

**Joint
Defense
ManTech
Panel**

**JDMTP Electronics
Processing and Fabrication
(EP&F) Subpanel
Overview for SAMPE 2015**



**Dr. Eric W. Forsythe
Army Research Laboratory
21 May 2015**

- **Electronics Subpanel Taxonomy (Thrust Areas)**
- **Current Technology Focus**
 - **2014 Electronics Portfolio**
 - **Electronics Subpanel Technical Working Groups (TWGs)**
 - **Interaction with National Network for Manufacturing Innovation**
- **Electronics Portfolio Highlights**

Electronics Processing & Fabrication Thrusts

Electro-Optics

- EO Sensor & Night Vision (IRFPA)
- Optical Communication & Networking
- Analog Photonics
 - Beam Forming
 - True Time Delay
 - Antenna Links
- Laser Systems & Optics
 - Windows & Domes
 - Lens & Coatings

Electronics Packaging & Assembly

- High Reliability Packaging
- Precision Automated Pkg
- System-On-a-Chip (SOC)
- Embedded Actives & Passives
- High Density Substrates
- MEMS Packaging
- Advanced Thermal Mgmt
- Affordable Anti-Tamper Microelectronics

RF System Component Technology

- Innovative RF Module Mfg Process, Packaging & Materials
- High Power Amplifiers
 - Wide Bandgap Devices
 - RF Circuit Integration
- RF SWAP & Sustainability
- Low Cost Non-Hermetic RF Modules

Power Energy Sources

- Production Base for Energy Storage
- Adv Mfg Initiatives for Batteries & Fuel Cells
- Weapon Systems Design using Batteries Fuel Cells
- Disruptive Man-Portable Energy Technologies
- Cost Effective Batteries

Lead Free Electronics

- Solder Free Assemblies
- Assembly & Rework using Pb Free Solder, Mixed Solder
- Tin Whisker Mitigation
- Nano Solders & Other New Alloy Solders

Printed Electronics/Other Innovative & Disruptive

- Multi-material Additive Mfg
- Additive Electronics Mfg
- Nano-Electro Mechanical Sys
- Innovative Nano-Processing
- Advanced CNT Processing
- Graphene Carbon Technology

Directed Energy

- Solid State Laser
 - Thermal Management
 - High Power Laser Diodes
 - Adaptive Optic & Beam Control
- High Power Microwave Switches & Capacitors

Integrated Photonics

- Hi Speed Optical Transmission
- Photonic Integrated Circuits
- Photonic Interconnects for Hi Performance Info Processing
- Optical Waveguides
- Free Space Optical Comm
- Photonic Imager and Displays

2014 Electronics Portfolio

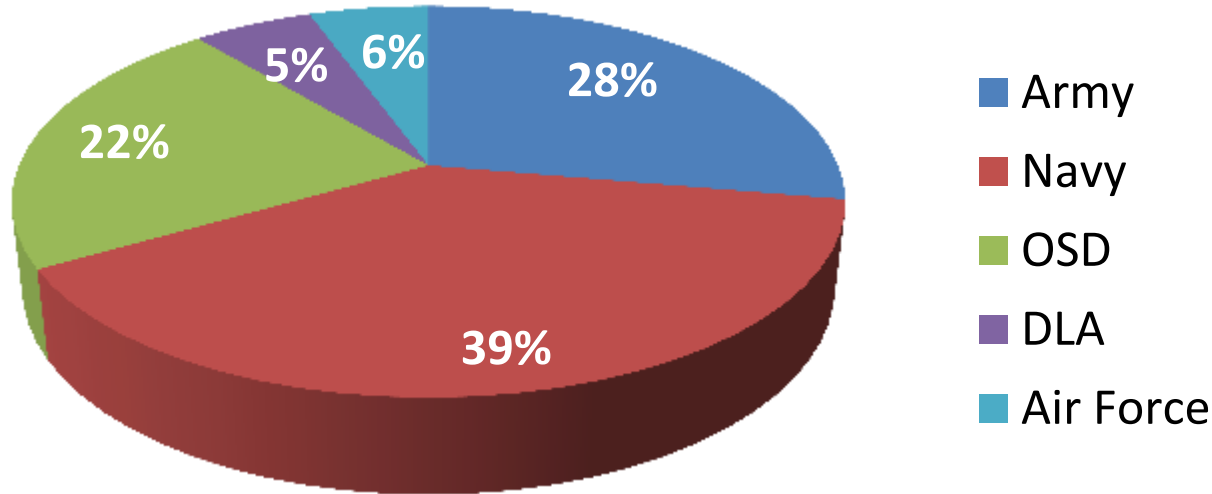
Project Distribution by Technology Area

Technology Area	# of Projects	% of Portfolio
Electro-Optics	20	56%
Packaging & Assembly	8	22%
Power Systems	5	14%
RF Electronics	3	8%
TOTAL	36	100%

