Lincotek
Surface Solutions

Fully-integrated Supply Chain Solutions

Special processes to lead innovation

Partnership for Success. Delivering for OEMs.

At Lincotek Surface Solutions, we work across many industrial sectors – but particularly in Industrial Gas Turbines (IGT) and Aerospace markets – to provide a vital service to OEMs. We specialize in the development and serial manufacturing of special processes including surface treatments, additive manufacturing and machining processes.

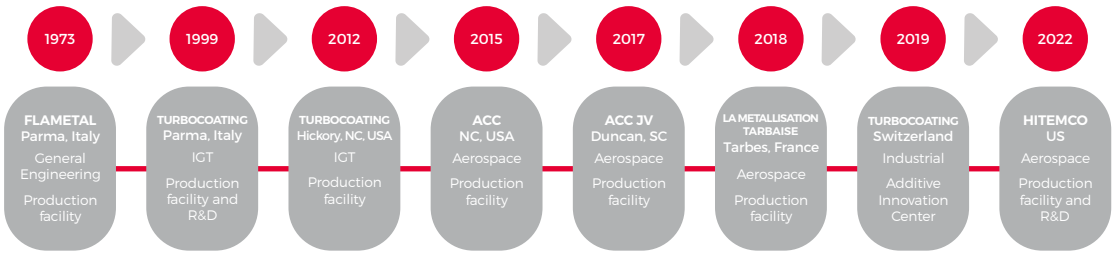
More than half a century of experience

We have been renowned for our engineering expertise since 1973, and now offer a unique and wide portfolio of services. From Additive Manufacturing through to surface treatments, post-coating services and final certification, we are able to assist our customers during all stages of their manufacturing journey. Whatever you need, we can help you realize your vision, simplify your supply chain, and shorten your overall lead time.

Headquartered today in Rubbiano-Parma, northern Italy, we also have plants in Spreitenbach (Switzerland), Hickory, NC (USA), Old Bethpage, NY (USA) and Tarbes (France).

In addition, we have a joint venture with GE Aerospace, ACC - Advanced Ceramic Coatings, which is based in Duncan, SC (USA).

Our company through the years



Lincotek Surface Solutions at a glance

- Solution Provider with specific focus on Integrated Supply Chain
- Segments: Aerospace, Space, Energy, General Industries
- 6 manufacturing sites globally – 25,000 m^2
- 600 employees
- €100M revenue
- 3 R&D centers globally
- Production volume: more than 500K parts per year
- 200+ customers
- 10+ countries

Our markets

AEROSPACE
Commercial & Military

ENGINE
Aircraft & Helicopter

- Hot section parts:
- Distributors
- Diffuser
- Turkey feather
- Flap
- Exhaust
- Burner can
- Fuel guide
- Fuel nozzle
- Airfoil
- Shaft bearing
- Engine case

TRANSIMISSION

- Shaft
- Sleeve
- Bearing
- Case

LANDING GEAR

- Actuator
- Brake drum
- Sleeve
- Hydraulic assembly
- Mooring ring
- Pin
- Steering component
- Strut
- Torque arm and bar
- Trunnion shock strut

SPACE

- Rocket nozzle
- Thrust chamber
- Pipe
- Valve

ENERGY

GAS TURBINE
Large and Aeroderivative

- Blade
- Vane
- Heat Shield
- Shroud
- Combustor chambers
- Segment
- Liner
- Burner
- Transition part
- Basket

NUCLEAR

- Diffusive Coating
- HVOF
- Grinding
- Dome
- Shell
- Sheet

OIL & GAS

- Ball valve
- Gate valve
- Shaft
- Reamer
- Pipe

GENERAL INDUSTRIES

- Automotive
- Braking system
- Syncronyzer ring
- Tyre
- Paper (roll, blade)
- Naval
- Hydro
- Motorsport
- Racing

From our main markets, such as land-based gas turbines and both military and commercial aerospace applications, we extend our expertise into other sectors including automotive, oil and gas, and nuclear. In short, we're a center of excellence with a unique and wide portfolio of services - fully-integrated to suit your business needs.

Our commitment to quality has led to many OEM approvals, along with:

- ISO 9001 Certified
- AS9100 Certified
- ISO 14001 Certified
- ISO 45001 Certified
- Nadcap accreditation
- Export license
- ITAR Compliance
- ISO 19443 Compliance

We are also members of the following bodies:

- IAQG - International Aerospace Quality Group · OASIS (Online Aerospace Supplier Information System)
- GTS (Association of Thermal Spray)
- NCAGE

Our approach

There is a line of thinking that we have followed since 1973: Always be ready to evolve and meet future challenges.

From the outset, our personality has been dynamic and focused on the future. That's deep in the soul of our business and has led us to grow over the years.

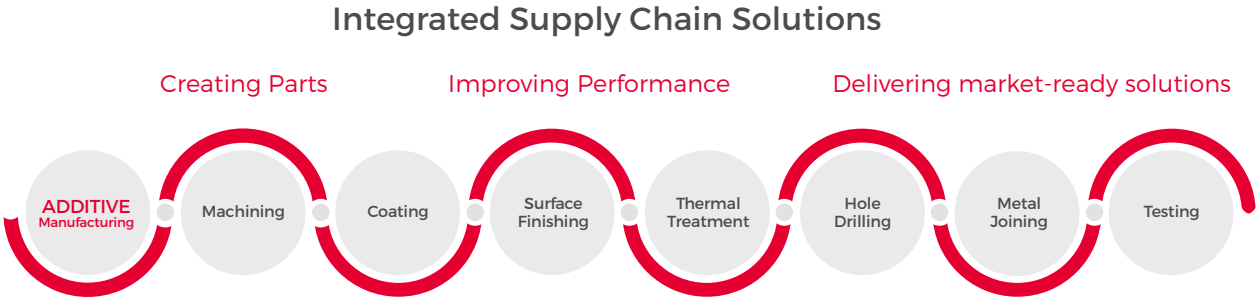
Our success has been built on R&D, innovation and entrepreneurship. Today, in an era of globalization and digital technology, we stand ready to meet the challenges you face, alongside you.

