Rapid-prototyping capabilities

Since its founding in 1949, Idaho National Laboratory (INL) has proven its capabilities as an applied engineering laboratory. It did this first by designing and testing experimental nuclear reactors and naval propulsion systems, and later through cutting-edge energy technology, cyber and nuclear security innovations, and novel materials for high-temperature environments and kinetic protection.

Researchers come to INL with a build-test-build mentality and a healthy curiosity for pushing the limits of science. Failure is sometimes a desired outcome, but only if it eventually yields a stronger product, an improved methodology, or a better machine. With this philosophy in mind, INL established a rapid-prototyping facility for advanced materials research and limited-run production.

STATE-OF-THE-ART EQUIPMENT

Inside a secure facility in Idaho Falls, Idaho, INL procured and installed $3 million in state-of-art machinery, including several multi-axis computer numerical control machines (CNC lathes, 4- and 5-axis milling machines, 7-axis mill-turn center), industrial 3D printers, laser engravers and dynamic and static material stress-testing equipment.

This capital purchase allows for rapid fabrication of custom prototypes including materials intended for use in harsh environments and battlefield scenarios. The industrial-scale production environment includes industry-leading machinery that meets stringent quality controls for precision and high-speed output. The machinery supports classified, sensitive, and routine production projects for the federal government.

TECHNICAL EXPERTISE

Equipment alone doesn't create a capability. It also requires technical experts with deep engineering knowledge and applicable production skills. INL employs some of the best mechanical, electrical and chemical engineers in the country. They work alongside leading material scientists, manufacturing technicians, electricians and drafters to produce innovative solutions for difficult national security applications. Due to the nature of this work, these experts are all U.S. citizens with verifiable security clearances.

INL
Idaho National Laboratory

INL researchers and customers who use the machining facility tailor rare and common materials for specific purposes by reengineering their physical and microstructure processes to meet specific needs. The goal is to produce materials that meet customer requirements, demonstrate improved performance, and that can be repeatably and affordably produced at scale.

EQUIPMENT INVESTMENTS
CNC LATHES AND MILLING MACHINERY

(2) Kitamura Bridgecenter-6G #50 12K 40 ATC

- Ideal for heavy, precise, accurate cutting and die/mold applications
- 4/5-axis machine at 12,000 RPMs
- Positioning accuracy: ±0.000078" fullstroke, repeatability: ±0.000039"

(2) Kitamura Mycenter 3020G 20K Vertical Machining Center

- Ideal for heavy cutting of molds and high-speed, accurate cutting of precision parts
- 4-axis capable at 20,000 RPMs
- Positioning accuracy: ±0.000078" fullstroke, repeatability: ±0.000039"

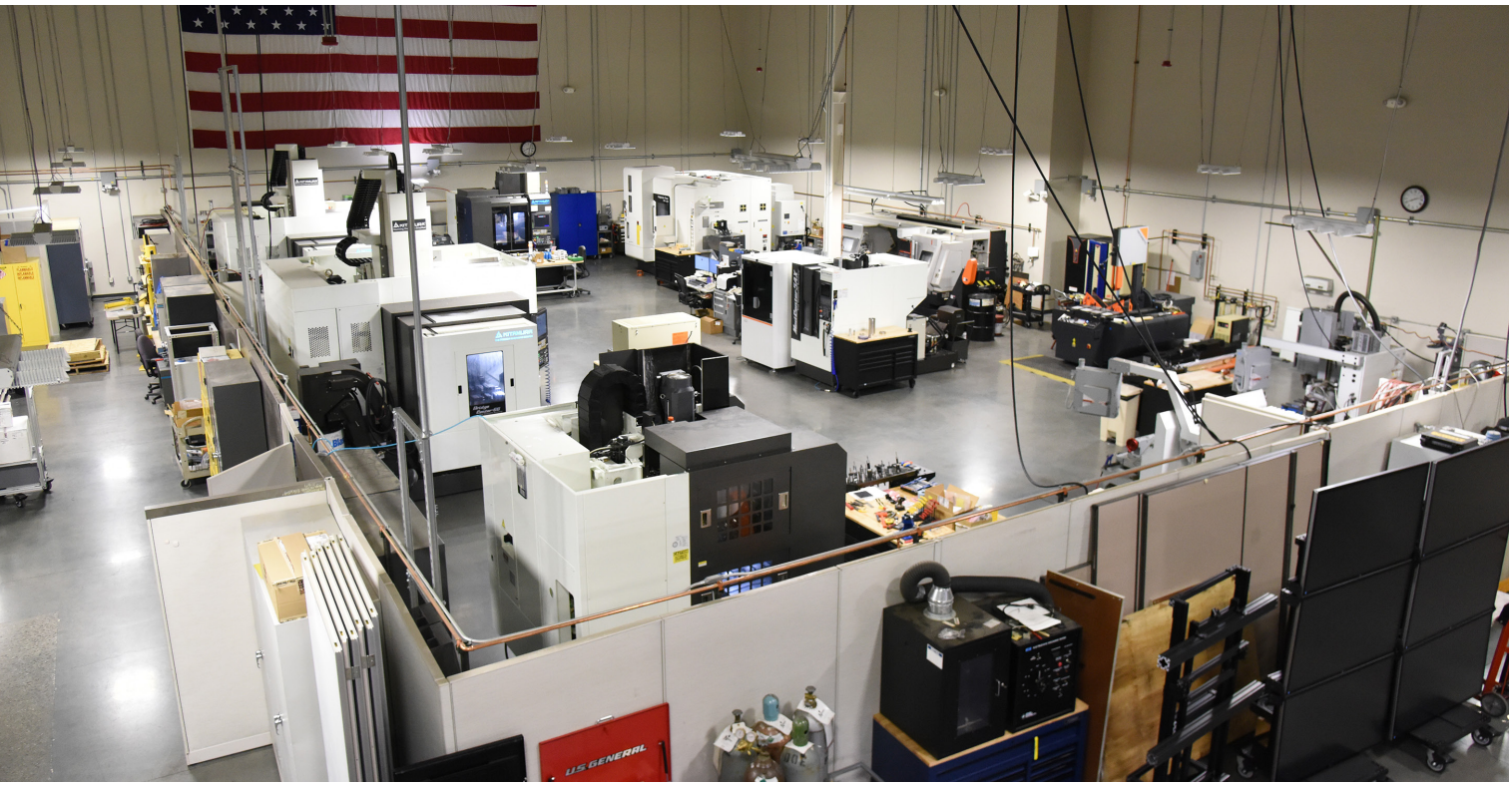
Kitamura MedCenter 5AX, 5-axis CNC Machining Center

