



GE Additive

Let's Build Anything Together







+ GE Additive

Ushering in a world with limitless potential

GE Additive is a global leader in additive design and manufacturing. We empower our customers to build innovative new products that solve manufacturing challenges, improve business outcomes and help change the world for the better. We partner with a variety of industries, including aerospace, healthcare, energy and automotive, to guide their additive journeys and support them with our additive knowledge and experience.

We are committed to be your honest and trusted partner in additive design and manufacturing. How can we help you on your journey?

Through our offerings of machines, software, services, and consultancy we help our customers overcome manufacturing challenges and improve business outcomes. Our commitment to lead the industry is realized through Arcam EBM and Concept Laser machines, AP&C powders and AddWorks™, our own engineering consultancy services. With each additive technology advancement, we accelerate innovations across industries and help the world work smarter, faster and more efficiently.

+ Customer experience

Once you've decided that additive technology is right for your business, the next steps may prove intimidating. We know this journey is about more than just installing additive machines—it's about changing the core of your manufacturing capabilities.

GE can put your fears to rest by confidently walking alongside you as your partner, helping you throughout each stage of adoption and helping to scale operations, from prototyping and small runs to full-scale production—reducing costs and allowing you to create newly designed products with improved performance. And as issues occur, you will be connected to a vast network of experts, partners and suppliers that will assist your organization in integrating additive manufacturing.

To help further adoption of additive technology, our Customer Experience Centers (CEC) also serve as training centers for additive design, machine operations, materials and software, providing hands-on instruction. In addition to providing support for our customers and their additive products, these centers will also operate as logistics hubs for machines, spare parts and materials. And to ensure GE remains at the leading edge of the industry, our CECs will continue to focus on additive research and material development.

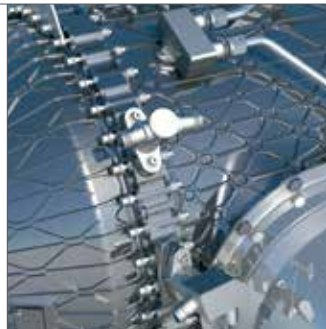
+ Proven applications

Additive manufacturing expands the design envelope and enables the creation of lighter and stronger, parts and systems.



GE Aviation's fuel nozzle tip

One of the first additively manufactured jet engine components, the CFM International* LEAP fuel nozzle tip combines 20 parts into one, offering five times the durability and 25% less weight. Designed for sustainably high, long-term output, we expect to produce more than 200,000 fuel nozzle tips during the life of the program.



The Catalyst engine

In developing the Catalyst engine for Cessna's new aircraft, the design condensed 855 conventionally manufactured parts down to 12, significantly reducing weight by 5% and improving fuel efficiency with a 20% lower fuel burn.



On-demand spare parts

Jung & Co., a specialist in stainless steel components for the beverage industry, relies on AM to ensure that spare parts are available more quickly. They have also begun utilizing additive to achieve a 35% weight reduction in can filler valves—successfully working with GE Additive's Concept Laser machines to significantly reduce parts and assembly.



Hip Cup

In recent medical applications, AM has been used to develop an acetabular cup (commonly known as a hip cup) to substitute for the ball-and-socket structure of the hip. Allowing greater design freedom to develop and manufacturer unique designs mimicking the bone structures of the recipients.

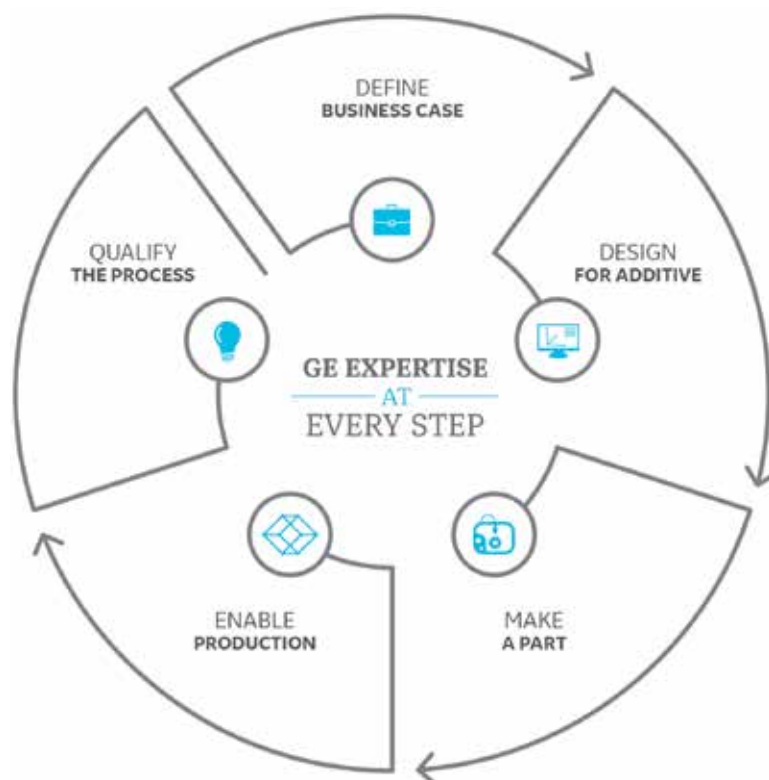
*CFM International is a 50/50 joint company between GE Aviation and Safran Aircraft Engines

