The NNMI Institutes

America Makes
National Additive Manufacturing Innovation Institute

LIFT
LIGHTWEIGHT INNOVATIONS FOR TOMORROW

PowerAmerica

NEXTFLEX

DMDII
DIGITAL MANUFACTURING AND DESIGN INNOVATION INSTITUTE

AIM Photonics

iACMI
Institute for Advanced Composites Manufacturing Innovation

Advanced Functional Fabrics of America (AFFOA)
Light weighting

Lift
Operated by ALMMII
Manufacture of Optimized, Multi-Material, Lightweight Structures for Transportation

Alan Taub – LIFT CTO
Lift Technology Project Categories

I. MEMBER IDENTIFIED TRANSITION OPPORTUNITIES

II. LIFT BROADCAST REQUEST FOR PROPOSALS

III. INDUSTRY SPONSORED PROJECTS

IV. GOVERNMENT SPONSORED PROJECTS
Lightweight Innovations For Tomorrow

Member of the National Network of Manufacturing Innovation (NNMI)

Location:
- Detroit’s Historic Corktown
- Launched: February 25, 2014
- Facility Ribbon Cutting: January 15, 2015
- Headquarters: ~100,000 sq. ft.

Agency Sponsor: Department of Defense
- Startup funding:
  - $70M: Public
  - $78M: Industry co-investment

Founding Research Partners:
- University of Michigan
- The Ohio State University
- Edison Welding Institute

LIFT Industrial Commons:
- 770,000+ sq. ft. in five core regions across the U.S
- Equipment Value: $187.7M
Our Mission

Establishing the U.S. as a world leader in lightweighting innovation

- **Accelerate** development and application of innovative lightweight metal production and manufacturing technologies
- **Benefit** the U.S. transportation, aerospace and defense markets
- **Ensure** the U.S. is the world leader in innovation and manufacturing technologies
- **Build** a robust talent pipeline for metals manufacturing

[Image: Various transportation modes]
Our Opportunity

To close the gap between idea and commercial ready technology

What is the problem?

- Designing and producing high-performance lightweight products is **costly and complex**
- Engaging all players early in the development of new materials and processes is **challenging**

The Result?

A “Valley of Death” syndrome in which new materials are **developed but never implemented** due to a disconnect between development, design and manufacturing.
Our Approach
Rapid development, qualification, optimization and deployment of new technologies for defense and commercial needs

LIFT’s bold approach includes:

- **Engaging** the full manufacturing supply chain
- **Employing** systems engineering principles
- **Developing** innovative processes in dedicated facilities with unparalleled capabilities
- Using high-fidelity **Integrated Computational Materials Engineering (ICME)**
- Developing a **model-based certification toolkits**
- Supporting scale-up to commercial use
- Preparing an eager workforce equipped with 21st century advanced manufacturing skills.
93 Membership Agreements Signed

Optimal Process Technologies, LLC

Start-ups

Simplicity

Engineered Performance Materials

Delphi Materials

Workforce/Education

Macomb Community College

IVY TECH Community College

MAGNET

Pelissippi State Community College
Our Technology Portfolio
Working across transportation, aerospace and defense industries

• All projects must have applications crossing **at least two industry sectors**

• All projects are:
  • **Identified and prioritized by industry partners**
  • With input from government agencies to ensure deployment plans are in place

• Projects authorized to-date: ~$22M
Our Technology Scope

Industry-led projects from concept to production

Priority metal classes and are:
- Advanced High-Strength Steel, Titanium, Aluminum and Magnesium

Our six pillars of technology development:
- Melt processing
- Powder Processing
- Thermo-mechanical processing
- Low Cost, Agile Tooling
- Coatings
- Joining and Assembly

Including eight crosscutting themes:
- Integrated Computational Materials Engineering (ICME)
- Design
- Life-cycle analysis
- Validation / Certification
- Cost modeling
- Supply chain
- Corrosion
- Ballistic / Blast
Current Technology Projects

Each project runs between one and two years and carries a total investment of between $1 million and $4 million

<table>
<thead>
<tr>
<th>Project Pillar</th>
<th>Project Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melt Processing</td>
<td>Two Projects - Thin wall casting: Ferrous and Non-Ferrous Components</td>
</tr>
<tr>
<td>Thermo-Mechanical Processing</td>
<td>Two Projects - TMP Processing for Assured Properties in Titanium and Al-Li Forgings</td>
</tr>
<tr>
<td>Coatings</td>
<td>Manufacturing Process Optimization Methods for High Performance Al Alloys</td>
</tr>
<tr>
<td>Joining and Assembly</td>
<td>Distortion-free construction of lightweight stiffened panels</td>
</tr>
</tbody>
</table>

