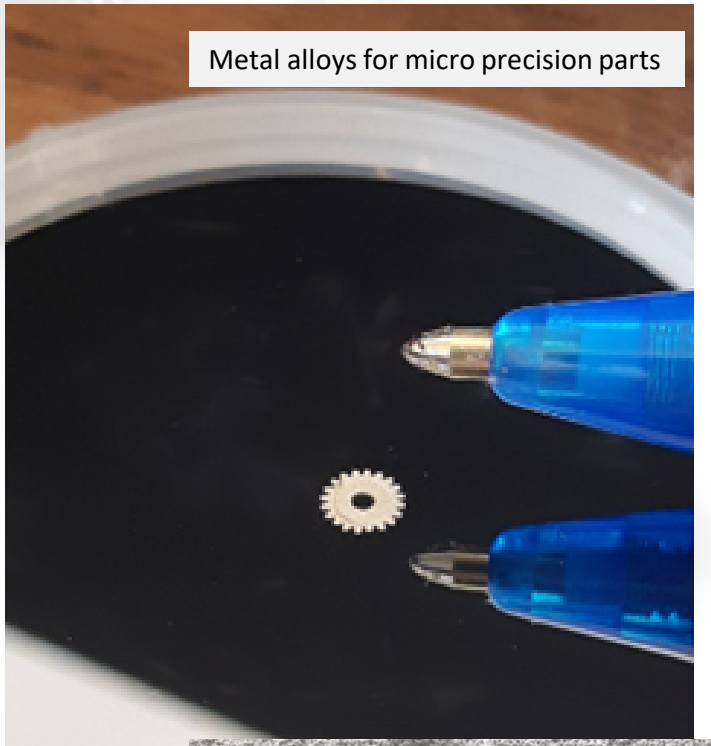
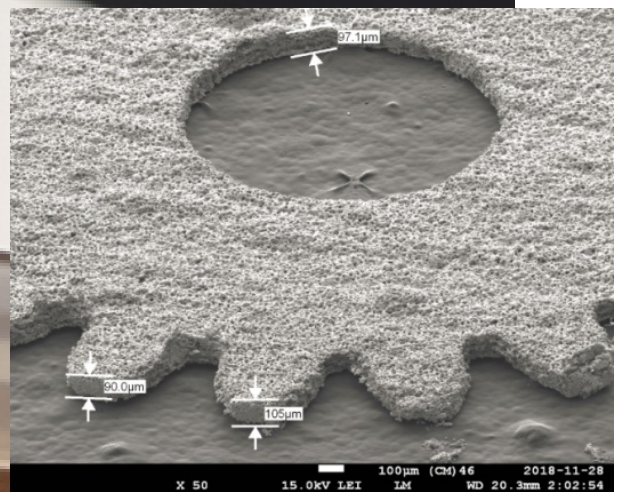
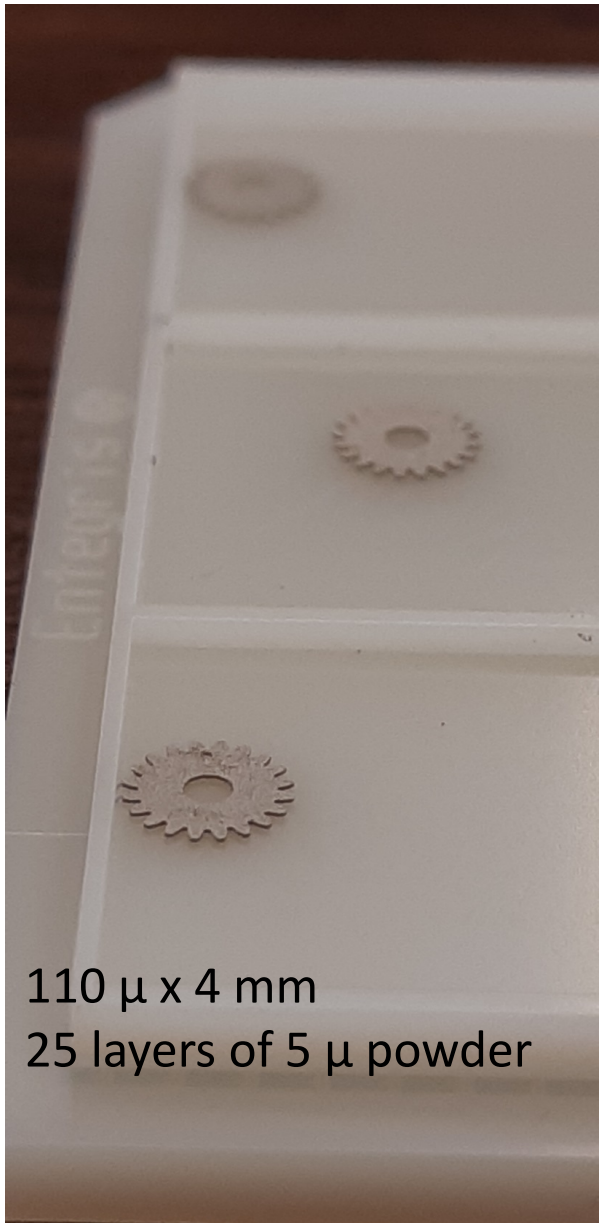
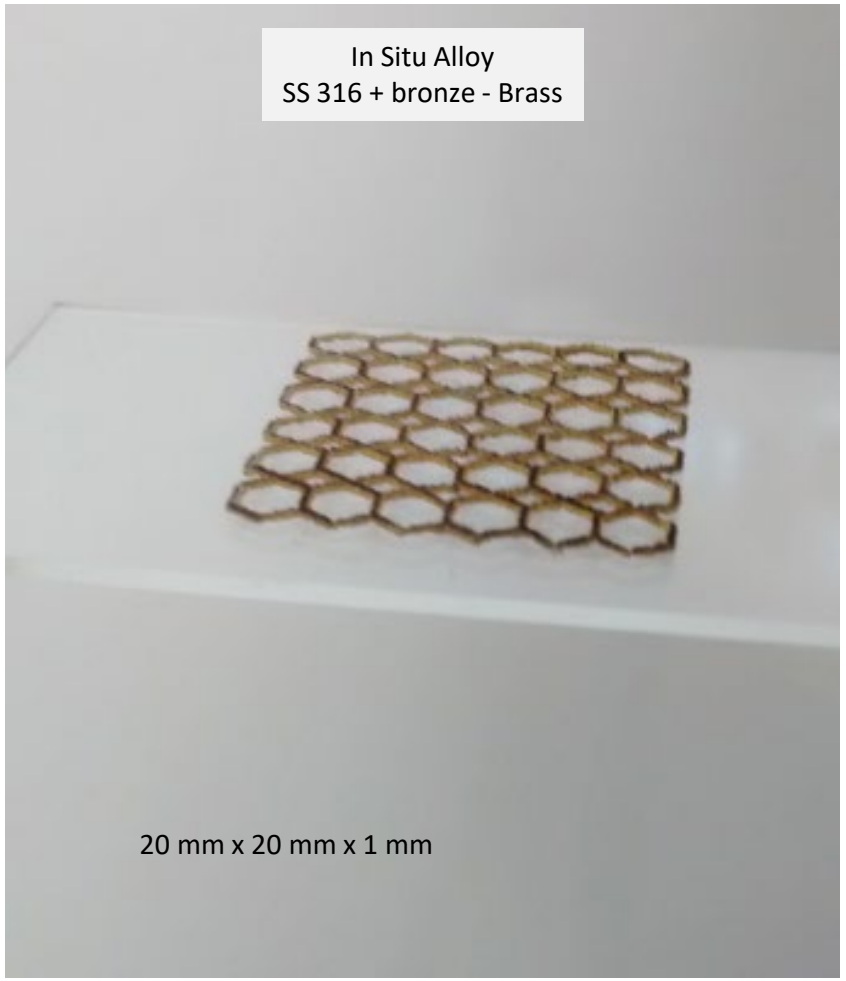
HIGH RESOLUTION PARTS









