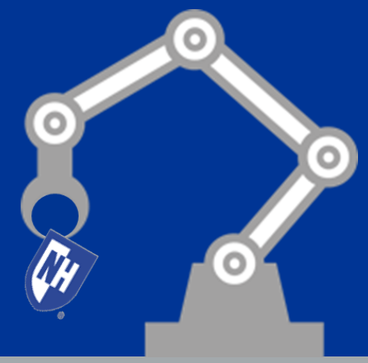
University of New Hampshire
John Olson Advanced Manufacturing Center

The John Olson Advanced Manufacturing Center

Transforming the Innovations of Tomorrow into the Solutions of Today

2021 Highlights



Message from the Director

Welcome to the John Olson Advanced Manufacturing Center's 2021 Highlights Report. As the new director of the center, I am excited to launch the Olson Center's first Annual Highlights Report which provides details on the engagement and growth that the center has undergone during 2021. In January of 2021, Dr. Kinsey, the center's interim director transitioned to the Olson Center's Advisory Board where his expertise will continue to support the center. As the new director, I am looking forward to getting to know and work with the region's manufacturers and businesses on shaping the future of the center as well as the region's faculty and staff, students and alumni.

As was true worldwide, for the Olson Center, 2020 started with business as usual then quickly morphed as the COVID-19 pandemic encompassed the globe. Between biopharmaceutical companies crash-pivoting towards developing a vaccine, PPE companies overwhelmed by the surge in demand, businesses grappling with shutdowns, remote work and supply issues, and testing facilities faced with ballooning their capacity, the world's eye quickly focused on manufacturing capacity, supply chains, and sourcing in ways that have not been seen in a generation. Worldwide, while vaccines were rapidly escorted through development and deployment, the capacity to test and monitor the spread of this disease quickly supplanted most other concerns. To that end, as a part of it's measures to protect students, faculty/staff, and the surrounding community, university testing capabilities were quickly established for large-scale COVID testing and the Olson Center was glad to play a supporting role in developing this capacity by helping to manufacture the parts required by the UNH laboratories as well as for other manufacturers working to meet the needs of our nation and across the globe.

Outside of these efforts, in 2021, the Olson Center also underwent a significant expansion in capabilities through the addition of two industrial-scale incremental forming machines as well as the ability to incrementally form extremely large (80 ft x 25 ft) sheet metal workpieces robotically. Through these additions, the Olson Center has established one of the world's most expansive capabilities for rapidly prototyping sheet metal parts; adding to the center's existing electromagnetic and other sheet forming technologies.

Building on the infrastructure and equipment already existing within the Olson Center, 2021 saw several additions in capability, including an increase in the center's material characterization infrastructure through the purchase of a DSC, DMA and MTS combined axial-torsional fatigue loading frame. With further expansions planned for the future, the Olson Center continues to maintain its role as the region's hub for cutting-edge manufacturing and material characterization technologies.

2021 also saw the launch of several new advanced manufacturing initiatives at the Olson Center, including: the Assistive Technology and Enabled Workforce Development Program; the Cybersecurity Assessment and Testbed Center; the Engineering Design and Support Services Initiative; and the Consortium for Advanced Space Manufacturing. Through these initiatives and other advanced manufacturing activities, the Olson Center continues to extend the frontiers of knowledge, helping to transform the innovations of tomorrow into the solutions of today.

While most of us still look forward with an uncertain eye, wondering when life will return to 'normal', one point that has become abundantly clear is that manufacturing plays a vital role in the economic health of our region and nation and it is a critical component towards the well-being of mankind; providing the medicines we need, the food we eat, and the environment we live in. Whether it is meeting education and workforce development needs, creating or deploying the solutions required to remain competitive, or providing advanced manufacturing connections and networking, UNH and the Olson Center are an asset that can help provide the manufacturing solutions needed by industry. Backed by the tremendous skills and knowledge of the faculty, staff, and students, and building on the tradition of excellence and service for which the University of New Hampshire is known, the Olson Center will continue to provide the springboard by which today's manufacturers will build the world of tomorrow.

