INDUSTRIAL BASE INNOVATION FUND

CANDIDATE PROJECT REPORT

July 2008

Deputy Under Secretary of Defense
(Acquisition & Technology) Industrial Policy

Industrial Base Innovation Fund

Candidate Project Report

27 June 2008

Purpose:
This is the Congressional notification for projects to be funded by the Industrial Base Innovation Fund (IBIF).

Background:

The Department of Defense Appropriation Act for Fiscal Year 2008, Pub. L. 110-116, provided $24 million for the Industrial Base Innovation Fund (IBIF) in the Research, Development, Test and Evaluation, Defense-Wide appropriation. This program is being executed through the Defense Logistics Agency's Manufacturing Technology Budget (Program Element 0708011S). The Conference Report[1] specified the purpose of the fund.

> INDUSTRIAL BASE INNOVATION FUND
> The conferees provide $24,000,000 for the Industrial Base Innovation Fund to ensure that investments are made to address shortfalls in manufacturing processes and technologies in support of the Department's long-term and short-term needs. The conferees direct that funds may not be obligated from the Industrial Base Innovation Fund until 15 days after a report detailing the projects to be funded is provided to the congressional defense committees.

IBIF Program Management:

The Defense Logistics Agency (DLA) received the tasking in January 2008 to execute the IBIF program on behalf of the Department of Defense. DLA has been instructed to execute the fund in coordination with the Joint Defense Manufacturing Technology Panel (JDMTP) and with the Office of the Deputy Under Secretary of Defense for Industrial Policy (ODUSD(IP)). Consultation with Congressional Staff resulted in a two part Program execution.

The two parts are: 1) An internal review, conducted by JDMTP and ODUSD(IP), to determine which ongoing efforts are candidates for expansion or schedule acceleration; and 2) An outreach effort conducted through a competitive process that will provide the maximum opportunity for all of industry and Government organizations to participate in the IBIF program.

[1] Report 110-434 "MAKING APPROPRIATIONS FOR THE DEPARTMENT OF DEFENSE FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 2008, AND FOR OTHER PURPOSES" pg. 346

Candidate Project Identification Process:

The internal review identified ongoing projects through a combined effort of the JDMTP, ODUSD(IP) and DLA. An initial call for white papers was issued from OSD to each military department, defense agency and to several industry associations. This resulted in over 170 candidate submissions. Selections were jointly made by the JDMTP, ODUSD(IP) and DLA, and 15 projects were chosen to pursue under the IBIF.

The outreach effort was conducted by DLA's Contracting Support Office using a Broad Agency Announcement (BAA) (Solicitation number**:** BAA030008). The BAA resulted in 131 proposal submissions. After evaluation pursuant to a formal Source Selection Plan, 10 projects were chosen for IBIF funding.

The selected projects for IBIF funding are shown in the Table of contents on the next page. An Executive Summary for each project is included at the referenced Tab Number.

Table 1 Selected IBIF Projects

TAB	Candidate	Cost
1	Thermal Battery Press Refurb & Press Upgrades	$ 600,000
2	Industrialization of Ultra High Power Lithium-Ion Technology for use in Joint Strike Fighter Aircraft (JSF), F-35	$ 1,400,000
3	AH-64 Apache Static Mast Ballistic Tolerant Structure	$ 680,000
4	Low Cost Titanium Extrusion Billets for Appliqué Armor	$ 500,000
5	USSOCOM - Pill Packing Technology	$ 462,500
6	Vibration Reducer Cell Ring Weld Repair procedure Development	$ 140,182
7	Retrofit of Value Regulated Lead-Acid(VRLA) Battery System	$ 140,243
8	Ballistic protection for Gasoline Tanker Trucks	$ 299,909
9	Improved Manufacturing of High Performance Integrated Ceramicx / Composite Armor	$ 699,659
10	Military Lens Fabrication and Assembly	$ 900,000
11	High Power Microwave Tube Sustainability Improvement	$ 250,000
12	Innovative Mass Production of Affordable Consolidated Titanium	$ 2,000,000
13	Near Net Shape Reduced Cost Ti-6Al-4V WDU-36 Warhead for the BGM-109 TOMAHAWK LAND ATTACK MISSILE, Block IV	$ 1,000,000
14	Ultrasonic Joining of Aircraft Tubing	$ 750,000
15	Lead-Free Solder Material Property Characterization	$ 150,000
16	Advanced Process Engineering for Cost Effective Composite Battery manufacturing	$ 2,000,000
17	Domestic Spinel Powder manufacturing: A Critical Industrial Base Need	$ 1,224,000
18	Landsafe Systems	$ 1,999,950
19	12 um Pixel Development & Demonstration	$ 1,998,778
20	Design & Implementation of an Innovative Manufacturing Process for Aerial & Land Supply Needs	$ 566,203
21	Maritime Integrated Improvement Plan	$ 590,336
22	Digital Depot Implementation @ Letterkenny for Manufacturing Process Modeling, Simulation & Optimization	$ 1,199,975
23	Compression Molded Composite Antennas - an application of Compression Molding as an alternative to Vacuum Bag/Autoclave Processing of Structural Composite Antennas	$ 638,486
24	Improved Microcircuit Characterization Tool for Reverse Engineering	$ 1,581,311
25	Weapon Power Systems Development of industrial process for high yield & high quality automated thermal battery stacking & inspection	$ 641,361
	Project Cost	$ 22,412,893
	OSD Withholds, Negotiation Reserve and Management Fee	$ 1,587,107
	Total	$ 24,000,000

Tab 1 – Project Title: **Thermal Battery Press Refurbishment & Press Upgrades**

Performing Organization: Eagle-Picher Technologies, LLC, Joplin, MO

Project Cost: $600,000

Government Point of Contact: Adele Ratcliff, OSD ManTech, adele.ratcliff@osd.mil

Project Summary:

This project will upgrade the equipment that produces the pellets (Lithium, Cathode, Electrolyte, and Heat) that make up a thermal battery. The United States military is increasingly dependent on the performance of batteries to sustain and improve warfighter capabilities. Current DOD use is around 100,000 batteries per year; peak deliveries during the most recent military action required 200,000 batteries per year.

Specifically the project will improve density control which will result in increased cell production rates while maintaining product quality. This project will upgrade seven presses used for thermal cell production. The long and short term benefits to the defense industrial base resulting from these upgrades include:

- Improved equipment operational efficiency
- Improved product consistency
- Reduced battery die scrap
- Schedule flexibility
- Increased capacity for current and future DOD needs
- Less material scrap reduces material exposure
- Domestic competitive edge on large cell diameter batteries

Tab 2 – Project Title: Industrialization of Ultra High Power Lithium Ion Technology for use in Joint Strike Fighter Aircraft (F-35)

Performing Organization: Saft America, Inc., Space & Defense Division, Cockeysville, MD

Project Cost: $1,400,000

Government Point of Contact: Adele Ratcliff, OSD ManTech, adele.ratcliff@osd.mil

Project Summary:
This project will facilitate insertion of the Ultra High Power Li-ion technology into the Joint Strike Fighter (JSF) application while reducing product cost and expanding technology availability to a variety of other defense applications that require high-power electrochemical energy storage.

