JABIL

FLEXIBILITY **REDEFINED**

How a distributed model and industrial 3D printing are creating a bold, new landscape in manufacturing

EXECUTIVE **SUMMARY**

In this paper, you will discover the close relationship between distributed production and additive manufacturing, and how both combine to enable exponentially new capabilities across a wide spectrum of industry verticals. New efficiencies in inventory, de-sign and cost are just the tip of the spear when it comes to the real value of the technologies.

TOPICS **INCLUDE:**

- Supply chain benefits of a distributed manufacturing model
- Real-world examples of how additive manufacturing supercharges component design
- A detailed breakdown of cost savings and efficiencies made possible by these technologies
- How a single digital thread can unite manufacturing technologies, both old and new

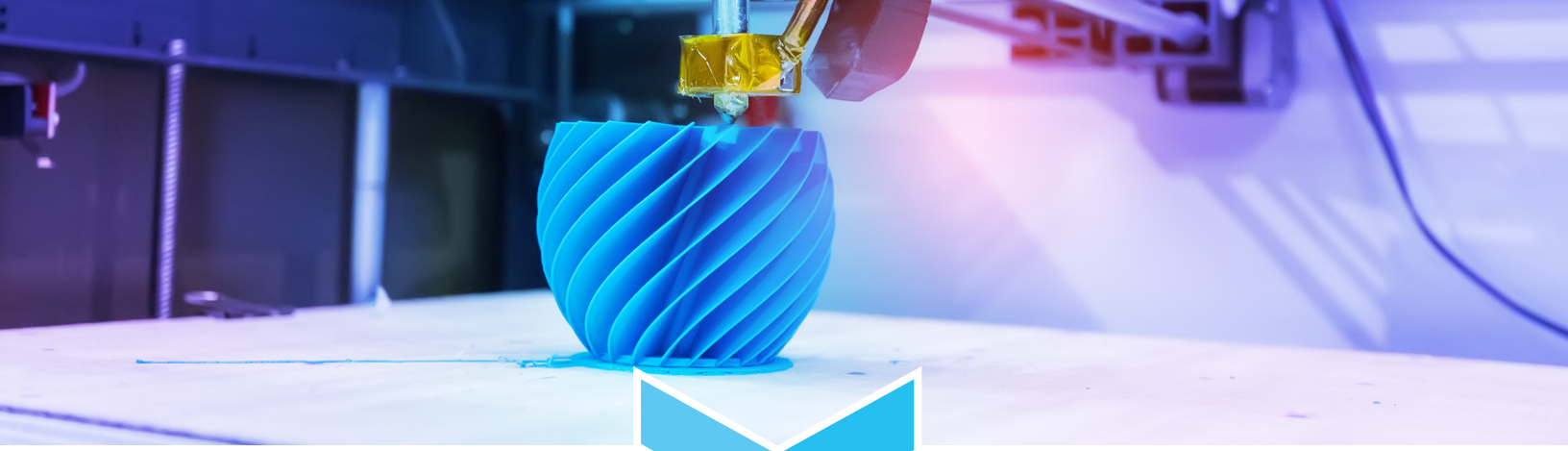
ADDITIVE MANUFACTURING DELIVERS **AGILITY AND BALANCE FOR 21ST CENTURY AEROSPACE**

Additive manufacturing (AM) deployed in a distributed manufacturing environment meets the demands of aerospace production in an increasingly connected and ondemand world. Only through the AM process can inventory levels maintain perfect balance anywhere across the globe by eliminating the need for hard tooling while creating the most efficient, complex geometries and shapes possible.

Picture this scenario:

- **You have a distributor in Nebraska that receives a small order for a specific type of tractor part.**
- **A building next door manufactures the part with additive manufacturing, with no retooling costs or the logistics and expense of long-distance shipping.**
- **Post-processing and quality control happen in the same building, and the part moves right upstairs for final assembly.**
- **The order is filled just-in-time and on-location. The faster fulfillment cycle builds stronger customer loyalty and ensures future orders, while savings during pro-duction create healthier margins.**

The best part about additive manufacturing is that it is practically industry agnostic. The scenario above can happen with any product, anywhere, at any time. That's the power of distributed manufacturing powered by AM.



DISTRIBUTED MANUFACTURING THROUGH **ADDITIVE MANUFACTURING BREAKS DESIGN BARRIERS**

Additive manufacturing enables complex geometries and shapes that are not possible through other manufacturing methods without highly-expensive engineering (if possible at all). To understand the value of this, it helps to evaluate a real-world example of this capability in action.

Consider this example from aviation:

The ventilation system of an aircraft consists of fans and ductwork. The fan in this example contained 73 components when that fan was assembled through a legacy manufacturing technology. But through AM, that same functionality was achieved through the production of one, highly-complex, lightweight shape printed on a 3D industrial printer. When that same fan is hand-assembled, it is built at the rate of a few a week. But 150+ fans can be 3D printed during the same period of time.