For the coating industry, we work alongside with our Equipment Division and can supply you with turnkey solutions for technology, manufacturing and production – industrializing process from equipment to scale-up. So, if you are looking to expand and develop new manufacturing sites, we have the technology, experience and passion to help you make it a reality.

Our Business Model

We can deliver an integrated, end-to-end supply chain:

- We create parts
- We improve performance
- We deliver market-ready solutions



With a unique and wide portfolio of services, from Additive Manufacturing to surface treatments and market-ready solutions, our company's integrated approach has evolved into an unparalleled set of offerings. We are able to provide a single development and manufacturing step to create parts and improve performance. Alternatively, we can deliver market-ready solutions or serve as an end-to-end provider.

The three pillars of our business model

What exactly is it that sets Lincotek Surface Solutions apart? Ultimately, we're a business that gives you confidence and helps you plan for the future – industrializing new solutions when needed and investing to support your growth.

Stepping in when some of our competitors step away, we have a smart work ethic, lean processes and are able to make quick decisions. What's more, we're committed to continuous improvement, working with you to redesign and optimize your production lifecycle.

Our model is based on three core principles:

Our partnership approach

We believe in a collaborative working partnership with our customers. It's much more than a classic customer-supplier relationship. We can develop the supply chain based on your needs, working alongside you to offer a truly integrated solution.

Our flexibility

We have the resources and expertise of a large business, but with the agility of a small one. That means we can offer a quick decision-making process and real attention to your specific needs.

Tribal knowledge

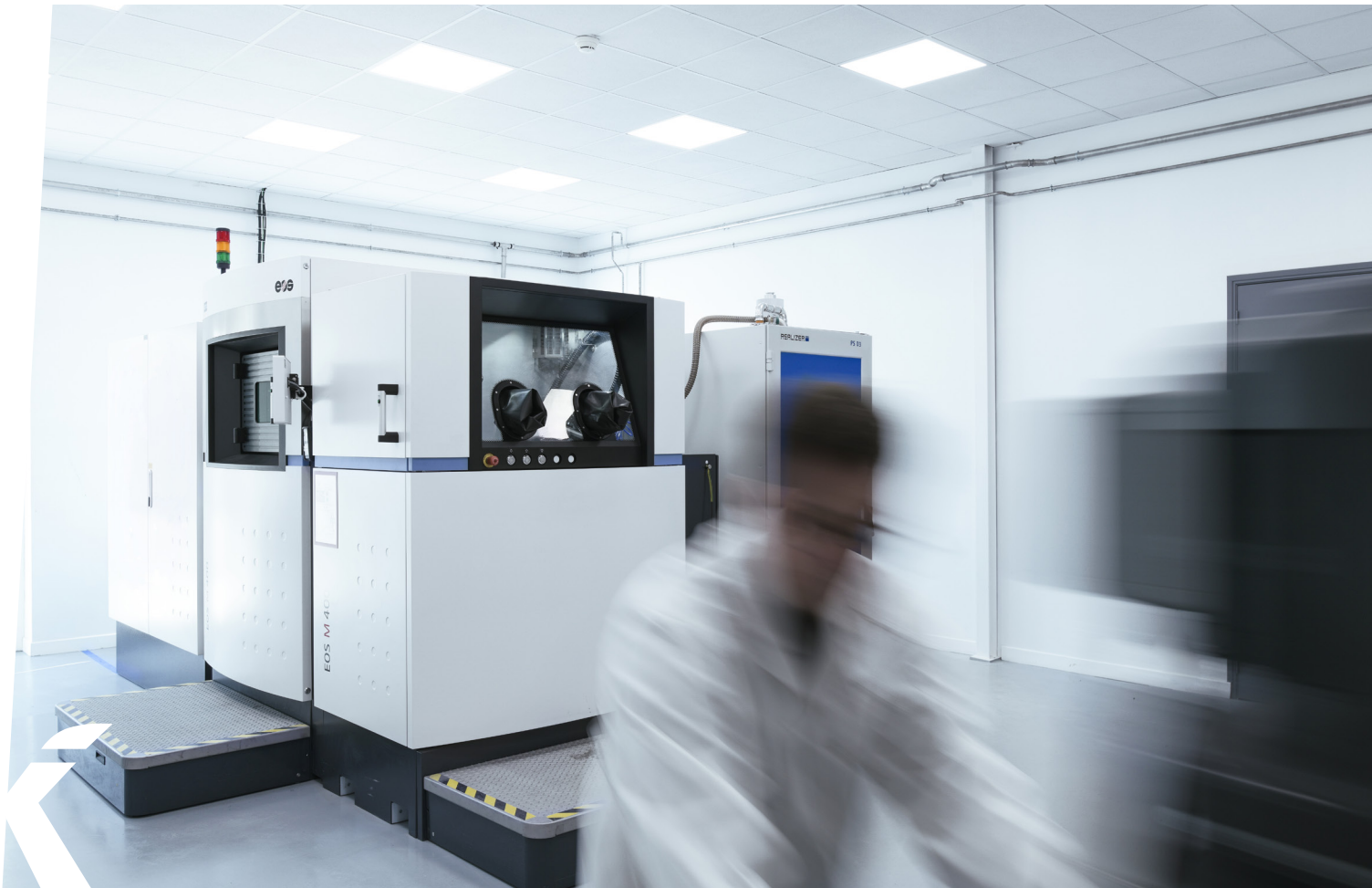
This is an inherent knowledge within the company, passed from person to person. It is the union of two fundamental elements: deep scientific and technological understanding built up through years of research and development, as well as the skills and experience handed down within the company year after year.