Saft high power Li-ion technology has been applied to the 28V and 270V batteries for the F-35 (JSF) aircraft. Currently Saft is delivering JSF program batteries for testing and integration in the airplane. The first flight took place December 2006 with a Saft battery on board. While the legacy VL-V batteries perform functionally as required, upgrade to VL-U Technology could resolve a safety issue. The legacy VL-V batteries require an externally imposed fuse to protect from the consequences of a short circuit. VL-U batteries should survive a battery short circuit without fire or other aircraft safety concern emanating from the battery and may eliminate the fuse. Without a fuse the current battery cannot safely handle a short circuit current event lasting more than a few hundred milliseconds in case of a fault. VL-U technology will reduce any risk associated with using the present cell and may handle short circuit current until depleted with no fire or other safety concerns. VL-U technology can also further increase the ability of the battery to provide absorption of regenerated power spikes coming back from the flight control actuators, as well as provide significantly increased power at all temperatures satisfying the always evolving flight requirements.

The new cell essentially uses the same hardware as the standard JSF cell but has much improved electrodes and mechanical interface. Saft developed novel electrode manufacturing techniques enabling unmatched performance. The new cell delivers twice the specific power of VL-V technology. and significantly improves very low temperature (-40°C) performance. Also, changes to the bussing of the cell enabling it to handle extremely large currents and to pass short circuit abuse test without major issues. However, the cells used in the JSF battery have a design frozen since 2003 and the advances to the Li-ion cell technology have not been inserted into the application.

Other possible applications of this technology include the Energy Storage Subsystem for The Electro-Magnetic Aircraft Launch System (EMALS) on CVN79, the second EMALS carrier. The current technology VHP cell fulfills these requirements and reduces on-board weight by 215 long-tons. However, the VL-U technology proposed here would decrease the size of the EMALS battery and save an additional estimated 85 long tons, bringing the total weight savings to EMALS to 300 Long tons.

Tab 3 – Project Title: AH-64 Apache Static Mast Ballistic Tolerant Structure

Performing Organization: U.S. Army Aviation and Missile Command, Huntsville, AL; Boeing, and Alion Science and Technology Corp.

Project Cost: $680,000.00

Government Point of Contact: Mr. Pete Stemniski, Army ManTech Principal, peter.stemniski@us.army.mil

Project Summary:
The project will develop the manufacturing techniques to both repair and limit or prevent the corrosion and wear of the Apache (AH-64) fleet helicopter rotor mast bases. The Army, Boeing, and Alion will develop a repeatable process that will improve manufacturing techniques and reduce the existing scrap rate of the mast base component.

A high scrap rate exists for mast bases used on aircraft in the field. Corrosion and wear associated with high operational tempo and environmental issues in the field have required the removal and replacement of this primary, critical component. This has resulted in an unforecasted, high rate of component scrap and extensive repair in the field and at the depot support level. The degraded life of existing mast bases has resulted in a reduction in operational readiness and an increase in operating and support cost to the Army Apache (AH-64) fleet.

The project will leverage previous work conducted by Army Research Laboratory (ARL), the Army's Apache Program Management Office, AMRDECs Engineering Directorate, Boeing, and the Alion Science and Technology Corporation and the Magnesium Corrosion Protection Program (MCPP), a successful program completed in July of 2005. The Process Technologies for Replacement Part Production (PTRPP) contract technical data will be utilized by Boeing in the creation of the manufacturing processes, techniques, design, and analysis to establish solutions for part discrepancies, which are currently impacting the scrapping and or repair of the mast base components in the field.

Project benefits include:

1. Manufacturing techniques that will prevent corrosion and wear.
2. Manufacturing and repair processes that extend the mast base life cycle by correcting and/or preventing mast base wear issues.
3. Process solutions that could reduce maintenance effort for aviation maintenance support for depot and non-depot level maintenance units in the field environment.
4. Project lessons learned will apply toward similar issues associated with other military aircraft including the UH-60 Black Hawk fleet, CH-47 Chinook fleet, the V-22 helicopter, as well as, other aviation metal components.
5. Improved Apache fleet readiness rate and fleet operating and support costs.

Tab 4 – Project Title: Low Cost Titanium Extrusion Billets for Appliqué Armor

Performing Organization: U.S. Army Research Laboratory, Adelphi, MD

Project Cost: $500,000.00

Government Point of Contact: Mr. Pete Stemniski, Army ManTech Principal, peter.stemniski@us.army.mil

Project Summary:
This project will develop a high volume manufacturing process to produce low cost titanium extrusion billets for appliqué armor attachments. General Dynamic Land Systems and ADMA Products Inc. will execute the project in six months with the overall objective to develop a high volume manufacturing process to produce low cost titanium extrusion billets for appliqué armor attachments. Low cost hydrogenated titanium powder will serve as the raw material for this powder metallurgy (P/M) process. This powder has successfully been used to manufacture various components by using the low cost blended elemental P/M approach. Early trials have demonstrated that titanium alloys produced by hydrogenated titanium powder have promise for low interstitial oxygen grade material meeting ASTM standards without extraordinary measures associated with multiple melts in conventional processing. These experiments have established that blended elemental P/M Ti-6Al-4V alloy material produced from hydrogenated titanium powder by cold-isostatic-press(CIP)/sinter is over 99% of theoretical density and does not require further expensive high temperature consolidation processes to obtain properties meeting ASTM and military requirements. P/M titanium components produced by this low cost powder have demonstrated the feasibility of substantial cost reduction. Along with the cost advantage, an additional benefit of the P/M approach is reduced lead time for manufacturing and delivery especially for nonstandard alloys.

This program will result in the qualification of a new production process, and adapted equipment for high volume production of extrusions/bars as a feedstock for General Dynamic Land Systems' threaded Fredserts, which are a principle way to attach appliqué armor and other appurtenances. The current titanium (Ti-6Al-4V) Fredsert fastener is machined from extruded Ti-6Al-4V billets (currently at $35/lb). This program will invest in the development of an alternative Ti-6Al-4V extrusion billet from low cost Ti powder.

Project benefits include:

1. Qualification of production processes that could reduce cost and lead-times associated with titanium components for defense systems.
2. Implementation of low-cost titanium powder as an alternate material for use in threaded fasteners to attach armor and other appurtenances could expand availability and expand use.

