A Department of Defense Program

DECEMBER 2016

60

ManTech

The Defense Manufacturing Technology Program

1956 – 2016






DEPARTMENT OF DEFENSE
DLA
MDA
ARMY
AIR FORCE
NAVY
MANUFACTURING TECHNOLOGY PROGRAM

OFFICE OF THE SECRETARY OF DEFENSE
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WASHINGTON, DC 20301-1000

MANUFACTURING &
INDUSTRIAL BASE POLICY

Our military capability depends on our ability to ensure technological advantage over our adversaries. We must constantly respond to world military challenges in a manner that is innovative, agile, robust, resilient, and affordable. The DoD Manufacturing Technology (ManTech) Program meets these challenges with its focus on cost effective, risk-mitigated manufacturing development and sustainment of defense systems.

This brochure highlights success stories of the manufacturing projects of the OSD, Army, Navy, Air Force, Defense Logistics Agency (DLA), and the Missile Defense Agency (MDA) programs. Collectively, these components make up the congressionally-chartered Joint Defense Manufacturing Technology Panel (JDMTP).

In the JDMTP's role of identifying and integrating requirements, it continues to transition defense manufacturing technologies through partnerships across the DoD, other agencies, industry, and academia. The examples in the brochure illustrate the ongoing benefit of how DoD ManTech strengthens U.S. manufacturing technology and the industrial base. The JDMTP also leverages other activities such as DARPA, Title III, and the Small Business Innovation Research program through its joint planning methodology.

This year's center article is written in celebration of the 60th anniversary of the Manufacturing Technology Program that was mandated by Congress under Section 2521 of Title 10, United States Code (U.S.C.), on August 10, 1956. ManTech continues to be fully committed to delivering critical technologies to enable our Warfighters who are so dedicated to defending and securing our country.

Finally, this brochure provides an update on the activities of the DoD-led Manufacturing Innovation Institutes and how they are working to increase domestic manufacturing competitiveness. DoD ManTech is making significant investments in the Institutes, as they transcend state and federal and defense/commercial industrial base boundaries to ensure the defense manufacturing base can address current and future technological needs.

For over 60 years, ManTech has continued to preserve our nation's technological advantage. ManTech plays a crucial role in fostering innovation to meet the challenges of our changing world and to ensure our nation maintains its competitive edge on the battlefield. We are pleased to present you with this year's DoD ManTech brochure and to represent the JDMTP team that continues to enhance our military's strength and ensure their technological advantage in today's world.

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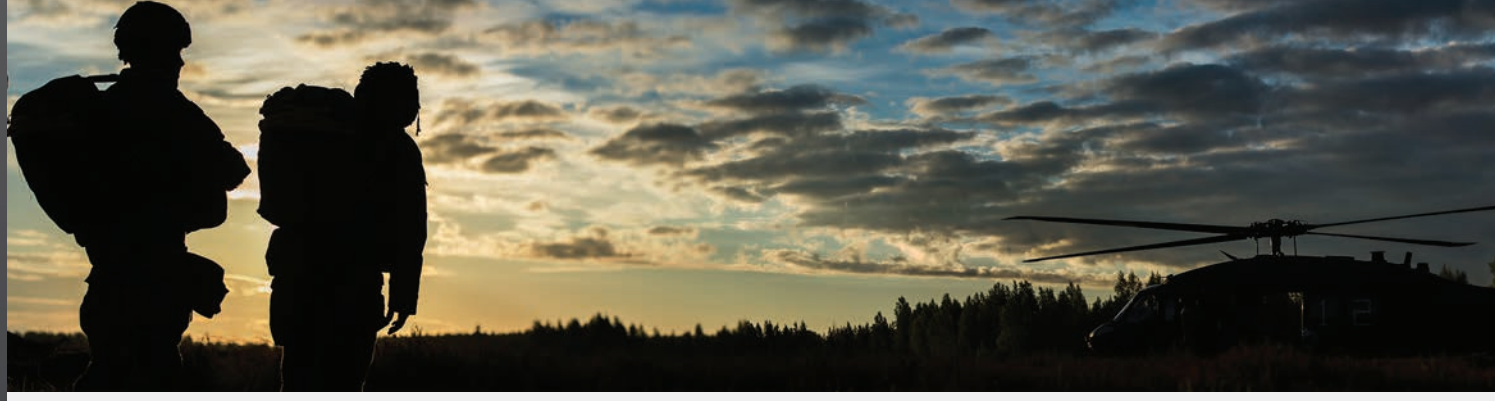


DEFENSE MANUFACTURING VISION

A responsive world-class manufacturing capability to affordably and rapidly meet Warfighter needs throughout the defense system life cycle.

FOCUS

Manufacturing Technology (ManTech) is focused on developing processes and enabling production capabilities that reduce the acquisition and sustainment cost of weapon systems and provide direct benefit to the Warfighter. Measures of effectiveness include improved mission capability, improved readiness, and reduced total ownership costs. Timely transition of the technology consistent with acquisition and operational requirements is essential.

STRATEGY

The DoD ManTech Strategic Plan prepared by the Office of the Deputy Assistant Secretary of Defense for Manufacturing and Industrial Base Policy (MIBP), in close collaboration with the Joint Defense Manufacturing Technology Panel (JDMTP), contains four strategic thrusts:

- **Thrust 1:** Develop advanced manufacturing solutions to meet DoD requirements
- **Thrust 2:** Active support for a highly connected and collaborative defense manufacturing enterprise
- **Thrust 3:** Active support for a strong institutional focus on manufacturability and manufacturing process maturity
- **Thrust 4:** Active support for a healthy, sufficient, and effective defense manufacturing infrastructure and workforce

The ManTech program strategy supports the broader defense industrial base to deliver maximum value to the Warfighter and the nation. The strategy is executed by the Component ManTech programs within the Army, Navy, Air Force, Defense Logistics Agency (DLA), Office of the Secretary of Defense (OSD) (e.g., Defense-Wide Manufacturing Science and Technology (DMS&T)) and Missile Defense Agency (MDA). The complete DoD ManTech Program Strategic Plan can be downloaded at **www.dodmantech.com**.

DOD MANTECH MISSION

The DoD Manufacturing Technology (ManTech) Program anticipates and closes gaps in manufacturing capabilities for affordable, timely, and low-risk development, production and sustainment of defense systems.

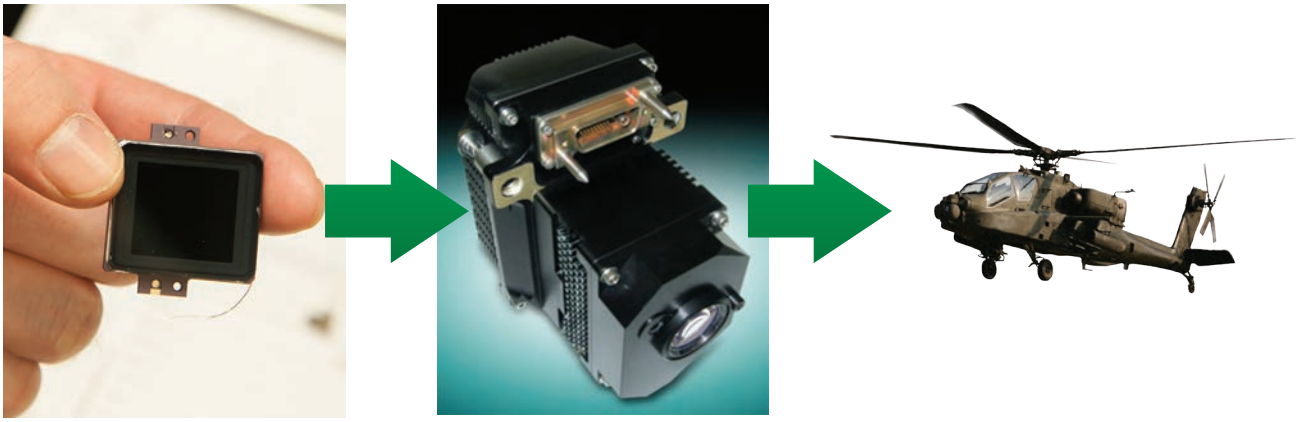
This brochure highlights twenty ManTech Program successes of the Component ManTech programs and DMS&T. The center two pages of this brochure focus on the 60th anniversary of the Joint Service Manufacturing Technology (ManTech) Program that was authorized by Congress on August 10, 1956 through the Air Force.

Finally, updates are provided on the activities of the six current DoD-led Manufacturing Innovation Institutes (MIIs), namely America Makes, the Lightweight Innovations for Tomorrow (LIFT), the Digital Manufacturing and Design Innovation Institute (DMDII), the American Institute for Manufacturing Integrated Photonics (AIM Photonics), NextFlex (the Flexible Electronics Manufacturing Innovation Institute), and in 2016 the Advanced Functional Fabrics of America (AFFOA).

ManTech Enables Affordable Low Light Level Sensors for DoD Systems

The Challenge:

Digital image intensified (I2) sensors are too expensive, not available in the quantities needed and fail to meet all performance requirements. Low light level devices provide the same or better performance as I2 sensors for many applications, but sensor manufacturing maturity, capacity and reliability were too low for new sensor transition across weapon system platforms.



Low Light Level Sensor utilized on vision systems for Apache Helicopter

ManTech Response:

- Army ManTech improved manufacturing processes of a high performance digital low light level sensor that increased operability and yield, resulting in manufacturing readiness level improvement from MRL 5 to MRL 9
- Photocathode was optimized for better photo-response and reliability
- Army ManTech investment of $7M with over $15M in industry cost share and PM leveraged funding

Impact:

- Reduced cost from $24.6K to $5.6K/unit in very high volume
- Improved operational life from 1,200 hours to greater than 10,000 hours
- Increased performance and reliability of sensor system resulted in user acceptance and multiple transition paths (Apache, F-35 Joint Strike Fighter and Enhanced Visual Acuity System for the Naval Air Systems Command)
- Improved production capacity from 5 per month to over 100 per month with sustained production

"Partnership with the Army Manufacturing Technology (ManTech) Program and industry partners has reduced low light level sensor unit costs by greater than 75 percent while providing a 3X improvement in performance. The Apache pilots I've spoken to are very pleased with the performance." — COL Hager, PM Apache

PARTICIPANTS

Army Research, Development and Engineering Command (RDECOM) Communications-Electronics Research, Development and Engineering Center (CERDEC), Intevac Photonics, Inc., NAVAIR, PM Soldier Sensors and Lasers (PM SSL), PM Apache

ManTech Demonstrates Improved Size, Weight, Power and Manufacturability for Flexible Sensors

The Challenge:

X-ray inspection and forensics used for Improvised Explosive Devices and Explosive Ordnance Disposal rely on fragile, heavy, expensive large area x-ray digital radiography panels. Current flexible x-ray panel demonstrators show promise, but need fewer production defects and affordable cost to meet counter IED requirements.