+ AddWorks™

Have you been thinking about taking the leap into additive manufacturing and aren't sure where to start? Or have you already made a commitment but need help taking additive to the next level? AddWorks helps organizations accelerate the adoption of additive manufacturing. The AddWorks team has successfully assisted customers across a variety of industries realize success with additive manufacturing.

AddWorks consultants have been on the front lines of advanced manufacturing and have made GE the leader in additive. They are the same engineers who have helped introduce parts to the market and advanced them to full-scale production. Some of these parts include the iconic LEAP fuel nozzle and the Catalyst engine, which is comprised of close to 35% additive parts. We are now ready to apply our more than 20 years' experience to help you take advantage of the benefits of additive. Let us show you how.

The additive journey



DEFINE

- Discovery workshop

DESIGN

- Disruptive design
- Materials development
- Material data

MAKE

- Prototypes
- Post processing

ENABLE

- Facilities consulting
- Production process development
- LRIP

QUALIFY*

- Part and machine qualification

**Securing and maintaining certifications or qualifications with the relevant regulators or to final customer quality requirements remains the responsibility of the customer.*

+ Electron Beam Melting machines

Arcam EBM machines create dimensionally accurate parts quickly and efficiently by utilizing a high-power electron beam for high melting capacity and productivity. The Arcam EBM process takes place in a vacuum and at a high temperature, resulting in stress-relieved components with material properties better than cast and comparable to wrought material.



Arcam EBM A2X

The Arcam EBM A2X is the ultimate additive manufacturing solution for titanium alloys and processing materials that require high-process temperatures.

BUILD ENVELOPE
200 x 200 x 380mm

ELECTRON BEAM POWER
3000 W



Arcam EBM Q10plus

The Arcam EBM Q10plus is the new generation EBM machine designed specifically for cost-efficient production of orthopedic implants.

BUILD ENVELOPE
200 x 200 x 180mm

ELECTRON BEAM POWER
3000 W



Arcam EBM Q20plus

The Arcam EBM Q20plus is specifically designed for cost-efficient production of aerospace components.

BUILD ENVELOPE
(ØxH): 350 x 380mm

ELECTRON BEAM POWER
3000 W



Arcam EBM Spectra H

The Arcam EBM Spectra H delivers faster builds and leading production at high temperatures.

BUILD ENVELOPE
250 mm x 430 mm

ELECTRON BEAM POWER
6kW



Fast Fact

Arcam EBM supplies the industry's only electron beam powder-bed additive manufacturing machines.

+ Direct Metal Laser Melting machines

Lasers are utilized to melt layers of fine metal powder and create complex geometries with incredible precision directly from a CAD file. A wide range of available machine envelope sizes and innovative features set these machines apart. One such feature—Concept Laser’s patented technology—combines laser and melting to create high-precision, mechanically and thermally resilient metallic components layer by layer.



Mlab cusing / Mlab cusing R

The Mlab cusing and Mlab cusing R are designed for manufacturing parts with delicate structures.

BUILD ENVELOPE

50 x 50 x 80mm³ (x,y,z)
70 x 70 x 80mm³ (x,y,z)
90 x 90 x 80mm³ (x,y,z)

LASER TYPE

100 W



Mlab cusing 200R

The Mlab cusing 200R is suited for high-surface quality and creating intricate part structures.