Project Process

- Project ideas are solicited from all LIFT members
  - Universities account for ~70% of submitted ideas and ~50% of selected projects
- Companies from more than one transportation sector are engaged in every project
  - All projects are led by an industry PI
- Each project has a number of university researchers engaged
  - A lead university researcher is assigned to assist the PI
Melt Processing

Developing and Deploying Thin Wall Ductile Iron Castings for High Volume Production

Project Objective

To obtain a 30% to 50% weight reduction in components by decreasing wall thickness through improvements in the methods of producing thin wall ductile iron castings and the alloys involved.

PRELIMINARY RESULT:
Achieved 40% weight reduction in first castings tested

Industry Partners: Grede, Comau, Eaton, PDA
Trade Association: American Foundry Society
Research Partners: Michigan Technological University, Massachusetts Institute of Technology
Melt Processing

Vacuum aided aluminum die casting production

Project Objective

To enhance the ability of ICME models to predict the performance of aluminum die cast parts by combining information about the microstructure of the metal with a host of design and production parameters.

These enhancements will be used primarily for aerospace, defense, and automotive applications.

Industry Partners: Boeing, Eaton, Alcoa, Comau, Nemark

Trade Association: American Foundry Society, North American Die Casting Association

Research Partners: The Ohio State University, Worcester Polytechnic Institute, University of Michigan, Southwest Research Institute, Massachusetts Institute of Technology
Thermo-mechanical Processing

Predicting the performance of aluminum-lithium alloys

Project Objective

To better predict the performance of aluminum-lithium alloys in formed parts by developing advanced computer simulations.

The project partnership will also include material process modeling and simulation of the properties evolution during industrial operations.

**Industry Partners:** United Technologies Research Center, Lockheed Martin

**Research Partners:** University of Michigan, Case Western Reserve University, The Ohio State University, Southwest Research Institute
Thermo-mechanical Processing

Advancing analytics to better predict performance of titanium alloys

**Project Objective**

To develop computer models that will reduce by 50% both the time and cost for materials development, component design, and manufacture.

These new computational tools will help improve performance in manufactured components.

**Industry Partners:** GE Aviation, Scientific Forming Technologies Corporation, Boeing

**Research Partners:** The Ohio State University, University of Michigan, University of North Texas, Purdue University, Southwest Research Institute
Joining and Assembly

Reduce warping in joining lightweight metal sheets in shipbuilding

Project Objective

To expand the ability of computer simulations to predict the results of large sheets of metal being welded together in a production environment.

The project will result in reduced rework, improved first time quality and increased productivity.

Industry Partners: Ingalls Shipbuilding, Comau and ESI NA
Research Partners: University of Michigan, EWI, Massachusetts Institute of Technology and The Ohio State University
Coatings

Better predict corrosion to improve airplane parts

Project Objective

To develop a database and computer models to better predict the way aluminum alloys corrode, based on the microstructure of every area of a finished component, after being put in use as parts for airplanes or other forms of transportation.

Large Industry Partners: UTRC, Lockheed Martin, DNV GL
Research Partners: University of Michigan, The Ohio State University
LIFT PRIORITIZED EQUIPMENT

The HQ facility will house unique pilot scale equipment. An extensive survey and iterative communication was conducted with our Gold & Silver industry partners and appropriate Gov’t Agency representatives to identify and then prioritize the equipment we will procure and install at HQ. The overarching priority/goal was to identify unique equipment that the industry members could use for both shared and proprietary projects as well as capabilities that would position LIFT for future government R&D needs.

