

PUBLICALLY AVAILABLE CTMA I, II, & III FINAL REPORTS **(Reports listed alphabetically by project title)**

155MM Spindle Corrosion Improvement Program (SCIP)

[NCMS Project 140478, Final Report 10/14]

The Spindle Corrosion Improvement Program – Phase I designed, fabricated and tested a prototype hard chromium plating (HCP) conforming anode system for depositing chromium onto 155mm Howitzer spindles. Plated spindles were subjected to an equivalent of approximately five months of unprotected exposure to the elements. The spindle plated using the CTMA prototype tooling performed approximately five times better than the existing HCP process.

2D-3D Data Model Between Fleet Readiness Center Southwest, Fleet Readiness Center East and Fleet Readiness Center Southeast

[NCMS Project 140503, Final Report 12/14]

The project focused on allowing resources from other FRC locations to participate in any portion of the Manufacturing Model Management System process via remote access to FRC Southwest's PLM environment to prove the "One FRC" concept promoted by COMFRC. Capabilities to search and share data enhanced maintenance and logistics processes.

Advanced Digital Fabrication & Repair (ADF&R), A Rapid Manufacturing and Repair Program (RM&R) – Phase I

[NCMS Project 140367, Final Report 8/06]

Advanced digital fabrication rapid prototyping (ADF-RP) rapid tooling technologies offer an economical and time-saving solution to the legacy and obsolescent part supply and repair issues being faced today throughout the maintenance and supply systems. Comprehensive investigations of ADF-RP technologies and their applications included: Benchmarking State-of-the-Art, Standards, Software/Data Capture, System Developments and Integration, Material Developments and Application, Advanced Digital Fabrication, and Technology Transfer.

Advanced Distributed Learning Using the Maintenance Mentoring System (MMS) – Phase I Deployment

[NCMS Project 130917, Final Report 10/99]

Both DoD and the commercial industrial sector had an immediate need for diagnostics and repair tools, based on logical thought processes and utilizing fully interactive information retrieval technologies, that allows skilled technicians with diverse experience, training, and expertise levels, to effectively troubleshoot and repair systems efficiently and at significantly lower costs. The Maintenance Mentoring System (MMS) was designed to increase the accuracy, cost effectiveness, and efficiency of the maintainer. The existing technical information was reengineered for during-the-job delivery. For deployment technology, commercial-off-the-shelf (COTS) hardware and software was utilized to implement the information solution directly at the worksite.

Advanced Mobile Electrical Fault Detection and Isolation Tester (AMEFDIT) for All Aircraft Subsystems

[NCMS Project 140509, Final Report 3/15]

The purpose of the initiative was to evaluate the new electrical wiring tester, AMUET, developed by a Canadian company, Solavitek, on two selected electrical subsystems on the C-130 at Warner Robins ALC. While the project budget imposed some limitations on the scope of work, the overall results demonstrated that AMUET was a very agile platform to configure and operate. AMUET capabilities were demonstrated on two subsystems on the C-130 (engine instrument and anti-skid

braking). Objectives for set-up and operational performance in the D-Level and potentially for the O-Level testing were met.

Alternate Fuel/Energy Conversion of USMC Ground (non-tactical) Vehicle – Assessment of Benefits and Maintainability

[NCMS Project 140716, Final Report 10/15]

The initiative focused on evaluating the utility, feasibility, and maintainability of utilizing propane fuel as a power source in wheeled vehicles converting select vehicles at Camp Pendleton, CA. Utilizing the Bi-Phase gas-to-propane conversion system, the USMC will become compliant with the DoD directives for reducing fossil fuel use, reduce operating costs, and improve the USMC CO² footprint.

America's VOICe™ Focus on Depots

[NCMS Project 140495, Final Report 2/15]

Imaginestics, created a web-based system called America's Virtual Opportunity Interchange Center (VOICe)™. Buyers could post their opportunities within that marketplace which either filtered to suppliers who were subscribed or use a state-of-the-art matching engine to automatically find supplier matches. As a secure, hosted networking platform, the America's VOICe™ platform allowed both buyers and suppliers to make their data and opportunities as public or private as desired and associate themselves with vetted trust networks of companies as appropriate for their needs.

Assembly Design and Documentation (AD&D) – Phase I

[NCMS Project 140407, Final Report 4/08]

Assembly/disassembly planning and documentation remains a manual process that is often dependent on the skill and experience of the individual defining the process. This project utilized commercial software solutions integrated with technology developed. Initial trial of the system achieved reductions in assembly process planning cycle times from about 30 days without the automation developed in this project to 15 days with it.

Attaining Manufacturability of Additive Manufacturing (AM) Parts via CTMA RARE Parts Collaboration

[NCMS Project 140730, Final Report 9/15]

The Rapid Access to Readiness Essential (RARE) Parts program through the National Center for Manufacturing Sciences (NCMS) has provided a wide range of services to the AM User community over the past 23 years. Under this initiative the DoD Metal AM Qualification and Certification Working Group and the NCMS Commercial Technologies for Maintenance Activities (CTMA) RARE Parts team worked together to keep the AM work of the RARE Parts collaboration going. It brought users and developers communities together for the significant benefit of wider adoption and use of AM. The RARE team provides a broad depth of knowledge and real-world experience, as well updates on the latest research and development in AM.

Automated Intensifier Measurement System (AIMS II)

[NCMS Project 140433, Final Report 12/10]

This project developed and deployed automated test equipment for night vision tubes which as the ability to replace the outdated manual test equipment presently used by government and industry. This capability will reduce cycle time for returned night vision devices and significantly reduce costs by increasing the reuse of image intensifier tubes.

Automated Intensifier Measurement System (AIMS) Correlation Upgrade Support

[NCMS Project 140500, Final Report 3/14]

AIMS uses automated machine vision techniques to reliably characterize image intensifier tubes and low light digital sensors. Although reasonable correlation was established between the NVESD manual test sets and AIMS, there were some tests that required refinements which were completed under this project. Upgrades were made to hardware, firmware, test procedures as well as adding new capabilities.