Tab 5 – Project Title: **Enhanced Pill Packaging Technology for the Combat Wound Pill Pack**

Performing Organization: U.S. Special Operations Command, Tampa, FL

Project Cost: $ 462,500.00

Government Point of Contact: Mr. Pete Stemniski, Army ManTech Principal, peter.stemniski@us.army.mil

Project Summary:
This project will assist the U.S. Public Service facility at Perry Point MD to advance pill packing technology and double the shelf-life of the current Combat Wound Pill Pack. The Combat Wound Pill Pack is a component of the Special Operations Tactical Combat Casualty Care Kits used by the Special Operation Force (SOF) operators from all the Services. These kits have, to date, reduced preventable battlefield deaths by 13% among SOF in the GWOT.

A capability gap exists in the packing technology available to Perry Point that limits their production rate to hand packing about 500 per month and the FDA limitation of a one year shelf-life regardless of original expiration date with hand sealed blister packs. The low production rate and short shelf life combine to greatly increase the sustainment cost and severely limit fielding. There is not enough capability to reach USSOCOM's Full Operational Capability and no capability to support other Services or agencies with the same life saving capability.

The project is expected to require two months for contracting, four months for delivery of materiel, one month for installation and prototype configuration. The capability will be demonstrated in eight months with an early user assessment. Independent laboratory testing and FDA approval require another two months. Full rate production is expected in the eleventh month.

Project benefits include:

1. Establishes a domestic source for automated pill packing machine manufacturing technology.
2. Significantly increase the production rate of Combat Wound Pill Packs
3. Increases the availability of Combat Wound Pill Packs by doubling the current shelf-life

Tab 6 – Project Title: **Vibration Reducer Cell Ring Weld Repair Procedure Development**

Performing Organization: Edison Welding Institute Inc., Columbus OH

Project Cost: $140,182.00

Government Point of Contact: Mr. John U. Carney, Navy ManTech Principal, carneyj@onr.navy.mil

Project Summary:
This project will develop repair methods that will extend the life of damaged vibration reducer piston/cell ring sets on submarines and eliminate the need to replace these components with new sets. The solution will develop weld repair, inspection, and machining methods that will bring the damaged piston/cell ring sets back to their original performance specifications. The work will be performed at Edison Welding Institute, Inc. (EWI) in Columbus, Ohio working directly with the Materials Engineering Scientific Services Branch at the Trident Refit Facility, Naval Submarine Base Kings Bay.

Damaged piston/cell ring sets must be replaced with new expensive components during refit of Navy submarines due to the lack of a repair method for these components. Every 10 years the Trident Refit Facility (TRF) Kings Bay removes and discards eight damaged piston/cell rings sets and installs eight new sets in the Ohio-class Trident (SSBN), Ohio-class Trident (SSGN), and Los Angeles-class (SSN) submarines. This project will reduce the need to replace piston/cell ring sets with expensive, new components. The repair technology developed during this project will be implemented at the Kings Bay Refit Facility.

Tab 7 – Project Title: **Retrofit of Value Regulated Lead-Acid (VRLA) Battery System**

Performing Organization: Edison Welding Institute Inc., Columbus OH

Project Cost: $140,243.00

Government Point of Contact: Mr. John U. Carney, Navy ManTech Principal, carneyj@onr.navy.mil

Project Summary:
This project will advance the manufacturing technology in the retrofit of Valve Regulated Lead-Acid (VRLA) Battery Systems on Los Angeles and Trident Class submarines.

The Los Angeles Class and Trident Class submarines are being retrofitted with Valve Regulated Lead Acid (VRLA) battery systems. During the retrofit, existing cracked lead bin canning plates are repaired by arc welding. The VRLA battery system also requires that new mounting brackets be attached. The work is performed to the envelope of a confined space in close proximity to components that have a maximum temperature restriction of 400°F. In addition, some of the repairs will be made near insulation and sound dampening materials, which could result in decomposition and fume generation.

The project will demonstrate a pulsed gas metal arc welding (GMAW-P) approach to replace the current welding process. Current processes dictate very restrictive procedures when performing hot work on or near sealed lead bins. This is driven by the requirements for worker safety and system integrity upon completion. Current requirements restrict the rate of welding considerably, which slows production and induces inferior weld quality. The Navy maintenance community performs a large quantity of shielded metal arc welding (SMAW) to sealed voids, lead bins, and restricted spaces. Developing technically acceptable weld processes that reduce residual back-side temperatures will have a tremendous positive impact throughout the entire maintenance community at Puget Sound and other Navy shipyards.

The directed schedule performance for this modification is approximately 90 days for all remaining hulls with only four exceptions. Those four hulls have target schedules of approximately 77 days.

The time savings from the first to the second installation was estimated at 764.6 labor hours (~62% reduction). This estimate does not consider the savings realized from reducing required support for nearly 95 man shifts of work, project schedule savings, TDY, or other related costs. The project's GMAW-P repair approach could provide additional savings due to reduced first-time installation and follow-on repair efforts than are expected in the future.

Tab 8 – Project Title: Ballistic Protection for Gasoline Tanker Trucks

Performing Organization: SCRA Applied Research and Development Institute, Anderson SC

Project Cost: 299,909.00

Government Point of Contact: (Mr. John U. Carney, Navy ManTech Principal, carneyj@onr.navy.mil

Project Summary:
This project will develop a mobile automated application process utilizing new robotic technology, to apply an external fuel tanker membrane system that minimizes fuel leakage on fuel tankers due to bullets or other ballistic projectiles. This process will allow the coating to be applied in theater, further improving the availability to this revolutionary technology, and potentially expanding its use beyond fuel tanker trucks to other military vehicles. The South Carolina Research Authority (SCRA) will work with High Impact Technologies (HIT) to develop a mobile, automated spray coating process to apply BattleJacket™ a spray-on polyurethane elastomer applied to fuel tanks that will expand and permanently seal punctures to prevent leaks.

BattleJacket™ is a self-sealing, self-healing external fuel tanker membrane system that minimizes fuel leakage on fuel tankers due to bullets or other ballistic projectiles. It is currently being used extensively on fuel tankers in Afghanistan and Iraq.

The BattleJacket™ coating consist of three layers of sprayed-on polyurethane elastomer. The coating's inner, outer and middle layers work together as a system to stop the leaks, fires and explosions caused when bullets or bomb fragments penetrate a fuel tank. The inner layer provides good adhesion to the metal tank. The middle layer contains a proprietary polymer additive that swells upon contact with hydrocarbons. The outer layer exerts compressive force on the middle layer to ensure that the swelling is directed inward, plugging any punctures.

Currently the coating is applied in a three stage, hand-sprayed application. This process is time consuming and labor intensive. This project will develop an automated application process that will provide benefit by increasing application throughput and improving availability.

