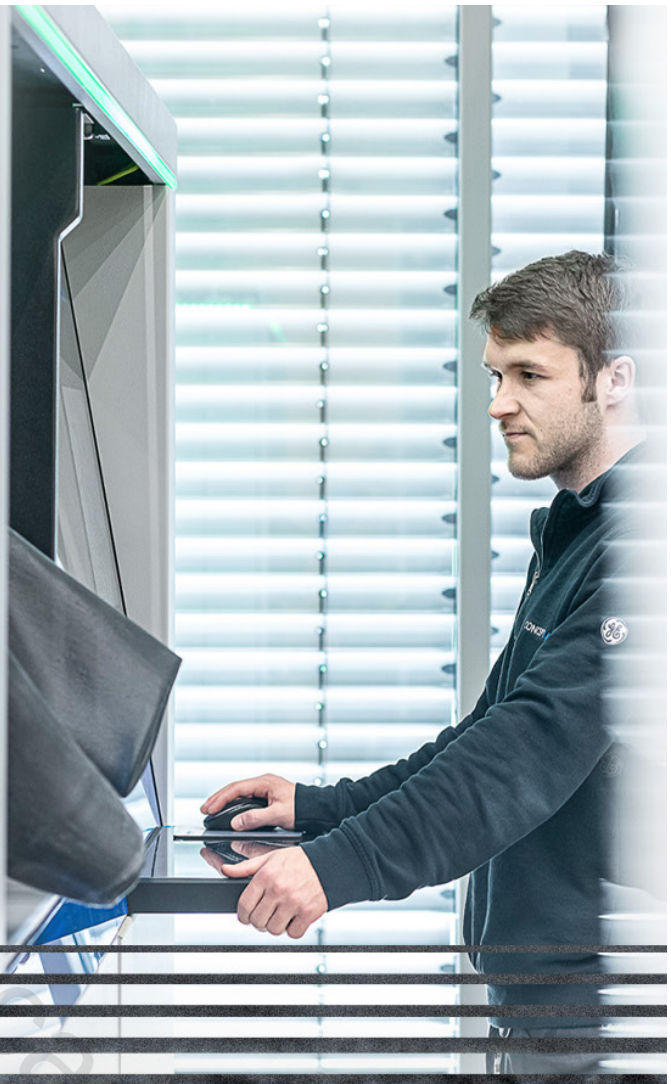
GE Additive

For the ready.

Take your company where it hasn't gone before—with metal additive.



GE ADDITIVE

There are no shortcuts when it comes to additive. No skipping steps. But for the ready, there is a way to get there faster.

To accelerate your path from prototype to full production.
To put the people who pioneered full metal additive production to work for you.

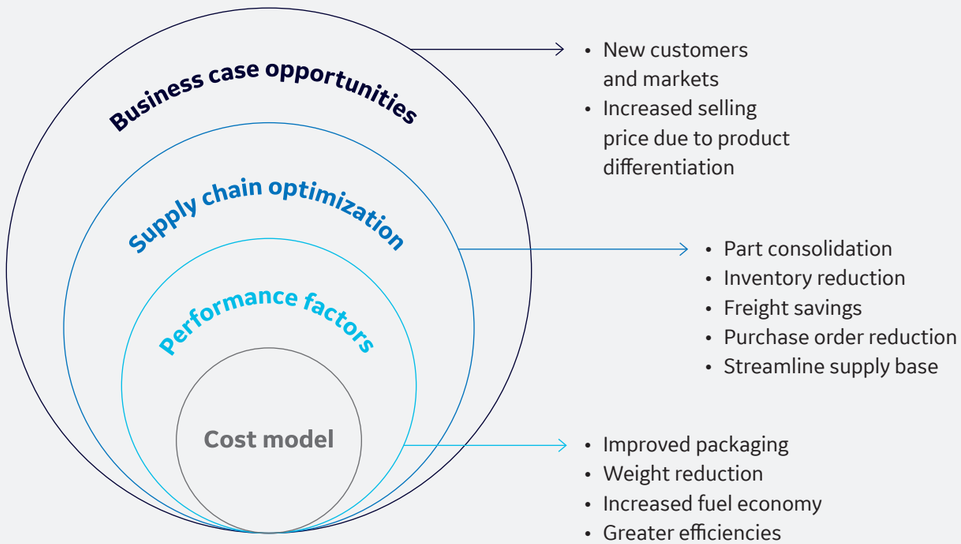
At GE Additive, we have the machines, powders and know-how to help you make anything you can imagine.