Best Regards,

John T. Roth
Director

2021 Engagement Highlights

John Olson Advanced Manufacturing Center

Vision

To become a primary source for obtaining information, education, connections, collaborations and solutions related to advanced manufacturing, materials, and product innovations

Mission

Helping small, medium and large manufacturers remain competitive within the continually evolving global advanced manufacturing landscape by:

- Fostering public and private partnerships, related to research, development, testing, and analysis, involving manufactured products, processes, and materials
- Reducing the barriers that impede the transfer of product, manufacturing and materials research and technological developments to industry
- Serving as a point of contact for manufacturers when exploring new engagement opportunities with UNH
- Providing a mechanism by which manufacturers can identify and engage with students, faculty and staff to develop innovations and solutions
- Helping address the skills gap in US manufacturing

Goals

Industrial Goals

- Provide manufacturers with access to the latest technology, techniques, processes and resources
- Help enterprises develop connections up and down the supply chain
- Deliver industrially-focused workforce and next-generation educational programs
- Empower business partners to adopt and deploy next-generation advancements
- Maintain innovative cross-disciplinary collaborative teams that can rapidly address industrial needs

Academic Goals

- Serve as a conduit to industrial environments, applications, and real-world problems
- Expand internship engagement opportunities
- Enable the transfer of advances in fundamental knowledge and science into deployed industrial solutions
- Create an inclusive hands-on interdisciplinary factory-based learning environment
- Educate and upskill the existing and future manufacturing workforce

Incubator Goals

- Facilitate faculty and student ingenuity through creative spaces
- Lower the economic barrier for start-ups through shared-use infrastructure
- Accelerate the development of prototypes
- Foster Tier X Supply Chain integration opportunities

COVID: Doing Our Part

Credit. UNH—Jeremy Gasowski

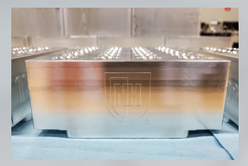
Battling the COVID-19 pandemic has taken a nationwide effort with many formerly disparate fields and groups needing to determine how to pivot their activities and come together in new ways in order to respond and provide for the needs of our nation and its people. CEPS and the Olson Center are proud to have been able to help with these activities. With the technology and expertise to quickly fabricate critical parts, the Olson Center has utilized its facilities and technical expertise to help test labs and manufacturers to provide the PPE and medical devices needed to confront the pandemic. Below are examples of these partnerships.

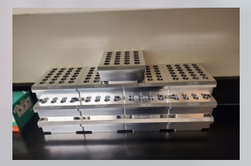
Pipette Cleaning Reservoirs

As a part of the operating procedure for sanitizing the tips of the pipettes used by the testing machines, each pipette is emersed into basins filled with sterilizing fluid. These basins, however, are test lab specific with respect to size and geometry. Thus, when expanding its testing capability the Olson Center worked with the UNH Covid Lab to 3D print these custom cleaning reservoirs.

Test Tube Racks

In addition to the pipette cleaning tanks, expanding the UNH Covid Lab's testing capacity required the ability to handle a large throughput of sample specimen test tubes. Managing the high volume of testing needed to ensure the safety of the students, faculty, staff and surrounding community required the fabrication of over a hundred custom test tube racks. Quickly producing these complex racks was accomplished through the utilization of the equipment in the Olson Center's automation cell. Coordination between the cell's 3 and 5 axis milling machines, along with specialized manual deburring and parts washing operations enabled the center to rapidly manufactured these parts, allowing the UNH Covid Lab to integrate these test tube racks into their facility's expanded capacity.





