Innovative Manufacturing Solutions

to Benefit the Small Modular Reactor/Advanced Reactor Industry and the Legacy Reactor Fleet

Capabilities Directory

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The past decade has seen the emergence of the next generation of commercial nuclear power plants, commonly referred to as Small Modular Reactors (SMRs) and Advanced Reactors (ARs). The relatively compact reactors, capable of generating up to 600 MW of power, can be “factory produced” and then transported in a few sections to a designated location for assembly. In addition, these reactors employ passive safety technologies that make them safer to operate.

Approximately twenty companies are developing clean, reliable, and economical technologies that will play a significant role in meeting future demand in the U.S. and other nations. It’s projected that hundreds of SMR/AR systems will be needed by the late 2030s, requiring a significantly different manufacturing approach than is currently used for constructing the current large Light Water Reactor systems.

The fundamentally different approach to manufacturing SMRs/ARs will challenge both nuclear suppliers as well as regulators. Numerous technical issues must be considered to facilitate efficient SMR/AR production, from addressing supply chain capabilities to developing mechanized/automated manufacturing processes to support higher demand volumes.

A critical gap exists in providing proven applied advanced manufacturing technologies to this emerging field.

Concurrent Technologies Corporation (CTC) is recognized as one of the world’s premier nonprofit applied scientific research and development organizations for the creation and implementation of advanced manufacturing technologies. The skills and processes developed at CTC are leveraged by the Center for Advanced Nuclear Manufacturing to benefit the U.S. SMR/AR industry and the legacy reactor fleet.
Our Experts

Highly qualified engineers and scientists delivering innovative, customized solutions

CANM’s full-service solutions team consists of engineers and scientific experts with in-depth experience in materials, design, analysis, rapid prototyping, testing, and manufacturing. We integrate these resources at the appropriate phase in the product development life cycle, and employ a first-pass design philosophy to minimize design iterations. As a nonprofit organization, we partner with clients to provide the best possible advanced engineering & manufacturing solutions in the following areas:

- Air Systems
- Ground Systems
- Sea Systems
- Weapons Systems
- Manufacturing Process Development and Optimization
- Mechanical Testing and Materials Characterization Services
- Fleet Readiness Services
- Additive Manufacturing
- Custom Fabrication Solutions
- Friction Stir Welding
- Integrated Logistics Support
- Maritime Engineering and Logistics
- Prototype Tool Development
- Secure Coatings Design

Utilization of Scanning Electron Microscope (SEM) to support failure and/or material analysis.
CANM operates from facilities in Johnstown, Pennsylvania, with over 400,000 square feet of combined office, laboratory, and high bay demonstration space tailored for acceleration of technology transition. These facilities, which support the CANM program in a number of ways, possess a Top Secret Facility Clearance with Secret Safeguarding, including classified and unclassified meeting spaces.

The Environmental Technology Facility (ETF) offers two large high bay spaces totaling over 130,000 square feet that are routinely used to develop and demonstrate advanced manufacturing technologies, as well as to fabricate large-scale, first-of-a-kind prototype structures. The larger of the two highbay spaces has approximately 40 feet of vertical clearance under the ceiling structure. Certain areas in these spaces have overhead crane service, and all areas can support portable cranes or other lifting systems as required. Our demonstration facilities serve as a test bed for the entire life cycle of projects from initial concept evaluation through final technology demonstration/validation.
Friction Stir Welding (FSW) is a joining process that offers significant advantages over conventional arc welding methods, especially for thick aluminum vehicle structures. FSW utilizes friction between the welding tool and material to heat (but not melt), soften, and “stir” material across the joint to produce a solid-state weld. Concurrent Technologies Corporation (CTC), which operates CANM, has repeatedly proven the superior performance and cost effectiveness of FSW relative to other conventional welding solutions. FSW circumvents or minimizes many arc welding shortfalls. CTC has experience developing FSW processes and equipment for ground vehicle structures, trailer beds, ship deck structures, and more. FSW technology can also be used in the aerospace, automotive, robotic, and other industries.