FOR THE READY

It’s time to realize ROI beyond the cost to make a part.

Now, the ready are evaluating beyond the part and considering how metal additive will benefit the entire system—from part cost to supply chain to potential new market opportunities.

Thinking through the bigger business case



The time is NOW. To leave molds and dies in the dust. To transform the way business is done. To find out:
How much further can additive take you?

Consolidate parts
Optisys LLC’s antenna for high-performance aerospace and defense applications

From: 100 parts per antenna
To: 1 part[1]

Improve sustainability
Avio Aero turbine blades replaced aluminum brackets with additively made titanium

50% weight reduction
10% lower fuel consumption
10% decrease in emissions[5]

Simplify supply chain
LEAP fuel nozzle

95% inventory reduction
30% lower costs per component[2]

Reduce waste
GE Aviation made new brackets using direct metal laser melting

≤90% reduction in scrap material waste[6]

Reduce production lead time
Jung & Co. Gerätebau GmbH filler valve in a can-filling plant

From: 8-10 weeks to manufacture the stainless-steel part
To: 1 week[3]

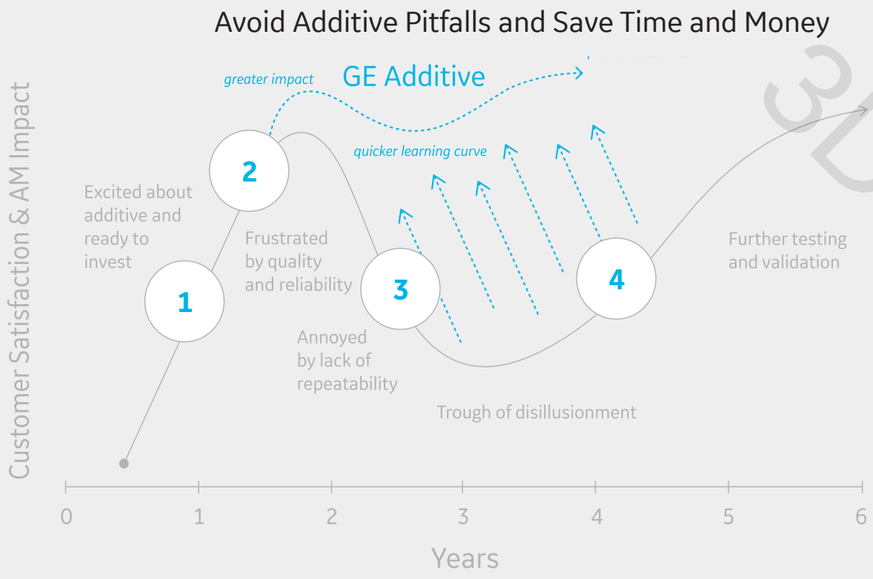
Reduce cycle time
Airbus metal cabinet bracket for A350 XWB aircraft

75% shorter time to develop[7]

Enhance performance
Sutrue Ltd.’s automated suturing device for safer surgeries

From: 1 stitch per 25 seconds by hand
To: 3 needle rotations per second[4]

Moving toward full production?
Make the move faster and more cost-effective with GE Additive.



Follow the faster path with GE Additive

Workshops and Consulting

Get help building your business case. Then bridge the talent gap with training from additive and industry experts to expedite the learning curve that comes with adopting new technology or having additive parts certified.