**Priorities Based on:**
- Industry Member Potential to Use for both Shared and Proprietary Projects
- Potential Relevance to Future Government Programs

<table>
<thead>
<tr>
<th>Prioritized Pilot Scale Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Melt Processing</strong></td>
</tr>
<tr>
<td>Melt and Tilt pour casting machine</td>
</tr>
<tr>
<td>Die casting machine</td>
</tr>
<tr>
<td><strong>Thermo-mechanical Processing</strong></td>
</tr>
<tr>
<td>Extrusion Press</td>
</tr>
<tr>
<td>Hydroforming Press (sheets and tubes)</td>
</tr>
<tr>
<td>Forging Press</td>
</tr>
<tr>
<td>Sheet Metal Forming Press with Local Temp Control</td>
</tr>
<tr>
<td><strong>Powder Processing</strong></td>
</tr>
<tr>
<td>Rapid Quench/Cooling Hot Isostatic Pressing)</td>
</tr>
<tr>
<td>Metal Injection Molding</td>
</tr>
<tr>
<td><strong>Agile/Low Cost Tooling</strong></td>
</tr>
<tr>
<td>Incremental Tube Forming</td>
</tr>
<tr>
<td><strong>Coatings</strong></td>
</tr>
<tr>
<td><strong>Joining</strong></td>
</tr>
<tr>
<td>Flexible robot cell for joining technology development</td>
</tr>
<tr>
<td>Linear Friction Welding System</td>
</tr>
</tbody>
</table>
LIFT Industrial Commons
Core Sites
1400 Rosa Parks Blvd. Detroit, MI 48216

LIFT Industrial Commons (core sites):
- 770,000+ sq. ft. in core regions across the U.S
- Equipment Value: $187.7M
Total Facility Area: 100,000 SQFT

1. Mfg./Lab (Hi-bay) : 86,837
   - Lift : 41,500
   - IACMI : 31,000
   - Shared: 14,337
2. Administrations (shared) : 13,163
Thermal Mechanical Processing
Extrusion

**Function** (Extrusion Press):
- Extrusion Alloy AlMgSi 0,5

**Capabilities:**
- Up to 400” plus long ext. sections
- 12 MN / 1344 US Tons
- Exit hole Ø7.9”/Ext. slot 11.9”
- Billet Ø6” x from 15.75 to 31.5” long
- Furnace for Billets /dies preheating (200Lbs @900F)

**Operational:**
- Est. Delivery Aug/Oct 17
- Installed 4Q 2017

**Vendor:** DANIELI BREDÁ
Function (Hydroforming press):
- Hydroforming

Capabilities:
- 1000 ton clamping actuator, 16" stroke
- 64”FBx76.5”SS x 36” daylight

Operational:
- Est. Delivery April/Oct 17
- Installed 4Q 2017

Vendor: Interlaken Technology (ITC)

- Near-zero deflection reaction frame
- 3 inches/second open and close rate
- 32” column spacing side to side
- 32” column spacing front to back
- Shut Height 20”
- Two feed actuators, 115tons each, 8” stroke
- Reaction plate/die shoe for tooling
- Hydraulic power supply
- 20,000 psi pressure intensifier, servocontrolled
- Closed-loop forming-fluid handling system
- Complete control system with multiple open channels for user inputs and outputs. Comes preloaded with software for tube hydroforming
- high rate data acquisition
- all interconnecting hoses, tubes, piping, wiring and cables
- position control to within 0.001”, force control to within 5% of full scale

Samples
**Function** (Stamping/forming)  
- Multi-purpose double action forming press

**Capabilities:**  
- Local temperature control  
- Double action forming 300x230Ton  
- FB35”xSS35”x 24” Daylight

**Operational:**  
- Est. Delivery Jan/Aug 17  
- Installed 4Q 2017

**Vendor:** Interlaken Technology (ITC)

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Super ServoPress 300 Ton (2670kN) clamp, 230 Ton (2046kN) punch  
- 609mm stroke on clamp and punch  
- 36” (800mm) between the columns, front to back and side to side, 24” (600mm) daylight  
- Up acting configuration  
- Work platform in front of press  
- Unitest control system  
- Hydraulic power supply  
- Complete system

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**TOOLING...**  
- IDH  
- Macorinak  
- FLC/FLD  
- Nakajima  
- Budge Testing, 100mm, 200mm  
- Hole Expansion, flexibility  
- Deep Drawing Test  
- Cup Test  
- Englerhart Test  
- Earing Test  
- Fukuul Test  
- Olson/Bichsan punches/rings  
- OSU Forming/Friction

**OPTIONS...**  
- Sheet & Tube Hydroforming  
- Hot Gas Forming to 1000°C  
- Hot Oil Forming to 300°C  
- Warm Forming to 500°C  
- Hot Forming to 1000°C  
- Hot Forming with in Die Quenching (Hot Stamping) to 1000°C  
- Isothermal Forging: 1400°C  
- Digital Image Correlation (DIC) camera system  
- Custom voltages/kHz  
- Metric or English display
Joining
Flexible Joining System