Automated Process & Inspection Guide (AP&IG) – Phase I

[NCMS Project 140421, Final Report 10/12]

The Commercial Technologies for Maintenance Activities (CTMA) Automated Process & Inspection Guide (AP&IG) Phase I project standardized both the inspection data and the inspections process for depot maintenance facilities. It utilized Aspire Solutions, Inc (ASI) commercial off-the-shelf (COTS) software application combined with COTS ultra-mobile PC technology to guide the user through the inspection process (improve accuracy) and standardize the defect data (enhance analysis capabilities).

Automated Process & Inspection Guide (AP&IG) – Corpus Christi Army Depot Pre-Shop Analysis (PSA)

[NCMS Project 140457, Final Report 10/13]

The project was unique in that it involved two pilots centered around a USAF Pave Hawk helicopter to standardize both the inspection data and processes for quality assurance and standardize pre-shop analysis evaluation data and processes. Strong bottom-line results reduced time and provided more consistent and repeatable evaluation processes.

Automated Process & Inspection Guide (AP&IG) – Data Capture at Rock Island Arsenal

[NCMS Project 140445, Final Report 11/13]

As part of the realignment of documentation from Rock Island to TACOM, this project focused upon how to effectively and efficiently extract meta-data and properly index a digital file to make it easily searchable. It also involved optimizing the file so that file sizes were manageable without impacting optical character recognition quality and readability.

Automated Process & Inspection Guide (AP&IG) In-Process Mobile Paper Replacement Validation Solution (IMPROVS)

[NCMS Project 140477, Final Report 12/13]

The project replaced inefficient paper-based processes with mobile data capture devices combined with Aspire Solutions, Inc.'s COTS software for Red River's repair programs. Return on investment for the first year is \$373K in combined manpower hours, paper savings, storage space and research hours expended.

Automated Process & Inspection Guide (AP&IG) Summarization

[NCMS Project 140421, Final Report 12/13]

Utilizing Aspire Solutions, Inc.'s commercial off-the-shelf (COTS) software in conjunction with COTS mobile computing devices allowed depots and worksites to realize improved accuracy and standardized inspection results. Strong bottom line results were delivered showing improvements in the cost to inspect/repair systems while reducing the overall number of personnel required.

Automated Rotor Blade Stripping System (ARBSS) Enhancement

[NCMS Project 140504, Final Report 3/14]

In 2009, an NCMS project successfully demonstrated that a laser-based coating removal system could be integrated with a robotic positioning capability to operate within a Navy rotor blade sustainment environment. Currently, however, the ARBSS coating removal process is not formally approved for use on V-22 material. The principal concern was that the copper mesh in the V-22 material may adversely interact with the laser energy to induce heating and substrate damage not observed in the original ARBSS qualification testing. There was no evidence that temperatures within composites processed reach levels that would cause concern nor was there any significant damage to the composite in terms of strength or modulus variations.

Automated Test Equipment (ATE) Synthetic Instrumentation – Phase I & II

[NCMS Project 140375, Final Report 6/12]

Since automatic test system test stations are employed throughout the DoD maintenance hierarchy, the transition from traditional instruments to synthetic instrumentation presented a significant opportunity to mitigate hardware obsolescence, reduce the equipment footprint, improve adaptation to emerging requirements and reduce the overall lifecycle cost of automatic test systems. Performance was benchmarked against the legacy U.S. Air Force F-15 Electronic Systems Test Set (ESTS).

Automated Test Equipment (ATE) Test Program Set (TPS) Migration System

[NCMS Project 140376, Final Report 7/09]

The Test Program Set (TPS) Migration System project was undertaken to provide lower migration costs, for depot Automated Test Systems (ATs) and their support lifecycles, when equipment modernization is required. ATs are employed to facilitate diagnosis and repair of failed and suspect weapon system components. These ATs are being upgraded with modern supportable commercially equivalent test platforms that are developed to take the Air Force repair capability forward for another extensive period. Initially the project evaluated emerging technologies for migrating test applications when ATs are modernized or upgraded. This capability analysis led to a more pragmatic focus on existing commercially available environments that held promise in resolving the cost issues with porting legacy applications to the new generation systems.

Barstow Air Pollution Control System (APCS) Improvements – Phase I

[NCMS Project 170605, Final Report 12/01]

Pollution control equipment for paint lines can be a manufacturing facility's costliest environmental item and coating facility operators are always interested in better and cheaper ways to achieve environmental compliance. As new manufacturing lines are built, and as old lines are upgraded, the technology must be periodically reviewed to be sure a facility is making the most sensible decision in selecting its pollution control equipment. This project worked with the Barstow Marine depot to identify pollution control technology for their current paint booth as well as a larger facility to be constructed. The results can be applied to a wide variety of military and commercial facilities.

Barstow Air Pollution Control System (APCS) Improvements – Phase II

[NCMS Project 170609, Final Report 7/06]

Painting operations release large quantities of solvent vapors into the atmosphere. Painting operations can constitute a facility's single biggest environmental impact, with the greatest associated environmental compliance costs. This project developed a fundamentally new biological design, from initial concept to a pilot model tested on an operating paint line expected to operate at 25% of the cost of a thermal oxidizer.

Casting Knowledge Reuse-Based Cost Advisor – Phase I

[NCMS Project 140390, Final Report 7/08]

A prototype of an Intelligent Casting Cost Advisory system that reuses existing casting knowledge to provide users with real-time advice on “should costs” and selection of optimal casting process based on part-design criteria was developed. It is a key technological breakthrough that makes capture of practical production information in a knowledge-based system possible having a significant impact in all facets of the design, development, manufacture and support of current and future weapon systems.

Centralized Fleet Management System (CFAMS)

[NCMS Project 140420, Final Report 7/09]

The Centralized Fleet Asset Management System (CFAMS) is a wireless fleet management hardware and software solution designed to optimize operations (both remanufacturing and supply), decrease maintenance costs, while improving equipment readiness, optimize fleet size, reduce vehicle and facility damage, and dramatically improve overall safety. Because CFAMS automatically captures motion hours, as well as movement with load data, the system enables changing to motion, or condition-based preventative maintenance.