BUILD ENVELOPE

100 x 100 x 100mm³ (x,y,z)
70 x 70 x 80mm³ (x,y,z)
50 x 50 x 80mm³ (x,y,z)

LASER TYPE

200 W



M1 cusing

The M1 cusing is specifically targeted toward industries where light-weighting is not the main concern, making it well-suited for dental and mold production.

BUILD ENVELOPE

250 x 250 x 250mm³ (x,y,z)

LASER TYPE

200 W (400 W option)



M2 cusing / M2 cusing Multilaser

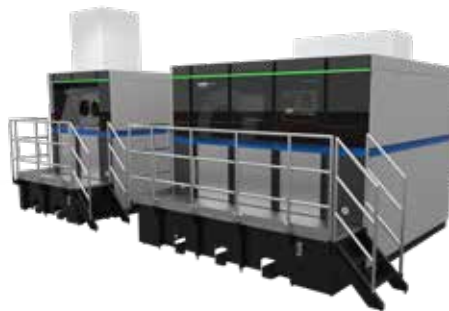
The M2 cusing and M2 cusing Multilaser are robust. The separation of the build chamber and unpacking make them suitable for 3-shift operation.

BUILD ENVELOPE

250 x 250 x 350mm³ (x,y,z)

LASER TYPE

Single or dual 200 W laser
(400 W option)



M LINE FACTORY

Engineered with an innovative modular machine architecture that offers automation, the M Line Factory enables economical series production on an industrial scale.

BUILD ENVELOPE

500 x 500 x 400mm³ (x,y,z)

LASER TYPE

3D optics with maximum power of 4 x 400 W or 4 x 1 kW



X LINE 2000R

As the world’s largest metal melting machine (160-liter build volume), the X LINE 2000R is a high-performance production machine with 2 x 1000 watt lasers for safe processing of reactive materials.

BUILD ENVELOPE

800 x 400 x 500mm³ (x,y,z)

LASER TYPE

Single or dual 1 kW laser



CONCEPTLASER
a GE Additive company

Fast Fact

Concept Laser provides the largest build envelope in a laser-based, powder-bed DMLM machine.

+ AP&C Powders

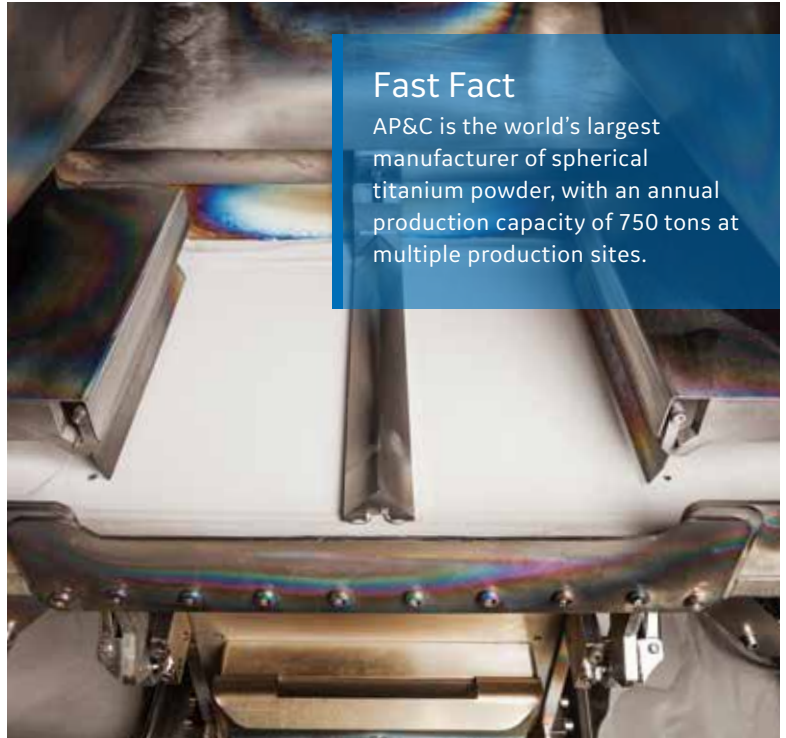


As an experienced producer of spherical metal powders designed for additive manufacturing, AP&C offers the quality powders designed for the EBM, DMLM, binder-jet and Direct Energy Deposition (DED) processes. In addition, this level of precision is available at competitive prices—allowing for reliable and cost-efficient production.