Tab 9 – Project Title: **Improved Manufacturing of High Performance Integrated Ceramic/Composite Armor**

Performing Organization: SCRA Applied Research and Development Institute, Anderson, SC

Project Cost: $699,659.00

Government Point of Contact: Mr. John U. Carney, Navy ManTech Principal, carneyj@onr.navy.mil

Project Summary:
This project will rapidly develop and demonstrate hybrid ceramic armor systems. An Integrated Product Team (IPT) consisting of advanced composite engineering, ceramic and composite manufacturing, testing and product/technology integration organizations has been assembled to ensure the successful design development, production, performance demonstration and transition to the fleet of hybrid ceramic armor systems. The project team consists of SCRA Applied Research and Development Institute (SCRA/ARDI), Anderson, South Carolina, Materials Sciences Corporation (MSC), Horsham, Pennsylvania; M-Cubed Technologies, Newark, Delaware; American Iwer Corporation, Greenville, South Carolina; and Seemann Composites Inc. (SCI), Gulfport, Mississippi. SCRA/ARDI will provide overall program management and IPT coordination. MSC, with extensive experience in the engineering design and analysis of advanced composite armor materials and structures, will develop the integrated ceramic composite armor design concepts, perform engineering analyses, and coordinate manufacturing and testing activities. SCRA/ARDI and MSC will work closely with the ceramic (M-Cubed), textile preform (American Iwer) and ceramic/composite fabrication (SCI) organizations. Each of these organizations provides extensive experience in the manufacturing of advanced ceramics, integrally woven fabrics, and low cost, high performance molded composites, respectively. Ballistic performance testing will be performed at H.P. White Laboratories, Inc. in Street, Maryland, to demonstrate the performance of candidate ceramic/composite armor systems. Improved methods for integrating the ceramic/composite armor design, reducing manufacturing costs and improving throughput are needed.

Ceramic armor systems have been used effectively in personnel and combat vehicle protection systems due to their weight-efficiency and enhanced performance compared to traditional monolithic armor, such as rolled homogeneous armor (RHA) steel.

Project benefits include;

1. Improved process for integrating ceramic and composite functional components into armor material systems.
2. Improved performance and manufacturing efficiency of future armor solutions

Tab 10 – Project Title: Military Lens Fabrication and Assembly

Performing Organization: Optical Systems Technology Inc. Freeport, PA

Project Cost: $900,000.00

Government Point of Contact: Ms. Persis Elwood, Air Force Principal,
persis.elwood@afosr.af.mil

Project Summary:

This project will build on previous successes to increase manufacturing capacity for lenses used in critical optics for DOD platforms and advanced night vision systems from 45,000 to 60,000 units per year. This goal will be achieved through the procurement of additional equipment and changes in manufacturing procedures and practices to increase throughput without sacrificing quality. This effort will result in a significant boost to domestic mono-spectral and multi-spectral optical lens production capacity.

The initial production facility was established in a Phase I project. During the Phase I effort, key production elements were developed and demonstrated and the equipment necessary to produce lens elements at a rate of 30,000 lens elements/year or 110 lens-elements/day was procured. Further development of the manufacturing processes was accomplished in a Phase II project resulting in the completion of a manufacturing work cell capable of producing 45,000 lens elements per year with the added capability of producing both mono-spectral and multi-spectral lens elements. Phase III shall continue to scale-up the manufacturing facility capacity from 45,000 to 60,000 lens elements per year. Another set of OptoTech equipment (1 generator and 1 Polisher), and lens tooling will be procured. In addition the key processes and procedures associated with producing the lenses will be revised to increase factory throughput.

During this Phase III project, the optical lens manufacturing equipment will be relocated to a new facility and new lead optical machine operators will be trained. In addition to establishing the capability to fabricate and assemble mono and multi-spectral military lens elements, subsystems, and systems, effort will be expended to improve lens manufacturability and reduce system cost by integrating mechanical fabrication, optical fabrication, assembly, and test into a single entity. The project will also explore methods to improve the performance and reduce the cost of existing thin film coatings for multi-spectral applications and to integrate laser protection into standard coatings for multi and mono-spectral lens elements and systems. The project will significantly increase domestic mono-spectral and multi-spectral optical lens production capacity, which are needed for optical systems in critical Defense platforms and for advanced night vision program

Tab 11 – Project Title: High Power Microwave Tube Sustainability Improvement

Performing Organization: LMI, Mclean VA

Project Cost: $250,000.00

Government Point of Contact: Donna Davis, DLA Principal, donna.davis@dla.mil

Project Summary:
This project is a manufacturing technology program with an objective to improve the sustainability of high-power microwave tubes. High power microwave tubes are used in radar, communications, and electronic warfare systems and subsystems throughout DoD. While newer systems may employ solid state microwave emitter technology, high-power communications and electronic warfare systems will continue to be built with tubes because of required power levels. Weapon systems already developed and fielded will continue to use these tubes for decades to come. DLA manages procurement and inventory of many of these tubes for DoD. Crane is DoD's executive agent for these products and also repairs, tests, and provides engineering support of these items for the Navy and other military services.

The industry is in decline. The microwave tube industry is relatively small with about $400M in U.S. sales annually (half the world market); the DoD represents approximately 80 percent of the total sales. While the technology continues to evolve slightly, the manufacturing methods for these tubes remain highly manual and labor intensive. Further, the industry is small, with three primary manufacturers, L-3 Systems, CPI, and Teledyne for military applications. Many of the designs are DoD unique and have only a single source of supply.

This effort will be performed jointly by LMI and Crane over 3-4 months after project implementation. The project will focus on support issues, manufacturer processes and procedures, field procedures, and defect analyses necessary to prioritize follow-on efforts.

Tab 12 – Project Title: **Innovative Mass Production of Affordable Consolidated Titanium (IMPACT)**

Performing Organization: Oak Ridge National Laboratory, Oak Ridge, TN

Project Cost: $2,000,000.00

Government Point of Contact: Col Scott Neumann, ODUSD(IP), Scott.Neumann@osd.mil

Project Summary:
For this project, Oak Ridge National Laboratory (ORNL) and Lockheed Martin and will produce alloyed Ti 6Al 4V and commercially pure (CP) titanium sheet from roll compaction of Armstrong titanium powders, produced by International Titanium Powder (ITP). Roll compaction is performed by controlling the flow of powder through counter rotating rolls that provide compressive and shear forces. The green sheet of titanium will be about 60 to 70% dense. The green sheet will be brought to full density via sintering. Chemistries will be checked before and after roll compaction. Once the powder has been consolidated into sheet form the project will validate the resulting chemistry, mechanical, physical and fatigue properties. These properties will be compared to existing properties of titanium sheet in industry specifications. For a point of reference, nickel sheet has been prepared in this fashion for over fifty years. The sheet will then be qualified for heat exchange and desalination components by AquaChem, validated for add-on-armor for the Stryker Armored Combat Vehicle by BAE Systems, and validated for sheet components that are used on the F-35 and F-22 aircraft by Lockheed Martin. The properties will be compared to existing specifications. Both efforts, the roll compaction of CP Ti and the roll compaction of Ti-6Al-4V, will be performed simultaneously. However, it is anticipated that the CP Ti will be qualified for use in a shorter time frame. An economic analysis will be performed to estimate production cost and compared to current pricing at Lockheed Martin, BAE Systems, and AquaChem. The tasks will be performed in a stage-gate format with the earliest set of deliverables to be completed within three and six months.