Global leadership

When you're working in markets where time is of the essence, you need a partner who can design a custom process quickly and efficiently. Working alongside OEMs, we have the capacity to integrate a complex combination of processes - that are already part of the design and development phase - and simplify your supply chain.

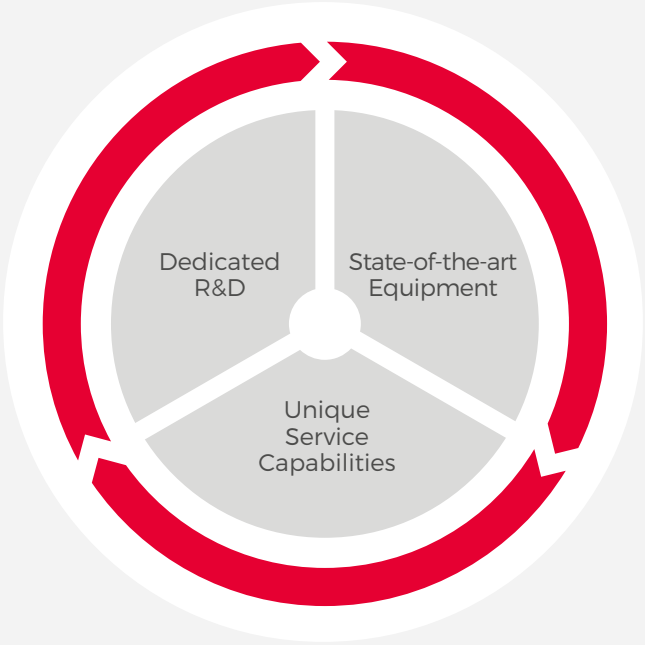
Specifically, we can offer:

- Subject matter experts in materials, process design and industrialization
- Deep knowledge of the technology and mastering of the process, covering a large variety of industries
- High proficiency in product development
- Flexibility to work on other small series or large scale-up programs
- Extensive expertise in production for special processes, along the full manufacturing chain
- An innovative coating campus, delivering R&D, services and equipment all under one roof
- Deep know-how in coating and additive manufacturing technology
- Great machining capability, with a wide range of machining solutions including Grinding, Turning and Hole Drilling technologies



A unique loop at the heart of Lincotek's success

Coating Campus: R&D, Services and Equipment all under one roof



Service – Operation

More than 50 years of expertise in thermal spray coatings, focused on continuously improving serial production, guided by automation/process controls and efficiency (cost/production), leading to cutting-edge performance and reliability.

R&D – product development

Fully dedicated R&D team focused on:

- Exploring and developing new solutions
- Interacting with our Equipment Division for design
- Performing validation tests

Equipment

Designing and manufacturing of tailor-made thermal spray turnkey equipment, applying cutting edge technology solutions.

R&D: central to our spirit of innovation

Our performance is based on impressive R&D capability, led by technical experts with a profound wealth of experience behind them. We foster a culture of continuous innovation. Wherever you are working in the market, we are able to offer in-depth insight and state-of-the-art solutions.

Our R&D department comprises specialists who drive forward developments in areas such as new materials, systems and processes, on standard and new base materials. We have been associated with hundreds of scientific publications and regularly participate at international conferences. Our ongoing collaboration with universities and research institutes worldwide is vital to our success. What's more, we are constantly updating our processes with new technology and methods and bring a refreshing open-mindedness to the challenges of our customers.

With our dedicated departments, we are able to get involved in co-development or process improvement to meet your needs and conduct R&D partnerships with OEMs. We also select and introduce new technologies based on market trends. The result is cutting-edge technologies, highly efficient processes and high-quality production standards.

All our projects are carefully managed from a technical, legal and financial perspective, with industrial results protected by confidentiality agreements, patenting, copyright, trademarking, registrations and contracts.

Meeting your challenges in the energy market

There is strong competition today with renewables and low-cost fossil (coal) energy, which means that gas turbines need higher efficiencies and lower NOx to be cost-competitive. Coating and cooling become fundamental to higher operating temperatures and a longer lifetime for engine components, affecting inspection intervals or the need for replacement parts.

The cycle time between engine development and upgrade is shortening. We can help you with increased efficiency, supply chain management and reduction in manufacturing process steps. From your perspective, this means shorter lead times and reduced time to market.

Shaping the future in the aerospace market

As aircraft and helicopter manufacturers innovate and push boundaries, it's important that high-performing coatings keep pace with the changes.

You need a supplier who is compliant with the highest industry standards, while adapting to the evolving market. We're known for supporting OEMs with the right level of capacity and with the flexibility to adapt to all circumstances to ensure timely delivery and best-in-quality products. In a constantly growing market, we are able to successfully qualify processes, ramp up volumes from a First Article Inspection (FAI) and target process efficiencies to reduce lead times and costs.