Advanced Plasma Atomization

AP&C's proprietary Advanced Plasma Atomization technology consistently delivers the same powder properties from one batch to another. Developed to meet the stringent requirements of the aerospace and medical industries, the melting wire never comes into contact with any solid surface, preventing contamination for a high purity product. The Advanced Plasma Atomization process uses plasma torches to melt and atomize the metal wire feedstock, allowing for an accurate feed rate and excellent control of the atomization process.

AP&C plasma atomized powders are well adapted for all additive manufacturing technologies—from R&D to large-scale production—offering exceptional flowability, purity, and density with a very low level of enclosed gas porosities. AP&C's powder quality helps improve the precision and batch-to-batch consistency of additive manufacturing processes.



AP&C specialties and customizations

Specializing in high-purity spherical powders of Titanium and Titanium alloys (as well as nickel-based alloys), the advanced plasma atomization process is also well-suited for almost any reactive or high melting point material. Upon customer request, AP&C can produce custom alloys, and leverage its experience to fine-tailor the finished powder qualities.

Quality certifications

AP&C is an AS 9100C / ISO 9001:2008 / ISO 13485 certified company that provides full traceability from the ingot to the final powder lot.

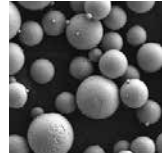
STANDARD MATERIALS

High purity titanium: CpTi grade 1 and CpTi grade 2

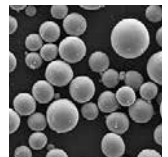
Powder chemistry may comply with standards: ASTM B348, ASTM F67, ASTM F1580 Typical particle size distributions (PSD): 0-20 µm, 15-45 µm, 15-63 µm, 45-106 µm, 45-150 µm

PSD	Size distribution by laser diffraction (ASTM B822)			Apparent density (ASTM B212)	Flow rate (ASTM B213)	Oxygen content	
	D10	D50	D90			Grade 1	Grade 2
0-25 µm	6 µm	12 µm	21 µm	2.7 g/cm ³ *	—	—	0.19 %
15-45 µm	17 µm	32 µm	44 µm	2.55 g/cm ³	29 s	0.13 %	0.19 %
15-63 µm	19 µm	36 µm	50 µm	2.56 g/cm ³	27 s	0.12 %	0.18 %
45-106 µm	50 µm	74 µm	100 µm	2.61 g/cm ³	23 s	0.10 %	0.16 %
45-150 µm	55 µm	82 µm	120 µm	2.62 g/cm ³	25 s	0.10 %	0.16 %

*Tap density per ASTM B527



AP&C CpTi grade 1 / 15-45 100um



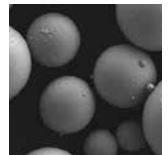
AP&C CpTi grade 2 / 45-106 500um

Titanium alloys: Grade 5 and Grade 23

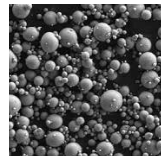
Powder chemistry may comply with standards: ASTM B348, ASTM F136, ASTM F1580, ASTM F2924, ASTM F3001, AMS 4998. Typical particle size distributions (PSD): 0-20 µm, 15-45 µm, 15-63 µm, 45-106 µm, 45-150 µm, 106-180 µm

PSD	Size distribution by laser diffraction (ASTM B822)			Apparent density (ASTM B212)	Flow rate (ASTM B213)	Oxygen content	
	D10	D50	D90			Grade 5	Grade 23
0-20 µm	6 µm	13 µm	19 µm	2.8 g/cm ³ *	—	0.19 %	—
15-45 µm	20 µm	34 µm	44 µm	2.49 g/cm ³	28 s	0.16 %	0.11 %
15-63 µm	24 µm	44 µm	61 µm	2.50 g/cm ³	25 s	0.15 %	0.10 %
45-106 µm	52 µm	71 µm	102 µm	2.47 g/cm ³	24 s	0.13 %	0.08 %
45-150 µm	54 µm	81 µm	123 µm	2.59 g/cm ³	25 s	0.13 %	0.08 %