Function (Multi-robot joining cell):
• Arc Welding
• Spot Welding
• Adhesive (bonding) Joining
• Mechanical Joining
• Surface Treatment – cleaning / coating

Capabilities:
• Small assemblies
• Large assemblies such as heavy truck frames
• Large plates for ships (both sides being welded simultaneously)
• 7 Axes cell – (6 Axes robot + 1x slide)
• Payload 16 and 300 Kg
• Reach 3.0-3.1 m

Operational:
- Est. Delivery Dec/16
- Installed 1Q 2017

Vendor: COMAU

<table>
<thead>
<tr>
<th>Robot &amp; Slide Content Summary</th>
<th>Qty</th>
</tr>
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<tbody>
<tr>
<td>SMART5 NJ 16-3.1 - Payload 16kg - Reach 3.1m</td>
<td>2</td>
</tr>
<tr>
<td>CMT Package - Single Torch</td>
<td>1</td>
</tr>
<tr>
<td>SMART5 NJ 370-3.0 - Payload 370kg - Reach 3.0m</td>
<td>2</td>
</tr>
<tr>
<td>HANDLING PACKAGE NJ &amp; C5G - FIELDBUS on AXIS 6 with BAZOOKA SLS</td>
<td>2</td>
</tr>
<tr>
<td>TMF4D: DOUBLE Carriage SLIDE with DRESSING HANDLING</td>
<td>2</td>
</tr>
<tr>
<td>Flexible Tooling Rail System</td>
<td>1</td>
</tr>
</tbody>
</table>
**Function:** Solid State Joining

**Capabilities:**
- 35 Ton Oscillating force
- 75 Ton forge force
- Universal machine capable of solid state welding of materials, sizes and geometries.
- Superior joint quality
- Energy efficient
- Quick welding
- Multi-material joining

**Operational:**
- Est. Delivery March 18
- Install 2Q-2018

**Vendor:** Manufacturing Technology Inc.
**Function:** Powder Pressing
- Rapid Cooling HIP - Hot Isostatic Pressing

**Capabilities:**
- Rapid Cooling
- Hot zone 6”dia x 12”L
- Furnace 1400° C molybdenum two zone furnace with a 150mm diameter x 30mm long hot zone.
- Vessel Interior Diameter 10 inches (250 mm)
- Vessel Interior Length 30 inches (760 mm)
- Working Pressure 30,000 PSI (207 MPa)
- Vessel Type ASME Section VIII, Div 2 code stamped pressure vessel, National Board registered. Hydro-Tested and stamped. SA-723 steel.
- Cooling: Treated closed loop cooling system with reservoir, pump and heat exchanger. Connects to customer coolant (city, re-circ, or chiller) at 15 gpm.

**Operational:**
- Deliver to Lift Sep 16
- Installed 4Q 2016

**Vendor:** AMERICAN PRESSES, INC
Powder Metal
Metal Injection Molding

**Function:** Metal Injection Molding

**Capabilities:**
- Total Clamping force max. US-tons 110
- Clamping force max. kN 1000
- Distance between tie bars inch 18.50 x 18.50
- Distance between tie bars mm 470 x 470
- Injection unit (170) horizontal, for injection through the fixed mold platen: 25 mm screw @ 59cm³ volume.

**Operational:**
- Arrived @ Lift 6/16
- Install 4Q-2016

**Vendor:** ARBURG

**Samples**
Melt Tilt Pour Casting Machine

**Function:** Tilt Pour Casting Machine / casting

**Capabilities:**
- Melt and Tilt pour casting machine
- HALL 3HS Permanent Mold Casting Machine (tilt pour gravity die casting machine)

**Operational:**
- Arrived @ Lift
- Install 4Q-2016

**Vendor:** Hall CMH Mfg.

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**Gravity Die Casting Machine**

**Features**
- Low maintenance due to few moving parts, heavy duty, rugged, and dependable.
- Frame open on 3 sides, plus front and bottom, to facilitate use of core pulls in 5 directions.
- Twin cushioned tilt cylinders provide a smooth lifting motion from start to stop.
- Twin ram cylinders provide a safety factor, as well as extra holding pressure and better clamping balance.
- Hydraulic power units available in manual, automatic, or with programmable controllers, sized to facilitate all available accessories at low operating pressure.