Flexible digital x-ray Integrated package (Android)

Flexible x-ray unit. Field Evaluations at the First Responder Bomb Squad Rodeo, July 2016

Portable x-ray sensor constructed with Flexible Electronics

ManTech Response:

- Army ManTech addressed technical challenges to produce higher-yield and improved electronic packaging for flexible radiography panels
- Improved form factor and user interface of 10" diagonal packaged devices
- Field tested at TRL 6 and demonstrated processes at MRL 5
- Army ManTech investment of $5.4M with over $17.3M in leveraged funding from other government, industry and academia

Impact:

- Reduced unit cost from $100K/unit to $30K/unit for quantity of 30
- Reduced defects which improved panel yield from 10% to >50%
- Major large (3rd generation x-ray panel) manufacturer will support transition to commercial scale
- Addressed a technology gap to meet an Explosive Ordnance Disposal (EOD) Joint Urgent Operational Need (JUON)

Capability for the Explosive Ordnance Disposal Community that includes a viable flexible IED sensor

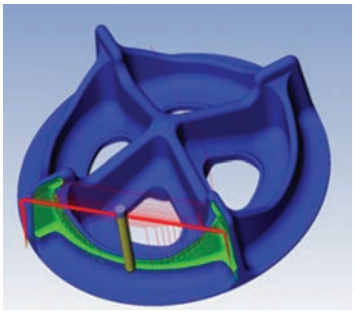
PARTICIPANTS

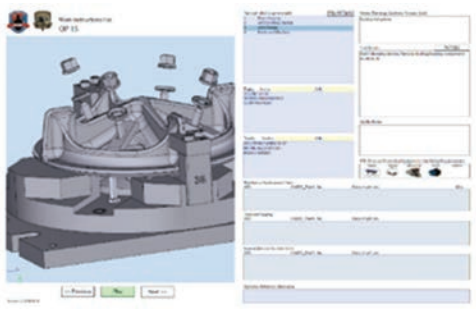
Army RDECOM Army Research Lab, Defense Threat Reduction Agency (DTRA), Arizona State University, PARC (a Xerox Company), General Electric, FlexTech Alliance, San Jose, CA

ManTech Helps Institute Digital Manufacturing in the Organic Manufacturing Enterprise

The Challenge:

The Army has operated its organic manufacturing capability using the practices of the 1950's, resulting in more reliance on outside contractors to develop and store manufacturing knowledge. The challenge is to develop ways to operate Army organic manufacturing activities as an enterprise, leveraging 3D product data throughout that enterprise, and creating and reusing process knowledge within both the organic base and the industry supply chain.





Reduced cycle time with Toolpath Optimization and Model-Based Setup Instruction — 81mm Mortar Base Plate

ManTech Response:

- The Army Accelerated Adaptive Fabrication Enterprise (A3FABE) has enabled the Army's manufacturing enterprise to utilize advanced model-based digital product data
- Demonstrated WindChill 2 system across AMRDEC and ARDEC
- Demonstrated a Manufacturing Execution System (JobBOSS) with Production and Quality modules
- Demonstrated and transitioned a DARPA developed Digitally Dynamic Tooling Library
- Enabled central storage of quality inspection data across machine tools
- Army ManTech Funding of $19M

Impact:

- Reduced overall production cost for 81mm mortar base plates through 70% savings in production time at Watervliet Arsenal
- Linked CAD and CAM solution at ARDEC to reduce prototyping cycle time and cost, resulting in a cost avoidance of $1.59M
- Enabled collaborative project execution using product data for the redesign and prototype manufacturing of the gunner protection kit
- Distributed Machine Network (DNC) and Machine Data Capture (MDC) expected to save $90K per year across the 9 demonstration machines
- Transitioned model based enterprise tools across all RDECOM Prototype Integration Facilities (PIFs)

Provided advances in organic business process efficiency through Model Based Enterprise (MBE) technology

PARTICIPANTS

Army RDECOM Armaments Research, Development and Engineering Center (ARDEC), Watervliet Arsenal, Aviation Research Development and Engineering Center (AMRDEC), RDECOM Prototype Integration Facilities (PIFs)

ManTech Improves Affordability of F-35 Canopies

The Challenge:

The largest component of the F-35 Lightning II canopy is a continuous shell of thermoformed acrylic. Textures imparted to the exterior and interior surfaces of the shell during forming must be removed using labor-intensive hand-held vibratory sanding equipment. The work is tedious, the risk of inadvertent damage to the shell from the procedure is considerable, and the process represents a significant portion of the labor effort.

ManTech Response:

- A Navy ManTech project adapted an automated precision sanding system, developed under an Air Force Small Business Innovation Research program with Aerobotix, Inc., for use on acrylic transparencies
- Both subscale and full-scale demonstration were required as some optical problems only show up over larger or more curved surfaces
- With precise position and force feedback in the sanding head, the robot was 'trained' to duplicate the hand sanding results to include sanding with various grits to improve adhesion and coating durability
- Testing conducted to ensure that the process does not impart polishing stresses in the acrylic surfaces
- Solution uses a modern industrial robot with a vibratory polishing head that is able to sand with heavier grits and polish with fine rouge-type materials to provide clean optical surfaces

ManTech Response (cont):

- Navy ManTech Investment of $1.1M

Impact:

- Demonstrated low-cost method of automated transparency clean-up that meets the requirements of the F-35 program and is safe for operator use
- Reduced process variability
- Appreciably reduced the amount of touch labor to produce a single transparency
- Reduced manual direct labor in the initial transparency forming process
- Technology applicable to F-18 canopies and implemented on F-35 in FY16

Total Estimated Cost Savings of nearly $170M

PARTICIPANTS

Office of Naval Research (ONR) Navy ManTech, Composites Manufacturing Technology Center, GKN Aerospace Transparency Systems, Aerobotix, Inc., NAVAIR, F-35 Joint Program Office

ManTech Reduces Virginia Class Submarine Maintenance Costs

The Challenge:

The retractable bow plane extend/retract hydraulic cylinders on VIRGINIA Class submarines (VCS) are experiencing premature seal failures due to the build-up of calcareous deposits on the extend/retract rods. This leads to excessive seal wear, sea water contamination, hydraulic oil leaks, and premature system failure. A reliable rod coating is needed to better protect the rods, to reduce system failures, and to extend the maintenance periods.

Test rod on left shows signs of wear and poor adhesion. Test rod at right nearly pristine after equivalent of 70 years of wear in laboratory testing.

ManTech Response:

- A Navy ManTech project team demonstrated a thermal spray coating resistant to wear and calcareous deposits
- Developed an optimized thermal spray process that will produce high adhesion strength coatings using METCO® 130
- Coordinated with a selected commercial producer to fabricate a full-scale coated extend/retract cylinder specimen for testing at General Dynamics Electric Boat
- In collaboration with General Dynamics Electric Boat, qualified a commercial vendor for the application of thermal spray coatings for extend/retract cylinder rods

ManTech Response (cont):

- Developed qualification test plan for selected coating process and obtained NAVSEA approval
- Navy ManTech investment of $1.2M

Impact:

- Reduced Total Ownership Cost of VCS
- Coating reduces calcareous deposits which enhances seal performance during operation
- Eliminated unscheduled dry docking for replacement of seals that had previously failed as often as 12 months after overhaul
- Increased planned maintenance periodicity from 72 to 96 months
- Implemented on SSN792 in October 2016

Estimated Life Cycle Savings of $8M/hull

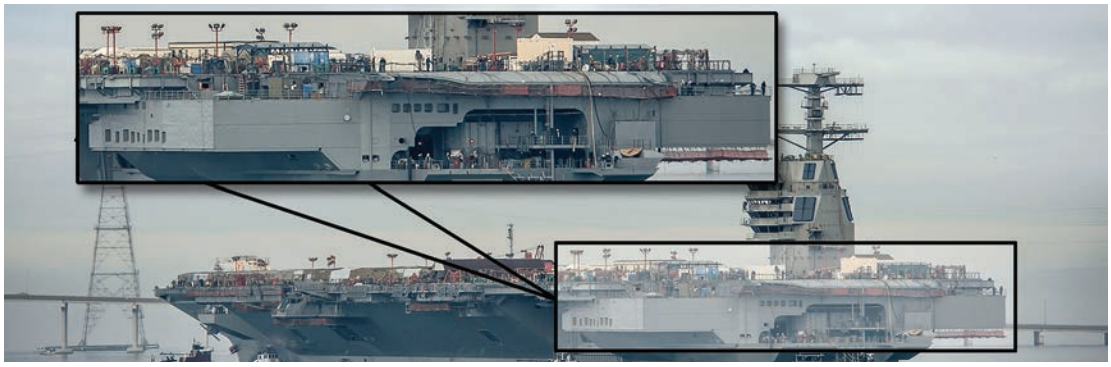
PARTICIPANTS

ONR Navy ManTech, iMAST/ARL Penn State, Naval Shipbuilding and Advanced Manufacturing Center, General Dynamics Electric Boat, PMS 450

ManTech Improves CVN 79 Affordability

The Challenge:

The build strategy for the Gerald R. Ford aircraft carrier (CVN 78) requires installation of ship outfitting items, such as piping, wiring, ductwork, insulation, machinery, and other equipment, on-board after erection of the ship. This creates access issues for workers and causes conflicting work assignments for crafts in the same space. Pre-outfitting these spaces prior to erection and concurrent with structural assembly will substantially improve efficiency and reduce cost on CVN 79 and all future ships.



Efficiencies can be realized for CVN by increasing the amount of construction work done prior to erection. The project target area is highlighted (Photograph courtesy of Chris Oxley, Huntington Ingalls Industries).

ManTech Response:

- A Navy ManTech project team identified systems and specific construction areas of future aircraft carriers that could benefit from pre-outfitting
- Benchmarked best practices of other shipbuilding programs and commercial industry
- Identified the target area of the ship to study pre-erection outfitting
- For the first time in CVN construction, developed a specific plan for complete outfitting of four spaces prior to erection that serves as a template for other pre-outfitting activities throughout the ship
- Identified an approach that combines multiple items onto a common frame or foundation, creating one unit that can be constructed in the shop and then installed as a single, pre-tested item on the ship

ManTech Response (cont):

- Navy ManTech investment of $1.2M

Impact:

- Reduced the number of direct production and support craft hours
- Reduced cost by 8X based on 1-3-8 rule (shop/platen/post-erection construction costs) (outfitting on board is eight times more costly than outfitting in the shop)
- Provided greater access for equipment and workers
- Reduced congestion and conflicting work and testing on hull after erection
- Newport News Shipbuilding has incorporated pre-outfitting in planning activities for CVN 79
- Implementation in construction will occur in FY17

Estimated Minimum Cost Savings of $4M/Carrier

PARTICIPANTS

ONR Navy ManTech, Navy Metalworking Center, Newport News Shipbuilding, Hepinstall Consulting Group, Inc., PMS 379

ManTech Facilitates Digitally Agile Manufacturing Strategy for DDG-51 Production

The Challenge:

U.S. Navy shipbuilders are required to handle, track, and install millions of pieces of material during ship construction. Material handling processes typically use time-consuming, paper-based management systems. Manual input of each material transaction is expensive and often results in material losses and re-buys. A digitally agile material tracking system is needed to reduce cost and improve the material handling process.