*Tap density per ASTM B527



AP&C Ti6Al4V grade 23 / 15-45 500um



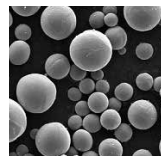
AP&C Ti6Al4V grade 5 / 45-106 500um

Nickel-based alloys: UNS N06625 & UNS N07718

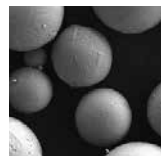
Powder chemistry may comply with standards: ASTM B472, ASTM B637, ASTM F3055, ASTM F3056, AMS 5596, AMS 5662, AMS 5666. Typical particle size distributions (PSD): 0-20 µm, 15-45 µm, 15-63 µm, 45-106 µm, 45-150 µm

PSD	Size distribution by laser diffraction (ASTM B822)			Apparent density (ASTM B212)	Flow rate (ASTM B213)
	D10	D50	D90		
0-20 µm	5 µm	10 µm	18 µm	5.0 g/cm ³ *	—
15-45 µm	20 µm	32 µm	43 µm	4.67 g/cm ³	—
45-106 µm	52 µm	73 µm	105 µm	4.86 g/cm ³	13 s
45-150 µm	52 µm	85 µm	137 µm	4.75 g/cm ³	13 s

*Tap density per ASTM B527



AP&C UNS N07718 grade 5 / 45-106 1.00um



AP&C UNS N06625 15-45 1.00um

+ GE Additive Materials

Leveraging decades of metal powder experience and materials science expertise

GE's commitment to the additive industry includes more than 1,000 material scientists, engineers, and characterization experts. These experts continue to help GE understand, develop and differentiate new powdered materials to help move the additive industry forward.

GE's materials expertise spans most relevant materials families including, but not limited to, aluminum, titanium, steel, nickel, magnetics, ceramics and polymers. And as a company, GE has filed thousands of patent applications covering Innovations in Materials Science and Additive Manufacturing.

We also offer a variety of mechanical behavior design data to enable efficient material selection, product designs and material science services to develop the data and parameter sets that customers require to adopt additive technology.

Advanced materials

Through Arcam EBM and Concept Laser, GE Additive offers a total solution for a selection of standard materials. For these materials, we provide metal powder, process settings and support.

Titanium

Cobalt chromium

Nickel-based alloys

Aluminum

Hot-work steel

Stainless steel

Bronze

Precious metals

We offer advanced training for parameter development so that our customers are able to optimize existing parameters for specific applications as well as develop their own parameters for unique material needs.

Tested and validated

GE Additive companies have a validated powder supply chain with traceability of every powder batch delivered. Our certified and tested powders undergo rigorous quality-control measures and feature tailored characteristics with high performance before delivery to our customers.



MATERIALS TO MACHINE MATRIX

<p><i>Use this quick guide to see what combination of additive material and 3D printing system is right for your application.</i></p>		ARCAM EBM MACHINES				CONCEPT LASER DMLM MACHINES					
		Q10Plus	Q20Plus	A2X	Spectra H	Mlab cusing / Mlab cusing R	Mlab cusing 200R	M1 cusing	M2 cusing / M2 cusing Multilaser	M LINE FACTORY	X LINE 200R
Material Number / Type	Description										
Arcam EBMTi-6Al-4V	Titanium alloy (TiAl6V4, Grade 5)	•	•	•	•						
Arcam EBMTi-6Al-4V ELI	Titanium alloy (TiAl6V4 ELI, Grade 23)	•	•	•							
Arcam EBM CoCr ASTM F75	Cobalt-chromium alloy (CoCrMo)	•									
Arcam EBM Ti Grade 2	Titanium alloy (Commercially Pure, Grade 2)	•									
Arcam EBM TiAl	Titanium Aluminide				•						
Arcam EBM Nickel 718	Nickel-based alloy 718			•	•						
CL 20ES	Stainless steel (316L, 1.4404)					•	•	•	•		
CL 30AL	Aluminum alloy (AlSi12)								•		
CL 31AL	Aluminum alloy (AlSi10Mg)					•	•		•		
CL 32AL	Aluminum alloy (AlSi10Mg)										•
CL 35AL*	Aluminum alloy (AlSi7Mg/F357)								•		
CL 41Ti ELI	Titanium alloy (TiAl6V4 ELI, Grade 23)					•	•		•		•
CL 42Ti	Titanium alloy (Commercially Pure, Grade 2)					•	•		•		
CL 50WS	Maraging steel (MS300/1.2709)						•	•	•		
CL 80CU	Copper alloy, Bronze					•	•				
CL 91RW	Corrosion resistant precipitation hardening steel							•	•		
CL 92PH	Precipitation hardening stainless steel (17-4 PH)					•	•	•	•		
CL 100NB	Nickel-based alloy 718							•	•	•	•
CL 101NB	Nickel-based alloy 625							•	•		
CL 110CoCr*	Cobalt-chromium alloy (F75)								•	•	
remanium star CL	Cobalt-chromium alloy (CoCrW, Dentaureum)					•	•	•	•		
rematitan CL	Titanium alloy (Ti64, Dentaureum)					•	•		•		
Silver	930 ‰					•					
Yellow Gold	18 carat 3N					•					
Rose Gold	18 carat 4N					•					
Red Gold	18 carat 5N					•					
Platinum	950 ‰					•					