Engineering Services

Engage experienced engineers to design and build the part for you to speed your process as much as possible.

Print Services and Design to Print

Move to production at scale with outsourced printing services or by working with us to build your own supply chains, reducing risk and cost in development of printed parts.

Critical steps to accelerate your path to metal additive success:

1
Build the business case

A business case with a part-centric, narrow scope is dead in the water. Reduce risk and save time and investments by evaluating beyond the part and looking at the whole system, using proven approaches and best practices.

2
Identify the right part

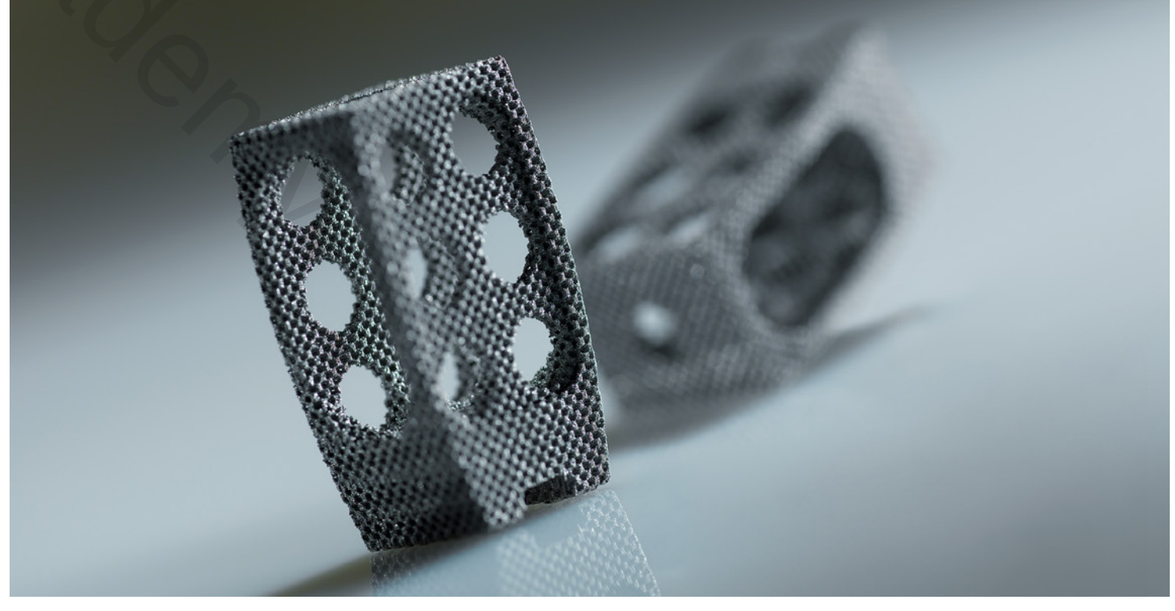
Additive requires a new way of thinking. That simple or costly part may seem like a good place to start, but it may not be the part where you see the best ROI. Find a part that's prime for additive and fits your larger business goals.