ManTech Response:

- A Navy ManTech project was initiated to reduce the cycle time and increase the accuracy of material transactions
- Provided a machine readable unique identification number and scanning capability for tracking and identifying individual items, containers of material, and loose materials
- Provided the capability to track equipment from the time it is received at the Warehouse until it is installed or otherwise disposed
- Enables monitoring of the transaction history (who, what, when, where and why) of each identified "traceable" piece of equipment
- Ensured visibility, traceability, and accountability for all material (purchased and fabricated) from receipt through delivery to the end user
- Navy ManTech investment of $1.5M

Impact:

- Reduced annual material processing time by 54,000 hours by minimizing manual entry, eliminating paper, and providing electronic links
- Reduced time to identify deficiencies and correct discrepancies
- In 6 months, eliminated 44,150 receiving forms and 104,616 Delivery Request Lists
- Improved inspector efficiency by decreasing time for Receipt Inspections by 8%
- Reduced annual material re-buys by $331,000 by detecting issues before items leave the warehouse, and providing a rapid look at material returning from dock to warehouse
- Implemented in FY16 at Huntington Ingalls Industries – Ingalls Shipbuilding

Estimated Cost Savings of $2.8M/DDG hull

PARTICIPANTS

ONR Navy ManTech, Huntington Ingalls Industries, Inc., Naval Shipbuilding and Advanced Manufacturing Center

ManTech Uses Digital Thread Concepts to Improve Material Review Board Process of F-35 Parts

The Challenge:

The current Material Review Board (MRB) process for assessing production of aircraft such as F-35 is manual, expensive, time-consuming and may require knowledge from prior dispositions. Information on past MRB actions, inspections and analysis is distributed across multiple information technology systems. As F-35 production scales up, the number of MRB actions are expected to increase significantly, so improvements are needed to the reduce MRB process costs.

Veri-Tag and Automated Non-Conformance Research improvements to F-35 MRB Process

ManTech Response:

- Air Force ManTech used digital thread concepts to improve the MRB process for F-35 inlet duct production at Northrop Grumman
- Translated digital photos of non-conformance into 3-D CAD on a tablet using Veri-Tag
- Improved MRB process with Automated Non-Conformance Research (ANCR) by combining information from independent databases into one tool to view similar dispositions and trends for MRB analysis
- OSD investment of $2.33M

Impact:

- Reduced labor hours and cost for MRB dispositions by over 30% using digital thread concepts
- Reduced errors in MRB tag creation process
- Initiated root cause analysis for process or design changes for repetitive MRBs
- Influenced early design changes in order to eliminate non-conformances and expensive re-design later on in production
- Created technical data package (TDP+) to monitor each specific tail number from production into the operations and maintenance phases of the systems' lifecycle

30% labor reduction in F-35 center fuselage production

PARTICIPANTS

Air Force Research Laboratory (AFRL) Materials and Manufacturing Directorate (RX), Northrop Grumman, Etegent Technologies

ManTech Reduces Cost by Casting Advanced Weapon Components

The Challenge:

Advanced weapons utilize a number of complex shaped steel components. The current manufacturing process for these components involves machining steel bar stock to remove excess material and achieve the desired component shape. This process is extremely costly and time consuming.

Investment casting process utilized to manufacture advanced weapons components

ManTech Response:

- Air Force ManTech and the CAST-IT team identified four parts as potential candidates for investment casting
- Created solid models of the components, modeled the casting process and produced rapid prototype patterns; cast prototype components
- Identified two parts that could be cast as a unified part to simplify manufacture, logistics, and assembly of the weapon components
- AF ManTech investment of $510K

Impact:

- Estimated cost savings of $47M from castings versus the machining process over the procurement of a typical program
- Demonstrated that cast steel meets the required material properties to replace forged or machined materials for high-performance weapons
- Casting to be an approved manufacturing method for components in new weapons upon successful testing

Significant reduction in material used and typical weapon system lifetime cost savings of $47M

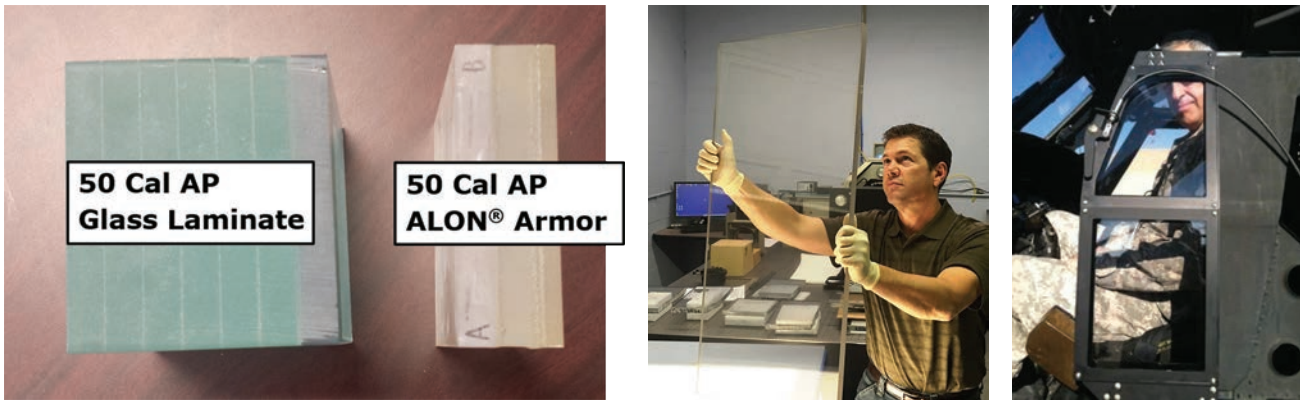
PARTICIPANTS

AFRL Materials and Manufacturing Directorate (RX), AF Life Cycle Management Center, Steel Founders Society of America, American Metalcasting Consortium CAST-IT Team (DLA-sponsored), MetalTek Intl., Rand Machine

ManTech Improves ALON® Transparent Ceramic Manufacturing Process to Obtain Larger Windows

The Challenge:

Infrared (IR) sensors need to be protected from the harsh flight environment by IR windows. Larger, more durable IR windows are needed to maximize pilots' field of view for improved situational awareness. Aluminum Oxynitride (ALON®) armor provides superior ballistic protection at less than is half the weight and thickness of a traditional glass laminate. However, equipment and manufacturing processing limitations restricted the size of ALON® windows to 2.8 sq. ft.



ALON® Transparent Armor Provides Significantly Higher Transmission and Situational Awareness

ManTech Response:

- A joint program was conducted by AF ManTech, DMS&T, and the Navy to improve ALON® manufacturing processes to obtain larger IR Windows
- Existing hot isostatic press (HIP) (capacity up to 15 sq. ft.) was retrofitted with a custom furnace and insulation package for processing large ALON® windows
- Through a design of experiments campaign, the forming, heat treatment, and polishing processes were scaled up to support ALON® windows up to 9 sq. ft.
- Funding: $1.5M Navy, $4.25M DMS&T, $750K AF ManTech

Impact:

- Scaled up ALON® transparent ceramic processes from 2.8 sq. ft. to 9 sq. ft.
- Higher transmission of 40% for Gen III night vision goggles for improved situational awareness
- Reduced cost and cycle time by 50% for large ALON® windows
- Transitioned ALON® windows of 3.7 sq. ft. and 4.8 sq. ft. size to Black Hawk

Transition of ALON® to the Black Hawk to replace opaque panels means the pilots no longer have to choose between being able to see or being protected — "it's changing the way we fly."

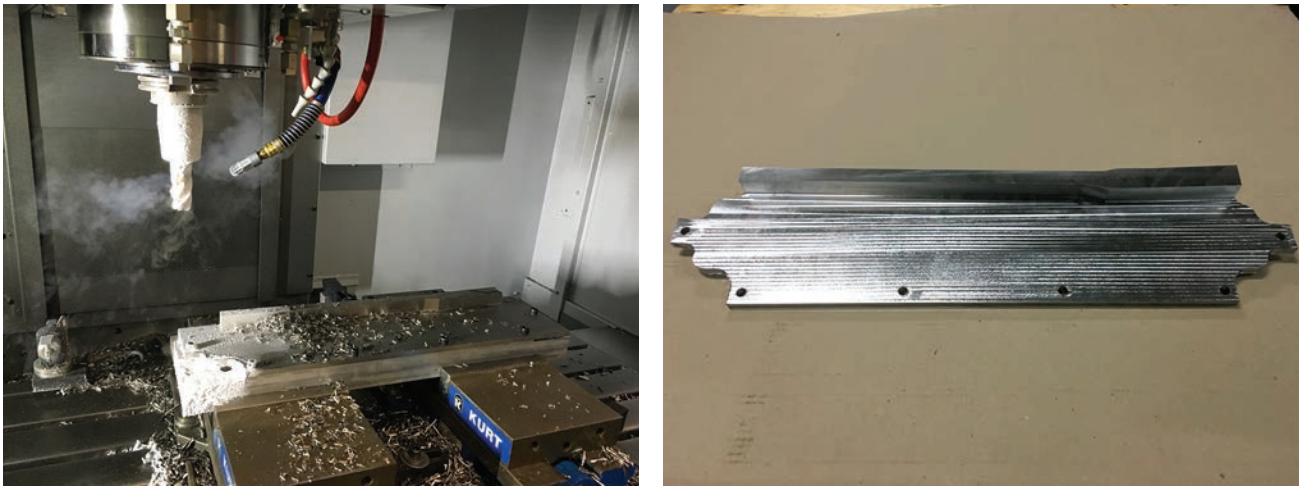
PARTICIPANTS

OSD Title III, Defense-wide Manufacturing Science & Technology Program, U.S. Navy, Air Force Research Laboratory (AFRL) Materials and Manufacturing Directorate (RX), Surmet Corporation

ManTech Demonstrates Cryogenic Machining to Produce F-35 Titanium Parts at Lower Cost

The Challenge:

Titanium aerospace components are expensive and difficult to machine at high speeds. This limits the application of titanium that could be of substantial benefit to the Warfighter because of its light weight. The traditional flood cooling manufacturing approach needs to be retrofitted to add lubricant capture and recycling systems in order to machine titanium.