DARPA's Titanium Initiative (DTI) Program contributed in maturing the Armstrong process that can produce alloyed titanium powder for less than $5/lb. ITP has begun construction of a production facility capable of producing 4 million pounds a year of titanium powder, scheduled for completion sometime in 2009. The IMPACT project will complement the commercial scale-up of this process by characterizing, developing and validating new manufacturing processes that produce near-net-shape titanium parts critical to Department of Defense aerospace and non-aerospace applications. The Armstrong Process has the advantages of being continuous and operating at relatively low temperatures, not requiring additional purification, and producing high purity powder, not sponge, suitable for metallurgical processes with no waste stream. The synthesized Ti-6Al-4V powder has been shown to have grade 5 chemistries. Overall, production of ITP powder would mean another conduit for obtaining titanium components, produced at significantly lower cost and less than half the energy expense of legacy methods.

This project also complements a Defense Production Act Title III investment in the Armstrong Process for producing titanium powder.

Tab 13 – Project Title: **Near Net Shape Reduced Cost Ti-6Al-4V WDU-36 Warhead for the BGM-109 TOMAHAWK LAND ATTACK MISSILE, Block IV**

Performing Organization: Oak Ridge National Laboratory, Oak Ridge, TN

Project Cost: $1,000,000.00

Government Point of Contact: Col Scott Neumann, ODUSD(IP), Scott.Neumann@osd.mil

Project Summary:
In this project, Oak Ridge National Laboratory and Ametek Inc. will develop, validate, and fabricate subscale WDU-36 warhead casings (and subsequently full scale casings if specifications and cost per pound are achieved) for the BGM-109 Tomahawk Land Attack Missile, Block IV for field testing and qualification. Validation of the powder metallurgy (PM) warhead casings will be easier to implement and commercialize than other applications due to the existing PM missile components. In general, qualification and implementation of solid state technologies to consolidate the new powders should lead to processing cost reductions of over 50%, and elimination of considerable scrap. Demonstration, validation, and fabrication of a subscale component would be completed within twelve months.

Many Department of Defense titanium components are machined from large titanium ingots. Currently, 95% of the titanium metal used in the U.S. is extracted from ore via the Kroll Process. Titanium produced by the Kroll process is energy intensive, costly, and time consuming. Vacuum arc re-melted (VAR) ingot must then be forged, milled, and/or machined to product form. Most aerospace components, including defense applications, require buy-to-fly ratios (weight of material purchased versus weight of finished component) of 8 to 1 or higher using conventional processing. The current Tomahawk Land Attack Missile (TLAM) warhead is a DoD component that is machined from Kroll melt ingot. Warhead casings must be hollowed-out from large solid billets, producing significant machining waste. Rising titanium and warhead costs are problematic, so eliminating waste and machining time and energy from production will save considerable costs. Other DoD applications will also benefit from adopting direct net shape consolidation of low cost titanium powders, including, Bradley Command Hatch's, F-22 and F-35 structural and engine components, M777 Howitzer structural components, and many other DoD applications. The TLAM warhead is a good entry point for near net shape consolidation of low cost powder due to lower mechanical property requirements compared to other aerospace applications, and previous acceptance of solid state consolidated missile components (Patriot missile components are currently consolidated from costly, conventional titanium powders, >$50/lb).

Tab 14 – Project Title: Ultrasonic Joining of Aircraft Tubing

Performing Organization: Edison Welding Institute, Inc. (EWI), Columbus, OH

Project Cost: $750,000

Government Point of Contact: Col Scott Neumann, ODUSD(IP), Scott.Neumann@osd.mil

Project Summary:
This project will develop ultrasonic soldering and brazing technologies to join tubes to end fittings. EWI has developed and patented a solder alloy specifically designed for ultrasonic soldering of difficult to join materials such as aluminum and titanium. The joining process will be demonstrated and transitioned to the original equipment manufacturing partners for qualification on their respective tubing hardware. The joining technology can be applied to the F/A-18, F-35, C-17, and V-22 aircraft and engines.

The technologies developed in this project will have significant and broad-ranging application for joining tubing used for fuel, hydraulic and other system on military aircraft, turbine engines, and weapons. The goal of this project is to develop improved methods for joining end fittings to tube assemblies for high performance applications to these air weapons systems. The new joining methods will improve the quality and life of tube joints (improving system safety), reduce manufacturing costs, and streamline throughput. The initial savings for seven representative defense applications should exceed $600,000 per year. The need for this technology is supported by at least three military contractors and will greatly improve their capabilities to support US manufacturing of military aircraft and components. The project can be completed in 7 months. The project will be performed at Edison Welding Institute, Inc, working directly with Boeing, General Electric Aviation, and Rolls Royce-Aircraft Engines who will implement the technology.

Once demonstrated, broader cost reductions and schedule impacts are realistic as the joining technology can be readily transitioned over to other systems, as well as reset, sustainment, and modernization of new systems.

Tab 15 – Project Title: **Lead-Free (Pb-free) Solder Material Property Characterization**

Performing Organization: Aviation and Missile Research Development and Engineering Center Redstone Arsenal, Alabama

Project Cost: $150,000.00

Government Point of Contact: Col Scott Neumann, ODUSD(IP), Scott.Neumann@osd.mil

Project Summary:

This project will determine the thermo mechanical characteristics of common Pb-free solders that remain undocumented in the public domain. This project will generate the required data using lap joints of solder with volumes on the order of those used in solder joints. The stress and strain will be applied in shear to best replicate the solder joint application.

The European Union (EU) enacted two directives effective in July 2006; 2002/95/EC Restriction of Hazardous Substances (RoHS) and 2002/96/EC Waste Electrical and Electronic Equipment (WEEE) that restrict or eliminate the use of various materials. One of the key materials restricted is lead (Pb), which is widely used in electronic solder and electronic piece part terminations. While these regulations do not apply to military equipment and may appear to affect only products for sale in the EU, the global electronics supply chain has reacted to this legislation by curtailing the availability of parts with Pb-bearing finishes, and introduces market pressure to produce more products with Pb-free solder. Both of these effects can impact the reliability and supportability of military equipment. The Pb-free finish of choice has been pure tin which poses the risk of forming conductive tin whiskers that can cause electrical shorts in electronic equipment. The use of Pb-free solders can result in unpredictable field performance in military applications, since some thermo mechanical properties of the various Pb-free solders have not been fully characterized.