3D Printed Head Bands

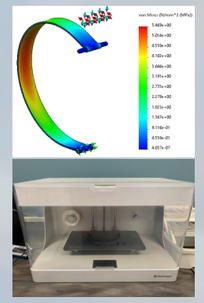
Responded to a request from the Portsmouth Naval Shipyard in Kittery, Maine, the Olson Center joined with other facilities within the university to manufacture the plastic headbands that are an integral part of the assembly of medical face shields. Coordinated by UNH's University Instrumentation Center, the 3D printing facility at the Olson Center joined with over a dozen other university 3D printers to provide headbands to a team at the shipyard which used these and other 3D printed parts to assemble and distribute masks to hospitals and medical facilities across New Hampshire, Maine and Massachusetts.

Open Source Ventilator

In support of the MIT Emergency Ventilator (E-Vent) Project, the Olson Center assisted a team of dedicated engineers at Sturm Ruger & Co. who were allocated by the company to assist with the work of this project. Using designs provided by the engineers, the center's waterjet cutting capabilities were employed to fabricated metallic parts that were incorporated into Ruger's ventilator fabrication efforts.

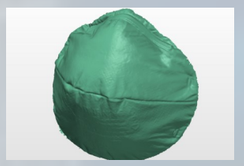
Adjustable Headband Project

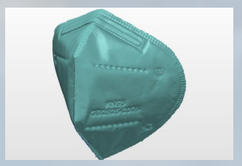
At the onset of the COVID-19 pandemic, 3D-printing technology was utilized to produce the headband components of face shields for essential workers using a generic part file that could be used with all available printers. However, individual part modifications were required by each facility based on the filament type and printer utilized in order to ensure that the headbands met the required part criterion. To overcome this necessity and to optimize the print file for each printer material combination, working with the Olson Center, a senior design team was tasked with creating an analytical model that can be incorporated into a CAD part file that automatically updates the part file based on the material input. Besides improving the part compliance for the headband application, this project also provides an excellent case study for distributed cyber manufacturing.



Face Mask 3D Scanning

In support of research being conducted at UNH investigating ways for front-line workers to safely reuse their protective equipment, the Olson Center's 3D scanning capabilities were utilized to generate the geometrical data necessary for developing digital twins of a variety of face coverings. While the current objective is highly focus on helping front-line workers, the investigation is part of a larger ongoing project with an ultimate goal of developing a UV device that could disinfect everyday items.





Corporate engagement

In 2021, the Olson Center significantly expanded its community outreach:

⇒ Engaging with over ***120 companies, groups, and organizations***

⇒ ***3x industrial projects*** in 2021 than all previous years combined

⇒ ***6x project revenue*** increase in one year

Northeast Passage

NIST Manufacturing Extension Partnership (MEP)

NASA

NH ADEC

iXblue

MRF Furnaces

Ford Motor Company

SH Racing

Mount Washington Observatory

FEMA

Pottery by Andy

BioMade

Ingersoll Production Systems

Combat Weapons

Portsmouth Naval Shipyard

Proctor & Gamble

Choice H_2O Caps

RIMOL Greenhouse Systems

The Olson Center works:

⇒ Collaboratively to help develop innovative solutions for start-up, small, medium, and large manufacturers

⇒ To meet the product, materials, process development, and supply chain needs of the nation

Beyond projects, in 2021, several manufacturers have also begun the process of ***co-locating operations*** inside of the Olson Center with industrial employees and interns ***working within the Olson Center's collaborative space***

The John Olson Advanced Manufacturing Center

Transforming the Innovations of Tomorrow into the Solutions of Today

2021 Student Engagement

Engaging faculty from 6 different departments

Immersing over 50 interns and researchers on industrial projects

Conveying state-of-the-art manufacturing technologies to over 200 students

Olson Center Internship Program

The Olson Center Internship Program provides students with the opportunity to gain hands-on experience running state-of-the-art production-scale equipment within an industrial-sized manufacturing facility. Moreover, Olson Center Interns engage on actual industrial projects, working to conceive innovative solutions that help manufacturers to remain globally competitive. The Olson Center supports the entire advanced manufacturing pipeline, offering on-site internship experiences to high school students, technical and trade schools, community colleges, and universities, providing engagement opportunities that align with each student's goals and priorities. With projects ranging across a broad spectrum of fields, (including: engineering design, equipment fabrication, manufacturing process innovation, materials characterization, robotics, automation, sensor development, vision, and cybersecurity, to name a few) the Olson Center intern teams provide a multidisciplinary backdrop of skills and expertise.