Centralized Fleet Automated Management System (CFAMS) Red River Army Depot Assessment Project (RRAP)

[NCMS Project 140449, Final Report 6/16]

CFAMS looks very promising and has exceeded initial expectations in cost savings and features, but highlighted a critical need within the DoD to more effectively manage its industrial vehicle fleet and garner considerable savings that have never been achieved previously specifically within the material handling equipment (MHE) fleet. RRAD was unable to implement the CFAMS pilot demonstration methodology due to a number of unforeseen extensive and uncontrollable delays which then became barriers and blockers to success at RRAD.

Coalition Logistics Interoperability/Joint Logistics Integration (CLI/JLI)

[NCMS Project 140487, Final Report 11/13]

The CLI/JLI project explored, demonstrated, studied, and calculated the benefits of a suite of advanced logistics interoperability enablers. Principal technologies were demonstrated and proven at three separate logistics technology exercises. The events provided unique opportunities to evaluate these capabilities and develop strategies for a way forward.

Collective Mind: Avoidance of Maintenance Cost Through Predictive Trending

[NCMS Project 140498, Final Report 12/14]

The Collective Mind initiative was launched to demonstrate the value of “Big Data” analytics in a maintenance environment. Big data analytic system algorithms are optimized for rapidly scanning and processing data systems to notify maintenance and supply managers about emergence of possible significant problems substantially earlier. The project began to explore the hypotheses and accomplished its limited objective.

Composite Materials Substitution Methodology Development

[NCMS Project 140163, Final Report 5/00]

The objective of this project was to provide a standardized methodology to enable DoD depot and field repair facilities to determine suitable substitute materials for weapon system repair and re-manufacture. The project deliverable included assessment of OEM specifications for material substitution issues, draft tests, and procedures to enable organic implementation of science based

material substitutions, and a software tool to aid in the implementation of the substitution methodology.

Contractor Property Management of Maintenance

[NCMS Project 140491, Final Report 11/13]

A detailed end-to-end study was conducted of the current Contractor Property Management process, taking into account the upgrades planned for the near future. Potential gaps were identified and recommendations were made to correct or alleviate these weaknesses.

Corrective Forming of 701 Skin Panels for F-18 Overhaul

[NCMS Project 140472, Final Report 8/13]

Metal Improvement Company, a subsidiary of the Curtiss-Wright Corporation, has developed an advanced laser peening process that can be used for custom metal forming to predict the laser peening pattern, intensity and coverage required to achieve a needed shape correction in out-of-spec 701 skins. The model has been benchmarked against a rigorous set of small panel tests for which the comparison of model predictions versus measured effect have been remarkably accurate.

Corrosion Resistant Solid State Thin-Walled Component Joining for Maintenance and Repair Applications (Deformation Resistance Welding) – Phase I and II

[NCMS Project 140439/140456, Final Report 2/14]

The project sought to develop and test a new solid state joining method called Deformation Resistance Welding (DRW) that did not melt the materials to be joined thus increasing dimensional accuracy, corrosion resistance, and weld cycle time. The solution was constructed and installed on two HMMWV vehicle sub-structures and blast tested.

Damage and Wear Assessment Using Condition-Based Monitoring

[NCMS Project 140324, Final Report 9/05]

Traditionally maintenance has followed the philosophy of either run-to-failure or planned maintenance at regular intervals. Each of these approaches has been found to be more expensive and time-consuming when compared to condition-based methods, under which the condition of a machine is monitored and maintenance is only undertaken if conditions warrant it. This method equally applies to manufacturing processes where the settings of some machines or components may need to be altered based on the monitored condition of the process.

Defense Procurement and Acquisition Policy (DPAP) Program Development and Implementation (PDI) Support

[NCMS Project 140455, Final Report 2/13]

This project provided support to the OUSD in their multi-faceted effort to improve business processes in the DoD. The overall objective was to examine the data structures and processes that support essential programs, procedures and policies providing accountability, visibility and interoperability among and between government agencies, industrial partners and international allies.

Development and Evaluation of Near-Dry Machine Tools for the Production of Aluminum Components – Phase I

[NCMS Project 150320, Final Report 4/03]

This report summarizes the first of a two-phases of The Development and Evaluation of Near-Dry Machine Tools for the Production of Aluminum Components (Near-Dry) project to determine if the near-dry machining (NDM) process offers enough technical and economic benefits to replace the

conventional high-pressure through-the-tool coolant process—the WET process. NDM, which uses small quantities of biodegradable lubricant, circumvents most of the health and safety issues associated with conventional metal-cutting coolants and it is less expensive to own and operate than the WET process.

Development and Evaluation of Near-Dry Machine Tools for the Production of Aluminum Components – Phase II

[NCMS Project 150320, Final Report 12/03]

This report summarizes the second of the two-phase project whose objective was to evaluate the achievable benefits from an advanced near-dry production machining process. Machining Enterprises, Inc. (MEI), a parts manufacturer for the automotive industry, piloted the first phase of the program by machining 30,000 GM engine brackets. Data from this pilot project established the technical and economic feasibility for using near-dry technology in a U.S. factory. In comparison to a conventional process incorporating high-pressure coolant delivered through the spindle, the near-dry process was determined to be 8.5% less expensive - even without taking into account the costs of eliminating a central coolant treatment facility as well as the costs of dealing with coolant-related health issues.

Development of a Validated U.S. Marine Corps Maintenance and Sustainment Lifecycle Cost Management Model

[NCMS Project 140483, Final Report 6/16]

As a result of a multi-pronged, holistic approach, the Marine Corps uncovered dated, redundant, and/or obsolete policies, inefficient processes across ground equipment management, inefficient sustainment strategies, ill-informed programming inputs, and recognized opportunities for maximizing stewardship and efficiencies. Modification of Marine Corps policies and practices for holding responsible and accountable officers to prescribed standards for equipment accountability has begun, but will be an ongoing effort.