These issues affect all DoD systems at all points of the life cycle (development through production and sustainment). The capability to determine the reliability of assemblies with Pb-free solder will enable appropriate assessment for military application of commercial off-the-shelf items that will increasingly use these materials.

This project will result in thermo mechanical characteristics that will support current and future Army aviation and missile weapons systems. Knowing these characteristics will allow the definition of effective test regimens to determine the reliability of assemblies that use these Pb-free solders, and allow development of design guidelines for reliable assemblies for military applications. Some of the gaps in knowledge of these materials' characteristics include stress relaxation and creep rates over military operating temperature ranges for representative strain and stress ranges.

This capability will allow qualification of Pb-free assemblies for particular applications and will benefit all the services and the defense industrial base.

Tab 16 – Project Title: **Advanced Process Engineering for Cost Effective Composite Battery manufacturing**

Performing Organization: Firefly Energy

Project Cost: $2,043,380

Government Point of Contact: Mr. John Dormer, Contracting Officer (john.dormer@dla.mil)

Project Summary:
This project will establish microcell battery electrode production capabilities that can meet large-scale market needs. Eventually, these optimized manufacturing processes and systems can be replicated throughout the existing U.S. lead acid battery industry. The project is a 24-month advanced process engineering effort to substantially lower capital costs per unit of its microcellular-based lead acid battery adapted for military applications for use in combat vehicle applications as a high-performance replacement for the 6T-size battery.

This new type of battery uses composite, three-dimensional microcellular porous carbon to replace traditional heavy, corrodible lead metal grids in lead acid batteries, thus increasing battery power, energy and cycle life. These batteries have been proved in the laboratory and pilot plant level. However, to produce these advanced microcell batteries with the performance attributes, in production quantities, and at a cost meeting the requirements of the military, process engineering is needed to advance the maturity of current manufacturing practices to bridge the gap from R&D to full-scale production.

The project offers significant potential benefits to the military and the warfighter. Microcell battery technology can increase battery runtimes by up to 50% and increase the cycle life of lead acid chemistry fourfold, delivering performance similar to advanced materials batteries (lithium and nickel), but at about one-fifth the cost. Using microcell technology also results in up to a 20% reduction in overall battery weight.

Microcell batteries last longer and hold a charge even after months of sitting idle while pre-positioned. These batteries enable “Silent Watch” applications, allowing for equipment operation with the vehicle’s engine off, ensuring stealth. Unlike other advanced battery chemistries—such as lithium, which can catch fire when the battery is pierced—sealed versions of Firefly Energy’s® advanced lead acid batteries will not spill electrolyte if the battery case is ruptured, ensuring crew safety.

Additional benefits include substantial cost savings over multiple weapons system platforms. The 6T-sized battery is currently used in 95% of Army vehicles. Based on preliminary estimates, if the DoD and the Services were to purchase only 100,000 of these batteries annually (20% of the current demand), more than $1 million per year could be saved. There also is potential for this battery to impact the aviation supply chain, as a replacement for current generation lead acid and NiCD batteries. In addition, Microcell battery technology might also be applied to the commercial automotive industry in an expansion of the hybrid vehicle market.

Tab 17 – Project Title: **Domestic Spinel Powder manufacturing: A Critical Industrial Base Need**

Performing Organization: Technology Assessment and Transfer, Inc.

Project Cost: $1,224,000

Government Point of Contact: Mr. John Dormer, Contracting Officer (john.dormer@dla.mil)

Project Summary:
The project will design, build, operate and refine a 5500 Kg capacity pilot plant for producing lower-cost, high-purity spinel ceramic oxide powder that is needed for the manufacture of transparent lightweight ceramic armor with superior ballistic protection properties and for the fabrication of ceramic domes and related optical components for missile seekers, reconnaissance pods and RF/laser communication systems. A modified flame spray pyrolysis method that has been used to produce small batches of high quality, pure, highly flowable powders will be scaled to a continuous process, the product of which will be high purity spinel powder with properties optimized for the aforementioned applications.

Spinel is a transparent polycrystalline ceramic whose combination of high hardness, light weight and optical properties make it a leading candidate for transparent armor and erosion resistant seeker and sensor domes and windows. Recent ballistic tests of transparent spinel ceramic armor at Aberdeen Proving Ground have demonstrated multi-hit performance against armor piercing projectiles at closer spacings with weights and thicknesses 50-60 % less than ballistic glass armor currently being used in Iraq. The only commercially acceptable source of spinel powder comes from Baikowski International in France at a cost of $130 per Kg which constitutes more than 25% of the cost of finished transparent armor components.

The project is based on a relatively simple and inexpensive solution-based technique that has been used to produce a variety of pure homogeneous ceramic oxide powders with high densities, desirable microstructures, and good flow characteristics. Laboratory scale quantities of softly agglomerated, nano-powders of the spinel material have been synthesized. The team which includes experts in the processing method and scaling of the process will design, build, and operate a pilot scale facility to demonstrate the viability and scalability of the process. The project is expected to produce spinel powder at a cost 30 – 40% lower than the currently available material.

The Army and Marines are anxious to field light weight ceramic Transparent Armored Gun Shield (TAGS) turret kits on HMMWVs, MRAPs, FMTVs, M1Arbams, HEMTTs, and other vehicles. This project would compliment a parallel effort, to scale up manufacturing capability for transparent armor to be used as side and front windows for ground vehicles. Emerging systems like the Joint Air to Ground Missile, the Air Force Small Diameter Bomb, the Navy DDG-1000 are also potentially large users for spinel-based optic components fabricated using this new source of high quality, lower cost ceramic powder.

Tab 18 – Project Title: **Landsafe Systems**

Performing Organization: Rockwell Collins

Project Cost: $1,999,950

Government Point of Contact: Mr. John Dormer, Contracting Officer (john.dormer@dla.mil)

Project Summary:
This project will accelerate the development of a fiber optic laser technology adapted from telecommunications industry components using Class I eye safe lasers to "sense through" dense particulate matter (dust, snow, rain, smoke, and fog) to provide altitude, groundspeed, and airspeed information to rotary wing aircraft aircrews that will aid in critical situational awareness needs. The implementation of this fiber optic laser technology was demonstrated in field tests early in 2007, and is undergoing evaluation by the United States Marine Corps.

Many lives have been lost and helicopters destroyed or damaged in combat operations in Iraq and Afghanistan due to Degraded Visual Environment (DVE)-related aircraft mishaps when aircrews lost situational awareness. Rockwell Collins, in partnership with Optical Advanced Data Systems (OADS), has undertaken development of a landing aid system for rotary wing aircraft, called LandSafe, which is built on proven fiber optic laser technology to reduce these losses.