**Benefits of FSW Compared to Arc Welding:**
- Creates improved mechanical properties (static, fatigue, damage tolerance)
- Reduces post-weld rework and fit-up issues
- Enables joining of dissimilar alloys with equal/better joint properties than joints made of lesser alloy
- Enables joining of different product forms
- Employs a much simpler process (Computer Numerical Control [CNC]) with fewer variables to control in manufacturing
- Requires less operator training than traditional aluminum arc welding
- Provides significantly higher production rates for thick materials
- Minimizes environmental, health, and safety concerns – “Green”

Our FSW machinery is able to seam together large plates, such as the pictured three 4’ x 12’ plates. We can create the necessary plate size for clients from standard mill run stock plates. FSW improves strength and resistance compared to traditional welding techniques.
SuperMIG® welding technology, originally developed and patented by PLT (now Heller Industries/Weldobot), combines two standard welding processes into one hybrid welding technology: Plasma arc and GMAW (MIG). The SuperMIG system uniquely integrates typical GMAW electrode (weld wire) and plasma electrode into one torch head. When the SuperMIG welding torch travels over the workpiece, the plasma arc is positioned to lead the GMAW electrode.

**Benefits:**
The SuperMIG system combines the key advantages of plasma arc for deep penetration with high arc efficiency and metal deposition of a GMAW. The combination of the two processes can deliver:
- Greater welding speed under variable root opening conditions
- Deeper weld penetration with reduced heat input
- Smaller heat-affected zones
CANM provides a wide range of prototyping solutions to meet our clients’ specific product and manufacturing needs. Our highly skilled technical staff uses the best engineering concepts to address requirements. They develop physical, numerical, and scale manufacturing process prototypes that are evaluated, tested, and refined to meet performance and design objectives. These prototypes are often used in scale-up for low-rate or mass production.

To support CANM’s prototype fabrication, our Environmental Technology Facility includes a machine shop that houses fully equipped machining, welding, and metrology capabilities to fabricate prototype components and structures. Those components are then transported to the nearby high bay areas for fabrication into larger structures.

**Benefits:**
- Enables the technical team to explore ideas and exchange feedback with clients to quickly demonstrate a part, system, or process
- Identifies and addresses problems early in the manufacturing process
- Improves the accuracy of system requirements and functionality
- Ensures that the solution performs as expected
- Confirms how the final solution will look and function
- Helps the developer estimate baseline costs, timescale, and resource requirements for low-rate or mass production
Hybrid manufacturing produces objects by employing both additive and subtractive technologies. Because of this dual nature, hybrid machines can begin producing a part by using either of the two processes. However, beginning production using additive manufacturing can be more efficient than milling alone and typically offers broader design freedom.

Benefits:

- Ability to add and/or clad materials to parts, and either perform dimensional restoration at the end of the process or periodically as the material addition progresses
- Relatively low and localized heat input when compared to other metal material adding processes
- No limit on deposition thickness
- Multiple heads for fine features or heavy deposition
- 1000-watt laser for added capability and extreme duty
- In-situ sensing and control to ensure thermal stability and reliable operation
- Multiple metal materials (non-reactive at this time)

The AMBIT™ system is paired with a HAAS VF-11 five axis milling machine. The working envelope is approximately 120” x 40” x 30” for large part repair or feature addition. Photo courtesy of Hybrid Manufacturing Technologies.
Powder Bed Fusion-Laser is an additive manufacturing process in which thermal energy (from a laser) selectively fuses regions of a powder bed layer by layer. The end part(s) can be extremely complex and contain features not possible with conventional subtractive manufacturing processes. Common terms used for this technology include: Selective Laser Melting (SLM), Direct Metal Laser Sintering (DMLS), Direct Metal Laser Melting (DMLM), Laser CUSING, and more.

**Benefits:**
- Focused laser offers small feature size and good surface finish
- Ability to create complex feature(s) and internal cavities
- Wide range of available materials and growing
- Material is recyclable
- Part density can be > 99%
- Fine microstructure characteristics
- Open parameter equipment allows modifications for build enhancements

With the SLM 280HL, we create metal parts using various materials including aluminum, titanium, stainless steel, cobalt-chromium, and others.
Cold spray is a solid-state spray process that deposits metal powder with temperatures below the material melting point through the use of a supersonic nozzle and pressurized/heated inert gas. CANM uses the cold spray additive process for the application of metals, metal alloys and metal blends to create new parts, repair existing parts, and/or enhance base material properties (e.g., improved corrosion or wear protection).

Benefits:
- Low heat input with no “heat-affected zone”
- Work-hardened and near-wrought properties can be achieved
- No limit on deposition thickness
- High deposit efficiency typically > 80%
- Deposition density > 99%
- Powder microstructure and properties are preserved
- No oxide formation, alloy decomposition, combustion product entrapment
- A diversity of materials can be applied from aluminum to refractory metals

This cost-effective additive method repairs/enhances metal parts, reduces lead times, and extends service.
Operating a full-service mechanical testing and materials characterization laboratory for over 30 years

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<td>MTS 3 - 200kip load capacity, 2200°F max temperature in ambient environment</td>
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CANM has extensive experience in part inspection, real-time build and virtual part alignment, analysis and data reporting, reverse design, interfacing with various types of portable metrology instrument, and development of complex automation operations to improve measurement and inspection efficiencies.