3
Design the part for additive

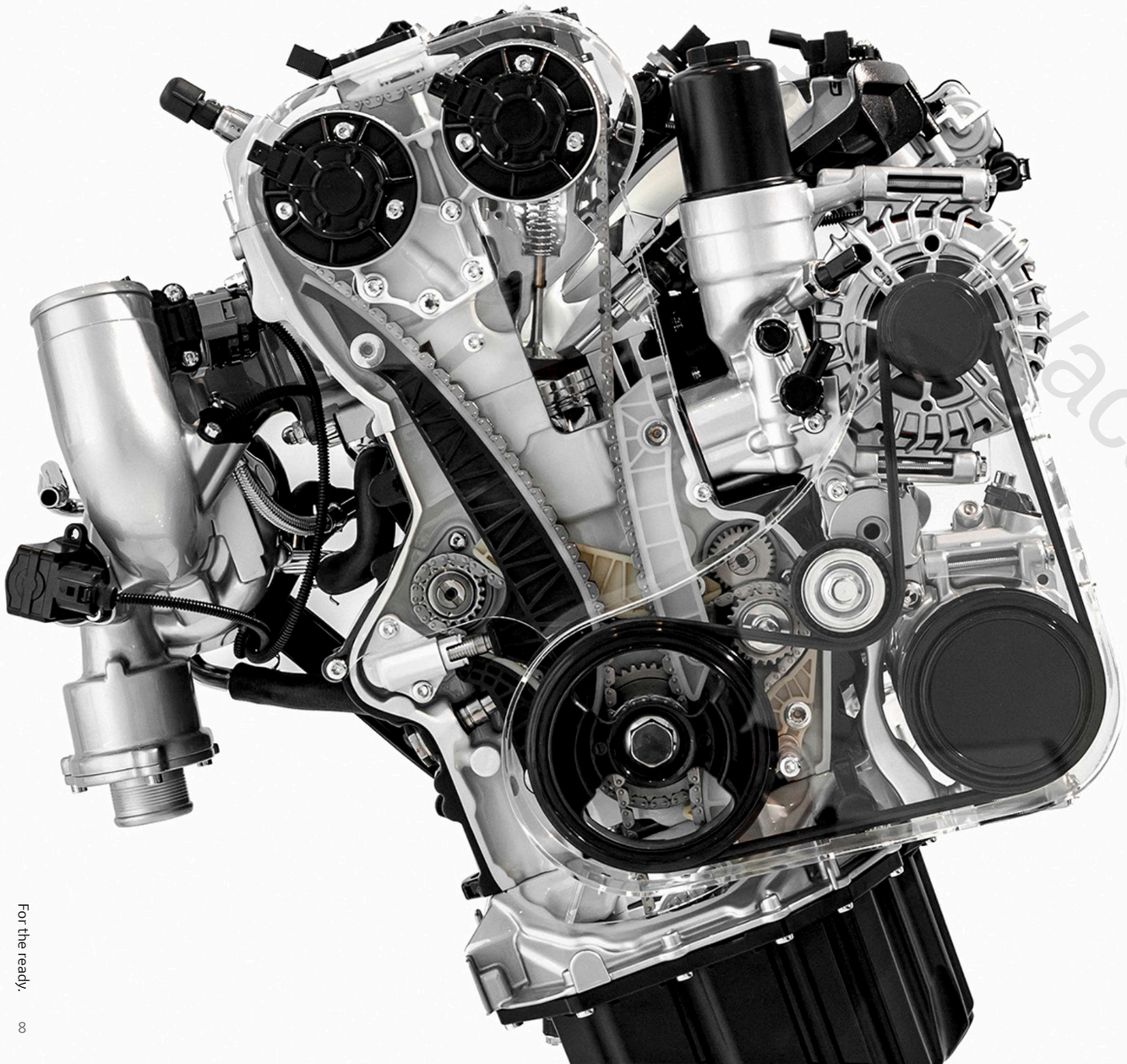
Some companies find holes in their original business case or part selection in this part design phase. They become disillusioned, struggling to see the ROI for their machines, powders and labor. Work through this phase faster by defining your key parameters and processes *for additive*, knowing they likely will vary from when your part was designed for traditional manufacturing.

4
Enable full production

As you invest in more machines, discover what you need to do to maximize machine productivity, achieve print repeatability and optimize for production. If you're in an industry with certifications, you must document repeatability and prove material quality of your additive parts. Coupling advanced analytics and testing can get you there faster.



Smooth your path to production. We're ready.



As the world's leading power user of additive technologies, we've seen firsthand how powerful this technology can be to an organization's top and bottom lines. Flatten your learning curve with these proven solutions to common challenges.

Challenge 1

Returning Investment Profit

Sometimes manufacturers won't see a positive ROI of additive if they look only at the cost to make a part. Then they lose out on the larger ROI additive can enable while competitors forge ahead with innovation.