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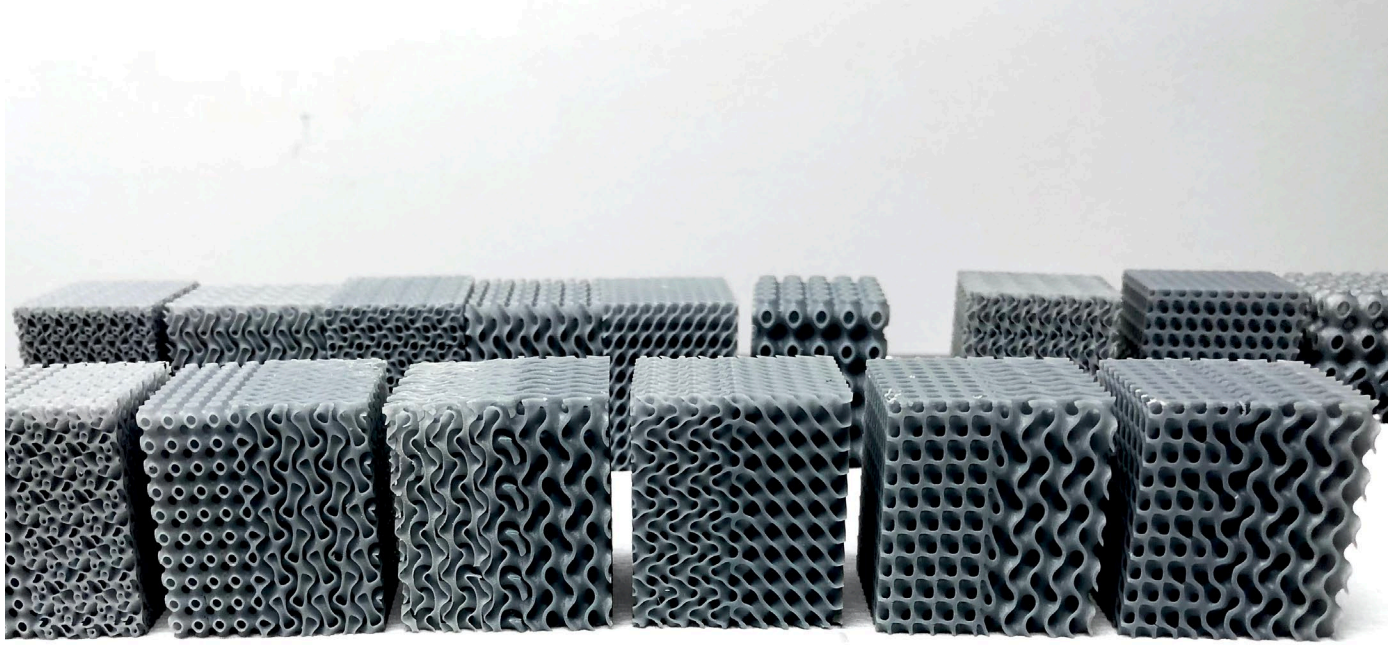
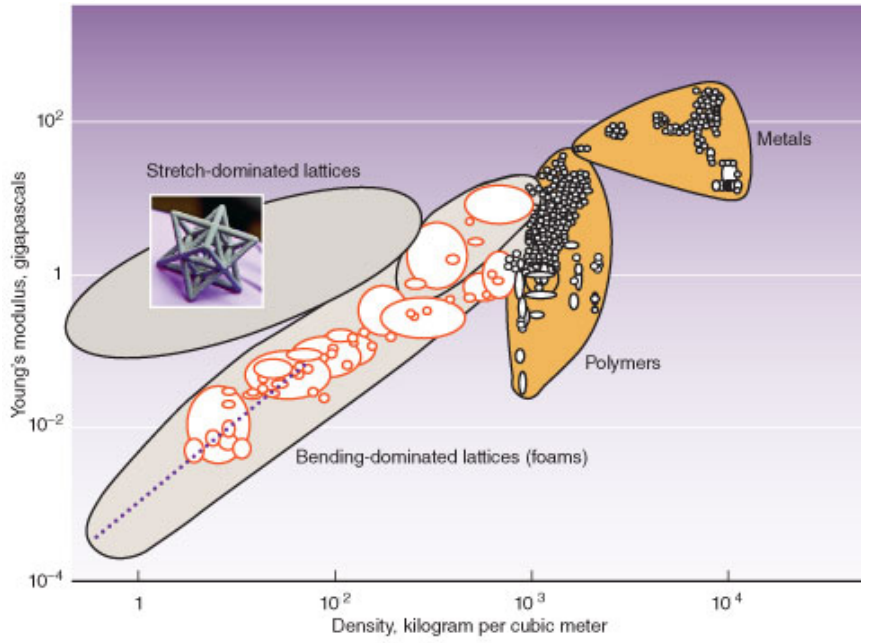
METAFOLD