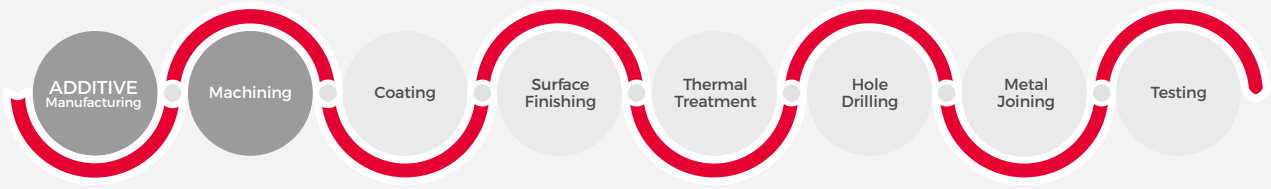
Our services at a glance

Service	Technology
Additive Manufacturing	Metal Superalloys Nickel Based Titanium / Aluminium
Machining	Wire EDM Sinker EDM Turning Grinding Milling
Coating	LPPS/VPS HVOF APS Chromide Silicide Pack Aluminide Vapor Aluminide Platinum Aluminide Solid/Dry-Film Lubricant Powder Flame Spray Wire Flame Spray Electrical Arc Spray Suspension Plasma Spray Stripping
Thermal Treatment	Vacuum HT Air HT HIP

Service	Technology
Surface Finishing	Surface Polishing Lapping / Grinding Tumbling Drag Finishing Electropolishing Robotic Finishing Shot Peening
Hole Drilling	Laser Drilling / Shaping FHD EDM Combined Drilling Solution
Metal Joining	Vacuum Brazing Laser Welding Tig Welding Auxiliaris Supply
Testing	Metallographic Laboratory 3D Scan CT Scan X-Ray Boroscope Check CMM Tensile Testing Microtrac (Powder Size) SEM Hardness Test Airflow Waterflow FPI TCF

The value we add: Explaining our Process

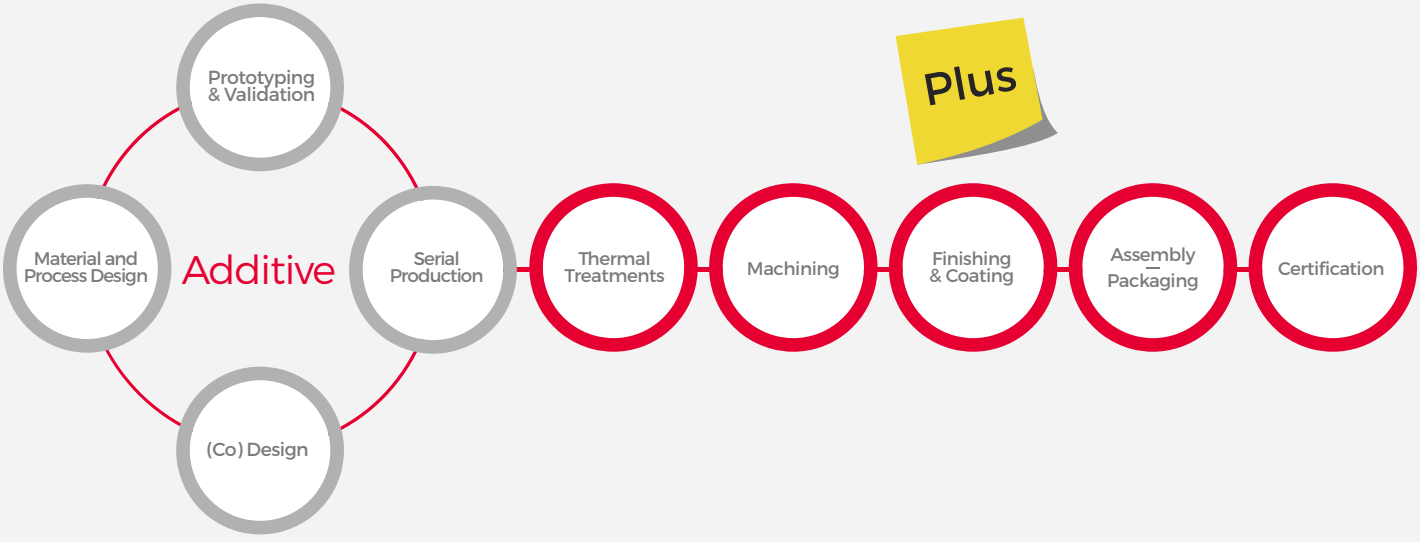
1 CREATING PARTS



If your business needs a reliable and sophisticated manufacturing partner, our track record is hard to beat. We have developed over the years from a typical coating shop to a center of excellence for the manufacturing of industrial parts in a market-ready configuration. In fact, Lincotek Surface Solutions is able to shape your part with both conventional and Additive manufacturing within the right parameters, budgets and technical demands, providing all the treatments you need. We believe in complete, efficient and quality-driven industrial production.

What sets Lincotek Surface Solutions apart?

It's all about matching Additive Manufacturing with conventional manufacturing to focus on full supply chain solutions.