- Ideal for ultra-high precision machining of small medical parts, micromachining
- Simultaneous 5-axis capable at 30,000 RPMs
- Positioning accuracy: ±0.000079" fullstroke, repeatability: ±0.000039"

Nakamura Tome Super MX100

- Ideal for compact high-precision multitask machining
- Simultaneous 4-5 axis machine at 20,000 RPMs
- Twin spindle, compact ATC head and lower turret

INL's state-of-the-art machine shop includes multi-axis computer numerical control machines, industrial 3D printers, laser engravers and dynamic and static material stress-testing equipment.



ELECTRONICS

PCB design and modeling

- Altium Designer, Ver 21 – Circuit design, schematic capture, PCB layout, and PCB fabrication

Electronic enclosure and assembly design

- SolidWorks Premium 2021, 3D modeling software

Pick and place inline component assembly

Manncorp AP430, automatic inline stencil printer

- High-precision, high-quality, fully automated
- Print area up to 400 x 350 mm
- Printing speed between 12 to 40 mm/second

Manncorp MC389 high speed, high mix, three head, pick and place

- Robust, high-mix machine providing stable and precise component placement
- Placement accuracy of 30 µm, 3 Sigma
- Rapid speeds up to 10,500 parts per hour

Manncorp CR4000C, four-zone SMT reflow oven

- 500 x 400mm steel mesh conveyor system for solder reflow
- Four independently controlled, forced hot-air convection zones
- Real-time temperature controls and profiling

IC PACKAGING

Datacon EVO 2200 die attach

- +-10 um accuracy in x, y, theta
- High precision machine vision
- Flip chip capability

Kulicke & Soffa IConn ball bonder

- +- 2.0 um accuracy
- High performance X-Y-Z motion control

March Instruments plasma etching system

Electroglas die probing station

- Program IC die before molding

Lawton IC molding station and singulation

RMI precision laser IC marking system

3D PRINTING

Formlabs Form 3L 3D resin (SLA) printer

- Large format resin 3D printer
- Allows 3D printing of high-resolution mechanical parts up to 13.2in x 7.9in x 11.8in
- Vertical build resolution of 100 microns (0.004in)

Formlabs Form 3B 3D resin (SLA) printer

- Medium format resin 3D printer

INL recently acquired a 7-axis Nakamura Tome Super MX100 machine. This compact high-precision multitasking machine features a built-in machining and turning center, advanced software, smart features and up to 96 tools.

- Allows 3D printing of ultra-high-resolution mechanical parts up to 5.7in x 5.7in x 7.3in
- Uses high-tech resins including bio-compatible resins and flexible resins
- Vertical build resolution of 25 microns (0.001in)

(2) Stratasys F370 3D fused deposition modeling (FDM) printers

- Industrial grade material printing including ABS, PLA, ASA, and other materials
- Accuracy of +/- 0.200 mm (0.007 in)
- Reliable, repeatable, human-scale operations

Formlabs Fuse 1 SLS (selective laser sintering) 3D printer

- Medium format powder SLS 3D printer
- Prints with high strength nylon powder
- 6.3in x 6.3in x 11.6in build volume
- Layer thickness is 110 microns (0.004")
- Modular build chamber for continuous manufacturing process
- 3D builds require no supports; no support post processing required

LASER ENGRAVING AND CUTTING

Epilog FusionPro 48 laser engraving and cutting machine

- Dual laser (CO2, 120W and Fiber, 50W) for cutting and engraving metals, plastics, and more
- Rapid acceleration and highly precise engraving
- Engraving speed up to 165 inches per second
- Work area of 1219 x 914 x 311 mm

Epilog MINI laser engraving and cutting machine

- 45watt, CO2 laser

MATERIAL STRESS TESTING

Split Hopkinson pressure bar

- Imposes a dynamic load on a material sample to test high strain rate properties
- Mimics real-world material strain conditions like vehicle crashes or other high-energy events

Creep frames

- Imposes static loads on materials to measure any deformity under the influence of persistent mechanical stresses.

INL produces high-speed analog and digital circuitry, has an IC packaging capability producing customized multichip and hybrid modules, and a full high-speed pick and place line for quick-response electronic assembly. These in-house capabilities ensure supply-chain compliance and integrity.

FOR MORE INFORMATION

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