Cryogenic Machining System on Mori Seki NVX-5100 II and demonstration part

ManTech Response:

- Air Force ManTech and the JSF Program Office partnered with Creare LLC to demonstrate their innovative Cryogenic Machining System (CMS)
- The team integrated CMS on a Mori Seki NVX-5100 II machine on the production floor of an F-35 Tier 1 supplier to Lockheed Martin Aerospace (LMACo)
- The team conducted a side-by-side comparison of cryogenic machining and conventional flood cooling in the rough machining of an F-35 tailhook
- Air Force SBIR investment of $900K

Impact:

- Reduced manufacturing cycle time for the tailhook by up to 44%
- Cost savings produced by the CMS relative to conventional flood cooling between 10% and 22%
- Overall cost savings between $14 million and $28 million per 100 ship sets if the CMS approach is broadly adopted across the F-35 program

F-35 tailhook demonstration reduced cycle time by 44% and lowered cost by over 10%

PARTICIPANTS

Air Force Research Laboratory (AFRL) Materials and Manufacturing Directorate (RX), Creare LLC, and Air Force Lifecycle Management Center

ManTech Delivers Faster and Better Quality Group-Sized Combat Rations to the Warfighter

The Challenge:

DoD acquires 27.6 million Meals, Ready-to-Eat (MRE) individual rations, annually. For combat rations, the current retort (heating) process often compromises the quality and taste of ration meals. DLA chartered the Microwave Assisted Thermal Sterilization (MATS) program to reduce cycle heating time and improve the quality of individual and group-sized rations. The goal is to provide DoD and the Warfighter with a shelf-stable, more nutritious, and better-tasting meal.

Microwave sterilization process improves heating cycle times delivering improved food quality to the Warfighter faster

ManTech Response:

- The Defense Logistics Agency (DLA) R&D Subsistence Network (SUBNET) led a project to demonstrate a microwave assisted thermal sterilization production capability
- Focused on sterilizing group-sized entrées and components, packaged in institutional sized pouches and polymeric trays
- Demonstrated cost benefits of combat rations processed via microwave sterilization versus over the current conventionally-retorted ration method due to faster heating rates
- Improved combat rations production and energy efficiency rates
- DLA Investment: $525K with an additional $1M from industry and university partners

Impact:

- Reduced process cycle times by 53% and potentially up to 80% by using MATS instead of conventional retort processing
- Potential annual cost savings of $2,222,061 due to reduced cycle times
- Improved food quality
- MATS process allows for scale-up surge capabilities of individual and group-sized combat rations for the Warfighter

Potential savings to reach $11M over 5 years

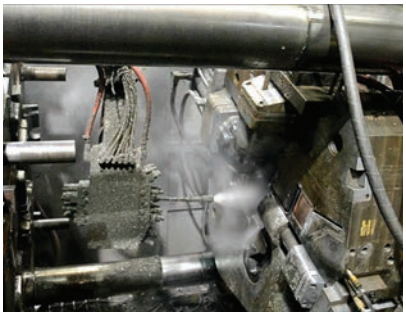
PARTICIPANTS

The Wornick Company, DLA R&D (Subsistence Network) DLA Troop Support, Washington State University, Ohio State University, and Natick Soldier Research, Development & Engineering Center

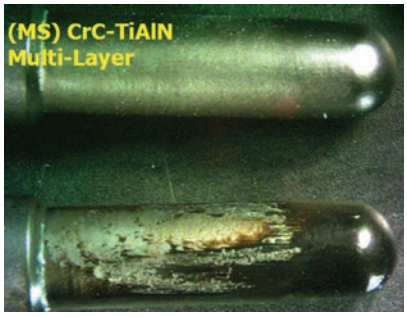
ManTech Develops Non-Stick Coating for Casting Dies

The Challenge:

Die casting currently requires that a liquid organic-based lubricant be applied to the casting die so that the metal does not stick to the die surface. However, the lubricant can also reduce the quality of the castings, causing porosity and defects of the surface finish. Higher operating and maintenance costs, including the die service life, are direct results of the use of lubrication on the dies. Lubricants can also severely reduce the die life due to thermal fluctuations that result from the hot die being sprayed with a cooler liquid lubricant. Additionally, the lubrication creates a messy, dirty and dangerous/slippery work environment which requires continuous cleaning of the machines and floor.



Spraying Lubricant



Coated vs. Uncoated Core Pin

Die Cast Part in Mold

ManTech Response:

- The DLA Casting R&D program staff teamed with Ohio State University (OSU), Case Western Reserve University and Colorado School of Mines (CSM) to identify permanent and semi-permanent non-stick coatings for steel dies
- Utilized advanced physical vapor deposition (PVD) methods to develop non-sticking and self-lubricating coatings for metal molds
- Conducted heat transfer modeling to assess the relative importance of spray for die cooling
- Achieved higher quality die cast parts with fewer defects and increased production reliability by eliminating lubricants

ManTech Response (cont):

- DLA ManTech investment of $739K with $232K of direct contributions and in-kind support by the partners associated with this project

Impact:

- Reduced total cost of casting by up to 2.5% by not using die spray lubricants
- Doubled the die life and decreased manufacturing cycle times with new non-stick coatings
- Eliminated having to exhaust and filter the air with lubricant-free process
- Reduced amount of scrap due to increased die life and product reliability

5–10% lower cost per part by reducing or eliminating die spray in casting

PARTICIPANTS

DLA ManTech, Advanced Technology Intl., CSM, Case Western Reserve Univ., OSU, Mercury Marine, Twin City Die Casting, Premier Tool and Die, Phygen, North American Die Casting Association.

60 YEARS OF MANUFACTURING EXCELLENCE

2016 represents the 60th birthday of the formal establishment by Congress of the DoD Manufacturing Technology Program (ManTech). On August 10, 1956, Congress mandated the ManTech program under Title 10, United States Code (10 U.S.C.), Section 2521 that states the Secretary of Defense shall establish a Manufacturing Technology Program focused on broad, defense-relevant technologies which are beyond the risk of industry, and that the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD AT&L) shall administer the program. Over the past sixty years, the joint Services, OSD and participating agency components have worked together to deliver paradigm-changing manufacturing capabilities to the Department and to our country. Some of these capabilities can be seen in the DoD ManTech Innovation Timeline to the right.

Since the 1950's, ManTech has helped implement critical defense technologies and weapons systems to ensure U.S. forces possess technological advantage over its adversaries. For example, in the 1950's, ManTech was involved in pivotal breakthroughs of Eisenhower's "New Look", otherwise known as the First Offset, that built a reliable nuclear capability to balance the Warsaw Pact threat. Then in the 1970's when Warsaw Pact forces outnumbered NATO forces by 3 to 1 in Europe, and post-Vietnam military reductions threatened our military advantage, ManTech helped strengthen the defense with programs to dramatically increase producibility and quality using total quality manufacturing (TQM) and six-sigma principles. This was all part of Secretary Brown's Second Offset that focused on precision guided weapons, stealth, space/night vision sensors, and computer networks. Currently, the National Military Strategy goal is to preserve technological advantage (as part of the Third Offset) by focusing on enabling next-generation power projection platforms using robotics, autonomy, miniaturization, cyber warfare, hypersonics and advanced manufacturing.

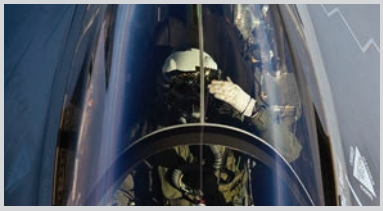
Over the last 60 years, the defense manufacturing industry has also grown stronger and closer in its relationship to ManTech. In the first decade of the ManTech Program, advanced defense technologies, including manufacturing processes, were tightly segregated from commercial sectors in the name of national security. However, over the next three decades, the 'spin-off' of technology from defense to commercial sectors represented a primary path to economic growth in technology-dependent markets, with U.S. companies delivering much of the advanced manufacturing technology and the country gaining a significant economic advantage. However, in the 1990's and 2000's, there became "spin on" of technology from commercial to defense due to dramatic increases in industry investment and global competition in manufacturing. Finally, in the past five years, the commercial and defense manufacturing worlds have integrated to enable more robust solutions to applying commercial technologies in DoD's demanding environments and service life needs. For example, beginning at p. 27 of this brochure, the public-private partnerships of Manufacturing USA show how advanced manufacturing projects result in the DoD gaining access to a robust and technologically vibrant industrial base that concurrently supplies a commercial market.

What is truly gratifying on this 60th birthday is the national recognition of the importance of manufacturing to this country, for both economic and national security. The Defense Manufacturing Technology Program has been central to creating many of the Department of Defense's and the United States' essential manufacturing capabilities over the years, and it is well-positioned and ready to meet the critical challenges of the future in its support of our Warfighters.

ManTech

Supporting the Warfighter from 1956–2016

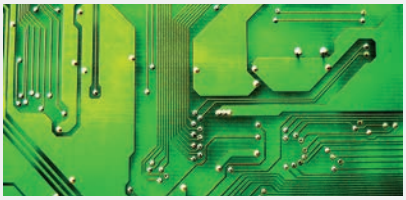
U.S. Air Force Courtesy Photos



Warfighter and Aviation Icon, Bob Hoover, passes away on October, 25 2016 at the Age of 94.
Go to: http://www.edwards.af.mil/News/Article-Display/Article/987709/aviation-icon-takes-final-flight

1950s

DoD ManTech developed the original numerically controlled machine tool and the associated programming language (APT) to advance military aircraft manufacturing — now used globally in countless manufacturing applications.

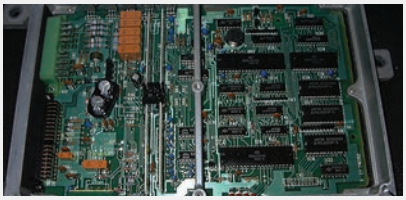


1960s

The DoD ManTech program developed the technology that became the foundation for the current microelectronics industry.

1970s

DoD ManTech developed processes for the production of the forerunners of precision laser guided missiles and munitions.



1980s

DoD ManTech developed a process for reverse engineering thousands of obsolete microcircuits that support weapon systems still in service — use and mission benefits continue to expand today.

1990s

DoD ManTech program developed magnetorheological finishing for advanced military optics. The process is now also used by all manufacturers of photolithographic optics.

2000s

- Provided revolutionary electronics such as Micro Electro-Mechanical Systems (MEMS) for field artillery systems and Focal Plane Arrays (FPAs) for sensor systems
- Enabled manufacturing of interceptor body armor currently used by our forces
- Manufactured next generation of enhanced combat helmets to replace 30-year old technology

2010 and beyond

- Developed automated processes for lighter, durable and more comfortable composite prosthetics
- Provided improved combat rations with high quality, safer, and surge-capable production
- Implemented higher power, longer duration batteries across weapon systems
- Applied model-based manufacturing and CAD in aeronautical and maritime construction for greater affordability

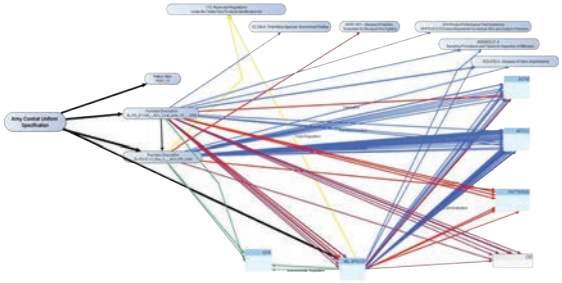
ManTech Develops a Knowledge Based Military Unique Requirements Solution

The Challenge:

The available knowledge base of needed military combat uniforms and individual equipment is contained in PDF documents — "electronic paper" — making it hard to maintain, hard to communicate and prone to error. A neutral platform with digital capability is needed to effectively communicate product data from the Services to DLA and to the clothing and textile manufacturers.