The Olson Center Internship Program offers several experience models for students to engage within. For all of these options, students have working space within the Olson Center and are provided access to the Center's facilities and infrastructure. Given the close proximity of the Olson Center's facility to the Durham campus, UNH students are able to easily integrate internship time around their class schedules, especially since the campus bus service allows students quick access to the center without needing their own transportation.

Olson Center High School Summer Internships

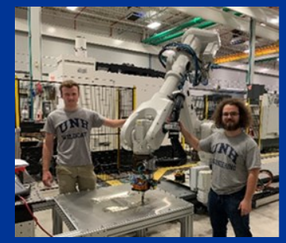
Preparation for a manufacturing-focused career often begins while progressing through the K-12 system. To foster those considering careers within the wide range of fields encompassed by the manufacture of products and goods, the Olson Center offers Summer Internship experiences to students, allowing these students to explore the full-range of career options required to successfully manufacture goods within today's rapidly evolving advancing manufacturing landscape. The Olson Center also opens its doors to schools and organizations, offering tours, hands-on exploration programs and other experiences for K-12 students.

Olson Center Internships and Co-ops (Breadth Option)

With this option, students are hired by the Olson Center to work on a wide variety of short duration industrially-oriented quick turn around projects. During their internship period, these students are integrated into projects from multiple manufacturers allowing them to gain a broad range of experiences with a *multiplicity of companies* from different industrial sectors and with an assortment of focal areas. Students with the 'breadth option' are often highly sought after by employers who are looking for a student who is well rounded and has a variety of hands-on experiences to draw upon once employed.

Manufacturer-specific Internships and Co-ops (Depth Option)

There are two tracks: one where the student is hired by the Olson Center and one where the student is hired by the company. In both cases, the student works at the Olson Center and is hired to work on projects associated with a *specific employer*. These students may work on a single longer-term larger scope project or may work on several shorter projects that are of priority to the company. With this option, the student and the company gain a deeper connection which can be helpful when a company is looking to strengthen their talent pipeline. This experience is also useful to students who wish to improve their chance of gaining employment at a particular employer's facility upon graduation.



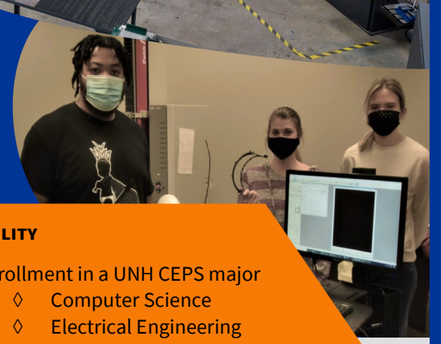
Off-site and Blended Internships and Co-ops (Traditional Option)

CaPS and the Olson Center also work with manufacturers to provide enriching opportunities where students can engage in a traditional offsite internship at a manufacturer's facility or through a blended option where the students work partially at the Olson Center and partially at a specific manufacturer's facility.

University of New Hampshire
John Olson Advanced Manufacturing Center

Olson Center Scholars

Transforming the Innovations of Tomorrow into the Solutions of Today



Do you want to:

- ✓ Acquire hands-on experience
- ✓ Solve real world problems
- ✓ Work with industry partners
- ✓ Utilize the latest state-of-the-art technologies

Eligibility

- ✓ Enrollment in a UNH CEPS major
  - ◊ Computer Science
  - ◊ Electrical Engineering
  - ◊ Mechanical Engineering
  - ◊ or other high technology field
- ✓ Full time student status
- ✓ Financial aid eligible