Fast Track: Assess how additive will impact the whole process, from part performance to efficiency to supply chain, when designing your business plan. You'll uncover all the opportunities for ROI. GE offers ways for you to invest with easy, flexible pricing models and proven solutions to get to production faster.

Challenge 2

Experience Gap/Talent or Resource Shortage

"Lack of adequate skill sets is an industry issue," according to an estimated three in four business executives.

Fast Track: Leverage GE's expertise, based on our own additive challenges and successes. Get consulting and training on designing for additive moving to full production and more from the global GE Additive AddWorks team of 200-plus engineers and specialists.

Challenge 3

Supply Chain Issues and Replacement Parts

Additive streamlines the supply chain for part production and replacement.

Fast Track: For the ready, that's great news. GE helps you devise a strategy to consolidate your supply chain by reducing part counts or by printing spare parts on demand, in-house, using additive. This cost-effective, small-volume production enables mass customization, such as patient-specific implants or zero-inventory, on-demand spares.

Challenge 4

Cultural Resistance to Change

Manufacturing with additive is a cultural (and foundational) change for engineers and business leaders.

Fast Track: Bridge the workforce's knowledge gap and foster excitement around the broader business opportunities of additive, amplifying your strong business case for additive so everyone in your organization can rally behind it. Workshops and consulting with GE experts can help your company along the path to change.

GO.

Just say the word.

When you're ready to transform the way business is done—to go from one-off parts to full metal additive production—GE Additive has the products, solutions and expertise to help.

Accelerate innovation

Leverage GE's global supply network of additive partners and diverse business experts to innovate at scale.

Reduce risk

Lean on GE's experience with qualifying additively made parts in highly regulated industries and our unparalleled level of material science.

Lower costs

Invest in additive with GE's easy, flexible pricing models while shortening the iterative process of making a metal additive part.

Transform your business

Take advantage of GE's unparalleled level of material science and application expertise to rewrite the rules of manufacturing and disrupt the supply chain.

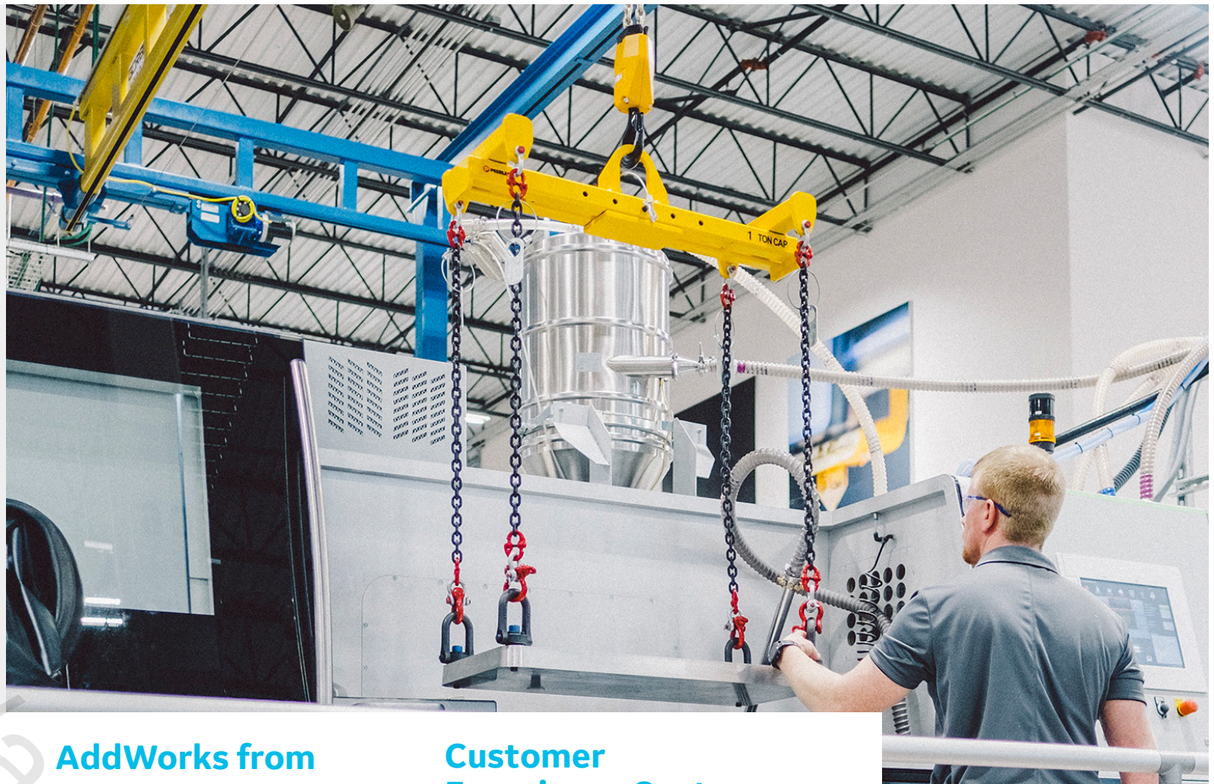
"Additive manufacturing makes it possible to produce geometries that cannot be achieved using traditional manufacturing methods. In addition, the parts have greater performance capacity or functional precision, or else they are extremely delicate or small."