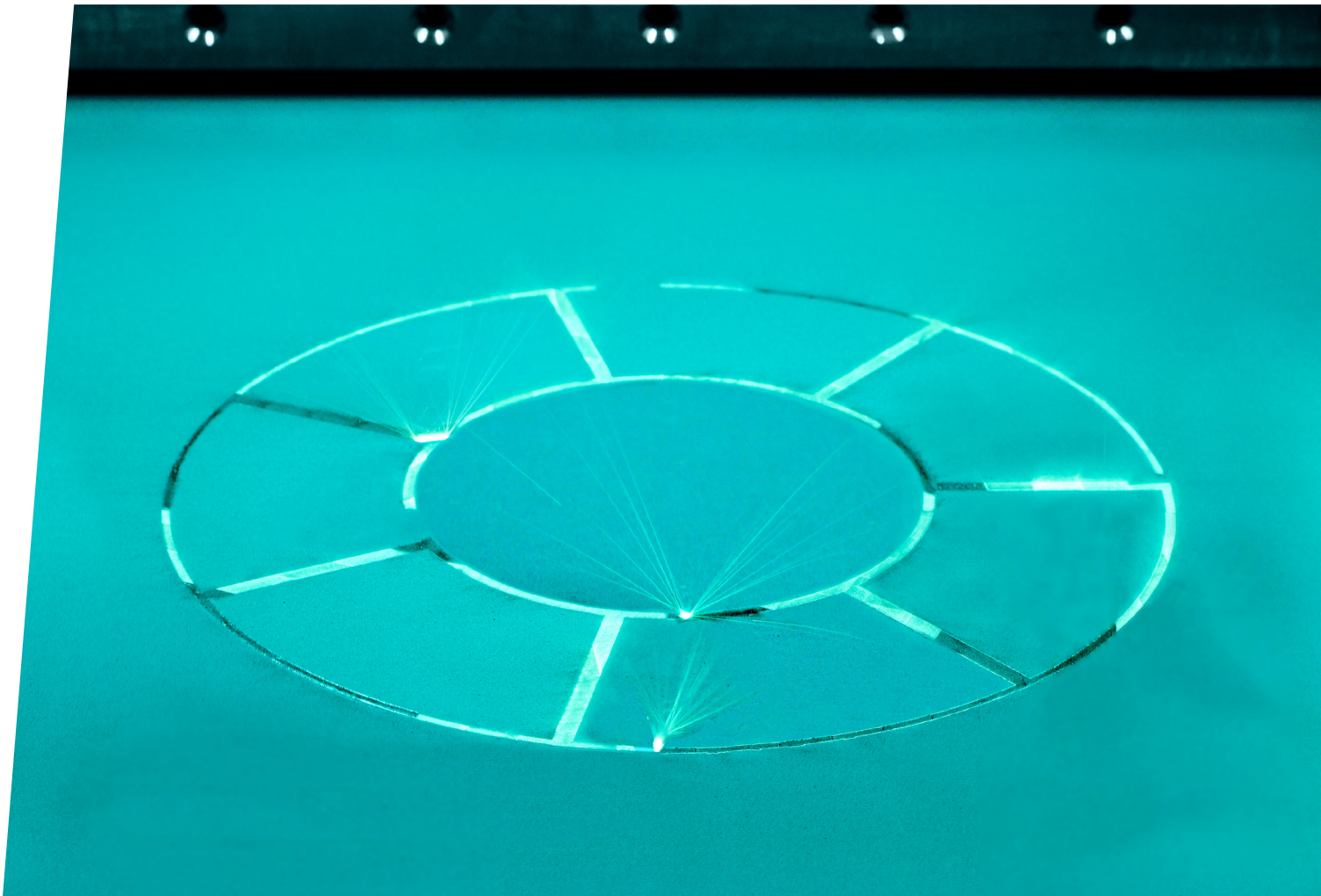
As we harness the disruptive power of Additive, we recognise that it is just one step in a much broader process. Our unique portfolio of special processes allows us to offer a complete value chain - starting from printing and going through to thermal treatments and machining, up to surface treatments and final certification.

When you have 3D-printed the part, you need to be able to complete it. Post-processing of AM parts is fundamental and truly challenging. It's this capability that sets Lincotek apart.

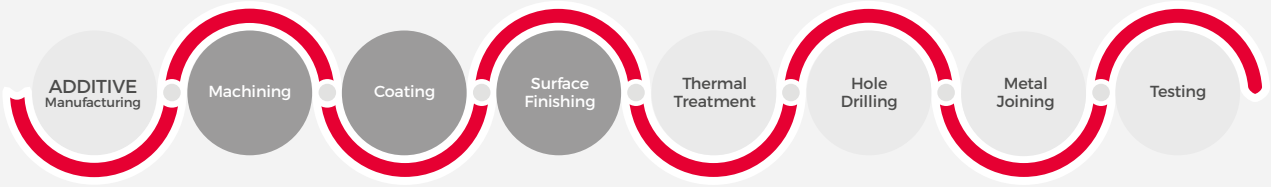
MMB VOLUME
3D COMPLEX PRODUCTION

Lincotek collaborate with MMB Volum-e - a successful, family-owned French business that offers an array of AM capabilities spanning several industries.

The partnership boosts Lincotek's Additive Manufacturing capabilities in Europe. Combining conventional and additive manufacturing under one roof, we are in a unique position to offer the most complete service for serial production, assisting customers from 3D printing to finished part.



2 IMPROVING PERFORMANCE



We design and develop processes with serial production in mind, drawing on an in-depth understanding of coating and how to reduce development lead time. We offer a wide range of coating, including thermal spray, diffusive processes and related services. A time-to-market approach for NPI is backed up by our custom-developed tools for coating, such as offline programming and simulation of thickness deposition.

Industrialization: from equipment to scale-up

We can design equipment based on customer need and develop processes in-house, protecting your know-how, starting from the equipment. We then give you the choice of whether we set up a plant alongside you or embed the coating production within your own business.

HITEMCO

Hitemco is a Lincotek Group Company. It is a successful, family-owned American business that offers an array of special coating (HVOF, plasma thermal spray, and diffusion) and surface finishing processes for the aerospace industry.