Mathematics powered 3D printing

Elements of 3D Printing	
Materials	Geometry
Polymers Ceramics Metals	Lattices Microstructures Metamaterials
Fixed Properties	Variable, controllable properties

***Metamaterials**:* engineering extraordinary material behaviour through geometry.





METAFOLD

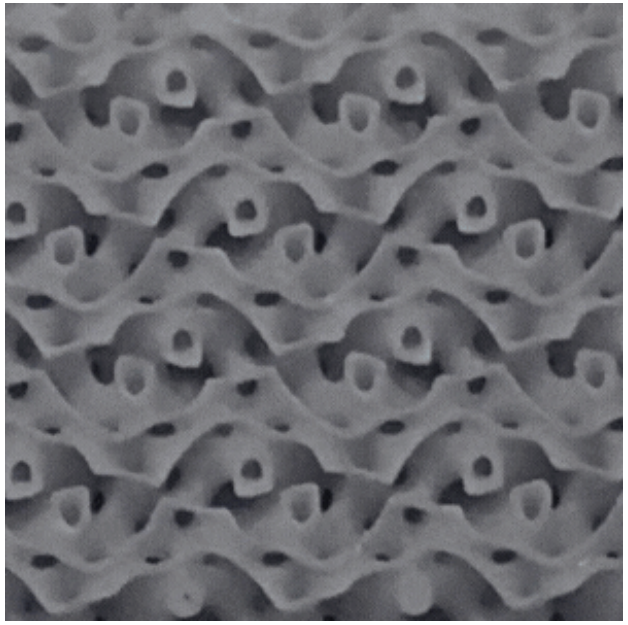
Mathematics powered 3D printing

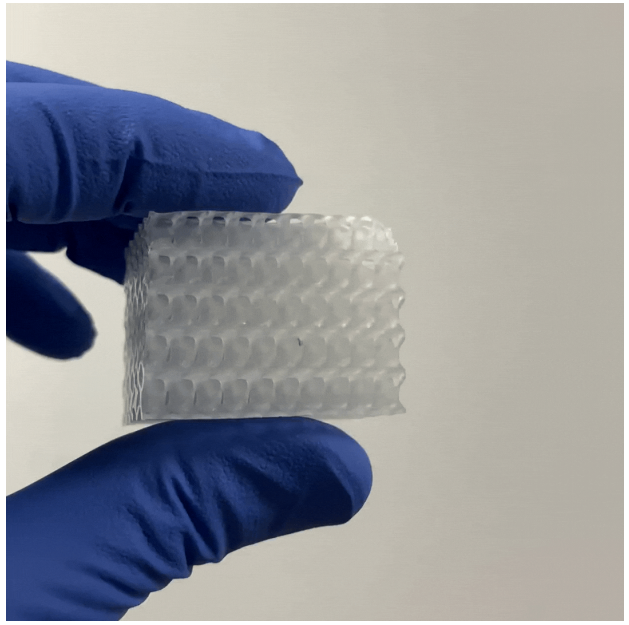
Metafold prints metamaterials*:*
We harness geometry to unlock extraordinary material performance beyond polymers, ceramics and metals.

Metafold prints lattices:
We handle *millions* of lattice unit cells while other systems struggle to print hundreds.