Development of Operational Transition Procedures and Sustainment Analysis for GCSS-MC Supply and Maintenance Functions – Phase I

[NCMS Project 140706, Final Report 6/15]

The global collaborative initiative enabled industry to have greater insight into the issues resulting from transitioning to a modern global logistics information system from legacy “stovepipe” information systems. Industry and DoD partners assessed current implementation gaps and developed optimal operation procedures for supply and maintenance activities that were required to maximize the benefits of global logistics information infrastructure implementation. The increased accountability accuracy derived from these efforts will lead to smaller on-hand inventories and stockage levels saving potentially millions of dollars in assets and man-hours.

Development of Operational Transition Procedures & Sustainment Analysis for Global Logistics Information Systems' (GLIS) Supply and Maintenance Functions – Phase I

[NCMS Project 140727, Final Report 2/16]

This initiative has acted as a force multiplier accelerating the GCSS-MC tool for MEF specific business processes, standard operating procedures and exercises. Through hands-on detailed training specific to each Unit's situation, a better understanding of the system has been gained. The ability to train and educate the Marines in their workspaces and conducting their Unit's actual supply and maintenance operations has provided an understanding that has increased efficiency and effectiveness.

Digital Pen and Paper for Capturing Maintenance Data

[NCMS Project 140501, Final Report 2/14]

The purpose of the study was to investigate the potential for time and quality improvements by capturing the user's written data with a digital pen. The study also investigated potential process improvements that could be undertaken as a result of the use of the digital pen. It was found that a median of 7-11 days cycle time reduction could be attained; up to a 6.3% cycle time improvement for a planned 175-day repair process.

Durable Non-Skid Coatings for Carriers

[NCMS Project 140399, Final Report 2/09]

Flight deck non-skid coatings must withstand extreme service conditions, including impact, abrasion and exposure to organic fuels and lubricants. Coatings were developed that met or substantially exceeded all MIL-PRF-24667B(SH) requirements for Type I (High-Durability) and Type V (Extended Durability) non-skid coatings.

e-CM: Electronic Collaborative Maintenance for Depot Repairs and Manufacturing (e-Collab)

[NCMS Project 140167, Final Report 12/04]

With defense electronic equipment lifetimes of 20 years or more, almost all such systems will, before the end of their useful life, encounter a situation where a component needed for repair is no longer available from routine stock. The current solution is for estimators to spend hours, even days, telephoning potential suppliers. This project sought to develop a web site to which estimators could post lists of parts sought, listed by project, and broadcast notifications of new posts to a list of potential suppliers. Suppliers could then scan the parts list and enter budgetary estimates of part prices for any parts they could supply. The estimator could then provide a much more accurate and timely estimate of the cost to repair a given system.

Embedded Decoupling Capacitance

[NCMS Project 160213, Final Report 12/00]

This collaborative effort advanced the use of embedded capacitance technology for power supply decoupling. The deliverables consisted of materials development and characterization, and board fabrication process development. This 132-page report presents the results of the tests to evaluate newly developed planar capacitance materials and fabrication processes. More than 135 charts, tables, photographs—many in color.

Enabling Interoperability in a NATO Environment through Maintenance and Repair Activities

[NCMS Project 140466, Final Report 2/13]

The goal of this project was to build and test (in a live environment), a system that can facilitate logistics interoperability among and between coalition partners. Commercial off-the-shelf tools were enhanced to facilitate the sharing of maintenance and supply data across the enterprise between coalition allies.

Enhanced Wiring Integrity Systems (EWIS) – Phase I

[NCMS Project 140328, Final Report 8/06]

The EWIS project provides improved commercially-available test systems to enhance the troubleshooting and testing capabilities of the maintainers and ultimately improving the overall integrity of electrical wiring systems. This technology is embodied in a handheld, easy-to-use, meter enabling the operator to rapidly connect, detect and locate hard faults in wiring assemblies. The unit performs a test in four seconds, displays the fault location in human readable characters and has

computer-based training that requires only 45 minutes to complete. Personal computer-based SWR software utilities provide the ability to download from the meter, via serial bus, test waveforms for analysis.

Enhanced Wiring Integrity Systems (EWIS) – Phase II

[NCMS Project 140430, Final Report 10/11]

Quick identification of the faulty wire path and location of the fault assists greatly in providing increased mission readiness. EWIS I was centered on a reactive maintenance posture that was practiced at all maintenance levels. EWIS I effectively incorporated the use of the EWIS technology in the established reactive maintenance environment. EWIS II, also funded through the NCMS/CTMA Program, targeted implementation of new methods of electrical inspection to help foster a proactive posture. Multiple test protocols and other prognostic test approaches were implemented in EWIS II for feasibility in the DoD maintenance community. The equipment delivered under EWIS II is scalable and open architecture, which enables integration of future test capabilities and technology enhancements.

Enhanced Wiring Integrity Systems (EWIS) at Barstow

[NCMS Project 140452, Final Report 7/13]

Wiring-based systems are the fundamental backbone that supports today's vital communication, weapons system and related asset control functions. Specific to Barstow, EWIS tools were provided and software developed to test electrical systems for the M1114 Humvee.

Enhancing DoD Maintenance Interaction with Industry using Virtual Methodologies

[NCMS Project 140497, Final Report 12/13]

Virtual events cannot replicate every aspect of physical meetings, but given budget constraints and travel restrictions, events using solutions like the one created for this project can prevent cancellations and foster virtual collaborations.

Enterprise Condition-Based Maintenance Plus (eCBM+) Interoperability – Phase I & II

[NCMS Project 140810/836, Final Report 12/16]

Key elements of this initiative included development of an overall eCBM+ template architecture, including integration with the data stores of NAVAIR's closed loop Hadoop environment, metadata management, governance, data cleansing methods and data quality assessments, as well as development and interpretation of appropriate advanced analytic methods based on specific use cases; specifically, an end-product that provided value to specific maintenance tasks.

Environmentally Friendly Hot Cutting Solutions for Support of the Opacity Initiative – Phase I

[NCMS Project 125261, Final Report 7/12]

This project sought to develop alternative environmentally friendly cutting methods and explore new methods of reducing emissions in order to comply with air operating and water discharge permit requirements at Puget Sound Naval Shipyard & Intermediate Maintenance Facility (PSNS & IMF). It included investigations of alternate oxyfuel gas cutting and equipment as well as alternate cutting processes, such as plasma arc cutting and laser cutting.