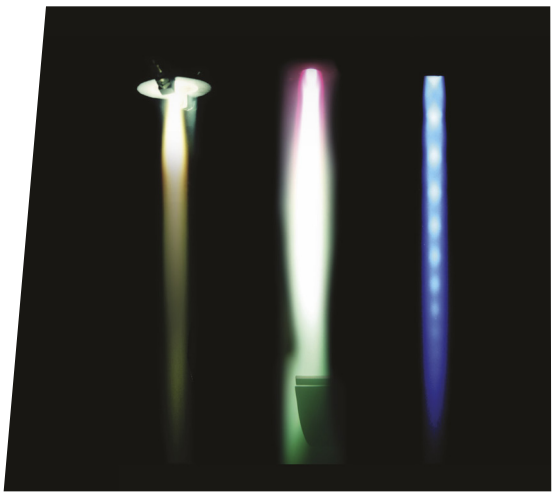
Together, we are able to offer a complete service, with enhanced lead times, and impressive levels of quality and reliability.

Coating Services and Finishing:

High Velocity Oxygen Fuel (HVOF) Coating

This is a type of thermal spray process that produces a finished surface on critical components, enabling them to withstand repeated force, abrasion and corrosion. For more than three decades, we have continually assessed, automated and fine-tuned our HVOF operations to ensure surface consistency and improve process efficiency.

Plasma Spray Coating



Plasma spray deposition is one of the most important technologies available for producing the high-performance surfaces required by modern industry. The most successful applications are in hot gas turbine section components, which are subject to a uniquely aggressive environment. Over half a century, Lincotek has mastered materials technologies related to abradables and abrasives, corrosion, oxidation (MCrAlYs) and thermal barrier coatings. Today, we can offer:

- Air Plasma Spray (APS)
- Suspension Plasma Spray (SPS)
- Vacuum Plasma Spray (VPS)
- Electric Arc Projection
- Wire Flame Projection

Diffusive Coating

Diffusion is a process in which a metal, such as nickel, cobalt, or refractory alloy is subjected to a coating material of aluminum, chromium, platinum, or a silicon compound. An atomic exchange of materials between the substrate and the coating alloy together forms an intermetallic coating that offers superior environmental protection.

Because the coating is alloyed with the substrate, diffusion coatings are integrally bonded, oxygen-impervious, and corrosion-resistant. They also deliver extreme thermal fatigue resistance.

Lincotek offers various diffusion coating methodologies including pack cementation, gas phase and slurry. Each process is tailored to a specific component's operating conditions to maximize performance. Diffusion coatings will create a protective alloy barrier operating at different temperature ranges to allow for reliable, long-term service.

Surface Finishing

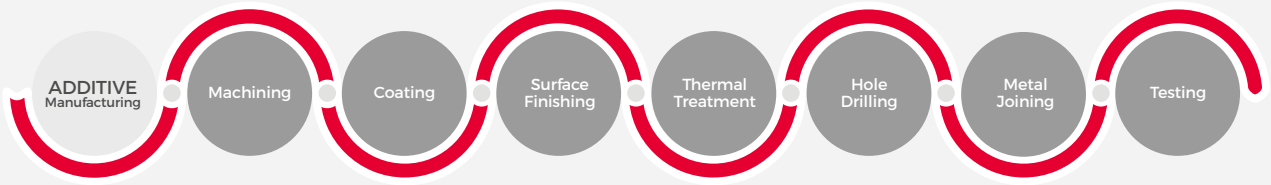
Performance components require a high level of precision manufacturing to meet harsh operating conditions.

Thermal sprayed coatings generate a coarse surface over the substrate coated. The coated products typically need to meet stringent assembly tolerances requiring accurate fittings and low friction rates.

Lincotek offers several cost-effective automated finishing technologies (CNC/Robotic), tailor-selected for the application. We can grind, prepare and finish coating or substrate on ID/OD, belt grind large surfaces and refine the surfaces even further to obtain a close-to-mirror effect (lapping, honing). Turbine airfoils require surface roughness reduction to reduce flow path friction and therefore operating temperatures. We offer solutions including:

- Tumbling
- Shot Peening
- Drag finishing
- Robotic finishing
- Sanding
- Grit blasting
- Electropolishing