When analyzing the performance of the ducting system, certain airflow restrictions may be considered acceptable, due to the limitations of legacy manufacturing techniques. But a 3D industrial printer can make the complex shapes needed to remove airflow restrictions. This means time and material costs are not only saved when making the ducting components, but there will also be less volumetric airflow require-ments, reducing costs even further.

Finally, consider how making components smaller and lighter through AM will reduce fuel consumption for the aircraft and enable a whole new range of creative design possibilities. Suddenly, the value of AM is occurring throughout the many different phases of the production lifecycle.

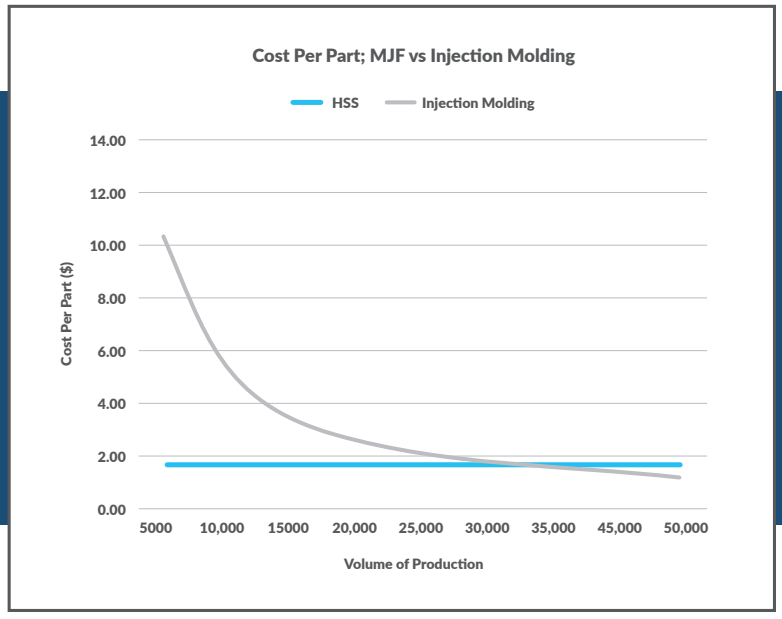
A DEEPER DIVE **ON COST**

The hard dollar value of distributed manufacturing through AM covers a broad spectrum, from reduced logistics and transportation costs to eliminated tooling requirements to more affordable materials. Consider the example of an industrial machines company manufacturing parts in various countries and shipping them to factories to be assembled into a final product. With 3D printing, this company was able to install industrial 3D printers in their assembly factories, manufacture the parts on a 3D printer and assemble them into the final product all in the same location. The bottom-line impact of this upgrade was to dramatically shrink shipping costs from tens of thousands of dollars to $0 and increase margins for the company at the same time.

As AM continues to grow, and equipment and materials become more cost efficient, the breakeven point of cost per part climbs. Depending on the geometry of a part and the 3D printer that the part is manufactured on, the breakeven point can vary. An example for an industrial equipment part made on the HP MJF, shown below, is currently more than 30,000 parts to breakeven when compared with injection molding.

ADDITIVE MANUFACTURING **SAVES ACROSS VERTICALS**

An automotive manufacturer utilized 3D printing to craft the necessary tooling and fixtures to support a traditional manufacturing process. The result was a reduction in tooling costs as high as 30%, depending on the specific tool that was printed.



INTEGRATING ADDITIVE MANUFACTURING **INTO A DIGITAL THREAD**

Additive manufacturing is not a cure-all that is applicable in every manufacturing scenario. Legacy technologies will still make the most sense in certain applications, which is why the best model is to integrate all technologies under a digital thread.

The right software can analyze a prospective part to develop a profile of both financial and technical performance, including durability, lifecycle, typical inventory levels and more. The digital thread can then test how this all of these variables are impacted by producing the part through each type of manufacturing technology. When comparing these financial and technical scores, the components that will thrive in an AM environment rise to the surface.

This type of dedicated, digital analysis can look at millions of parts to find the top 40 to 50 that would benefit from AM. Then, through the complexity of design that this technology makes possible, overall systems and the number of parts required to run them can be reduced. Ultimately, AM operating under a digital thread can deliver the overall most efficient design possible. And distributed manufacturing through AM can yield the most agile manufacturing process possible.

HOW TO **GET STARTED**

To build the right distributed manufacturing environment to make the most of AM, several key structures need to be in place:

- **A secure transfer mechanism needs to be in place to share a digital design file at any location in the world.**
- **Equipment must always be calibrated and in-synch.**
- **Materials must be of consistent quality and delivered through a reliable supply chain.**
- **You need a relationship with a partner that has a network in place to provide the resources to enable nearsite/onsite and on-demand industrial 3D printing, and it all needs to be controlled through a comprehensive digital thread.**

Jabil can help you with all these efforts. If you want to see firsthand what AM operating in a distributed manufacturing model can offer your business, contact a Jabil representative today.