Army Combat Uniform (ACU) Jacket

Army Individual Equipment



ACU Coat Acquisition Documentation Network — 98 Documents, 5053 pages

ManTech Response:

- DLA ManTech established the Military Unique Sustainment Technology (MUST) Program to develop a digital knowledge-based capability for improved collaboration and accessibility amongst stakeholders
- New Knowledge-Based Capability includes:
  - Platform to enable document exchange of digital models
  - Auto extraction and conversion of government tech data to commercial spec
  - 3D visualization tool to transform design into 3D models
  - Virtual assessment of performance fit and functionality
- Conducted demo and proof of concept pilots to validate and implement MUST system
- DLA ManTech Investment of $8.6M

Impact:

- Estimated net present value of MUST is $60M for the 5-year cash flow analysis
- Improved quality, lowered cost and reduced inventory
- Improved military uniform quality by ensuring visibility, accessibility and accuracy of Tech Data requirements with minimized errors, omissions and ambiguity of uniform specifications

Return on investment of 3.58

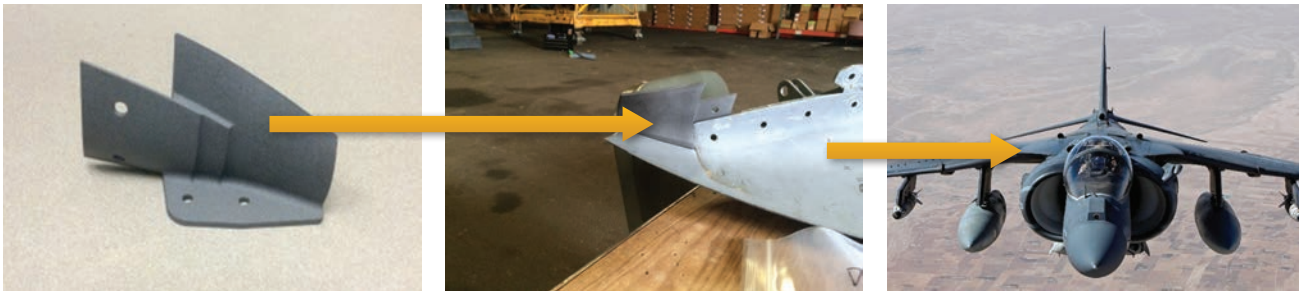
PARTICIPANTS

DLA ManTech, DLA Troop Support Clothing & Textile, DLA Product Testing Center, Navy Clothing and Textile Research Facility, Army Textile Material Evaluation Team, Air Force Uniform Office, Marine Corps Product Manager – Infantry Combat Equipment, AdvanTech Inc., Clemson University, LMI, XSB

ManTech Pioneers Additive Manufacturing (AM) Parts Approval Process

The Challenge:

Weapon system mission availability is dependent upon the availability and cost of parts. In many cases, parts for legacy systems may not be available (hard to source) or they are cost prohibitive due to a loss of industrial capability or obsolescence of manufacturing technology. Additive Manufacturing technologies and techniques provide new sources of replacement parts for these hard-to-procure items.



AV-8B 'Under Leading Edge Root Extension (LERX) Fairing' Prototype made from NYTEK 1200 CF Polymer using Additive Manufacturing technology to be flight tested in FY16

ManTech Response:

- The DLA R&D Program, Navy (NAVAIR) and industry partnered to develop systematic methods to obtain engineering approval for AM parts
- Developed candidate parts lists for a number of out-of-stock, difficult-to-procure parts
- Selection criteria focused on aircraft parts, Critical Application Items, and material substitution requirements
- Based on criteria, the AV-8B LERX fairing was the first part selected for AM prototyping
- Load factor analysis showed the AM material provided an excellent margin of safety
- Production parts were produced and submitted to NAVAIR for engineering approval and flight testing
- DLA R&D and Navy investment of $775K

Impact:

- Defined process for engineering approval of AM parts
- Improved availability of legacy parts for the Warfighter
- Reduced production lead times by 90%
- Reduced minimum production lot sizes and economic order quantities

Cost of LERX AM prototype was 90% less than previous DLA supplier

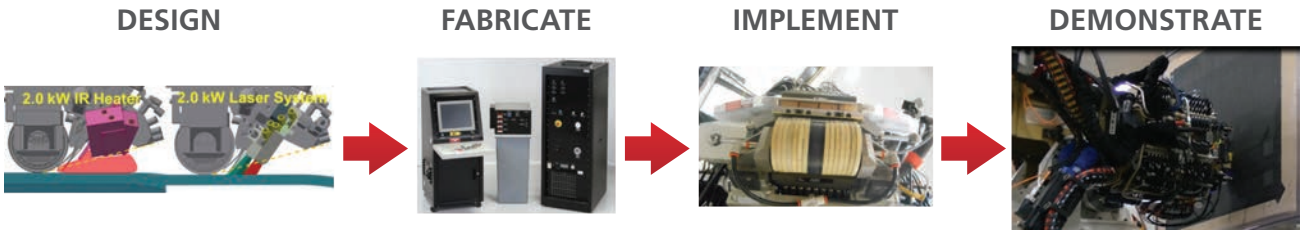
PARTICIPANTS

Defense Logistics Agency Research and Development Program, Naval Air Systems Command (NAVAIR), 2Is Inc., Stratasys, 3D Systems

ManTech Improves Quality of Aerospace Structures with Laser Assisted Consolidation of Advanced Composites

The Challenge:

Aerospace structures for 5th generation fighter aircraft such as the F-35 Lightning II require advanced composite materials for high strength, high stiffness and low weight. These composite materials are difficult to produce using automated fiber placement (AFP) due to the low tack of the high temperature materials that must perform in environments of 400F and above. Infrared heaters are employed to increase tack, however, they are slow to respond, imprecise, and inefficient.



Overview of System Operation

ManTech Response:

- The Air Force Research Laboratory (AFRL) adapted a Small Business Innovation Research (SBIR) program to implement lasers as a replacement for infrared preheaters in AFP machines
- An industry team of small business, machine manufacturers, and F-35 parts suppliers worked to design, fabricate, integrate, install, and demonstrate the prototype system on a full scale F-35 component in a relevant manufacturing environment (TRL 7)
- The team demonstrated closed loop control of material temperature while maintaining an open manufacturing floor compliant with all laser safety protocols
- AFRL/RX working with the F-35 joint program office, Lockheed Martin, part suppliers, and machine manufacturers to qualify the system for production
- DMS&T Industrial Base Innovation Fund (IBIF) funding of $3M

Impact:

- Improved operational machine speed by 37% with substantial increases in quality, operator control, and total lay down rate
- Reduced programming and debugging on future low rate production and prototype composite aero-structures
- Improved process tolerance to material tack variability
- Reduced maintenance and downtime vs 100 hrs on $3k bulb
- Improved operator safety with faster shutoff and cool-to-touch during machine operation
- Expected to be integrated by OEM (Fives Machining Systems) for production at part suppliers (Albany Engineered Composites)

Enables improved control, productivity, and quality in AFP operations

PARTICIPANTS

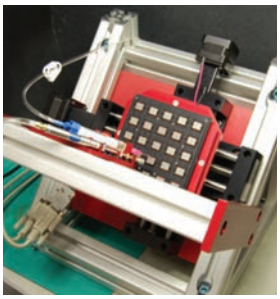
Air Force Materials Directorate, AF SBIR, Navy SBIR, F-35 Joint Program Office, Creare LLC, Fives Machining Systems, Albany Engineered Composites, Lockheed Martin Aeronautics, DMS&T IBIF

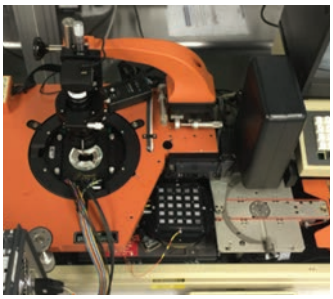
ManTech Improves Industrial Base for Low Cost Shortwave Infrared (SWIR) Camera

The Challenge:

The Warfighter is able to maintain his advantage with low-light imaging, hand-held and helmet mounted systems for persistent surveillance, weapon sights, and laser see-spot applications. High quality and ruggedized systems are available using shortwave infrared (SWIR) technology, however, the associated sensors and cameras are prohibitively expensive due to significant manufacturing touch time, low yield, and low scale of operations.

Current High Labor/Low Throughput Manual Process





Future Reduced Labor/High Throughput Automated Process

ManTech Response:

- The Air Force Research Lab (AFRL) and Defense Manufacturing Science and Technology (DMS&T) office worked to develop a low cost, light weight, small size, SWIR camera without the need for a thermoelectric cooler
- Advances made in probe testing of SWIR Focal Plane Array (FPA) and Vacuum Package Assemblies (VPA) leading to a better characterized, integration-ready product
- Developed tools to automate production and replaced the traditional serial processing (one at a time) of FPA with Wafer Level processes
- Strengthened partnerships with the supply chain with significant focus on the epitaxial and substrate suppliers

ManTech Response (cont):

- Implemented Automated Optical Inspection (AOI) for defect mapping
- DMS&T Investment of $5.8M

Impact:

- Reduced touch time by 80% with automated focal plane array (FPA) probe testing
- Reduced the cost to <$5k per camera with improved sensor quality and performance in rugged environment
- Lower cost, reduced size camera enables every Joint Terminal Attack Controller (JTAC) to carry one of these cameras for protection
- Other impacted systems: COSI, COS3, AWST, JETS, IDNST, PAWS, MTS-B
- 1st transition target: UAV application in FY16

Reliable DoD source of high quality SWIR components at >50% reduction in cost

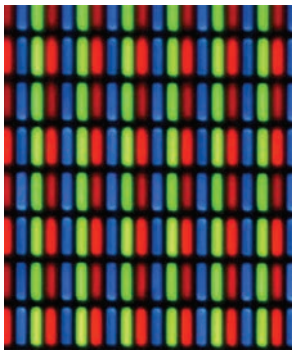
PARTICIPANTS

Air Force Materiel Command, DMS&T, Defense Advanced Research Projects Agency (DARPA), Army Night Vision Electronic Sensors and Devices (NVESD), ONR, MDA and SBIR

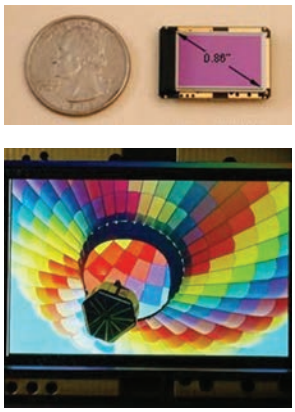
ManTech Enables Affordable Manufacture of Full Color High Brightness OLED Microdisplays

The Challenge:

Current fielded full color microdisplays cannot simultaneously achieve high contrast and high brightness to clearly display see-through imagery required for high ambient conditions without obscuring the scene. Fielded Organic Light Emitting Diodes (OLEDs) can achieve this for monochrome, but refinements to the manufacturing process, are necessary to improve manufacturing efficiency and luminance critical for military applications. Additionally, all silicon backplanes for OLED microdisplays are currently manufactured off-shore.