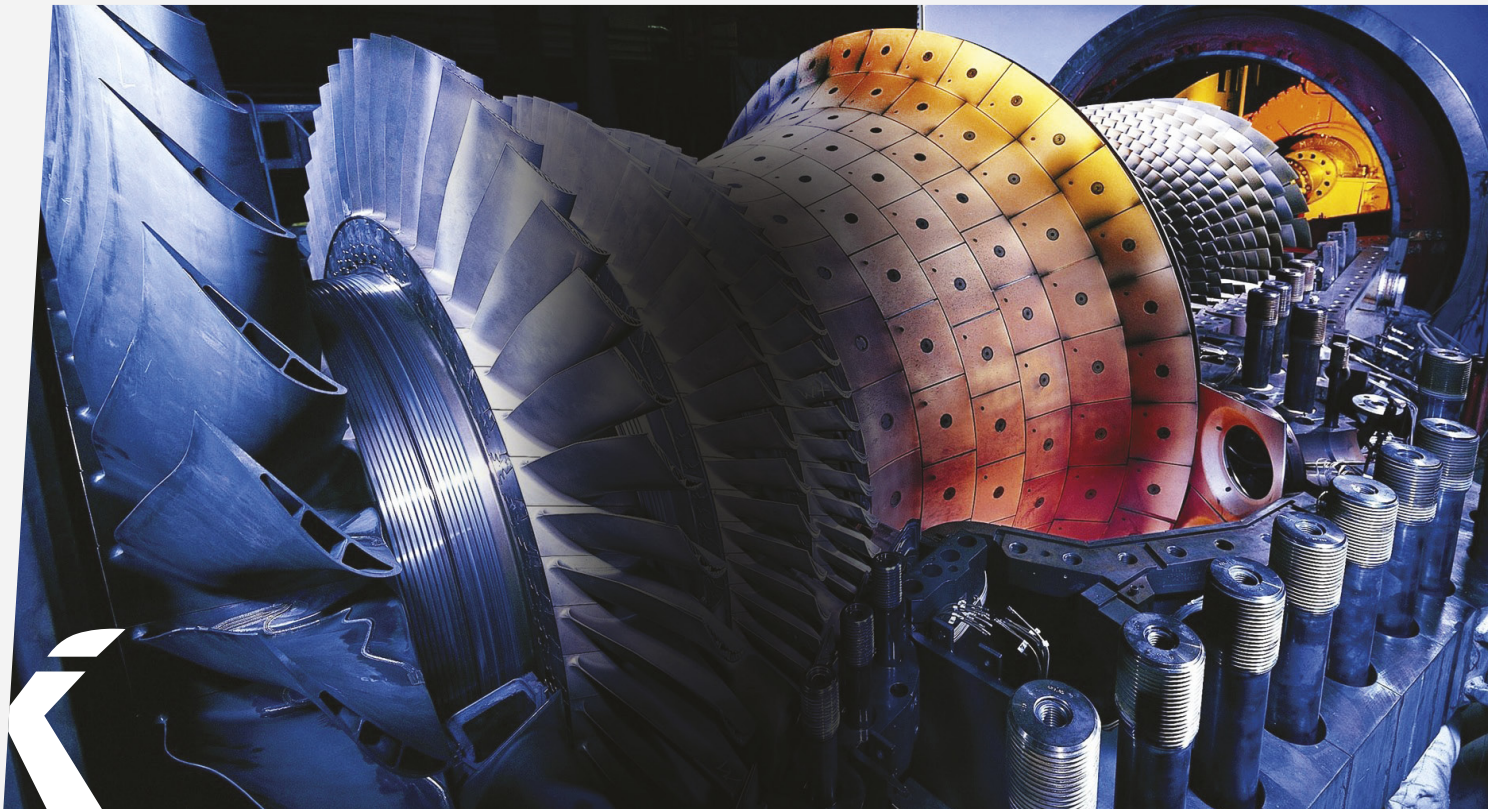
3 MARKET-READY SOLUTIONS



At Lincotek Surface Solutions, we offer much more than coated parts. Our lean manufacturing mindset allows us to provide a responsive and competitive service in a fast-changing market environment.

We carry a high level of expertise in each service and, as a result, we understand the impact of each operation (service) to any subsequent step. We are able from fine-tune each process step to harmonize all operations together and create a better product with no deviations from design intent. We have the capability to recommend changes in operational steps to improve manufacturability of the product, with enhanced quality and productivity.

We are your partner in providing integrated supply chain solutions, reducing lead time and costs. Our dedicated team will take the lead throughout the entire development and manufacturing scale-up processes, right through to the delivery of your products. It's a market-ready service.

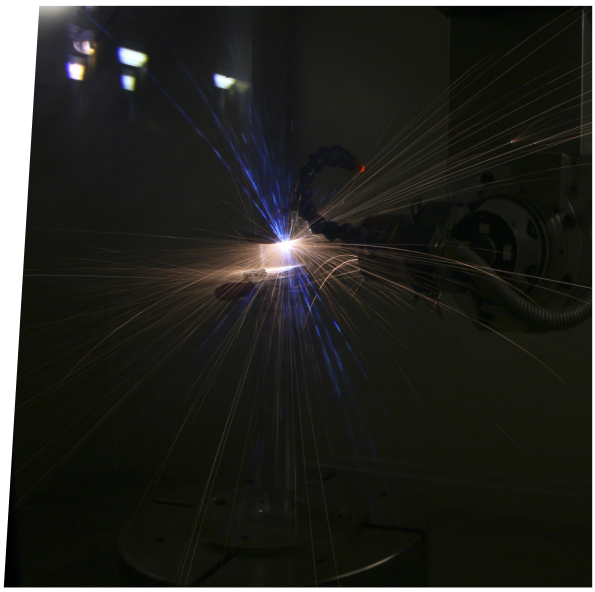


Thermal Treatment

Our heat treatment (both air and vacuum) provides coatings with the microstructure needed to withstand the performance levels of the product in operation. The systems, designed for high-temperature alloys, comply with the highest standards in the industry (including AMS and NADCAP certifications).

Your experts can optimize the routing of products with downstream operations such as coating, brazing and testing. Hipping services are sourced through a network of qualified partners.

Drilling and Shaping of cooling holes



High-speed EDM hole drilling was designed for fast, accurate small- and deep-hole drilling applications, capable of drilling through any conductive material. We can provide LASER technology for drilling through non-conductive Thermal Barrier Coating (TBC) coated products with complex cooling geometries.

The main challenges are typically avoidance of TBC delamination during the drilling process, sensitive alloys prone to micro-cracking and complex hole shapes that may have no line of sight.

Lincotek has engineered specific applications to meet the most sophisticated cooling pattern design by introducing different drilling techniques, including the combined use of LASER and EDM to drill through coating. Our process can offer cylindrical or shaped (fan) hole drilling patterns meeting your design requirements thanks to 3D modelling, probing methods and optical enhancements of process control ensuring a consistent airflow rate.