Erosion/Corrosion Resistant Coatings for Gas Turbine Engine Compressor Systems Operating in both Sand and Maritime Environments

[NCMS Project 140428/440/459/476, Final Report 6/16]

The overall approach started with previous efforts to first document the condition of inducted T56 compressor airfoils and conduct component erosion and corrosion tests on uncoated and coated

compressor airfoils. MCT's BlackGold® erosion/corrosion resistant coatings successfully completed a competitive evaluation of the coating by Rolls-Royce. MCT's BlackGold® erosion/corrosion coating demonstrated significant benefits for T56 engine operations that will translate into reduced maintenance and fuel costs, increased engine readiness and decreased emissions.

Extended Life of Lead-Acid Deep Cell Cycle Batteries Through a Planned Maintenance System using Chemical Battery Corrosion Desulfation

[NCMS Project 140510, Final Report 8/14]

One can double the life expectancy of rechargeable lead-acid batteries by a proper planned maintenance system and TBDSCC corrosion desulfation. The end result was a cost avoidance of \$5,000 to \$12,000 or more for one battery "unit" in prematurely replacing deep cell cycle battery systems. Additional costs can be avoided which would be associated to machinery downtime and labor. Corrosion desulfation with TBDSCC Compound extends the life of the battery and reduces capital expenditures on additional batteries.

Extending Advanced Distributed Learning Initiatives through Maintenance Activity Mentoring Systems – Phase II (MMS II)

[NCMS Project 130925, Final Report 2/04]

The MMS II collaborative project team developed a software application, the MMS, to assist technicians in the repair and maintenance of large, complex mechanisms such as the AV-8B Harrier aircraft engine, MMS II tested the effectiveness of distributed learning technologies for maintenance activities for workforce productivity improvements when overhauling the AV-8B Harrier Rolls Royce engine at the Marine Corps Air Station (MCAS) NADEP Cherry Point, North Carolina.

Fastener Removal Improvement Technology Adoption (FRITA)

[NCMS Project 140471, Final Report 9/15]

E•drill is a handheld implementation of electro-discharge machining (EDM) technology that cuts a circular groove into the head of a fastener to a depth corresponding to the head thickness. After cutting, a thin fillet of material is left between the fastener head and shank; this fillet is easily fractured when the cut fastener is struck with a hammer and punch. While demonstrations have shown great potential in labor savings and health, safety and environmental benefits, it was difficult to expand its usage beyond a couple applications within the Department of Defense (DoD).

Fast Field Fluid Assessment Support Tools (3 FAST) – Phase I-III

[NCMS Project 140414, Final Report 7/13]

The joint collaborative project was established in order to supply specifically a handheld infrared spectrometer with an integrated viscometer reporting kinematic viscosity at a fixed temperature. The project resulted in successful deployment of two handheld products for the analysis of fluid condition and contamination properties of lubricants and some fuels.

Global Combat Support System-Marine Corps (GCSS-MC) Future Capabilities Assessment and Prioritization Initiative

[NCMS Project 140711, Final Report 5/15]

The purpose of initiative was to assist in the development of investment recommendations for the GCSS-MC program. Given current fiscal realities, alternatives were required to identify a means to provide the greatest amount of capability at the least cost. Foundations were laid for improvement in GCSS-MC capability development. The Marine Corps can use the results of this analysis to prioritize capability development and programmed resources.

Heat Induction Removal of Special Hull Treatment (SHT) using Exoskeleton and zeroG® Arm Technology

[NCMS Project 140481, Final Report 2/13]

This study proved that using human augmentation to accomplish shipyard tasks involving heavy tools can improve productivity while mitigating a significant cause of worker injury. The study addressed both quantitative measures of productivity (residue removal rate) and qualitative measures of productivity (worker fatigue, ergonomics, etc.)

Heat Transfer Classification for Production Tooling and Composite Repairs

[NCMS Project 140379, Final Report 7/11]

This project is leading to a paradigm shift in the approach to the autoclave curing of composite parts. Improvements in computer power and sensors now enable higher quality composite manufacturing, and greatly reduced scrap as well. This project developed and tested tools to manage heat transfer for ovens and autoclaves used in the production and repair of composites.

High-Density Chip-on-Board (HDCOB)

[NCMS Project 160207, Final Report 1/04]

The purpose of this project was to develop the assembly process and to test the reliability of using the emerging higher-density surface-mount technology (SMT) devices and the chip-on-board (COB) die on the same printed circuit board with conventional SMT parts. Because of the much smaller and tighter traces and solder pads of this technology, development of the rework/repair processes is a significant capability need for industry and the DoD depot community. This report documents the results of designing, manufacturing, populating, assembly rework and reliability testing of printed circuit boards populated with the variety of high-density components using advanced SMT.

High Performance 3D Scanning Systems

[NCMS Project 140396, Final Report 10/08]

This project resulted in the development of high-speed commercial metrology grade digital shape scanning system. The system does not require special lighting, or use of coatings in many applications, to enable inspection at the point of need without transporting parts to dedicated central inspection areas. Cycle time reductions gained resulted in the need for less pipeline inventory and greater availability. Accuracies of 0.002" were attained to improve quality and reliability. The system is applicable to many other depot and commercial applications.

High Throughput Production Processing (HITHRU) Aluminum Part Deployment

[NCMS Project 140368, Final Report 12/04]

In HITHRU deployment a demonstration was conducted for the conclusive benefits by using Cimskil™ to develop processes for three F-15 real production parts for Warner Robins Air Logistics Center. Programming time was tracked and production metrics captured for comparison to the original processes reinforcing the lessons learned in HITHRU.

High Throughput Production Processing of Five- (5) Axis Aluminum Components (HITHRU) – Phase I

[NCMS Project 150337, Final Report 9/02]

In Phase I an older software system automatically recognized turning and 3-axis milling machined features and automatically created NC code was updated. Feature recognition for 5-axis features typically found in aerospace structural components was developed. Dynamic characteristics of the Cincinnati Machine Lancer V5, vertical 5-axis machining center were measured and cut tests performed to map safe operating zones that maximized the use of spindle power while avoiding

chatter zones. Based on those results an algorithm was devised to calculate axial and radial depth of cut plus spindle rpm for high productivity machining. Feature recognition and cutting processes were validated by using the software on actual aerospace parts. In Phase II the formerly Unix only system was ported to MS Windows and a new user interface developed that allows users to modify feature recognition and method generation rules.