– Alex Berry

Director and shareholder at Sutrue Ltd.

Leverage our advanced, end-to-end solutions for your success.

Wherever you are in your additive process, we have the expertise and solutions to accelerate your speed to market with additive technology.



Machines

GE offers specialty machines with low machine-to-machine variance to meet your industry requirements and scale production. Our machines:

- Concept laser, direct metal laser melting
- Arcam EBM, electron beam melting
- Binder Jet, faster 3D metal printing with binding agents

Powders

We create certified, high-performing powders for every metal additive need, taking into account a variety of mechanical behavior design data and material science.

- Advanced AP&C powders, spherical metal powders designed for additive manufacturing at competitive prices
- GE Additive's powders, sourced and optimized powders specifically for GE Additive machines for an end-to-end solution

Print Services

Ensure quality and speed to market when you send your printing to GE, no matter how complex or large the part. We serve you a printed part in one hand and a product roadmap in the other.

- Large-format printing
- Design to print
- Production printing

AddWorks from GE Additive

From training to print services, our global team of engineers and manufacturing specialists can support your team and accelerate additive adoption anywhere in the process.

- Workshops and training
- Consulting services
- Engineering services
- Print services

Customer Experience Centers

GE experts are ready to collaborate in person when you visit one of our two on-site locations, designed to help you from initial design to full production.

- Cincinnati, OH, USA
- Munich, Germany


GE Additive
Are you ready?
To hit the production floor running.
To turn complex into a competitive advantage.
To turn a business case into a full-scale production at the speed of today.
To look forward, not back.
When you're ready to revolutionize your business with metal additive,
the people who pioneered its full production are ready to help.
Let's go. Talk to GE today.
ge.com/additive
[1]The additive journey: THE TIME IS NOW, Industry in 3D, TBDURL.COM (accessed TBD Date 2020).
[2]GE Additive Production Playbook. Nov. 2019, TBDURL.COM (accessed TBD Date 2020).
[3]The additive journey: THE TIME IS NOW, Industry in 3D, TBDURL.COM (accessed TBD Date 2020).
[4]The additive journey: THE TIME IS NOW, Industry in 3D, TBDURL.COM (accessed TBD Date 2020).
[5]GE Additive Production Playbook. Nov. 2019, TBDURL.COM (accessed TBD Date 2020).
[6]GE Additive Production Playbook. Nov. 2019, TBDURL.COM (accessed TBD Date 2020).
[7]The additive journey: THE TIME IS NOW, Industry in 3D, TBDURL.COM (accessed TBD Date 2020).