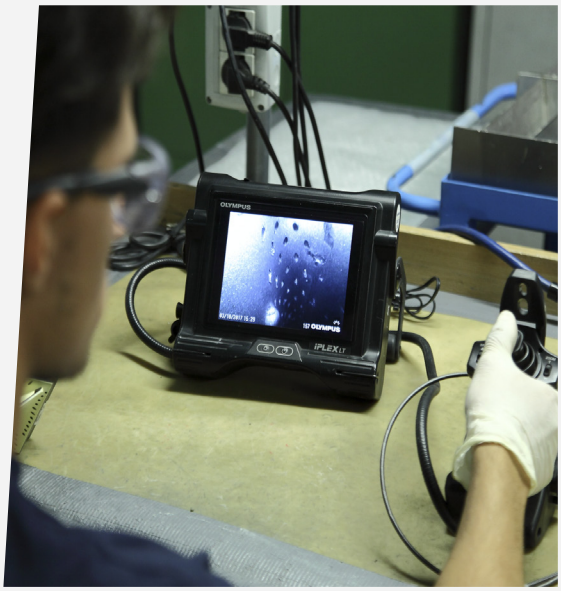
Metal Joining

Joining technologies are necessary to manufacture and finish complex high-performing components. The assemblies grant the product functional performances where the metal-to-metal joining process is a structural element of the final part. Our technologies include: Tungsten Inert Gas (TIG) Welding, LASER welding and Brazing.

Most metal joining technology involves welding through TIG and LASER processes. Alternative solutions for advanced applications include high-temperature vacuum brazing – a process which allows the joining of different alloys in a simple or complex design geometry.

We have considerable experience in surface preparation (cleaning, tack welding, stop-off material and filler selection), as well as heat treatment process definition.

Testing

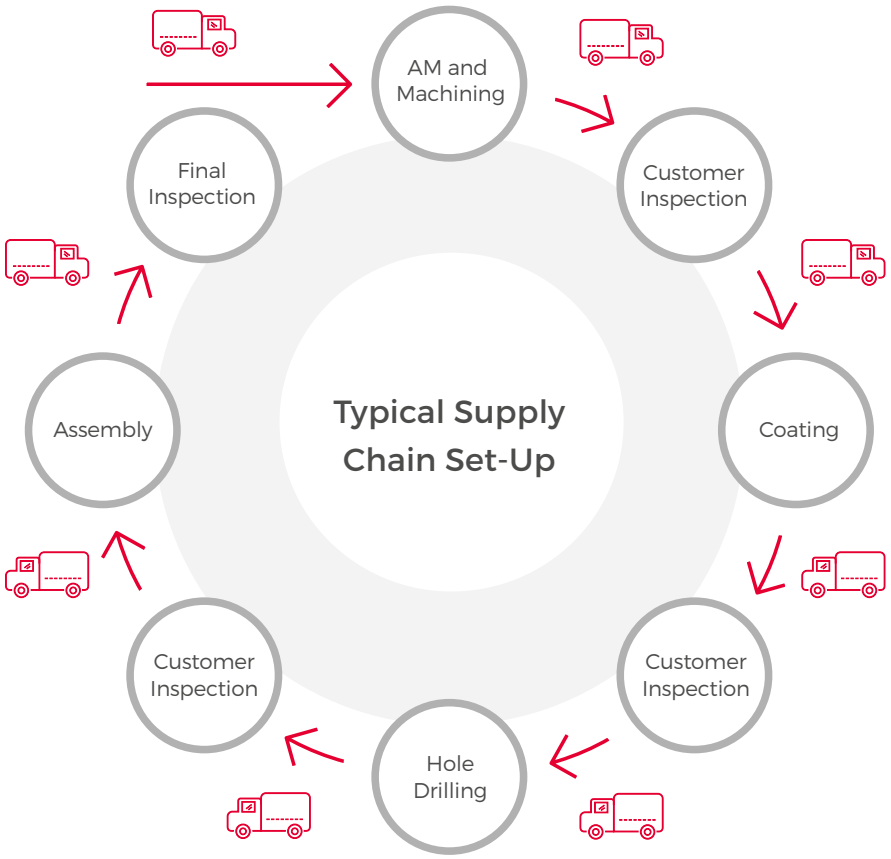


We have integrated all the inspection methods necessary to self-release products in line with customer specifications. All destructive and non-destructive techniques are available in-house to ensure 100% product compliance.

- CT scan
- X-Ray
- FPI
- CMM
- 3D scan
- Metallography (optical microscopy)
- Tensile
- Creep
- Hardness
- Thermography
- Airflow and Waterflow
- SEM
- EDX
- XRD
- TCF
- Boroscope inspection

Advantages to the Customer

Lead time optimization by single supplier



- ▲ High Transportation Cost
- ▲ High Inventory Cost
- ▲ High Scrap Rate risks & NCR management
- ▲ More Manpower (Cost)

Lincotek Solution

50% Lead Time Reduction

Lincotek
AM • Machining • Coating • Drilling • Assembly

- ▼ Low Transportation Cost
- ▼ Low Inventory Cost
- ▼ Low Scrap Rate risks & NCR management
- ▼ Low Manpower
- ▲ High Flexibility
- ▲ Improved Product Quality

More about our Group

- Solution Provider with specific focus on Integrated Supply Chain
- 3 divisions: Surface Solutions, Equipment, Medical
- More than 50 years in thermal spray coatings
- 20 manufacturing sites globally
- 1,700+ employees
- Double digit % sales growth over last 10 years
- > 15% Revenue invested in CAPEX
- 60+ thermal spray systems
- 38 additive printing units in production
- 125 precision machining centers
- 7 R&D centers globally
- Privately owned

Lincotek

Surface Solutions

The highest standard in
IGT and Aerospace markets.
A global player in Industrial.

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