High Throughput Production Processing Five- (5) Axis Titanium Components III (HITHRU III)

[NCMS Project 150339, Final Report 8/04]

In Phase III cutting processes were developed for components made of titanium, 5-axis feature recognition improved, and provision was made for embedding in automated NC output special functions such as torque controlled machining and probing cycles.

Implementation of Innovative Hard Chromium Plating Tooling at Corpus Christi Army Depot – Phase I

[NCMS Project 140384, Final Report 1/06]

Conventional chrome plating process is slow and expensive. Parts must first be masked so that only the desired areas are plated, a time-consuming task that must be performed by skilled artisans. Chrome in a standard plating setup is deposited slowly and unevenly, requiring extensive machining to bring parts back into tolerance. The extra labor contributes significantly to the overall turnaround time and cost of aircraft refurbishment. This project demonstrated the ability of a new development, “no-mask” tooling, to eliminate labor for masking, and to achieve much faster plating times and more uniform chromium deposits. The quality improvement and cost savings were so dramatic that no-mask tooling was adopted for standard production while the project was still underway.

Implementation of Innovative Hard Chromium Plating Tooling at Corpus Christi Army Depot – Phase II

[NCMS Project 140403, Final Report 7/07]

The no-mask concept is relatively new to chromium plating. It involves the design/fabrication of a rack and anode fixture, which are customized to particular parts. The main advantages of this approach are reduced labor for masking, faster plating times and more uniform chromium deposits. Hard chromium plating provides superior wear resistance for a wide variety of surface geometries. During Phase II, custom no-mask anodes were designed, fabricated and implemented for an additional six frequently plated aircraft parts (two during Phase I and six during Phase II), plus design changes were made to one of the Phase I anodes. Also during Phase II, generic tooling was developed for several less frequently plated parts.

Implementation of New Commercial Hard Chrome Plating Tooling at Naval Air Systems Command Depot North Island

[NCMS Project 140404, Final Report 3/07]

The objective of this project was to introduce new electrodeposited hard chrome plating equipment into Naval Air Systems Command (NAVAIR) Depot North Island maintenance activities, including advanced racks, fixtures, and anodes. New prototype tooling was designed, fabricated and tested and changes in production parameters, including costs and process steps were measured and documented. The results of this project will enable plating facilities to produce higher quality parts with substantially less time and effort than was possible with previous technology.

Implementation of Predictive Modeling in Support of USMC Systems Command – Product Group Nine (PG 09)

[NCMS Project 140448, Final Report 7/12]

The Total Life Cycle Systems Management Assessment Software Tool (TLCM-AT™) was used to run “what if” scenarios on maintenance, logistics, policies, removal of parts for repair; and spare consumption for return on investment in terms of readiness and costs for secondary repairable items.

Improved Stealth and Lower Cost Operations for U.S. Naval Ships using High-Performance Cordage (HPC) Deck Edge Netting (DEN)

[NCMS Project 140432, Final Report 6/12]

The primary objective for this project was to extend the use of High-Performance Cordage Deck Edge Netting (HPC DEN) in lieu of nylon strap netting by installing developmental square HPC DEN Spectra/polyester cordage aboard a U.S. Navy test vessel.

Increased Reliability of Full Authority Digital Engine Control (FADEC) System – Phase I

[NCMS Project 140507, Final Report 6/14]

Intermittent electrical failures are driving acquisition and Operations & Sustainment costs in rotary wing aircraft. The purpose of this initiative was the definition of a reliable testing protocol that quickly and consistently identifies electrical issues associated with degradation of reliable performance by FADEC systems on both the MH-47G and MH-6M. The initiative used the Automatic Wire Test Set (AWTS) developed by Eclipse International to develop and successfully execute FADEC testing protocols.

Increased Reliability of Full Authority Digital Engine Control (FADEC) Systems – Phase II: Test Program Set (TPS) Integration and Training

[NCMS Project 140721, Final Report 5/16]

The Phase II CTMA initiative operationalized the use of the Eclipse technology by the U.S. Army 160th SOAR personnel. They were trained in the design of test adapter cables, and for the basic programming and operations of test program sets (TPSs) enabling them to quickly respond to issues being faced in weapon systems electrical systems that were jeopardizing readiness and reliability.

Industrial Human Augmentation Systems (iHAS) for Improved Shipyard Operations

[NCMS Project 140710, Final Report 5/16]

This project conducted a productivity assessment to evaluate the benefits of applying exoskeleton technology to assist depot workers as they used a variety of tooling (e.g. sanders, drills, grinders, etc.) that require periods of prolonged use. Designed to carry the weight of heavy tools, the iHAS allowed the completion of arduous tasks with a higher degree of quality while eliminating most of the physical stress and fatigue experienced by the work force.

Inspection & Repair Preparation Cell (IRPC) – Phase I

[NCMS Project 140350, Final Report 7/12]

Phase I of the project identified computer controlled advanced technologies including digitizing, shearography, ultrasonic photo imaging, microwave, mechanical impedance that can be integrated into an automated work cell to detect defects, moisture, and delaminating with the capture of historical data in digital form. While the IRPC project focused on the C-130 Radome, the work cell will be applicable to the repair of many different types and sizes of large composite structures such as helicopter side panels.

Integrating Sensors & Predictive Maintenance Systems with Performance Support Technology to Achieve Increased CH-53E Readiness & Reliability – Phase I and II

[NCMS Project 140418, Final Report 4/11]

The Electronic Performance Support System (EPSS) provides CH-53E helicopter maintenance technicians with a seamless prognostic, diagnostic, and repair suite that measurably increases the readiness and availability of the aircraft while reducing or eliminating associated maintenance expenditures. Phase II of the project further developed EPSS content pertaining to three additional CH-53E systems: Flight Controls, Propulsion, and Transmissions (TM series 140, 220, and 260 respectively).