To apply

To submit an application, visit ceps.unh.edu/Olson-Center/

Deadline: **November 30th, 2021**

Scholarship recipients will be notified by the end of December

Visit ceps.unh.edu/Olson-Center/Scholars for additional details and requirements

Provides:

Up to $2,500 in funding as an academic-year scholar

Secured paid summer internship at the Olson Center

Potential for two additional years of continuing support

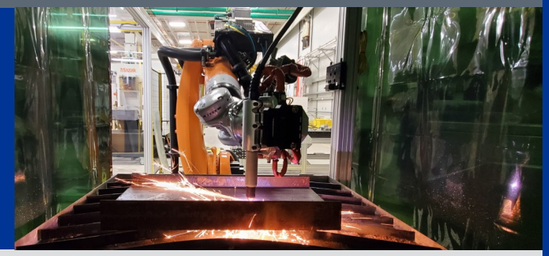
This scholarship is made possible through the Whelen Engineering Company Scholarship

What does the Scholars Program entail?

The Olson Center's Scholars Program provides students with the practical knowledge and experiences that allow them to confidently move into today's state-of-the-art Smart Manufacturing workplace through an integrated year-long internship.

Designed to bridge the gap between idealized academic knowledge and actual industrial applications, student teams are integrated into a variety of projects ranging from product conceptualization through full manufacturing automation and production.

During the academic year, scholars spend 5 - 10 hours per week at the center and generally focus on one project at a time. Designed for flexibility, Olson Center Scholars are provided adjustable work schedules, allowing students to schedule around classes, exams, project meetings, and other academic priorities.



Over the summer, scholars are guaranteed placement as one of the Olson Center's full-time paid interns; engaging on multiple industrial projects simultaneously, gaining enriching experience with a variety of manufacturers from across the region and around the world.

With two years of potential continuing eligibility, the program complements the student's academic growth over their four-year progression within their university major through participation on projects aligned to utilize the knowledge gained through their coursework.

Designed to complement the University's academic programs, Olson Center Scholars utilize their academic knowledge, coupled with the latest technologies, to solve today's real world challenges.

The John Olson Advanced Manufacturing Center

Transforming the Innovations of Tomorrow into the Solutions of Today

Assistive Technology and Enabled Workforce Development Program

Partnered with Northeast Passage, an organization that assists individuals with disabilities to define, pursue and achieve whole life health through purposeful engagement in recreation, the John Olsen Advanced Manufacturing Center strives to enable individuals with disabilities to lead full active lives through technology and employment.

The ***Assistive Technology Initiative (ATI)*** brings teams of students together from both Northeast Passage and the Olson Center to create unique assistive technologies that solve real problems for individuals with disabilities.

Focused on personalizing assistive technologies, especially as related to adaptive sports and recreation activities, the student teams interface with individuals with disabilities to identify personal limitations within existing adaptive devices. Integration of trained student interns within the broader internship programs of both the Olson Center and Northeast Passage allows teams to be rapidly assembled and deployed as projects arise, and to provide timely solutions that support access and engagement. Guided by program managers with years of experience related to assistive technologies and design for manufacturability, the teams collectively conceptualize, and design individualized assistive innovations for enhanced barrier-free living. With access to the state-of-the-art visualization and fabrication facilities within the John Olson Advanced Manufacturing Center, the teams prototype, manufacture and deploy the innovations.

The ***Advanced Manufacturing Enabled Workforce Initiative (AMEWI)*** will provide workforce development and re-training for individuals who experience disability.

With the looming advanced manufacturing job deficit in the U.S., this pilot program is focused on enabling a portion of the workforce not traditionally considered for many manufacturing jobs. Manufacturing jobs have typically been considered to be dirty, dark, and dangerous, requiring strength and mobility from those employed within the workforce. However, the degree of automation within today's smart factories enables all levels of manufacturing careers, from the trades through R&D, to be viable career paths for those with disabilities. From CAD to final part, fabrication can be done through a computer and using automation.