Applications:

- Aerospace: ultra lightweight yet strong structures
- Medical: bone implants, vascularized tissue
- Environment: high surface area filtration media
- Consumer: sportswear to enhance athletic performance

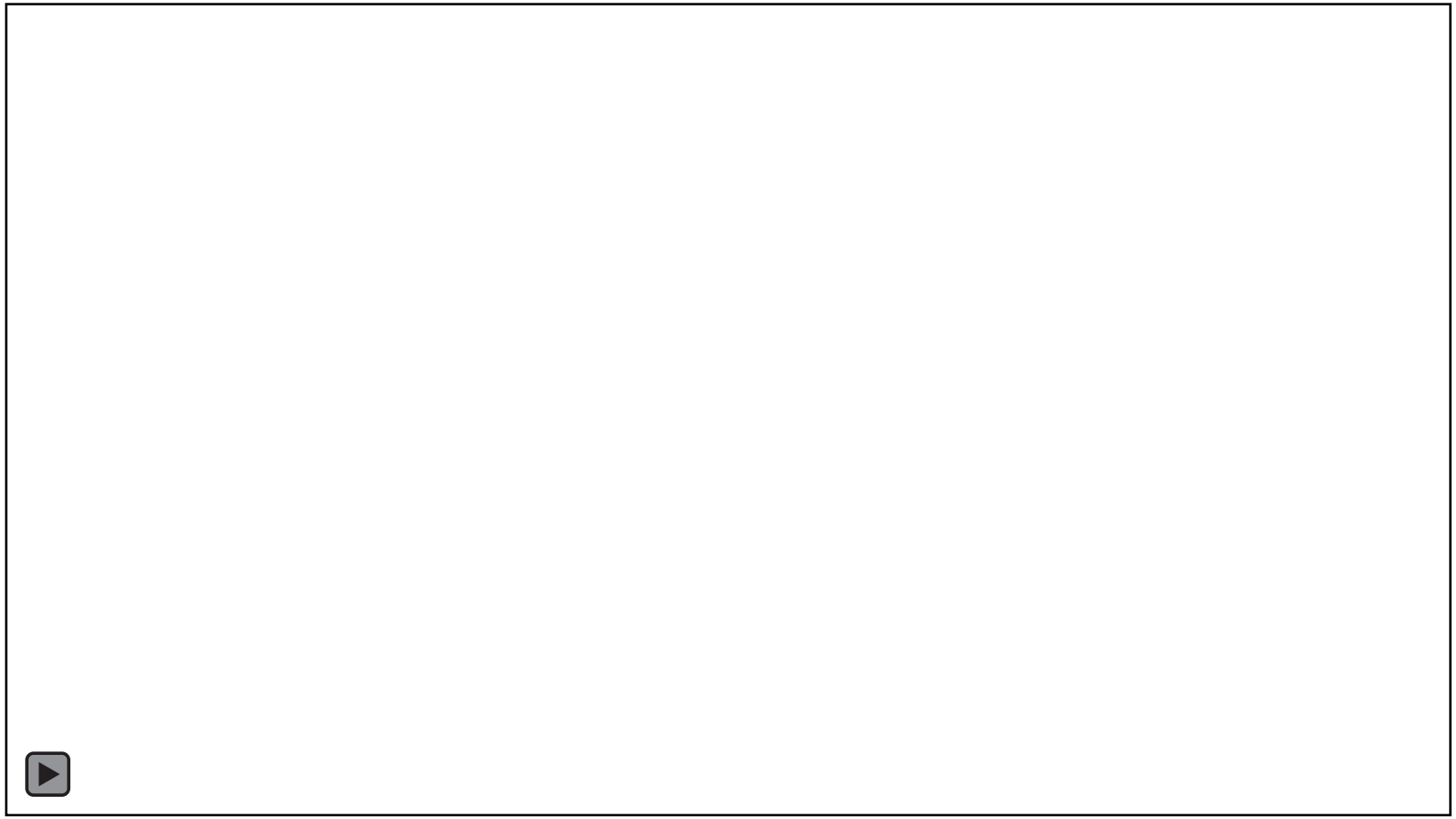




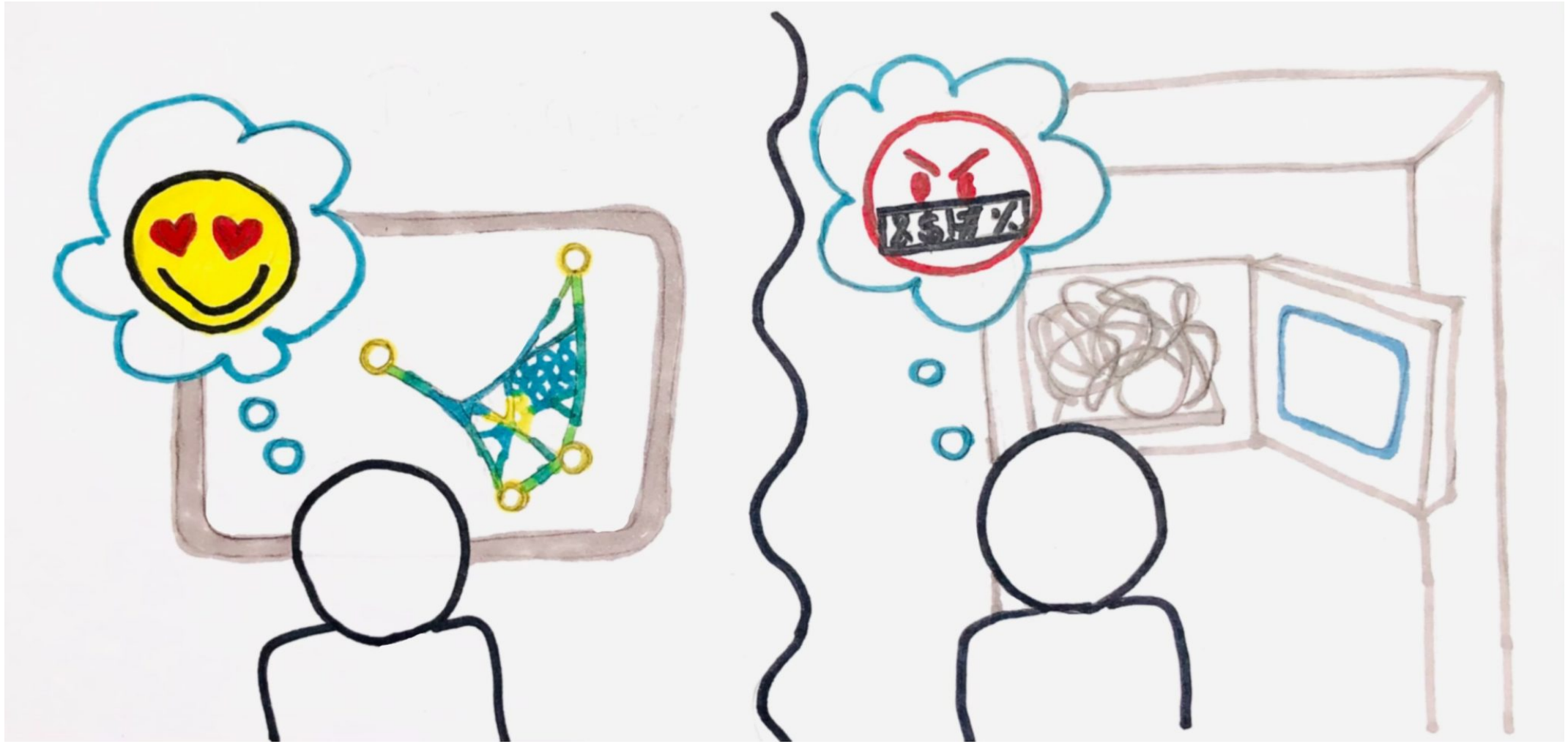
What could *you* do with metamaterials?