In addition to PolyWorks and SpatialAnalyzer metrology software packages, CANM has the FARO Edge ScanArm HD, an industry-leading portable measurement device. This technology precisely measures machined components and/or fabrication assemblies to the required accuracy. It features rapid scanning speed, high-definition data, and the ability to scan challenging materials and create highly accurate and repeatable measurement data. In addition, it is compact, lightweight, and simple to use.

Benefits:
- Improved reliability and capability
- Quick measurements without a computer
- Diagnose setup issues affecting performance
- Meet quality standards
- Deliver products more quickly

CANM uses FARO Edge and ScanArm HD technology, a revolutionary portable metrology system.
Concurrent Technologies Corporation’s (CTC’s) innovative water recycling technologies purify and treat wastewater up to potable standards so that it can be safely recycled and reused, addressing pressing water needs.

No other technology matches the efficiency and benefits in providing clean water for unrestricted reuse—including human contact applications. Our systems recover more water at better quality using less energy, operations, and maintenance.

CTC’s technologies allow water to be reused for a wide variety of applications, such as industrial and commercial laundry, toilet flushing, and landscaping.

Because CTC’s research and development (R&D) work includes Department of Defense projects, our solutions comply with strict national water reuse standards and mandates, enabling quicker transition to the field.

CTC offers the following to meet your needs:

- More than 30 years of research and development experience
- Customized engineered solutions using innovative water processing technologies to meet your unique needs
- Scalable, modular, portable systems that are energy efficient and low maintenance
- Significant cost savings—achieved through reduced water, energy, and sewage fees
- Social and environmental benefits, especially in water scarce regions and disaster relief operations across the U.S. and abroad
- Full, turnkey services including design, construction, and installation
- Technologies to promote achievement of Net-Zero Water goals and mandates

In partnership with our affiliate, Enterprise Ventures Corporation (EVC), we offer the ability to fully design, develop, test, prototype, and build systems that will reduce your costs and water usage.

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The increasingly inter-connected nature of processes, machinery, information systems, and mobile devices in the lab and on the shop floor expose organizations to a new level of cyber security threats.

In partnership with Catalyst Connection and the Pennsylvania Industrial Resource Center (IRC) Network, CTC, CANM’s operator, developed a tailored cyber security assessment methodology for small- and medium-sized manufacturing enterprises. The IRCs continue to vet this approach and build upon best practices with each assessment.

**Benefits:**
- Strengthening the first line of defense through greater employee awareness
- Independent assessment of third party services
- Specific recommendations for continuous improvement
- Increased compliance with new federal contracting requirements
Operated by CTC, CANM benefits from the company’s outstanding quality standards. CTC’s commitment to quality is exemplified by its early participation in the national and international standards-setting organizations and its subsequent ISO 9001:2015 and AS9100D:2016 (quality) and 14001:2015 (Environmental) certifications. CTC was one of the first nonprofit research and development organizations to simultaneously certify to both the ISO 9001 and 14001 international standards, achieving this distinction in 1998. Since that time, CTC has maintained both certifications and all locations conform to ISO practices and procedures.

**CTC Quality Policy Commitments:**

- Quality products and services that meet or exceed requirements of our internal and external clients to ensure the successful attainment of business objectives and goals
- Effectiveness & Efficiency by striving to limit activities to only those required to meet or exceed our clients’ requirements and then working to improve the efficiency of those activities
- Compliance with internal, regulatory, and statutory requirements
- Continuous Improvement in our products and services, and the effectiveness of our management systems

CTC’s quality management system is certified to the ISO 9001:2015 and AS9100D:2016; CTC’s environmental management system is certified to 14001:2015.
The center for Advanced Nuclear Manufacturing (CANM) is operated by Concurrent Technologies Corporation (CTC). CTC is an independent, nonprofit, applied scientific research and development professional services organization. Together with our affiliates, Enterprise Ventures Corporation and CTC Foundation, we leverage research, development, test and evaluation work to provide transformative, full life-cycle solutions. To best serve our clients’ needs, we offer the complete ability to fully design, develop, test, prototype, and build. We support our clients’ core mission objectives with customized solutions and strive to exceed expectations.

CTC:
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