GE Additive

Create large additive metal parts with

Concept Laser X Line 2000R

A unique capability

Print large parts safely, efficiently, and consistently

The Concept Laser X Line 2000R offers the unique ability to print otherwise impossible parts safely, efficiently, and consistently. With a generous build volume of 400 x 800 x 500 mm, the X Line 2000R offers reliable, consistent performance with one of the largest build volumes available today. The X Line 2000R was designed specifically for the production of large, quality parts, which makes it ideal for a variety of industries, including space, aviation, and automotive.

Built with efficiency in mind

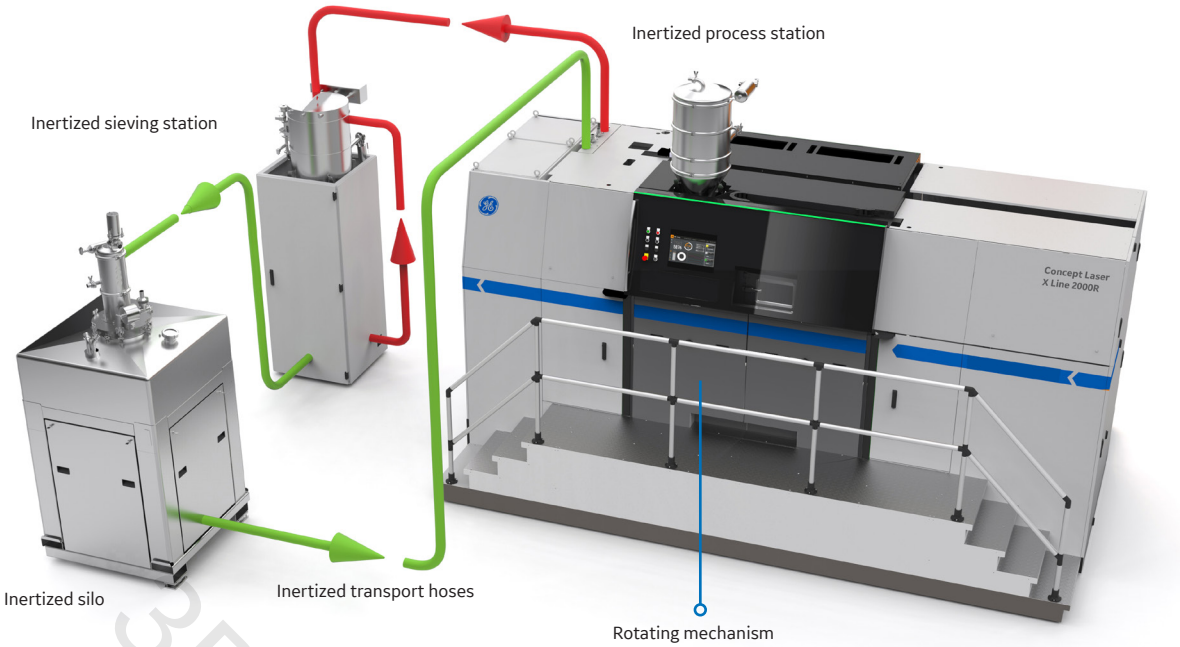
The X Line 2000R features a dual-processing chamber that enables the operator to unpack and set up a new build while another one is being printed. The mechanism rotates 180 degrees so a new build is automatically transferred from the handling to the process side, allowing for minimal downtime and faster turnarounds.

The separated material handling side features the glove box and a control panel for managing the glove box and the coupled build module. The working area of the handling station is the glove box, where the build module for the DMLM process is armed or disarmed. The protective door of the glove box is equipped with a large glass front panel to provide an optimum view.
Dual-laser technology, featuring two powerful 1,000-watt lasers, enables the production of large complex builds. Smart software and control mechanisms ensure the lasers never operate "in-line," ensuring the laser beams have a consistently clear and soot-free optical trajectory.