This project will address the greatest need, the manufacture and test of the fiber optic laser components, and will be accomplished over a one-year timeframe. Specifically, this project will assemble and prove out the production processes for laser modules and lens assemblies, including assembly procedures for the laser fiber amplifiers using advanced fiber splicing techniques, optical sub assembly test instrumentation, and proper fiber handling techniques. Also, the project will transition commercial off-the-shelf (COTS)-based laser modules to readily manufactured assemblies, optimize the design and parts base for ease of supply/repeatability, and package the technology into aircraft suitable housings. Finally, the project will optimize the design of the lens assemblies and transition their previous COTS approach to aircraft suitable packaging.

Project benefits include:

1. Direct application to the CH-53E, V-22, H-1, CH-46, CH-47, H-60, CSAR, Coast Guard and Special Operations aircraft that may be required to safely operate in DVE.
2. The fiber optic laser module manufacturing process developed by OADS is a unique defense capability. Automation of an all fiber optic laser module manufacturing process would facilitate mass production of LandSafe systems as well as laser altimeters, laser air data, wind profiling and less expensive, lighter laser designators at a lower life cycle cost for multiple DoD programs.

Tab 19 – Project Title: **12 Micron Pixel Development & Demonstration**

Performing Organization: BAE Systems Information and Electronic Systems Integration Inc.
Lexington, MA

Project Cost: $1,799,962

Government Point of Contact: Mr. John Dormer, Contracting Officer (john.dormer@dla.mil)

Project Summary:
This project will develop and evaluate 12 micron pixel microbolometer (non-cooled infrared detector) focal plane array (FPA) technology that follows a proven reduction in pixel size from 46 to 28 to 17 microns achieved over the past several years. FPAs will be packaged and tested, followed by an imaging demonstration in a camera. Smaller pitch microbolometer technology is key to further reductions in thermal imaging system size, weight and cost, and reduced supply risk for germanium optics.

Uncooled thermal imaging technology provides our soldiers an unmatched mission advantage. The ability to detect and engage threats during periods of darkness and reduced visibility is critical. The continued reduction of size and weight is necessary to reduce physical burden on soldier performance. With continued reductions in size, weight, and power, new miniaturized and hand held devices may be realized. Twelve micron pixel pitch is the next generation pixel size that maximizes performance and cost benefit. This project will develop and evaluate 12 micron pixel technology over 24 months prior to large scale sensor and system development.

Project benefits include:

1. Smaller focal plane array increases availability to Warfighter without capital investment
2. Smaller aperture reduces cost and dependence on germanium optics
3. 12 micron pitch optimizes system range performance – additional gains below 12 um are small
4. Man-portable applications become smaller and lighter but maintain performance
5. New soldier-borne applications enabled

Tab 20 – Project Title: **Design & Implementation of an Innovative Manufacturing Process for Aerial & Land Supply Needs**

Performing Organization: Rutgers University

Project Cost: $566,203

Government Point of Contact: Mr. John Dormer, Contracting Officer (john.dormer@dla.mil)

Project Summary:
This project will design and implement a fully automated innovative manufacturing process for the development and production of a flexible cushioning system. The cushioning system allows for loads of supplies to be free-dropped from an aircraft at very-low altitude. Because of the structural attributes or characteristics of the package itself, the supplies land at the desired point in the area of operation with no damage to the supplies and in a condition that facilitates quick recovery and distribution. Other applications of the use of this manufacturing process include the design of flexible light-weight high-strength pallets from paper and composite materials to be developed in collaboration with U.S. Army Natick Soldier RD&E Center.

This project leverages previous development of a geometric theory for folding flat sheets of material into intricate three-dimensional patterns. The theory ensures that the generated patterns can be folded and can generate patterns with extensive geometric variations within the same family of patterns. The generated patterns can then be used, depending on the sheet material and type of applied loads, in many applications such as such as sub-packs for low-cost, low-altitude, free-drop pallets and other high energy absorption packaging systems for the US Army supply chain system. It was shown through impact testing and field testing at Tobyhanna Army Depot that the new cushioning system is capable of absorbing high energy without damaging its contents. The manufacturing process will be fully automated to produce cushions and other protective systems and pallets with different energy absorption capabilities depending on the fragility of the cargo being shipped or air dropped and the conditions of the drop. The project will demonstrate a prototype machine with many features that begin by using input data from the user such as the weight of the package content, the fragility of the items being transported (via air or land) and the altitude of the drop and other relevant information. In turn it calculates the optimum design for the cushioning system. Once accepted by the user, the machine will control manufacturing parameters to produce folded patterns with lengths equivalent to the size of the cushion pads with the calculated thicknesses. Once the proper number of layers of folded sheets is stacked to meet the desired size of the pad, the finished pad is ejected and the process continues for making the remaining pads.

Project benefits include:

1. Capability for the Department of Defense to produce new sub-packs and low-cost, reduced-volume, delivery protection systems.

Tab 21 – Project Title: **Maritime Integrated Improvement Plan**

Performing Organization: WELCOR, Inc., College Park, MD

Project Cost: $590,336

Government Point of Contact: Mr. John Dormer, Contracting Officer (john.dormer@dla.mil)

Project Summary:
This project will identify and report quality and process improvements to the casting industry critical to the US naval shipbuilding industrial base. The project will consider four commercially available and demonstrated project elements; Job Shop Lean, Physics Based Software Tools, Technical Process Evaluation, and Computed Radiography integrated into a best practice suite of skills. High impact casting houses in the maritime sector will be selected and a benchmarking effort will be conducted with the target foundry. WELCOR will determine which of several tools and processes would most benefit the foundry, and then implement those elements leaving the foundry with the tools needed to continue at an industry best practice level.

Empirical data from submarine casting houses indicate that over 90% of castings require significant surface repair and that approximately 10% require significant through wall weld procedures to meet quality requirements. Late casting component deliveries of engine room and auxiliary components tripled the installation costs and were the direct cause of significant and costly schedule work-arounds.

Tab 22 – Project Title: **Digital Depot Implementation at Letterkenny for Manufacturing Process Modeling, Simulation & Optimization**

Performing Organization: BAE Systems

Project Cost: $1,199,975

Government Point of Contact: Mr. John Dormer, Contracting Officer (john.dormer@dla.mil)

Project Summary:
This project will leverage recent Army ManTech investment in Model Centric Design for FCS-MGV production readiness; and significantly change the paradigm that depots follow to produce work instructions and other production documentation. The project will give depots, like Letterkenny, the tools and skill sets necessary to prepare audio visual based work instructions using the same 3D models used to design vehicles like BAE Systems' RG33 MRAP(Mine Resistant Ambush Protected). The targeted application is MRAP vehicle repair, remanufacture, and sustainment.