- Over ½ of the electronics manufacturing projects are in Electro-Optics:
 - Focal Plane Arrays and Flexible Displays for soldier applications
 - Fiber optics and EO sensors technology for shipborne applications
 - Other projects include nano-composite coatings, laser assemblies, and fiber optics
- Most packaging & RF electronics projects address affordability for Navy platforms
- All services addressing different aspects of EO transparent ceramics and windows technologies to protect sensors systems and the warfighter
- Power sources projects (at DLA) develop Li-Ion batteries and wearable batteries

\$77.5M Total Investment in Electronics Projects Reviewed in 2014

2014 Electronics Portfolio Project Distribution by Service/Agency



- Navy has largest number of projects that are focused on ship affordability for its key acquisition programs: CVN-78, VCS, DDG 51, LCS, JSF, and CH-53K
- Army programs focus on FPAs, flexible displays, some munitions, EO sensors and batteries for ground vehicles and soldiers
- Air Force projects moving toward agile manufacturing – that is, establishing processes to be able to respond quickly to Warfighter needs
- OSD partners with Services to fund projects with cross-cutting defense needs
- DLA projects focus on BATTNET (batteries) & advanced microcircuit emulation

For more info: <https://www.dodmantech.com/ManTechPrograms/>

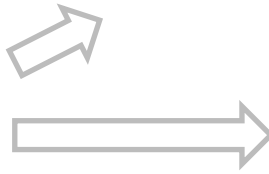
- **TWGs provide forum for DoD components to collaborate on specific critical technology topics**
- **TWGs identify needs, develop joint strategy, create roadmaps, and conduct joint program planning**
- **Goals of the 2015 Electronics TWGs:**
 - **Joint Power Sources and Fuel Cells TWG** – provide uninterrupted provision of portable power to the Warfighter
 - **Photonics/RF Component Systems TWG** - improve the quality of communications, discernment of potential targets, and power delivery for electronic warfare
 - **Printed Electronics TWG** - Leverage emerging commercial printed electronics capabilities to develop sustainable DoD/supplier manufacturing capability for high reliability material (sensors, antennas, unique targets and tags, and weapon systems)

- Electronics Subpanel actively collaborates with:
 - America Makes Institute
 - Integrated Photonics Institute for Manufacturing Innovation
 - Flexible Hybrid Electronics Manufacturing Innovation Institute
- These institutes address the “next big areas” in electronics manufacturing technologies
- See www.manufacturing.gov for more info on the manufacturing institutes

Electronics Portfolio Highlights

The Challenge:

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



Low Light Level Sensor utilized on vision systems for Apache Helicopter

ManTech Response:

Army ManTech matured the manufacturing quality, capacity and yield of the first high performance digital low light level sensor and achieved 77% cost reduction per system.

Subpanel Flexible Displays – from Project to Institute

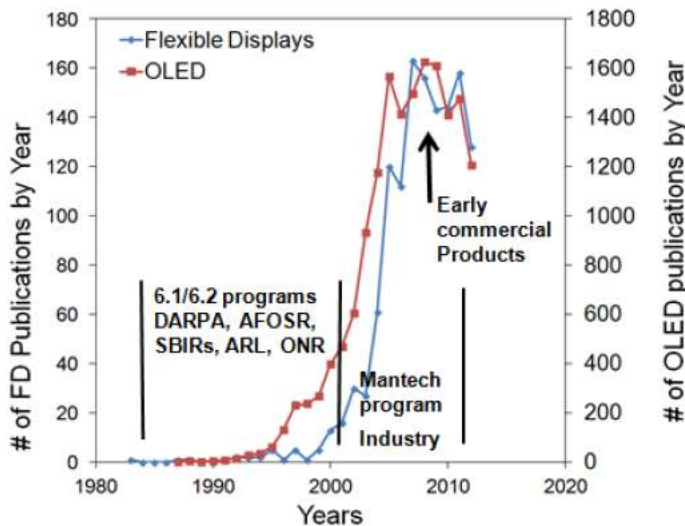
DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.



Flexible Display History EXAMPLE ManTech and Industry IRD

Influencing \$100B/yr revenue industry w/ \$130M/10yr Army investment

{ \$10M/yr FDC & \$3M/yr FTA (USDC) }



*Flexible Displays in the Market:
Adapted from traditional
manufacturing approaches*



Samsung Edge
Plastic OLED



LG Watch
Plastic-OLED
(P-OLED)



Plastic EINK Sony Mobius e-reader

2004 Professional Staff
From Semi-industry
43k sqft cleanroom



2013 14.7" World's
Largest full color
flexible-OLED
Army Mantech 2004-13



2008 Wearable Flex EINK
Transition: PEO Soldier &
SOF



**FLEXIBLE HYBRID ELECTRONICS
MANUFACTURING INNOVATION INSTITUTE
PROPOSERS' DAY**

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

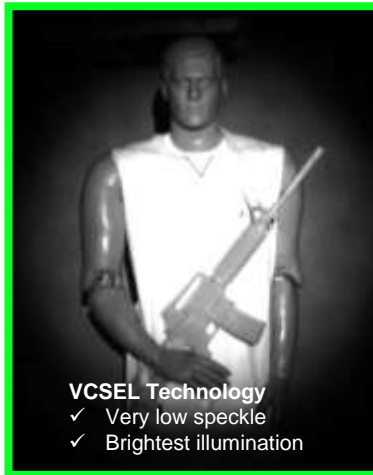


NIST

The Challenge:

For laser illumination applications, high power vertical-Cavity, Surface-Emitting Lasers (VCSELS) – laser diodes emitting the near infrared wavelengths – offer the Warfighter a tactical advantage over incumbent edge emitter lasers. VCSELS enable long-range imaging with unparalleled uniformity and low-noise properties where edge-emitter lasers fall short, however, high-power VCSELS were too costly for wide deployment.