Integration of Laser Coating Removal for Helicopter Blade Refurbishment – Phase II

[NCMS Project 140394, Final Report 7/11]

The primary objectives in Phase II were to overcome scale-up and technical integration issues and to deliver an operational ARBSS for test, evaluation, and eventual production. This report summarizes the work conducted under the Phase II effort summarizing the design requirements and overall system design, then provides details of the laser workhead, the integrated robotic system, and the user interface.

Interactive Visualization

[NCMS Project 140208, Final Report 9/02]

Visual simulation technology has been available in the market for several years, and has been used selectively in high-end graphical applications. Use of the technology for practical applications has typically been limited in deployment due to the traditionally high costs of these types of systems, as well as previously awkward methods (special viewing glasses or lenses or sometimes in sacrifice of quality of the image) of being able to easily “view” the results. The Interactive Visualization project achieved the goal of understanding where and how to apply the enhanced visualization technology for benefit in targeted applications areas, while also identifying areas of improvement or modifications of the technology that would better enhance the objectives of the individual projects.

Intermittent Fault Detection Isolation System (IFDIS) Central air Data Computer (CADC) Test Program Set (TPS)

[NCMS Project 140493, Final Report 12/13]

Capabilities were provided to Hill AFB to test F-16 chassis circuitry for intermittent faults, open circuits and short circuits directly addressing the no-fault found problem currently costing the DoD as much as \$10B annually.

Isotropically Conductive Adhesives (ICA)

[NCMS Project 160216, Final Report 1/06]

This project sought to develop a novel replacement for lead- (Pb) based solders. The focus of the material for development was a copper- (Cu) based ICA for use in the Electronics Industry, since there was a resolute market drive to eliminate lead-containing solders from all commercial electronics. During this ICA project, the team investigated two different methods to apply the ECORAP (electrically-conducting, oxidation-resistant adhesion promoter) coating without agglomerating the particles using scaleable processes. The successful demonstration of a scaleable vapor process was pursued with a fluidized bed reactor, while the solution coating process was demonstrated using a stirred-tank reactor.

Item Unique Identification (IUID) Markings for Legacy Parts

[NCMS Project 140435, Final Report 12/10]

The Department of Defense (DoD) in 2003 mandated that all parts meeting specified criteria receive Item Unique Identifier (IUID) marks. The mandate can be relatively easily implemented for new acquisitions, but the non-recurring engineering (NRE) cost for updating the technical data for hundreds of thousands of legacy National Item Identification Numbers (NIINs) and physically marking millions of legacy parts in inventory is a daunting task. To address at least a significant portion of the total legacy part issue, an automated IUID Engineering Change Order (ECO) process was successfully developed under this IUID project.

IUID Data Utilization Strategy and Policy Initiative for Sense & Respond Logistics Total Lifecycle Management (TLCM)

[NCMS Project 140490, Final Report 10/13]

This project took a two-pronged approach to examine several key areas in the rapidly changing logistics landscape. The first was an analysis of current Marine Corps practice and policy regarding Total Lifecycle Management and Sense & Respond Logistics with particular attention to Item Unique Identification. The second element of this project was exploration of the potential benefits to be obtained by integrating mobile computing into the logistics information infrastructure, as well as an examination of the hurdles. The benefits of the mobile computing approach were demonstrated at the Marine Corps ExLog Wargame where Marines were trained in the use of the platform. A proposed policy document was submitted suggesting future Marine Corps policy based upon the lessons derived from this project.

IUID Enabled Workscope Optimization

[NCMS Project 140499, Final Report 4/15]

This project set out to determine the effect of a unique identification program on a legacy engine program in terms of efficiency, labor, accuracy, and logistics. A demonstration at a T56 Maintenance Depot in San Antonio proved that IUID reduced the labor associated with USAF database entry by 86%, which accounted for a significant amount of the total maintenance process. The return-on-investment was also estimated to be achieved soon after implementation; therefore, providing significant cost savings to all stakeholders and reducing cost of ownership for Department of Defense very rapidly.

IUID Marking for Legacy Parts – Navy Pilot

[NCMS Project 140470, Final Report 12/13]

DoD mandates that all parts and subassemblies valued over \$5,000 receive Item Unique Identifier (IUID) markings for life cycle tracking purposes. IUID marking technology is mature so the mandate imposed no significant challenge for new items. For legacy items, however, tech data must be modified to specify how and where to mark the part. For legacy parts already in inventory, the non-recurring engineering (NRE) cost is prohibitive. This project demonstrated a cost saving solution for parts falling under the mandate that already have data or name plates. Shape search provided a means of using a name plate shape as a template to find the plate in the body of a drawing.

Joint Intermittence Testing (JIT) Capability

[NCMS Project 140701, Final Report 6/15]

While there were several newer technologies that allowed the identification and isolation of electrical faults in weapon systems, including intermittent faults, there was no joint test protocol for intermittent fault emulation equipment. To properly assess the capabilities of such devices offered by industry, there needed to be a validation process for detecting and isolating intermittent faults, and set standards for an Intermittent Fault Emulator. A new joint military test specification (MIL-PRF-32516) was one of the deliverables achieved through the project.

Joint Intermittence Testing (JIT) Capability – Phase II

[NCMS Project 140801, Final Report 12/16]

The JIT initiatives incorporated all aspects of CBM+ to include a systems engineering approach to collect data, enable analysis, and support the decision-making processes for system acquisition, modernization, sustainment, and operations. Phase II leveraged the DoD JIT Working Integrated Product Team to develop and publish a Joint Service Intermittence Testing Protocol to identify and validate test methods needed to ensure the intermittence test equipment could perform to Joint MIL-PRF specification parameters.

Joint Maintenance Data Enterprise Interoperability (JMDEI) – Phase I

[NCMS Project 140718, Final Report 12/15]

The initiative developed and recommended specific deliverables for the J4 Staff for three main areas: CONOPS, Business Rules, and Demonstrations & Mapping. Implementation of the proposed recommendations developed during this project will reduce maintenance costs of joint operations while facilitating the sharing of lifecycle data and “digital thread” information enabling greater asset accountability, visibility and readiness.