Magnified view of directly patterned OLED emitters showing subpixel detail



Manufactured OLED

F-35 Visor (Left) and Apache Display Tech Demo (Right)

ManTech Response:

- Army RDECOM and the OSD Defense-wide Manufacturing Science and Technology office partnered to establish an on-shore advanced backplane manufacturing process for silicon backplanes ready for OLED deposition
- Manufactured fully functional high brightness OLED microdisplays on on-shore wafers
- Built the first high resolution, direct patterning OLED deposition tool and integrated it into the primary OLED manufacturing production system
- Manufactured fully functional full color high brightness OLED microdisplays using the new deposition tool, demonstrating significant improvements in luminance and efficiency
- DMS&T investment of $4.95M

Impact:

- Established capability of on-shore foundry for advanced backplane wafers for OLED deposition
- Increased luminance of manufactured microdisplays by >10X to >1,300-fL
- Increased efficiency of manufactured microdisplays by >14X to 7 cd/A
- Integrating early prototypes into High Definition Aviation Digital Display (HiDADD) Apache vision system upgrade tech demo (FY16), F-35 visor (FY16), and Soldier Visual Interface Technology (SVIT) tech demo (FY17)

Enabled On-Shore Source of Microdisplays for Day/Night Situational Awareness

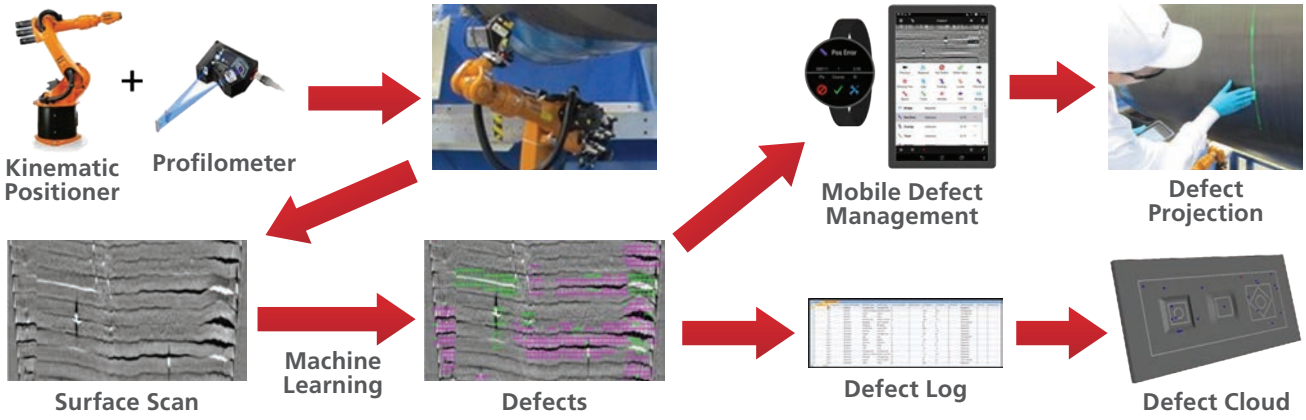
PARTICIPANTS

Defense-wide Manufacturing Science & Technology Program, Army RDECOM Communications-Electronics Research, Development and Engineering Center (CERDEC), eMagin Corporation

ManTech Automates On Tool Inspection of Automated Fiber Placement

The Challenge:

Modern military and commercial systems are increasingly using composite materials. Composites provide many benefits including great strength with lighter weight, however, one of the drawbacks is that current composite lay-up practices require fiber placement to be 100% manual visually inspected for defects after each fiber ply. Manual inspection processes are very time consuming, reduce production rates, and ultimately make up a large portion of the composite manufacturing costs.



ManTech Response:

- Air Force ManTech and OSD Defense-wide Manufacturing Science and Technology (DMS&T) developed the stand-alone Automated Composite Structure Inspection System (ACSIS) to replace the manual inspection process
- Provided commercially viable product across all DoD & commercial platforms using fiber placement
- Utilized independent hardware that can be used at any location with all fiber placement equipment
- Installed system at current production facility to conduct live system testing
- Developed a smart watch to allow the operator to manage the defects "hands free"
- AF ManTech and DMS&T funding of $4.7M with additional industry cost share

Impact:

- Automated inspection system 4 scanners resulted in wider surface scans leading to productivity improvements
- Demonstrated a system at the McNair Center at the University of South Carolina to showcase the technology to industry and other interested parties
- 25% reduction in inspection costs
- Agnostic to any automated fiber placement (AFP) machine and can be installed in any factory on a wide variety of platforms
- Potential systems impacted: F-35, V-22, F/A 18 & commercial aircraft
- Eliminates paper tracking systems and provides a digital record

Defect detection rate of up to 99.7% during testing of F-35 Nacelles

PARTICIPANTS

Air Force Research Laboratory (AFRL) Materials and Manufacturing Directorate (RX), National Center for Defense Manufacturing & Machining, Ingersoll Machine Tools, Orbital ATK, General Dynamics Information Technology (GDIT)

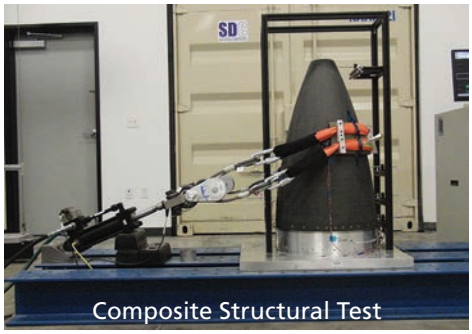
ManTech Innovations Enable Reliable Missile Defense

The Challenge:

The Missile Defense Agency (MDA) develops, produces, and fields an integrated, layered ballistic missile defense system. To meet its Warfighter commitments, the Agency continues to develop cutting-edge designs to counter evolving missile threats. These designs demand innovative manufacturing technologies to deliver the most reliable missile defense capability at the lowest cost to the Warfighter. One MDA ManTech initiative is developing missile nosecones with longer shelf life, enhanced producibility, and lower cost and weight using technology that is scalable to a variety of shapes and sizes.


Interface Rings


Thermal Protection System Braiding



Composite Structural Test

Manufacturing Innovation Response:

- MDA recognized that emerging technologies offer alternatives to conventional production approaches like filament winding and solid-block machining
- MDA partnered with small business to leverage its expertise in structural engineering, materials science, and manufacturing technology to develop new production methods for composite nosecones
- Three suppliers have since collaborated on multiple MDA projects to develop unitary and clamshell style nosecones consisting of the composite substructure, deployment system, and thermal protection system
- Subscale nosecones have been tested at relevant heat fluxes at the Arc Jet Heater Facility
- Full scale structural testing completed in July 2015
- Full scale dynamic deployment testing completed in August 2016

Impact:

- These new manufacturing approaches promise to increase the storage life and producibility of nosecones
- Implementation of these technologies will increase missile performance, reduce assembly steps, and lower unit cost
- This nosecone development effort could provide a model for other MDA missile platforms
- ManTech implementation will help MDA meet its goal of increasing yield above 90%

Mentis Sciences, San Diego Composites, and Systima Technologies have each received prestigious OSD awards in the past 5 years, such as the Nunn Perry Award and Tibbett's Award

Expected cost reduction for missile nosecone production and extended storage life

PARTICIPANTS

Missile Defense Agency, Mentis Sciences, San Diego Composites, and Systima Technologies

MANUFACTURING INNOVATION FOR TODAY AND TOMORROW: THE NATIONAL NETWORK OF INSTITUTES

President Obama has stated his intent to maintain the United States' edge in innovation and expand American manufacturing. In 2012, he initiated the National Network for Manufacturing Innovation (NNMI), a public-private partnership of innovative manufacturing institutes across the United States. Each institute has a distinct technology focus area but works towards a common goal to secure America's future through manufacturing innovation, education and collaboration.

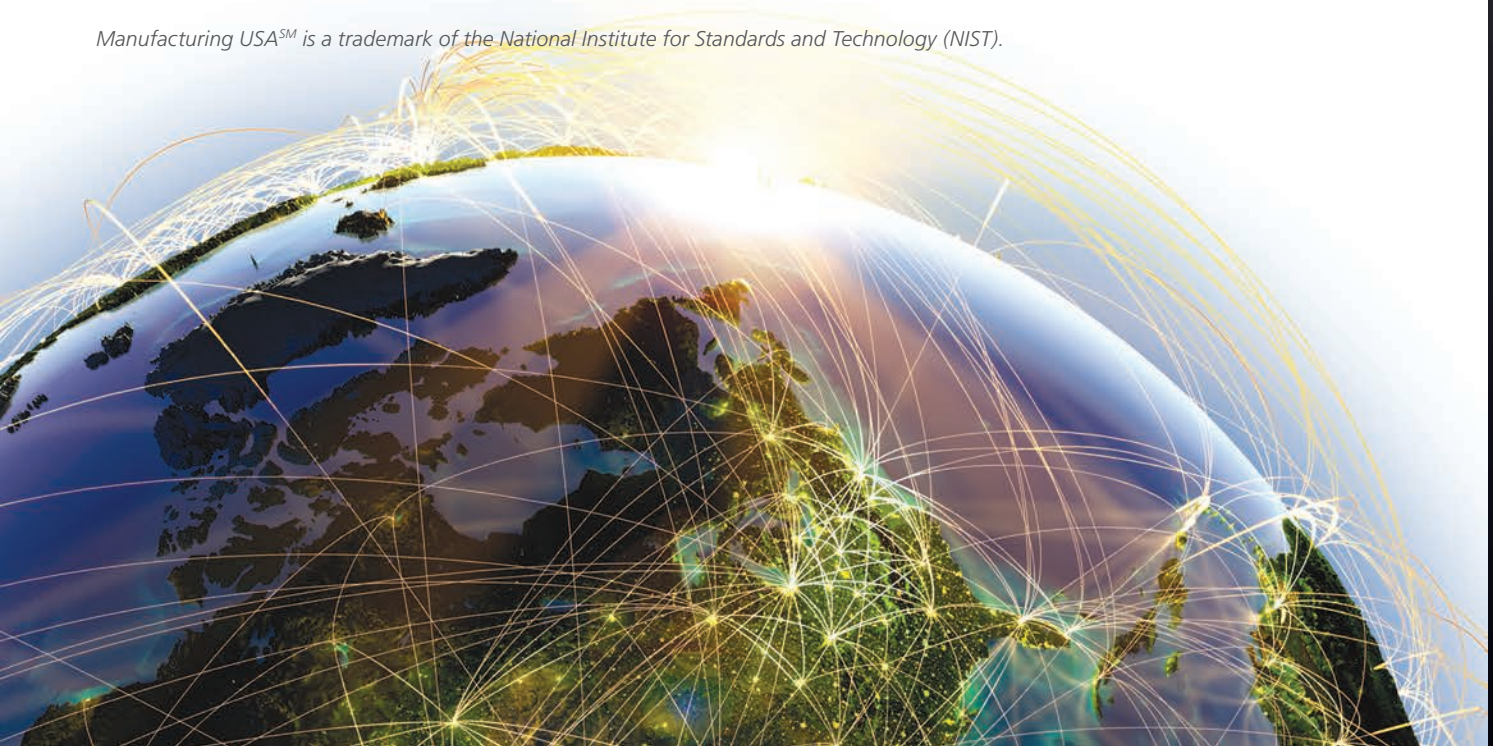
Over the past four years of the program, six DoD-led and three DoE-led manufacturing innovation institutes have been established with six more being planned by 2017. In 2016, the NNMI was rebranded as Manufacturing USA℠. Manufacturing USA brings together industry, academia and federal partners within a growing network of advanced manufacturing institutes to increase U.S. manufacturing competitiveness and promote a robust and sustainable national manufacturing R&D infrastructure.