**Specifications**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Clamping pressure</td>
<td>58,960 lbs. (26,717 kg.)</td>
</tr>
<tr>
<td>Max. mold size</td>
<td>36 x 38 in. (91 x 97 cm)</td>
</tr>
<tr>
<td>Max. mold weight</td>
<td>4,006 lbs. (1,815 kg.)</td>
</tr>
<tr>
<td>Ram stroke</td>
<td>30 in. (76.2 cm)</td>
</tr>
<tr>
<td>Daylight opening</td>
<td>17.56 in. (44.5 cm)</td>
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<tr>
<td>Pressure height center</td>
<td>12.56 in. (31.8 cm)</td>
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<tr>
<td>Machine weight</td>
<td>8,156 lbs. (3,697 kg.)</td>
</tr>
<tr>
<td>Tie bar size</td>
<td>2 in. dia. (5.08 cm)</td>
</tr>
<tr>
<td>Tilt speed</td>
<td>7 sec.</td>
</tr>
</tbody>
</table>

**Options**

1. Tie Bar Extensions
2. Manual Swing In Casting Catcher
3. Powered Swing In Casting Catcher
4. Front Ejector
5. Proportional Tilt
6. Custom Platen Drilling or Sizes
Quality & Met Lab

**Function:** Quality Control

**Capabilities:**
- Quality Lab
- Wet chemistry lab

**Operational:**
- Arrived @ Lift
- Install 4Q-2016

**Vendors:** LECO & Hexagon

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<th>QTY</th>
<th>ITEM #</th>
<th>DESCRIPTION</th>
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<tr>
<td>1.00</td>
<td>801-900</td>
<td>VC-50 VARI/CUT, 0-500 RPM, low deformation</td>
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<tr>
<td>1.00</td>
<td>826-400-3</td>
<td>MSX-255M Radial Feed Metallographic Laboratory</td>
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<tr>
<td>1.00</td>
<td>863-208</td>
<td>LECO LR300TD DIGITAL TWIN Tester.</td>
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<tr>
<td>1.00</td>
<td>863-783-1</td>
<td>(P2-LM) PAXcam2 LM camera. PAX-it Lite software</td>
</tr>
<tr>
<td>1.00</td>
<td>863-790-2</td>
<td>LECO LM-310AT Vickers Microindentation Tester</td>
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<tr>
<td>1.00</td>
<td>863-889</td>
<td>LECO/Olympus SZ61 Stereo Microscope</td>
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<tr>
<td>1.00</td>
<td>861-250-2</td>
<td>Ringlight Adapter For Olympus Sz</td>
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<tr>
<td>1.00</td>
<td>861-722-3</td>
<td>Digital stage micrometer (English &amp; Metric)</td>
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<tr>
<td>1.00</td>
<td>862-596</td>
<td>Test Block HR 15N 90-91</td>
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<tr>
<td>1.00</td>
<td>863-460-1</td>
<td>AMH43 STYLE sample holder Upgrade kit</td>
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<tr>
<td>1.00</td>
<td>863-703</td>
<td>(U-V105C) 0.5x CCD Camera Adapter with C-mount.</td>
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<tr>
<td>1.00</td>
<td>863-783-8</td>
<td>Description: EasyLED Ring Light Plus</td>
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<tr>
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<td>812-534-5</td>
<td>Mold Assy 50mm Complete Snmc220</td>
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<tr>
<td>1.00</td>
<td>861-520</td>
<td>2.0x Aux Lens WD:38mm (1-S822)</td>
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<tr>
<td>1.00</td>
<td>1</td>
<td>7.10.7 GLOBAL PERFORMANCE CMM</td>
</tr>
</tbody>
</table>
**Machining Lab**

**CNC Fabricating Lab**

**Function:** Support Technology Operation/Machining

**Capabilities:**
- Building tooling
- Modify tooling
- **Operational:**
- Punching
- Notching
- Install 4Q-2016

**Vendors:** Knuth

### Multipurpose Machines
- Drill Press
- Vertical Band saw
- Horizontal Band Saw
- Surface Grinder
- Belt/Disk Sander
- Arbor Press
- Sheet Working Machine
- Wire EDM
- Tube bender
- CNC Lathe
- Workshop press
- Milling Machine and others