www.metafold3d.com

Dr. Elissa Ross, CEO
elissa@metafold3d.com

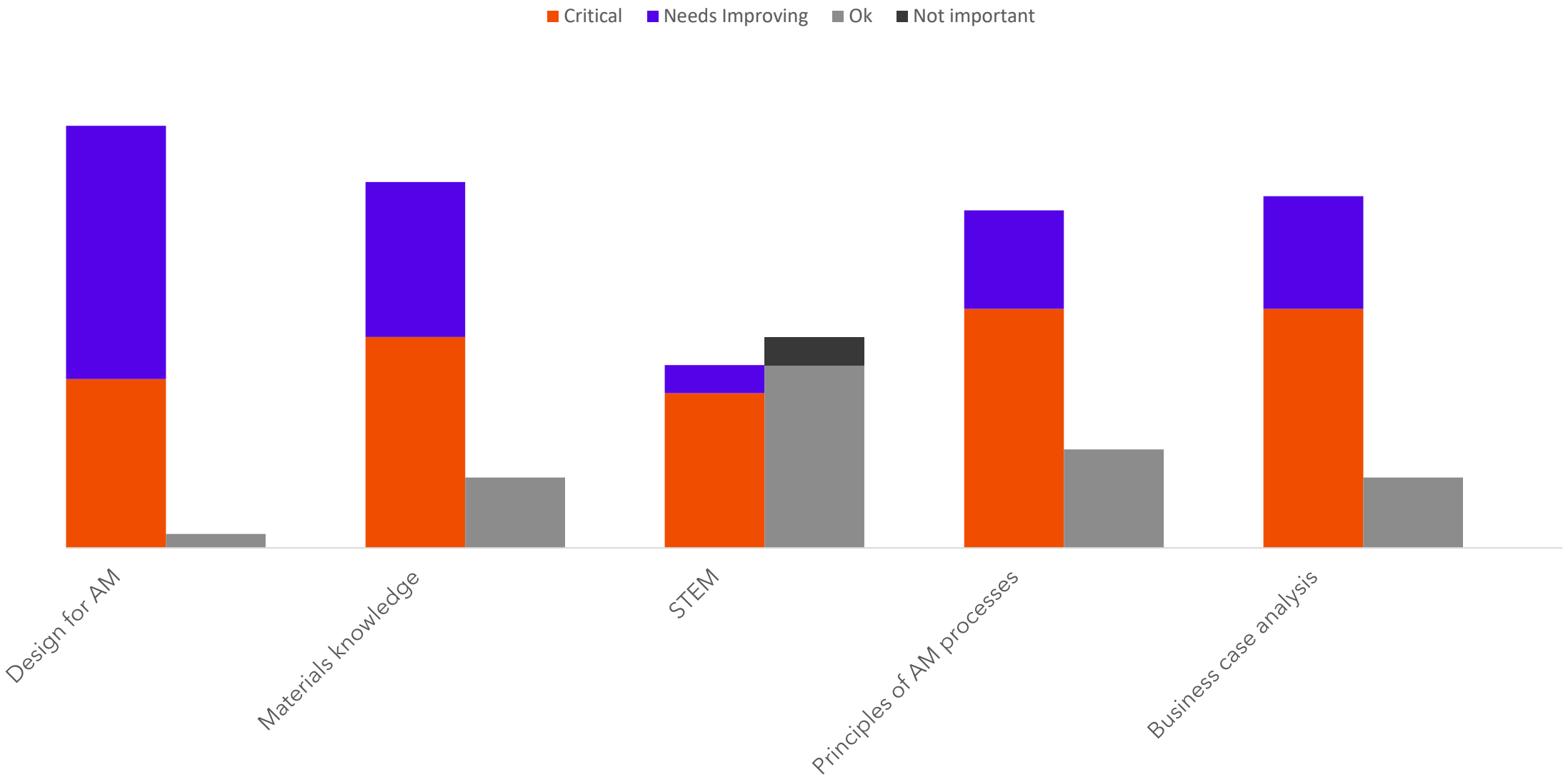


DfAM/MfAM Make Anything…

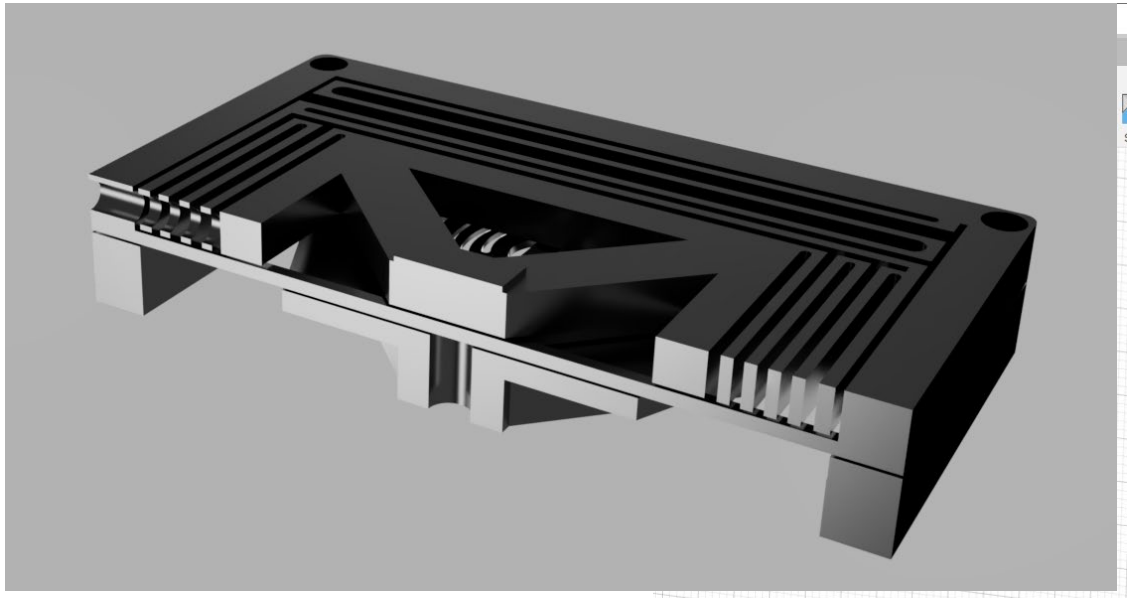


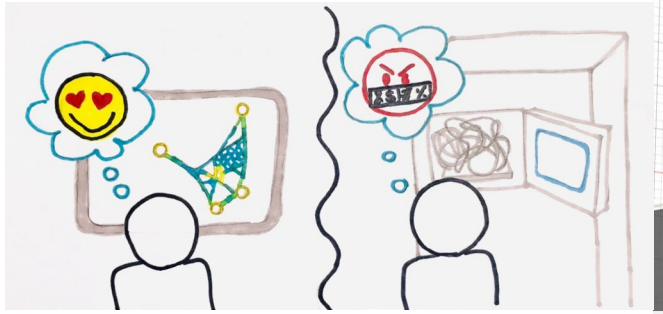