Employing the Olson Center's fully accessible and usable equipment, workforce re-training in advanced manufacturing careers is accessible for those who experience disability. In partnership with Northeast Passage, individuals will complete aspects of workforce training that includes not only the technical skills of manufacturing, but also addresses whole life health, work life balance and the interpersonal and self-management strategies that support successful engagement in teams and undergirds long term successful employment.

Through collaboration with high schools and the region's community colleges & universities, and other organizations, foundations and agencies, AMEWI will provide educational and career opportunities in advanced manufacturing.

With programs tailored for the individual, the Assistive Technology and Enabled Workforce Development Program deploys the latest advances in advanced manufacturing to enable people to achieve.

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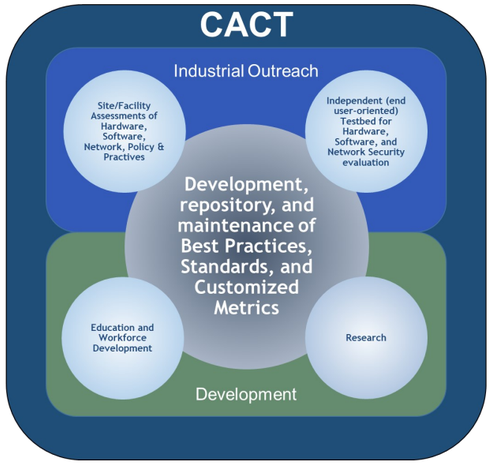
Cybersecurity Assessment Center and Testbed (CACT)



The integration of sensors, Internet of Things (IoT) devices, and other smart devices into all aspects of society, including manufacturing facilities, utilities, hospitals, transportation systems, and even our homes, has allowed for intelligent decision making, micro-control of processes, and the optimization of operations. The amalgamation of these instruments and applications into phones, cars, pipelines, and factories has paved the way for smart cities, increased workplace safety, improved product quality, and reduced environmental impact.

As control is transferred to these intelligent devices, however, there is an escalated risk of malicious agents stealing data, corrupting devices, hi-jacking production, or ransoming operations. Unfortunately, the security protection for edge devices and their networks has not kept up with the booming speed of connecting low-end edge nodes and any loophole in the security, even seemingly minor ones, creates an opportunity for an adversary intrusion.

As the number of incidents increases, there has been a rapid rise in the demand for highly trained cyber-specialists. This demand, however, significantly exceeds the supply of these professionals. Moreover, while large corporations have the capacity to hire teams of experts to monitor and secure their data and devices, small and medium manufacturers do not have the leeway to support this increase in headcount. As such, there is a significant need for a facility that alleviates this inadequacy.

To meet this challenge, the University of New Hampshire's John Olson Advanced Manufacturing Center is forming a Cybersecurity Assessment Center and Testbed. The activity of the center includes:

The Cybersecurity Assessment Center

Teams of cyber-assessment specialists who (1) develop evaluation metrics based on standards and customized to the facility, organization, and industry, and (2) perform evaluations of facilities and factories, examining hardware, software, and network security, as well as, cybersecurity policy, procedures and practices to assess cyber-vulnerabilities and produce recommendations for improving cybersecurity culture and practices, resilience/continuity of operations, and cyber risk management. Clients will receive an assessment of their current technical and organizational cybersecurity contexts as well as suggestions and tools for self-regulated continuing evaluation with these metrics to maintain situational awareness of their own cybersecurity preparedness and resilience. While protecting client confidentiality, the center develops, maintains, and shares its body of knowledge regarding manufacturing metrics, standards, and common industry practices.

The Cybersecurity Testbed

A testbed wherein businesses can have hardware and/or software infrastructure analyzed and hardened against cyber-risks using a comprehensive integration of hardware foundation, software platform, and application mapping that (1) forms a reliable and sustainable testing environment, (2) enables the validation of new ideas for realistic IoT and sensor networks, (3) identifies new compound security threats from multiple layers in the network stack, (4) fosters new holistic defense mechanisms, (5) promotes technology transfer for real deployment, (6) provides an adaptive curriculum for project based cybersecurity education and (7) promotes the research which enables the next generation of cybersecurity solutions.