The OSD Defense-Wide Manufacturing Science and Technology (DMS&T) program in partnership with Army, Air Force, DOE, NSF, and NASA, established the first DoD-led pilot Institute, America Makes, in 2012 to address additive manufacturing. Since then, five more DoD-led pilot institutes have been added: In early 2014, the Digital Manufacturing and Design Innovation Institute (DMDII) and Lightweight Innovations for Tomorrow (LIFT) were established. In 2015, the American Institute for Manufacturing Integrated Photonics (AIM Photonics) and NextFlex (for Flexible Hybrid Electronics) were established. Finally, this year we welcome the Advanced Functional Fabrics of America (AFFOA) institute.

The three DoE-led institutes are: Power America (wide bandgap semiconductors), the Institute for Advanced Composites Manufacturing Innovation (IACMI), and Clean Energy Smart Manufacturing Innovation Institute.

Go to **ManufacturingUSA.com** for more information on Manufacturing USA. A summary of the activities of the six existing DoD-led manufacturing institutes is found on the following pages.

Manufacturing USA℠ is a trademark of the National Institute for Standards and Technology (NIST).



America Makes

A proud member of Manufacturing USA

Scan for More Information

America Makes, the National Additive Manufacturing Innovation Institute, is located in Youngstown, OH. In Year 4 of operations, America Makes ramped up its core activities and continued to grow to 177 members, including over 48 large businesses, 63 small businesses, 39 Universities and Community Colleges, 13 non-profit organizations and 14 government partners. America Makes continued developing its relationship with its pilot Satellite Center at the University of Texas El Paso, extending the institute's presence to a new region and expanding its in-house capabilities.

America Makes has completed four institute-driven project calls, awarding 38 projects with $27.5M of public funding matched by $31M of private cost share for a total portfolio value of $58M. The average institute-driven project team has just over seven members, including several levels in the supply chain and a built-in path for technology transition.

Accompanying the projects executed through America Makes is an industry-driven technology roadmap that guides institute investments. This rigorous process influences industry members to realign their internal research & development resources with the roadmap, further leveraging the investments of all members. America Makes has also facilitated a roadmapping process for DoD, and each of the services, which has identified synergies and priority investment areas in additive manufacturing. Together, these roadmaps lay the foundation for future partnership between the public and private sector.

America Makes is also conducting R&D projects that are directed by the DoD services, government agencies, members, and outside organizations. The Air Force, DARPA, NIST, and NASA have asked America Makes and its members to perform 18 agency-driven projects funded at over $47M in agency funding plus private cost share.

One highly successful project is bringing additive manufacturing options to small machine shops. Small business member Optomec, along with MachMotion and TechSolve, developed a modular kit to retrofit any computer numerical control (CNC) machine to create a hybrid machine with additive manufacturing capabilities. Now these hybrid CNC/AM machines can perform both additive and traditional subtractive processes on a metal part. This achievement gives manufacturers and machine shops the ability to adopt additive manufacturing technologies at a fraction of the cost — for a 60 percent savings compared to purchasing a new additive manufacturing machine with equivalent capabilities. This product now is commercially available and has been purchased by DoD suppliers.

For more information, go to **AmericaMakes.us** or contact the DoD lead, **Dr. Dennis Butcher**, at **dennis.butcher.1@us.af.mil**.

LIGHTWEIGHT INNOVATIONS FOR TOMORROW

A proud member of Manufacturing USA

Scan for More Information

The **Lightweight Innovations for Tomorrow (LIFT)** (formerly Lightweight & Modern Metals Manufacturing Innovation (LM3I)) institute was established in February 2014 to advance our national metals manufacturing industry. The institute brings together the U.S. Department of Defense (DoD), state governments, leading manufacturers, professional societies & organizations, universities, and other research partners.

LIFT's primary objectives are to accelerate the development and application of innovative lightweight metal production and component manufacturing technologies to benefit the U.S. transportation, aerospace and defense market sectors. LIFT benefits extend beyond the commercial market to DoD activities to support the Navy, Army, and Air Force weapons systems to improve the Warfighters' capabilities through reduced fuel consumption and cost, improved transportability, speed, and ground troop mobility.

The LIFT headquarters opened its doors on Jan. 15, 2015 in the historic Corktown neighborhood of Detroit. LIFT is proud to be a part of the larger ongoing effort, along with local industry and policymakers, to impact jobs and facilitate the revitalization of the city.

The LIFT team consists of nearly 100 member organizations working together to improve U.S. manufacturing competitiveness through the introduction of lightweight metal products and components while improving affordability and facilitating the transition of these new technologies to the industrial base. Among the LIFT organizations working together are nearly 40 small businesses, a dozen of which are start-up companies, and 19 leading universities from across the country.

LIFT membership has launched a technology portfolio of projects valued in excess of $27M in technology thrust areas of Melt processing, Powder processing, Thermo-Mechanical Processing, Coatings, Joining/Assembly, and Agile tooling. In addition, LIFT has launched over 20 Education and Workforce Development initiatives within its five state region, ranging from increasing access to STEM education to additional training in skilled trades and supporting a national credentialing program with a value of $8M.

LIFT is led by the American Lightweight Materials Manufacturing Innovation Institute (ALMMII).

For more information, please visit **www.lift.technology** or contact the DoD lead, **Johnnie DeLoach**, at **johnnie.deloach@navy.mil**.

DMDII

A proud member of Manufacturing USA

Scan for More Information

The **Digital Manufacturing and Design Innovation Institute (DMDII)** was established in February 2014. The Institute is a unique public-private partnership acting as a world-class, first-of-its-kind manufacturing innovation accelerator. Based in Chicago and in collaboration with UI LABS, the Institute has the capabilities and collaborative expertise to transform American manufacturing. DMDII focuses on enterprise-wide utilization of the digital thread, enabling highly integrated design and manufacturing of complex products in order to reduce cost and accelerate the pace of new products coming to market.

DMDII is largely supported by the U.S. Department of Defense (DoD) and its top tier industry partners. In 2016, the total number of partners grew to over 250, spanning 33 states. In addition to large companies, these include over 40 premier university partners and over 150 small and medium firms. A full list of partners can be found at **dmdii.org/membership/members**.

DMDII's Kelley Patrick operates precise measurement equipment showcasing the future of manufacturing: clean, connected, and digital.

As of July 2016, the Institute has publicly announced $34 million in applied R&D funds going to 60 unique organizations across the United States, with many more in the pipeline. Projects are tackling systemic issues in DMDII's research thrust areas — Advanced Manufacturing Enterprise, Intelligent Machines, and Advanced Analysis — including specific efforts in augmented reality solutions for manufacturing, cybersecurity standard compliance for manufacturing floors, and facilitation of the adoption of modeling and simulation tools across the supply chain.

As part of a foundational effort to define and map the future of digital manufacturing jobs in the U.S., DMDII has partnered with ManpowerGroup, the world's leading innovative workforce solutions provider, to identify the skills needed for 20 roles on the leading-edge of manufacturing and design. Additionally, DMDII is embarking on an effort to create a suite of open, online courses on digital manufacturing and design as part of a partnership with online coursework provider, Coursera.

Since opening its doors in May 2015, the UI LABS Innovation Center, home of DMDII, has hosted 1,000+ visitors monthly. The facility has served as the venue for a variety of programmatic and partner events including DMDII's first-ever hackathon, which attracted coders from across the country to create apps related to real-life manufacturing floor issues that will be available on the Digital Manufacturing Commons (DMC). In addition, DMDII has launched pilot regional chapters in Rockford and the Quad Cities, expanding its direct outreach to small and medium-sized manufacturers in these manufacturing strongholds.

The UI LABS Innovation Center, home of DMDII, features a 24,000 sq-ft manufacturing demonstration floor that shows the digital thread in action.

For more information please visit **dmdii.org** or contact the DoD lead, **Anthony Holden**, at **anthony.r.holden.civ@mail.mil**.

A proud member of Manufacturing USA

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American Institute for Manufacturing Integrated Photonics (AIM Photonics) Institute was established in July 2015 and is led by the Research Foundation for the State University of New York on behalf of the SUNY Polytechnic Institute. The Institute is an industry driven public-private partnership that focuses the nation's premiere capabilities and expertise to capture critical global manufacturing leadership in a technology that is both essential to National security and positioned to provide a compelling return on investment to the U.S. economy. The Institute's goal is to emulate the dramatic successes experienced by the electronics industry over the past 40 years and transition key lessons, processes, and approaches to the photonic integrated circuit (PIC) industry. AIM Photonics supports Small and Medium Enterprises (SMEs), providing practical access and technology on-ramps for U.S. industry, government, and academic communities. AIM is creating a National PIC manufacturing infrastructure that will be widely accessible and able to meet the challenges of the marketplace with practical, innovative solutions.

AIM Photonics spans several industry segments including Datacom (currently the largest commercial driver of the integrated photonics field), microwave photonics, photonic arrays and integrated photonic sensors. The Institute is focusing the majority of its resources on developing an infrastructure in electronic-photonic design automation, a multi project wafer offering, and test, assembly and packaging. These efforts are focused on the supporting SMEs, universities, federal agency needs, and large companies. AIM Academy, an organization within the overall Institute, has been established to foster education and workforce development. Lastly, AIM is developing a roadmap that is closely coordinated with the existing integrated photonics road mapping activities but seeks to capture the future of areas not addressed in the prior roadmapping efforts.