<table>
<thead>
<tr>
<th>QTY</th>
<th>ITEM #</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot / page</td>
<td></td>
<td>Multipurpose Machines for machine shop</td>
</tr>
<tr>
<td>1.00</td>
<td>301231</td>
<td>MF 1 KVP: Multipurpose Milling Machine</td>
</tr>
<tr>
<td>1.00</td>
<td>162337</td>
<td>SSB 40 F Super: Column Drill Press</td>
</tr>
<tr>
<td>1.00</td>
<td>102500</td>
<td>VB 300 Vertical Bandsaw</td>
</tr>
<tr>
<td>1.00</td>
<td>152797</td>
<td>HB 280 B Band Saw Machine</td>
</tr>
<tr>
<td>1.00</td>
<td>124288</td>
<td>HFS 2550 VC - Hydraulic Surface Grinder</td>
</tr>
<tr>
<td>1.00</td>
<td>112700</td>
<td>BTM 250 Belt/Disk Sander</td>
</tr>
<tr>
<td>1.00</td>
<td>109540</td>
<td>ST Arbor Press</td>
</tr>
<tr>
<td>1.00</td>
<td>110047</td>
<td>3 in 1 / 1000 Sheet Working Machine</td>
</tr>
<tr>
<td>1.00</td>
<td>129112</td>
<td>Hydraulic Tube Bender 1/2” - 2” diameter pipe.</td>
</tr>
<tr>
<td>1.00</td>
<td>100105</td>
<td>ZNC-EDM 250 - Electrical Discharge Machine</td>
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<tr>
<td>1.00</td>
<td>300821</td>
<td>V-Turn 410/1500 - Precision Lathe</td>
</tr>
<tr>
<td>1.00</td>
<td>131745</td>
<td>Hydraulic Workshop Press with double-acting cylinder</td>
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</table>

<table>
<thead>
<tr>
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<tbody>
<tr>
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<td>Multipurpose Machines for machine shop</td>
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<tr>
<td>1.00</td>
<td>130172</td>
<td>HPS 55/110 D Ironworker : punching, cutting &amp; notching</td>
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<tr>
<td>1.00</td>
<td>130240</td>
<td>KMT 1353 - Motorized Swing Beam Shear</td>
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<tr>
<td>1.00</td>
<td>102785</td>
<td>DS Turning Tool Grinder</td>
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<tr>
<td>1.00</td>
<td>129061</td>
<td>Inside Micrometer Set 3-POINT 11-20</td>
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<tr>
<td>1.00</td>
<td>108880</td>
<td>magnetic v-block 1</td>
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<tr>
<td>1.00</td>
<td>108796</td>
<td>Magnetic Micrometer Holder 5 in 1</td>
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<tr>
<td>1.00</td>
<td>US400065</td>
<td>KEYED Accessory Set for Drill Presses MT 4</td>
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<tr>
<td>1.00</td>
<td>US522235</td>
<td>ABS 280 B Band Saw Blade</td>
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<tr>
<td>1.00</td>
<td>US400074</td>
<td>B 150 Belt Package</td>
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<tr>
<td>1.00</td>
<td>US400075</td>
<td>BTM 250 Belt and Disc Package</td>
</tr>
<tr>
<td>1.00</td>
<td>146372</td>
<td>3-Jaw Lathe Chuck 200mmD1-6 (steel)</td>
</tr>
</tbody>
</table>
**Function:** Support Technology Operation/treating

**Capabilities:**
- Cleaning
- Coating

**Operational:**
- Arrived @ Lift
- Install 3Q-2016

**Vendors:** Plasmatreat

Coating/Cleaning:
Plasmatreat: Coating/Surface treating
Bonding/Joining pertains to; PLASMATREAT Openair® and Aurora® plasma and plasma polymerized films facilitate usage of lightweight metals and composites
Adhesives / Sealants / Ink/Prints/ Coatings/
Paints
Function: Material handling

Capabilities:
- Material handling /load/unload
- Safety and timing sensitive processes
- 3 axis CNC Machining