Check with your GE Additive sales team member for the status of new alloys
 *Material is currently being prepared

+ Flexible financing with GE Capital

Find solutions tailored to your needs

GE Additive offers flexible financing solutions through our dedicated GE Capital financing team. The GE Capital Industrial Finance team provides comprehensive financing solutions to meet the needs of GE Additive customers across the globe, helping them to adopt and scale transformative additive technologies. Our dual expertise in both manufacturing and equipment finance allows us to create competitive financial solutions that support our customers' strategic business goals.

Additive manufacturing within reach

With a dedicated team focused on supporting GE Additive and its customers, GE Capital is aligned with our mission to make additive manufacturing available to businesses interested in incorporating it into their operations. Thanks to this partnership, it's now easier than ever for customers to access transformative 3D printing technology, spurring growth in several critical industries, including medical, aerospace, automotive and machining.

Customized life cycle financing

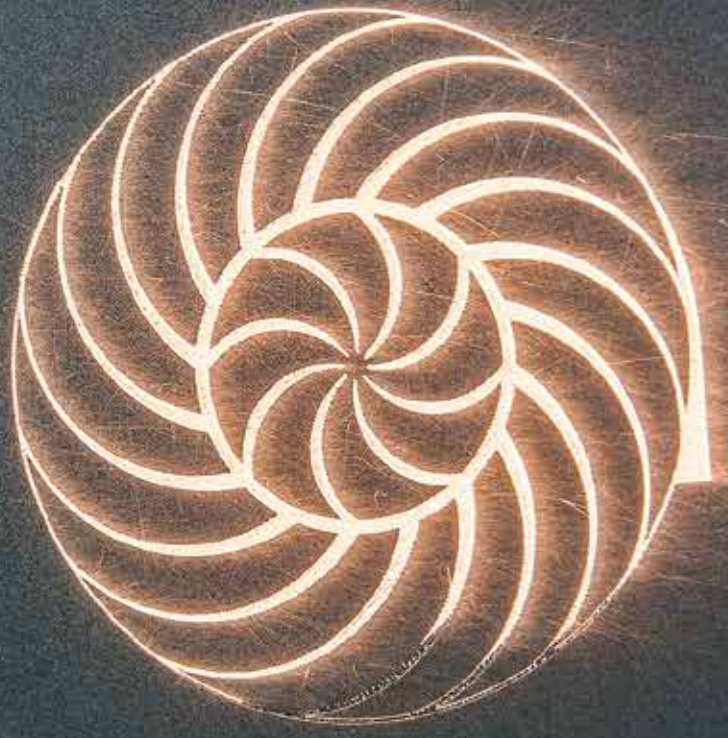
We offer a full range of financing products with global execution capabilities that increase flexibility and convenience through customized term, payment and end-of-lease options. We can empower you to manage your additive technology evolution with a clear equipment upgrade path, while improving your cash management, optimizing working capital and avoiding large capital outlays. Easily combine equipment, materials, maintenance and services into one low monthly payment.

[Learn more at *gecapitalindustrialfinance.com/additive-manufacturing*](https://gecapitalindustrialfinance.com/additive-manufacturing)



By partnering with GE Capital, we're now able to democratize additive manufacturing, making it easier for businesses to buy additive machines, fostering their competitiveness and accelerating the adoption rate. We're excited to be part of the additive revolution."

MOHAMMAD EHTESHAMI
Vice President, GE Additive





GE Additive

 **Arcam EBM**
a GE Additive company

 **AP&C**
a GE Additive company

CONCEPTLASER
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Learn more at [ge.com/additive](https://www.ge.com/additive)