AIM Photonics has fourteen ongoing 2016 projects and is currently evaluating a slate of project proposals that are scheduled to launch in early 2017.

AIM Photonics has 46 members from 29 states consisting of 30 companies; 14 universities plus community colleges, 2 trade associations and 11 government partners. The Institute has an initial five year budget of $612M, including $110M federal and $502M state, industry and university cost share, including $250M from New York, $28M from Massachusetts and $26.7M from California.

For more information go to **www.aimphotonics.com** or contact the DoD lead, **Neil Supola** at **neil.d.supola.civ@mail.mil**.

NEXTFLEX

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NextFlex | America's Flexible Hybrid Electronics Manufacturing Institute was announced on August 28, 2015, by Secretary of Defense Ash Carter. Flexible hybrid electronics is an innovative manufacturing industry segment at the intersection of the electronics industry and the high-precision printing industry creating the next-generation of sensor platforms that conform, stretch or have reduced weight for novel commercial and important Department of Defense (DoD) applications. These FHE manufacturing processes will integrate ultra-thin silicon ICs with sensors and power components, adapting and innovating processes using conductive and active inks and pastes on flexible, stretchable substrates. Flexible hybrid electronic technologies enabled through innovative FHE manufacturing will preserve the full operation of traditional electronic circuits in flexible, conformal, and stretchable architectures. These highly functional devices can be attached to curved, irregular and often stretched objects and humans.

On August 31, 2016, one year after the announcement of NextFlex, an Innovation Opening Day was held to present how Flexible Hybrid Electronics (FHE) will impact the world and open the FHE pilotline. NextFlex has attracted more than 55 members to date, and issued two project calls that are rapidly stimulating the FHE manufacturing ecosystem. Several projects from Project Call 1.0 kicked off August 30, 2016. NextFlex has been engaging the education and workforce development community with projects ranging from Hack 4 Defense with the Defense Innovation Unit Experimental (DIUx) for DoD personnel, community college learn-and-earn programs, local area K–12 student tours, and interns joining the institute headquarters to support the pilotline installation and operation.

The NextFlex technical working groups made up from industry, government, and academic experts have developed nine roadmaps that provide detailed analysis for the future direction FHE technology and the manufacturing gaps that can be addressed through the NextFlex Cooperative Agreement. The project calls address the manufacturing gaps through focused calls for proposals addressed through the public-private institute members. Please contact the Executive Director, **Dr. Malcolm Thompson**, via email at **mthompson@nextflex.us**. For more information on the program, go to **http://www.nextflex.us** or please contact the DoD Program Manager, **Dr. Eric Forsythe**, at **eric.w.forsythe.civ@mail.mil** or the Government Chief Technology Officer, **Dr. Ben Leever**, at **benjamin.leever@us.af.mil**.

Dr. Jill Biden addresses NextFlex on Importance of Community College and Future Workforce

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On April 1, 2016, Secretary of Defense Ash Carter announced that a consortium of universities and manufacturers will spearhead a new manufacturing innovation institute in partnership with the Department of Defense (DoD). This manufacturing institute, organized by the Massachusetts Institute of Technology (MIT) under a new non-profit company known as **Advanced Functional Fabrics of America (AFFOA)**, is headquartered in Cambridge, MA. It brings over $315 million in public-private investment to American fibers and textiles manufacturing, fostering innovation in futuristic fabrics and textiles, helping accelerate the revival of textiles manufacturing in the United States.

While our clothes help define us, the fabrics we wear have remained virtually unchanged for thousands of years. Recent breakthroughs in fiber materials and manufacturing processes will soon allow us to design and manufacture fabrics that see, hear, sense, communicate, convert and store energy, regulate temperature, monitor health and change color — heralding the dawn of a "fabric revolution." After a decade of decline in U.S. manufacturing during the 2000s, the American textile industry is adding jobs for the first time in two decades, increasing shipments by 14% from 2009 to 2015. The institute will build on this momentum in American textile manufacturing and lay the foundation for future leadership in the production of sophisticated fiber and textile technologies.

AFFOA unites partner companies, non-profits, independent research organizations, universities and start-up incubators in an effort to ensure that America stays at the leading edge of fiber science and the production of fibers and fabrics. AFFOA brings together fiber and textile manufacturers, system integrators, and product companies to transform traditional fibers, yarns, and textiles into highly sophisticated, integrated, and networked devices and systems. To achieve this mission, the institute will establish a nationwide network that addresses the spectrum of manufacturing challenges associated with multi-component, functional fibers and technical textiles. AFFOA will provide technology transfer, prototyping and pilot production facilities throughout a collaborative ecosystem called the Fabric Innovation Network (FIN). AFFOA will rapidly and flexibly produce end-item prototypes through this unique FIN collaborative infrastructure. The institute will also combine fibers and yarns with integrated circuits, LEDs, solar cells, and other capabilities to create textiles and fabrics for a variety of industries, such as apparel, automotive, medical, defense, and sports and leisure.

AFFOA has developed membership for four categories of participants: industry, academic, FIN, and start-ups, and a streamlined membership agreement that makes membership accessible and affordable. AFFOA is currently engaged in its stand-up phase, conducting renovation and outfitting of its "Fabric Discovery Center," an end-to-end prototyping and workforce development facility located at its headquarters in Cambridge, MA and expected to be open in March of 2017. If interested in learning more about participation in AFFOA, please contact **Tina Gilman**, Director of Administration and Membership, via email at **tina@affoa.org**. For more information on the program, please contact the DoD Program Manager, **Mr. Stephen Luckowski**, at **stephen.l.luckowski.civ@mail.mil** or the Government Chief Technology Officer, **Ms. Carole Winterhalter**, at **carole.a.winterhalter.civ@mail.mil**.

2016 DEFENSE MANUFACTURING TECHNOLOGY ACHIEVEMENT AWARD NOMINATIONS

The Defense Manufacturing Technology Achievement Award (DMTAA) is awarded to ManTech teams who demonstrate outstanding performance in executing and delivering ManTech solutions for DoD. This year, 19 teams were nominated for their work on the projects listed below. The Joint Defense Manufacturing Technology Panel would like to recognize these teams for their hard work and congratulates the winners of this year's DMTAA, to be announced at the Defense Manufacturing Conference.

PROJECT TITLE	SERVICE	SUBPANEL
Manufacturing Technology for Advanced Nanocomposite Coatings	Army	Electronics
VCS Retractable Bow Plane Repair	Navy	Metals
Capacity Planning Automation	Navy	AME
Modular Outfitting / Packaged Units	Navy	AME
Trade-Friendly Locating Dimensional Techniques S2550	Navy	AME
Manufacturing Cost Reduction for LCS Scalable Electronic Warfare (EW) System Phase 1	Navy	Electronics
Optical Windows – ALON*	DMS&T	Electronics
128 Kilobit RAM/ROM Microcircuit Emulation Project	DLA	Electronics
High Operating Temperature Multi-Band FPA*	Army	Electronics
Advanced UT Methods of NDT of Hull Welds S2499	Navy	Metals
Improved Tiling Systems	Navy	Metals
Mechanized Cable Pulling*	Navy	Metals
Sonar Dome Fabrication Process Improvements*	Navy	Metals
Industrial Base for Low Cost Shortwave Infrared (SWIR) Camera Cores	DMS&T	Electronics
Laser Assisted Consolidation of Advanced Composites	AF & DMS&T	Composites
On Tool Inspection for Automated Fiber Placement	DMS&T	Composites
Digital Thread for Material Review Board*	AF	AME
F-35 Transparency Clean-up Automation*	Navy	Composites
Microwave Assisted Thermal Sterilization (MATS) of Group-Sized Combat Rations	DLA	N/A

*Finalist

DEFENSE MANUFACTURING TECHNOLOGY ACHIEVEMENT AWARD WINNERS

The Joint Defense Manufacturing Technology Panel (JDMTP) seeks to recognize and honor those individuals most responsible for outstanding technical accomplishments in achieving the vision of the Department of Defense (DoD) ManTech Program. That vision is to realize:

"A responsive world-class manufacturing capability to affordably and rapidly meet Warfighter needs throughout the defense system life cycle."

To this end, the Defense Manufacturing Technology Achievement Award was established in the Fall of 1999.

AWARDEES

2015 – F-35 Electro-Optical Targeting System (EOTS) Producibility

2015 – Welding of High Strength Steels

2015 – Manufacturing Technology for High Power Vertical Cavity Surface Emitting Lasers (VCSELS)

2014 – Chip Scale Atomic Clock (CSAC)

2014 – F-35 Canopy Thermoforming Automation

2014 – Low Light Level Sensor

2014 – Large Affordable CdZnTe Substrates (LAS)

2014 – Establishing the Production Capability for Lighter, Higher Energy Soldier Batteries

2013 – Advanced Body Armor

2013 – Plate Edge Preparation Improvements (PEPI)

2013 – Restoration of Aerospace Parts by Cold Spray

2012 – Fastener Insertion Live Link System (FILLS)

2012 – Customer/Supplier Interoperability During Collaborative Design

2012 – 3D Technical Data Package and Certification

2011 – Use of Digital Radiography for Final Part Acceptance of Aerospace Casting

2011 – Prosthetics & Orthotics Manufacturing Initiative (POMI)

2011 – Automated Fiber Placement of Carbon Fiber Bismaleimide Materials

2010 – High Power, High Energy Density Lithium-Ion Batteries

2010 – Seal Extrusion Development and Demonstration (SEDD)

2010 – Weld Seam Facing and Back Gouging

2009 – F-35 Inlet Duct Robotic Drilling

2009 – Low Cost Manufacturing of Materials for Improved Warfighter Protection

2008 – Laser-Welded Corrugated-Core (LASCOR) Panel Evaluation

2008 – Low Observable Paints for Aircraft

2007 – Lean Battery Initiative

2007 – Low Cost SiC-N Ceramic Tile

2007 – Translational Friction Stir Welding

2006 – Uncooled Focal Plane Array Producibility

2006 – Engine Rotor Life Extension

2005 – Large Aircraft Infrared Countermeasures

2005 – Large Marine Composite-to-Steel Adhesive Joints

2004 – Lean Depot Repair

2004 – Uniform Cannon Tube Reshaping

2003 – Laser Additive Manufacturing

2003 – Laser Shock Peening

2002 – Composites Affordability Initiative

2002 – Apparel Research Network

2001 – Enhanced Manufacturing Processes for Body Armor

2000 – Advanced Optics Manufacturing

2000 – Flexible Manufacturing of Microwave Vacuum Devices

1999 – Advanced Fiber Placement

For further information, scan or visit:

www.dodmantech.com