The Design Engineer’s creation (left) and the Production Engineer’s reality (right) (Image courtesy of Laura Ely)

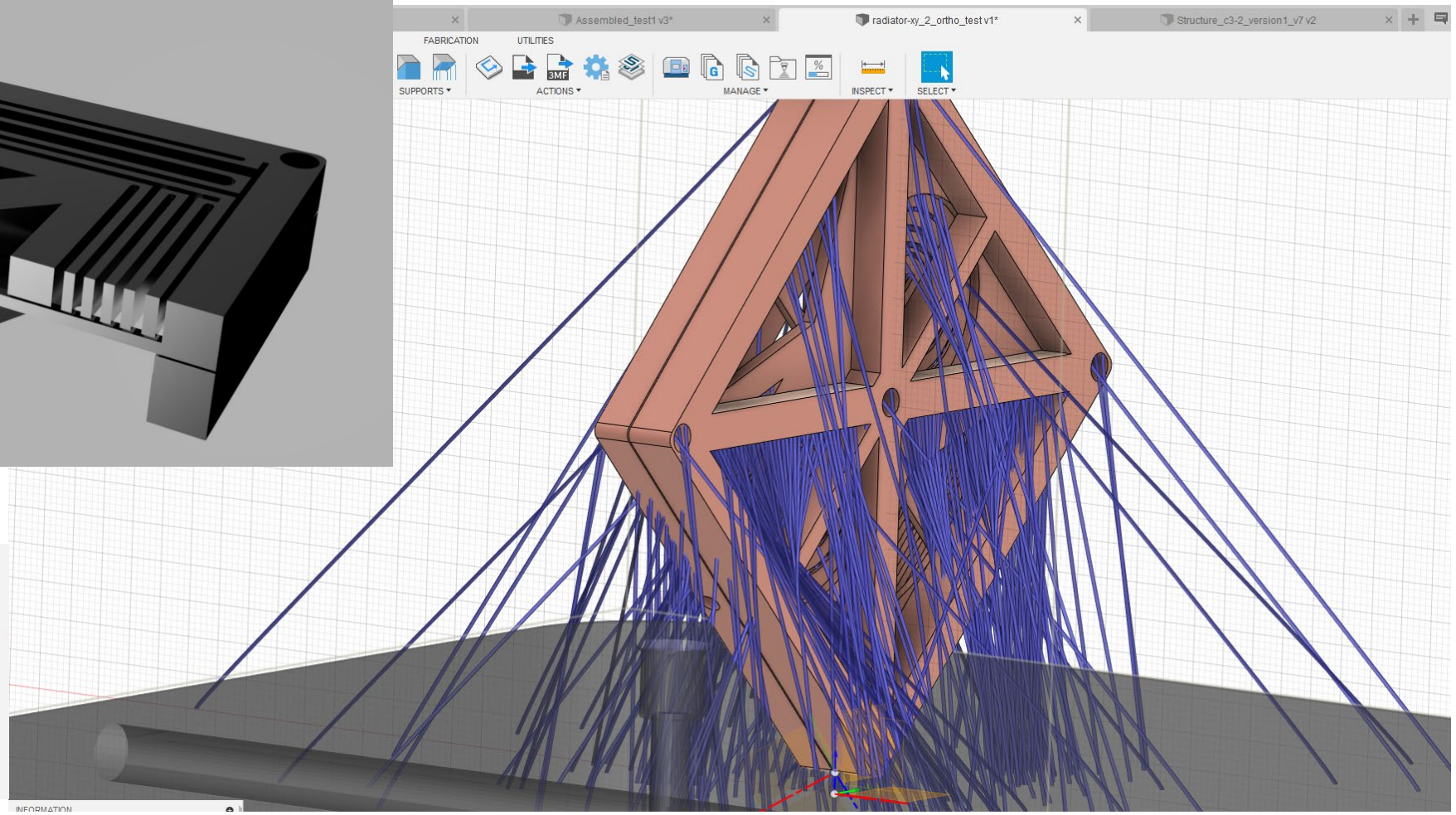
What skill sets for additive manufacturing are most important for your organisation?