See the VCSEL Difference



ManTech Response:

AF ManTech developed volume manufacturing processes to achieve 10X reduced cost for high-power VCSELS.

The Challenge:

The current energy storage system for the Long Range Advanced Scout Surveillance System (LRAS3) uses two lead acid and twelve other rechargeable batteries. During a silent watch mission, these batteries cannot be directly charged by the vehicle and must be changed multiple times during the mission. Therefore, the Warfighter must carry multiple sets of replacement batteries in which the battery power source system weighs more than 200 pounds.

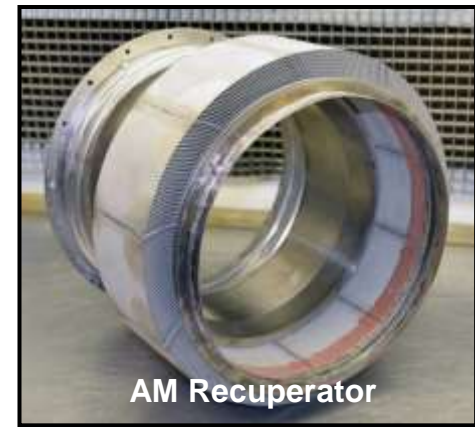
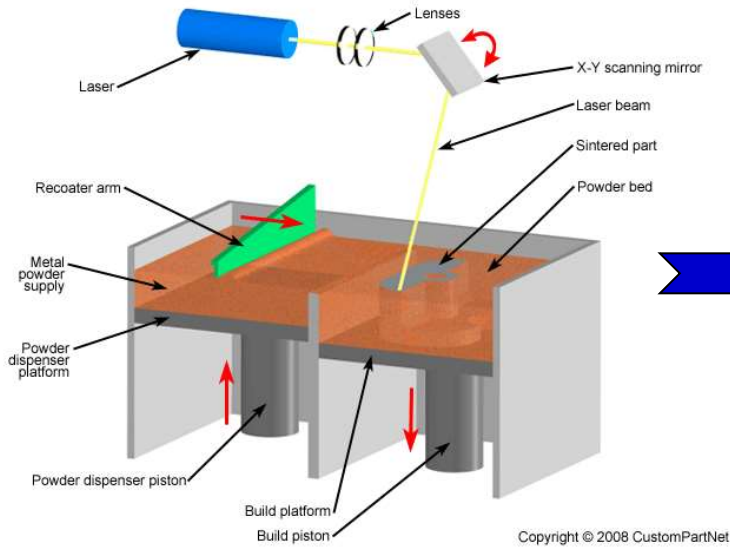


ManTech Response:

OSD, Army, and DLA worked together to integrate newly developed, proven cell technology and battery electronics into the production design of an advanced lithium-ion power source for the LRAS3 to achieve 75% reduction in battery weight and \$12.5M cost savings.

The Challenge:

Propulsion system components are limited in their design and the materials with current manufacturing methods. Additive manufacturing (AM) enables more advanced designs, however, AM-built components needed to be demonstrated and their manufacturing processes qualified for acceptance in propulsion systems.



AM Recuperator
Photo Courtesy from Williams Int.

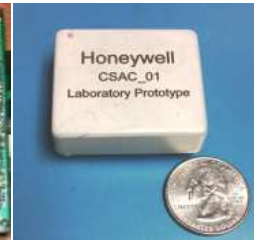
ManTech Response:

The AF used Additive Manufacturing (Direct Metal Laser Melting) to successfully produce thin walled recuperator segments for a small turbine engine to achieve 50% improvement in fuel economy on small engines



Other 2014 ManTech Achievement Award Winners

- OSD/Army Chip Scale Atomic Clock
- OSD/Army Large Affordable CdZnTe Substrates
- Establishing the Production Capability for Lighter, Higher Energy Soldier Batteries (DLA project)



Navy Patuxent River Activities in Additive Manufacturing (AM)

- Naval Air Systems Command (Vice Admiral Dunaway) is a large proponent of AM for naval aviation systems
- Pax River senior leaders have formed working group to implement AM parts although flight certification of parts remains the largest challenge
- Navy's Cherry Point NC Depot (works on Marine Corps aircraft) has 3-D printer and is considering AM to produce high failure items

JDMTP Electronics Subpanel Support:

Becky F. Stewart, B.S.E.E.

JDMTP Electronics Subpanel Support

Universal Solutions International (USI)

8280 Willow Oaks Corporate Drive

Suite 550

Fairfax, VA 22031

(540) 287-3722