The Cybersecurity Education Pipeline

Courses, education and hands-on training to upskill the existing workforce and to prepare a pipeline of future specialists in the latest techniques and tools available to combat this rapidly morphing field.

Providing the bedrock of knowledge and highly trained specialists upon which manufacturers can confidently and securely build the endeavors of tomorrow.

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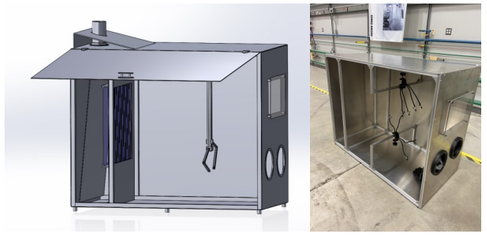
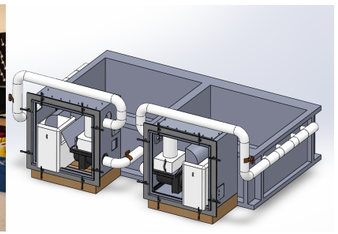
Engineering Design and Support Services

To further support UNH research and operations, the Olson Center has started to provide internal engineering design and support services. Now individuals or groups within UNH who need engineering project support can make an internal support request to have the Olson Center help with a project.

Design of Paint booth - Parsons Hall

Project with Metrology Lab and Environmental Health & Safety to develop an alternative system for spraying materials samples. The existing setup involved a cardboard box within a chemical hood which was causing problems with the electronic controls inside the building ducting.



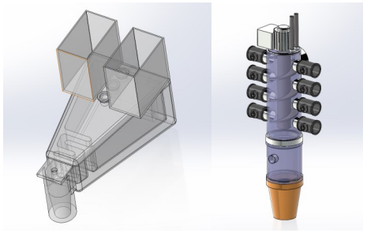


Design of Isotope Labeling Chamber - James Hall

Project to modify / redesign an arctic chamber for plant-based carbon isotope tracing for the sequestration of carbon within arctic soil. The greenhouse system involved two chambers with independent control of environmental parameters.

Design of Concrete Additive Printer

Project to develop the world's first large-scale robotic additive manufacturing system for the rapid prototyping of fiber-reinforced functionally-graded foamed concrete structures. The printing system will allow for the printing of pre-form concrete structures over 60 ft in length. In addition, this system will include the ability for the in -situ addition of continuous or discrete carbon or glass fiber-reinforcement. Moreover, with the capability of foaming the concrete material during application, functionally-graded structures can be created that have strength where needed, but can also have control over the structures total weight. With several other additive controls, this additive system will significantly extend the design option available for concrete structures.



Material Sample Preparation Services

Service to allow the UIC or faculty to request material sample preparation support including sectioning, grinding, polishing, etching and image collection.

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Advanced In-Space Manufacturing (AISM) Initiative

Figure 1. Depiction of a "Factory-in-Space" a centralized industrialization hub for extracting/processing materials, assembling products, and transporting finished goods

Recent years have seen the global economic sphere rapidly expand outwards into space as the number of missions, satellite launches, tourism expeditions, and other enterprises has dramatically risen. A space-based economy, founded upon a backbone of in-space manufacturing (ISM), will promote economic growth, and increase national prosperity and security. With the evolving commercialization of space, development of off-Earth manufacturing resources will provide strategic economic benefit to endeavors leveraging this capacity. Moreover, the enhanced design possibilities, flexibilities, and efficiencies enabled by removing the requirement to design-for-launch will enable enterprises utilizing ISM to outperform comparable structures built within Earth's gravity well. With the commercialization of space poised to springboard the next-generation of space technologies, scientific discoveries, and explorations, distinct advantages will be realized by whichever nation first establishes these "Factories-In-Space" for manufacturing, assembly, repair, and reclamation in non-terrestrial environments (Fig. 1). Furthermore, with the known multiplicative nature of space technological advancements, the first countries to develop this capability will have a high probability of stimulating a multitude of spin-off technologies across a plethora of related fields, thereby providing distinct competitive advantages.