DfAM mentoring

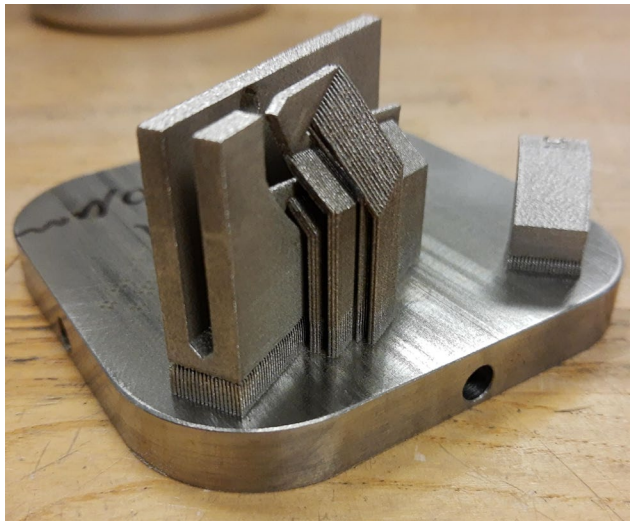


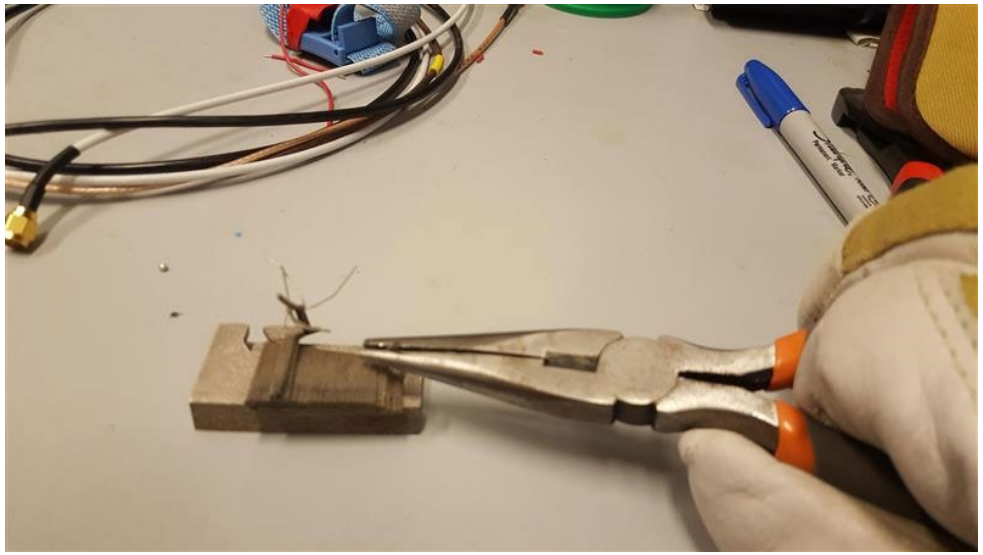


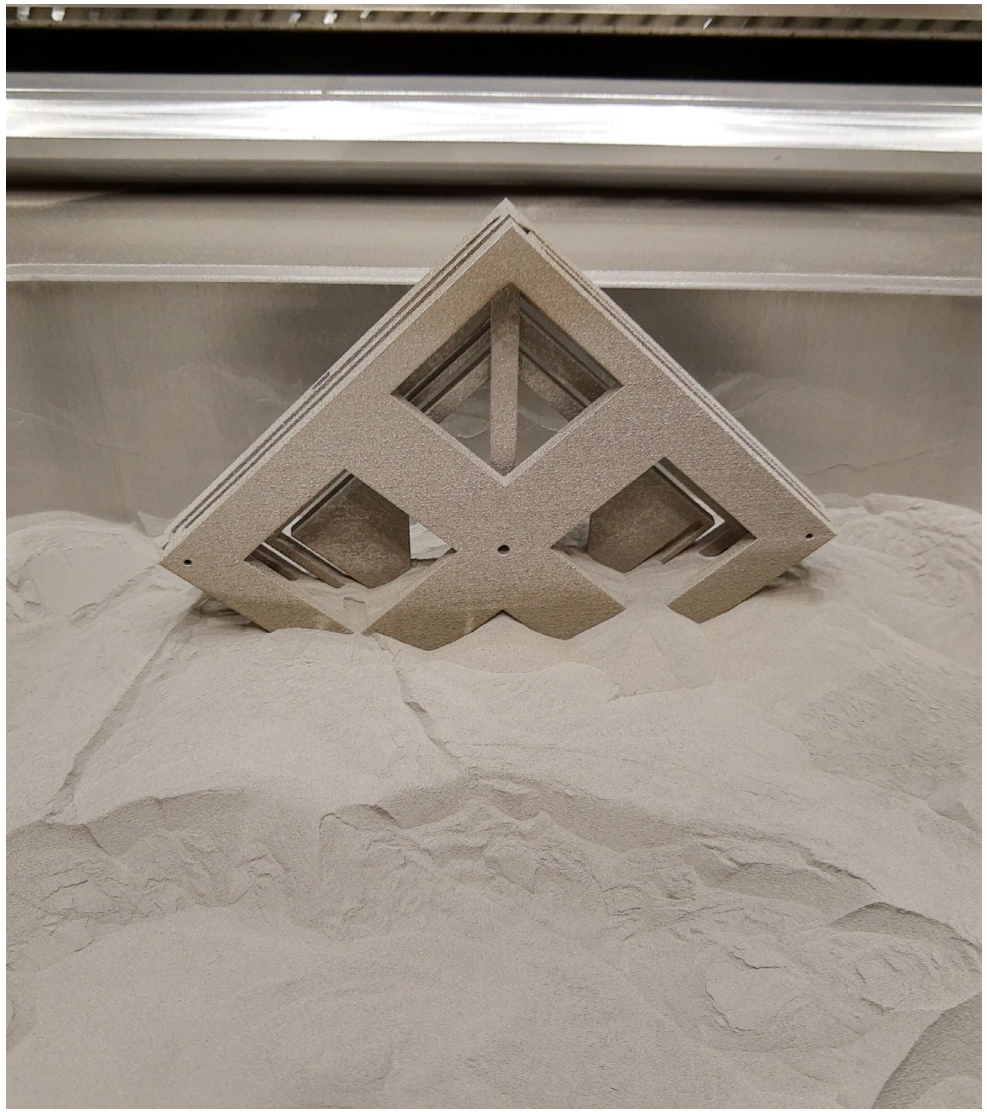


Mark: Nothing beats removing supports from a weak structure to learn yet another engineering trade-off

R: I have steady hands. I beat three dentists in a game of jenga once

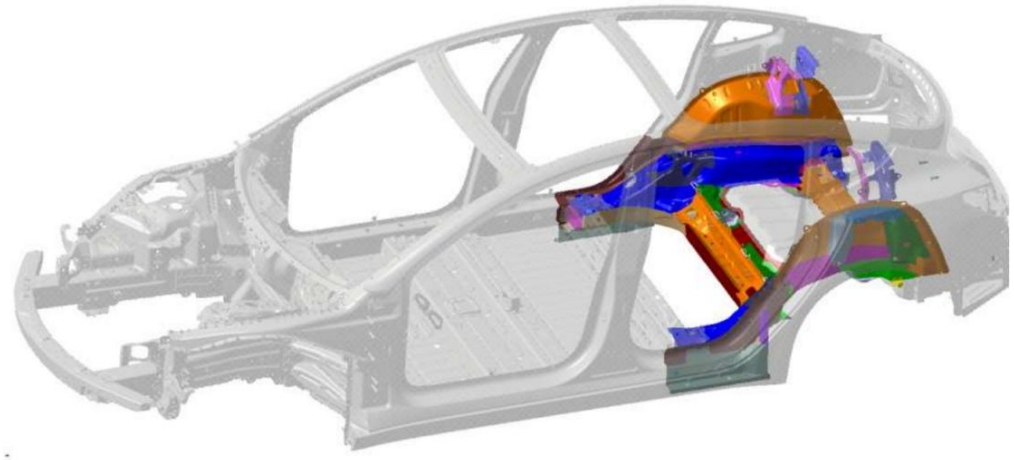






1% of $1.4Tn?

SIMPLIFICATION OF VEHICLE STRUCTURE AND MANUFACTURING



Model 3 rear underbody
70 pieces of metal



2 p

NGen Next Generation Manufacturing Canada

Additive Manufacturing in Canada

Q & A

What's Next Thought Leadership → March 25th Event

Join us **Thursday March 25th at 11am EST** for our next *What's Next Through Leadership* series event.

Topic: Carbon Mitigation as a Competitive Advantage

We'll be joined by Greg Zilberbrant (McMaster) and Paul Rak (Veriform) to discuss opportunities and best practices in carbon mitigation. Paul will be sharing real-world experience in his journey of introducing carbon mitigation in his facility.

Watch your email for further details, and to register!



Special Announcement!

Join us **Wednesday April 28th** for a special event:

Strengthening Resilience and Agility in Canada's Manufacturing Supply Chains

We'll be exploring various topic areas including:

- **Scaling Up to Support the Evolving Canadian Supply Chain**
- **Digital Tools that Transform the Canadian Supply Chain**
- **Increasing Supply Chain Resilience with Op Ex.**
- **And much, much more!**

Watch your email for further details, and to register!