Powder handling

A unique, closed-loop powder handling system automatically transports unused powder from the overflow containers of the X Line 2000R to an inertized sieving station – where large particles are removed – into an inertized silo and then back to the machine. This eliminates operator contact with the powder and promotes safer handling of reactive materials.

- Automatic powder handling under inert conditions
- Protection of the powder from oxidation
- Fully inertized machine, sieving station, silo and transport hoses
- Safe, contactless powder handling (no need for operation)
- Maximum operator safety



Superior part quality and consistency

The process chamber features an optimized upper and lower gas flow for better part quality and consistency.

- High volume flows in the upper areas of the build chamber eliminate the possibility for soot or powder particles to deposit on the chamber windows.
- 3D-printed plenum ensures the highest level of flow uniformity, while the aerodynamically designed guide vane delivers a steady, high velocity lower gas flow over the powder bed.

The improved thermal system now offers a system cooling capacity of 12 kW, providing more optical stability and robustness. The result: increased capacity, stability and control for long and complex builds.

QM System software modules enable the monitoring, control, and validation of various system states, providing process repeatability and quality. Additional in-line process modules are available to further ensure reproducibility and process quality.

The X Line 2000R also features a filter module with extended filter life. Two high-volume modules filter soot and metal powder particles from the inert gas, for clean builds and better part quality.

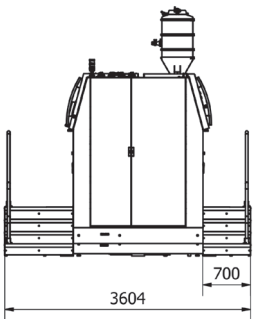
Innovative software helps to save time

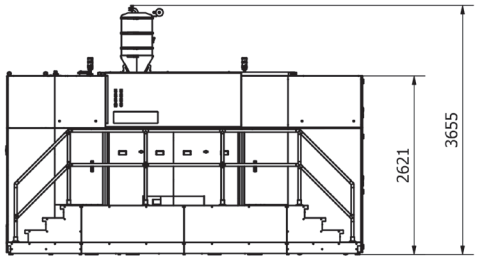
The CL WRX Control software enables improved response times when operating the system. It further enables minimized waiting times when switching between parts or when shifting focus. This results in reduced machine downtimes. Additionally, the offline pre-calculation of complex parts eliminates layer delays and further reduces production time.

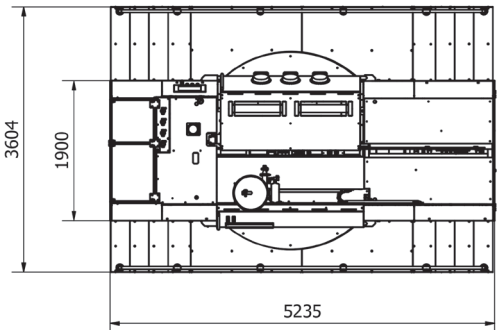
X Line 2000R

Technical data

Build envelope	800 x 400 x 500 mm (x, y, z)
Layer thickness	30 – 150 µm
Production speed	up to 120 cm3/h (depending on material, parameter, geometry)
Laser system	2 fiber lasers, each 1,000 W (cw)
Max. scanning speed	7 m/s
Focus diameter	approx. 100 – 500 µm
Heating	9 kW, maximum temperature 200°C
Connected loads	Average power consumption 13 kW Power connection 3/N/PE AC 400 V, 50 A, 50 – 60 Hz
Inert gas supply	1 gas connection available
Inert gas consumption	approx. 17 – 34 l/min *
Dimensions	5,235 x 3,655 x 3,604 mm (B x H x T)
Weight	approx. 9,500 kg (tare weight)
Operating conditions	15 – 25°C
Necessary peripheral equip.	Sieving station, powder silo







Materials available

- Aluminum - AlSi10Mg
- Titanium - Ti64 ELI Grade 23
- Nickel - Ni718

*Inert gas consumption during the building process with N2

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ge.com/additive