Operational:
- Delivery est. @2Q17 Lift
- Install 3Q-2017

Vendors: Fanuc / Comau
**Function:** Support Technology Operation/CT scan

**Capabilities:**
- NDT / Quality / reverse engineering
- CT scanning
- X-ray inspection

**Operational:**
- Install 3/4Q-2016

**Vendors:** Vijay Technology

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### Beta CT Scanning

#### Function:
Support Technology Operation/CT scan

#### Capabilities:
- NDT / Quality / reverse engineering
- CT scanning
- X-ray inspection

#### Operational:
- Install 3/4Q-2016

#### Vendors:
Vijay Technology

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<table>
<thead>
<tr>
<th>MiniCT</th>
<th>ValuCT Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>50kV</td>
<td>160kV</td>
</tr>
<tr>
<td>X-ray source</td>
<td>50kV, 50W, focal spot size &lt; 50µm as per EC00336</td>
</tr>
<tr>
<td>Detector</td>
<td>1024 x 1024 pixels, 48 µm pixel size</td>
</tr>
<tr>
<td>Spatial resolution</td>
<td>36 µm voxel size at M=1.3; 18 µm voxel size at M=2.7</td>
</tr>
<tr>
<td>Helical function</td>
<td>50mm length of stroke function</td>
</tr>
<tr>
<td>Magnification</td>
<td>Up to 2.7x</td>
</tr>
<tr>
<td>Sample Size / Weight</td>
<td>Diameter &lt; 45 mm, height &lt; 85 mm, &lt; 250g</td>
</tr>
<tr>
<td>Equipment Dimension</td>
<td>350 mm x 300 mm x 230 mm + 17” laptop</td>
</tr>
<tr>
<td>Equipment weight</td>
<td>&lt; 25 kg + 17” laptop</td>
</tr>
<tr>
<td>Site power requirements</td>
<td>230V, 50/60 Hz</td>
</tr>
<tr>
<td>Other required utilities</td>
<td>None</td>
</tr>
<tr>
<td>Site location requirements</td>
<td>Benchtop device</td>
</tr>
<tr>
<td>Radiation protection</td>
<td>50kV shielded cabinet with manual parts door; meets all international radiation safety standards, including 21CFR1020.40 and EN 60510-2-931 2012</td>
</tr>
<tr>
<td>Software</td>
<td>Vevo 6/Video 10</td>
</tr>
<tr>
<td>PLC/HMI</td>
<td>Windows-based software application via laptop computer, or similar</td>
</tr>
<tr>
<td>Operator skills level</td>
<td>Student/Technician Level</td>
</tr>
<tr>
<td>Advanced analysis options</td>
<td>Available as additional software module licenses</td>
</tr>
</tbody>
</table>
Education & Workforce Development

Building a **confident and competent** manufacturing workforce

**We Believe:**

We must **develop the educated and skilled workforce** necessary to use new technologies and innovative processes.

**Education Tied to Technology:**

Education and Workforce Development will be tied to each of our technology projects and include measurements:

- Will it impact design, production or both?
- What new educational content is needed?
- What will the results be for the workforce?

**State Teams:**

Teams in five states made up of leaders in **education, workforce development, economic development and labor** help guide our initiatives
<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding workforce demand-supply gaps</td>
<td></td>
</tr>
<tr>
<td>Reconnecting disconnected youth to high</td>
<td></td>
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<tr>
<td>quality, middle skills jobs</td>
<td></td>
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<tr>
<td>Teaching the teachers</td>
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<td>Expanding work and learn opportunities for</td>
<td></td>
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<tr>
<td>students</td>
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<tr>
<td>Creating enhancements to engineering</td>
<td></td>
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<tr>
<td>curriculum using lightweighting technologies</td>
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<tr>
<td>Offering on-the-job training solutions for</td>
<td></td>
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<tr>
<td>our industry partners</td>
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<tr>
<td>Attracting students and workers to educational</td>
<td></td>
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<tr>
<td>pathways to careers in manufacturing</td>
<td></td>
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<tr>
<td>Connecting separating military personnel and</td>
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<tr>
<td>veterans to fast track skills development and</td>
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<tr>
<td>manufacturing careers</td>
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<tr>
<td>Deploying pathways from K-12 through</td>
<td></td>
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<tr>
<td>community colleges to university four-year</td>
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<tr>
<td>degree programs, with more on and off ramps</td>
<td></td>
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<tr>
<td>to employment</td>
<td></td>
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<tr>
<td>Ensuring students gain STEM foundational</td>
<td></td>
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<tr>
<td>skills for success in manufacturing careers</td>
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<tr>
<td>Linking and leveraging resources and related</td>
<td></td>
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<tr>
<td>initiatives on the ground today</td>
<td></td>
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</tbody>
</table>
Proud Member of the National Network for Manufacturing Innovation

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