The capability to perform In-Space Manufacturing (ISM) will undoubtedly drive a future industrial revolution. Space exploration, defense, and commercial market objectives are the primary drivers for advancements in ISM technology today. Long-duration space exploration missions are already adopting ISM as a shift in the paradigm of space architectures to provide a solution for resilient Earth independent missions through on-demand fabrication, repair, and recycling capabilities for critical systems, logistics, and maintenance. Furthermore, future ISM capabilities for platforms of national security will be a disruptive factor for the U.S. presence in space. Additionally, in the long-term, ISM will supply resources, goods and services as a routine element of international economic activity and cooperation.

As a leader in advanced manufacturing technologies, the Olson Center, together with NASA and other technology innovators, is helping to envision this future through the Advanced In-Space Manufacturing (AISM) initiative. Two current engagements related to this endeavor include:

The Sciences of Space Manufacturing, a campaign of fundamental, computational and applied sciences underpinning and advancing manufacturing outside of Earth's gravity, is being prepared jointly by the UNH Olson Center, NASA, Northwestern, and others as a white paper for the **Decadal Survey on Biological and Physical Sciences Research in Space 2023-2032** by the National Academies of Sciences, Engineering and Medicine.

The **Consortium for Advanced Space Manufacturing, led by the University of New Hampshire**, together with the University of Alabama, Purdue University, Physical Sciences Inc., Southwest Research Institute and NASA, will explore a new paradigm in manufacturing for the equitable commercialization, industrialization and democratization of space.

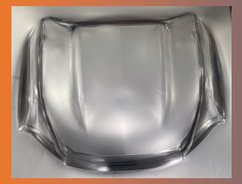
With a mission of towards developing a new paradigm in manufacturing for the equitable commercialization, industrialization, and democratization of space, the Olson Center is helping to envision the world of tomorrow.

Olson Advanced Manufacturing Center

Rapid Prototyping using Flexible Dieless Forming

Using incremental forming tooling, this manufacturing process allows for sheet metal parts to be rapidly prototyped using CNC pathing software similar to that used for milling operations

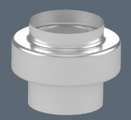
Double Sided Incremental Forming Technology

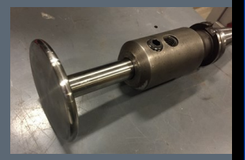


Dieless Forming of Complex Geometries

Integrating incremental forming technology with complex tooling and then fixturing this system to a multi-axis positioning platform sounds complicated. However, with this flexible, highly adaptive, and dieless forming system, complex sheet metal geometries can be fabricated that cannot be achieve by traditional stamping.

Visit the Olson Center to see the sheet metal part geometries that this system achieves.





Facility Infrastructure and Equipment

Rapid Prototyping of Extremely Large Parts

Utilizing specialized manufacturing heads attached to a 7th-axis production-scale track robot, the Olson Center is able to fabricate extremely large parts up to 80 feet in length and 25 feet in height. With process maturation activities focusing on developing heads for sheet metal production, fiber-reinforced functionally-graded foamed concrete printing, and friction stir solid-state additive manufacturing of metallic parts, the Olson Center is able to assist manufacturers with rapidly realizing next generation products and innovations.

The Olson Center serves as the hub through which manufacturers can:

- ⇒ engage with the University's world-renowned researchers and engineers
- ⇒ seek assistance solving complex materials and manufacturing problems
- ⇒ fulfill workforce and educational development needs
- ⇒ deploy the latest technologies, processes, automation, and simulation techniques

Showcasing the latest manufacturing technology and material characterization equipment, including a new tension-torsion test frame and upgraded DMA and DSC capabilities, the Olson Center helps manufacturers remain competitive in today's global environment by helping to navigate the continually evolving advanced manufacturing landscape.