"We have experts in almost every field who make these advances in manufacturing possible. We've been able to create a culture of innovation here that's incredible to be a part of."

Brian Post,
Large-Scale Additive
Manufacturing Researcher

Innovations in Advanced Manufacturing

A thriving manufacturing sector is vital to the nation's economic health and global security, yet few companies possess the research and development (R&D) capacity essential to staying competitive. Oak Ridge National Laboratory (ORNL) draws upon unmatched capabilities in materials, neutrons, and computational science to develop innovative manufacturing technologies, helping large and small companies alike. These efforts are directed toward solutions that will drive US economic competitiveness and energy productivity.

Using ORNL's world-class resources for scientific discovery, such as Summit, the world's fastest supercomputer, the Spallation Neutron Source (SNS), and the High Flux Isotope Reactor (HFIR), researchers can examine microstructures to better design new materials and fabrication methods, leverage multidisciplinary expertise for the development of new bio-based materials, and measure residual stress to certify printed components.

CONTROLLING microstructure in 3D-printed metal parts

CUTTING carbon fiber costs by more than 50%

PRINTING large-scale objects: cars, houses, molds for tooling

CREATING better batteries with new alloys

SOLVING metal 3D-printing challenges

Research and Development

Next-generation materials—Strong lightweight and bio-based materials for a range of applications.

Innovative processes—Additive manufacturing or 3D printing, machine tools, and carbon fiber composites.

Artificial intelligence and enabling technologies—Advanced computation, data analysis tools, machine learning, advanced visualization/sensors and characterization.

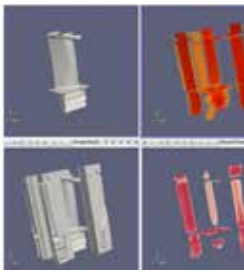
Robotics, controls and automation—Cyber-physical systems and closed-loop systems with born-qualified components.

Machine tools—Advanced manufacturing to shape metal components for tools critical to national defense.

Additive manufacturing for nuclear reactors





Recent Impacts

- Developed lower cost trim tool using additive manufacturing and composite materials made with carbon fiber and ABS thermoplastic.
- Operated the world's first large-scale 3D thermoset printer.
- 3D printed 40 ft long wind blade mold demonstrating decrease in time and cost compared with traditional production.
- Used in situ data analytics to born certify parts every single time.
- 3D printed tooling for precast concrete molds for large-scale renovation project in New York City, proving more durable alternative to wooden tooling.
- Expanded Big Area Additive Manufacturing capabilities to print large-scale polymer materials up to 13 ft long.
- 3D printed mold to directly infuse boat hulls.
- Used bioderived composite materials to 3D print components of large outdoor pavilions.
- Created manufacturing method combining 3D printing with traditional casting to produce damage-tolerant components composed of multiple materials.

170	Industry Partners
50	University Partners
104	Publications in FY 2018

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Unique Facilities

The **Manufacturing Demonstration Facility** (MDF) is the nation's only large-scale open-access facility for rapidly demonstrating early stage R&D manufacturing technologies and optimizing critical processes.

The **Carbon Fiber Technology Facility** (CFTF) is developing methods using low-cost feedstocks to assist industry in overcoming the barriers of carbon fiber production cost, scalability of processes, and development of fiber-reinforced polymer composites for end use.

The **Battery Manufacturing Facility** (BMF) is the country's largest open-access battery and research development center focused on high-performance, low-cost water-borne processing technology, high-speed curing for advanced electrodes, low-cobalt and cobalt-free cathodes, and high-performance computing for advanced processing, performance validation, and life prediction.