BAE recently finalized an agreement with Letterkenny Army Depot and has established an on-site BAE production facility at the depot. BAE has subsequently transferred much of its RG33 MRAP Final Assembly activity from their York, PA plant to the Letterkenny partnership area. Through this partnership RG33 Final Assembly is being performed by government employees at the depot on BAE new-build MRAPs. This presentes an opportunity to also use the BAE 3D design models and Model Based Definition for the repair and rebuild of MRAP vehicles at the Depot. The 3D model based definition for new-build production documentation can be readily reconfigured to provide animated (AVI-based) work instructions for maintenance assembly and disassembly.

Digital Depot significantly reduces the cost and cycle time associated with preparation and application of depot maintenance work instructions and labor support material. Savings in excess of 30% are common. The animation provided for process visualization facilitates rapid learning and optimized application of quality engineered repair/rebuild procedures. This capability enables those depots committed to MRAP vehicle sustainment to do so in the most cost effective and schedule efficient manner possible. This then helps to ensure rapid vehicle throughput at the depots, timely return to theater, and added protection and safety for the Warfighter.

Tab 23 – Project Title: **Compression Molded Composite Antennas - an application of Compression Molding as an alternative to Vacuum Bag/Autoclave Processing of Structural Composite Antennas**

Performing Organization: BAE Systems, Nashua, NH

Project Cost: $638,486

Government Point of Contact: Mr. John Dormer, Contracting Officer (john.dormer@dla.mil)

Project Summary:
This project will develop an alternative process to manufacture high performance imbedded composite antennas. This alternative approach will use a heated platen press and precision molds as an alternative to vacuum bag/autoclave processing as a means for improving product quality and cycle time, while reducing capital expenditure, cost, floor space, and energy costs. The work will be performed at BAE Systems Advanced Composites Manufacturing (ACM) facility, located in Merrimack, NH. The process will result in higher processing throughput with reduced variation compared to current vacuum bag/autoclave processes. The vacuum bag/autoclave process currently used is predominate in the industry. This development represents a substantial departure from that norm. BAE Systems will purchase and install the necessary platen press required to support this process development effort in early 2009 in support of this initiative. Included in this project are material costs necessary to support the destructive and non-destructive testing required to develop the process and fully qualify the final resultant process. The project period of performance is expected to be 18 months.

This development project provides for improved and sustainable production capability, an enabler to meeting one shipset per day F-35 Full Rate Production, and ability to meet surge requirements should that be required. An estimated 30% cycle time and 10% labor improvement is anticipated, while a 50% reduction in floor space required to meet rate is expected. This development provides for more affordable aperture products for the JSF and will enable ACM to provide realistic schedule execution of full rate production of 4 apertures per day.

Tab 24 – Project Title: **Improved Microcircuit Characterization Tool for Reverse Engineering**

Performing Organization: Sarnoff Corporation

Project Cost: $1,581,311

Government Point of Contact: Mr. John Dormer, Contracting Officer (john.dormer@dla.mil)

Project Summary:
This project will improve the resolution accuracy, time to complete a netlist extraction, and the efficiency of the reverse engineering process associated with the microcircuits in the military electronics supply chain. The upgraded reverse engineering tool will be integrated into the Advanced Microcircuit Emulation Validation (AME) Program under the Defense Logistics Agency (DLA) Manufacturing Technology Program at the Integrated Circuit Center in Princeton, New Jersey. It will be used to support the emulation of a larger class of obsolete microcircuits. It will also be used to support certifications regarding the state of trust of microcircuits entering the military supply chain from non-U.S. manufacturing locations as directed by the Department of Defense.

Under the AME Program, a prototype reverse engineering tool was designed and built that demonstrated that the netlist for a microcircuit could be extracted from a physical specimen. The sample was a microprocessor used in the F-15 aircraft. During the course of the reverse engineering of the microprocessor, the reverse engineering tool which employs electron beam and optical imaging sensors, identified circuits that were not a part of the master documentation owned by the original manufacturer (the situation was resolved in favor of the reverse engineering findings). Using the extracted netlist created by the tool, the processor was emulated and successfully tested to be an equivalent microprocessor. The project demonstrated the reverse engineering tool could detect undocumented circuits and could be used in conjunction with emulation to create Qualified Manufacturers List (QML) certified National Stock Number (NSN) replacements.

The current tool is the property of DLA. Improvements proposed will remain under DLA ownership. There are no technical or programmatic impediments to completing the proposed project. The prototype tool, which required seven years of development, has been completed and demonstrated. Hardware and software associated with the quantified improvement goals can be purchased and integrated into the existing tool architecture. The engineering staff assigned to the proposed project are the individuals who developed the prototype reverse engineering tool. The improved tool will be capable of keeping pace with newer more complex microcircuit electronics to fill Defense Supply Center Columbus (DSCC) bins and support aviation, maritime and land based weapon systems.

The benefits to the military supply chains, when the upgraded reverse engineering tool project is completed, are: less reliance on documentation as a requisite for emulation, less pressure for lifetime buys, a larger class of NSN microcircuits capable of benefiting from emulation, and a means to certify the trustworthiness of microcircuits for military use.

Tab 25 – Project Title: **Weapon Power Systems Development of industrial process for high yield & high quality automated thermal battery stacking & inspection**

Performing Organization: Advanced Thermal Batteries Inc. Cockeysville, MD

Project Cost: $ 641,361

Government Point of Contact: Mr. John Dormer, Contracting Officer (john.dormer@dla.mil)

Project Summary:
This project will develop an automated manufacturing process for producing advanced thermal batteries for defense use. Even after 50 years of dependable service to the warfighter, the majority of today's thermal batteries are manually assembled. The project will develop the use of advanced assembly robots or pick and place technology and machine vision system to eliminate the labor intensive manual operators for layout, stacking, and inspection of the electrochemical and pyrotechnic powders cold pressed into one or two layer disk pellets that make up these batteries. The process should allow fast and reliable automated assembly and electronic visual inspection. The robot would eliminate mis-assemblies and be able to operate around the clock for increased production throughput.

Changeover and the ability to reprogram quickly will be critical features for the robot as small lots of 50-200 batteries are typical. The advantages of this automation process are: improved quality and reliability by reducing the human factor, reduced labor cost, increased production capability, and fast response capability to production surge. This effort provides an improved quality product at a lower cost and will benefit the warfighter by increasing safety and mission success due to the quality and reliability enhancement. Period of performance for this project is within 14 months. The project will result in saving from 5 to 10% of thermal battery manufacturing costs (reduced labor and improved yield). ATB will invest in the capital equipment estimated at $350,000. The improvements described in this proposal will apply to thermal batteries in many systems used by the Army, Navy, Air Force and Marines. The manufacturing achievements of this task may be transferred to all thermal batteries suppliers compounding the quality improvement and cost saving to the government. Savings to the government by ATB alone are estimated to exceed $500,000 per year and grow to $1,000,000/year within a few years.