Joint Maintenance Enterprise Interoperability

[NCMS Project 140474, Final Report 2/13]

Successful modern logistics depend upon information technology (IT). The various Service components, departments and organizations with the DoD have embraced IT to achieve the many individual goals of each. In order for these programs to reach their maximum benefit particularly in the joint environment, IT applications must become interoperable across platforms, Services components, nations and industrial partners. This project pursued meaningful steps toward enabling that necessary interoperability.

Joint Test Protocol for Gas Turbine Engine Materials

[NCMS Project 140479, Final Report 2/14]

The project examined natural and manufactured sands and dusts to determine key features needed in a manufactured CMAS test media. A new test media was developed that appears to form CMAS glass with the concurrent formation of water, sulfate, and chloride vapor. It took a model of what the test media should behave like and developed a real, testable, material that can be used in laboratory and for full-scale testing.

Kinetic Spray Metal Deposition Technologies for Corrosion Protection

[NCMS Project 140382, Final Report 6/07]

Restoration of metallic surfaces plays a significant role in maintenance activities for both military and commercial applications. A variety of technologies are used in an effort to thwart corrosion. Kinetic spray technologies overcome a number of traditional spray “shortcomings.” Kinetic spray deposition does not rely upon molten droplets that impact the surface and then solidify. Instead, the particles are accelerated, impact the surface, deform plastically, and cold fuse to the surface. This results in a better surface coating with less oxidation and higher density. Centerline’s Fusion Series 3800 system was successfully evaluated for this project. Additionally, the technology is amendable to portability, meaning the potential to use this technology in intermediate and field operations.

Laser Coating Removal Systems for Helicopter Blade Refurbishment – Phase I

[NCMS Project 140347, Final Report 7/05]

The removal of paint from H53 and H60 main helicopter rotor blades is a labor intensive, expensive and environmentally sensitive operation. Determined to improve this process with advanced laser and vision systems, the Automated Robotic Blade Stripping System (ARBSS) team developed a proven automated robotic laser paint stripping technology that strips helicopter blades 75% faster than traditional methods, with practically zero error.

Laser Engineered Net Shaping Solutions (LENS™) Solution for Commercial and Defense Manufacturing Repair and Overhaul Applications – Phase I

[NCMS Project 140209, Final Report 12/02]

This project pursued the merits and feasibility of a material deposition repair technology called Laser Engineered Net Shaping (LENS™). The collaborative project participants produced a commercialized version of the LENS™ equipment and proceeded to determine both technical and economic feasibility on commercial and military applications.

Laser Engineered Net Shaping Solutions (LENS™) Solution for Commercial and Defense Manufacturing Repair and Overhaul Applications – Phase II

[NCMS Project 140211, Final Report 12/06]

As tanks, ships, submarines, and aircraft continue to operate beyond their intended life, part obsolescence management becomes an increasing challenge for asset sustainment, compromising military readiness. This project further developed the additive metal process, laser engineered net shaping, into a more robust system designed to repair a wider variety of parts vital to weapon systems readiness.

Lasershot Peening of Landing Gear Components

[NCMS Project 140158, Final Report 11/03]

A variety of landing gear components are failing without having reached their desired service lives. The failures are due primarily to stress corrosion cracking (SCC) and fatigue. The objective of this project was to improve the fatigue life and SCC resistance through the application of laser peening technology to selected components.

Leak Test Technology Development (LTTD) & Prove-out

[NCMS Project 173003, Final Report 4/02]

The project identified and evaluated a number of advanced technologies at national laboratories and universities in an effort to find a viable solution for leak testing in today's manufacturing environment. Four technologies were selected for research and development. Three primary objectives drove the project: cycle-time reduction, sensitivity, and simultaneous leak location. Secondary objectives were: robustness, cost effectiveness, and ease of use. The metrics used by the industrial participants to evaluate these new technologies were: long-term facilities cost savings, headcount savings, quality, and overall efficiency of the leak test operation.

Legacy Lifecycle Management (LLM)

[NCMS Project 140412, Final Report 5/10]

To assist ballooning processes, the project team developed intelligent Optical Character Recognition (OCR) technology with a dictionary that includes General Dimensioning and Tolerancing (GD&T) symbols as well as both machine generated and handwritten alpha-numeric symbols. Artificial intelligence built into the OCR technology allows it to “learn” with use so that recognition accuracy improves over time. A key feature of the solution is that it divides the drawing into zones, separating drawing from title and notes blocks, which enables the use of specialized dictionaries for each zone, also improving recognition accuracy. To demonstrate a secure supplier collaboration environment,

the project team leveraged learning from the Transatlantic Secure Collaboration Program (TSCP) which had already defined the requirements and architecture for a web-enabled system.

Legacy Test Program Migration Organization

[NCMS Project 140496, Final Report 11/13]

During the project, Analysis, Integration & Design Inc. (AIDI) accomplished the design and generation of an ITA based on the migration of a selected Common Automated Support System (CASS) legacy test program onto a new commercial test platform using ConVEx® implementing the resource pre-allocator and the ITAG tool. Cost and scheduling results showed drastically reduced test program set (TPS) migration times and significantly faster ITA design and generation times that lowered average costs incurred via engineering efforts.

Light Armored Vehicle (LAV) Condition-Based Maintenance (CBM) Life Cycle Logistics Support Tool – Phase I

[NCMS Project 140352, Final Report 5/05]

Efficient logistical support and timely effective repairs, while critical to ensure that equipment is combat ready, have become increasingly complex and difficult to manage. This project delivered advanced sensor and energy management technology installed on two Light Armored Vehicles (LAVs). An off-board diagnostic tool demonstrated the capability of performing a “health check” on the vehicle. Also demonstrated was on-LAV communication via an on-board capability to send “health check” data to the Depot Data Center for immediate action on the affected vehicle.

Light Armored Vehicle (LAV) Sense & Respond Support System – Phase II

[NCMS Project 140392, Final Report 7/07]

The Phase II project objective was to develop, demonstrate and evaluate tools and techniques necessary to support Sense & Respond concepts in the LAV community. Asset health monitoring was refined and a support infrastructure was established to be able to make use of the data collected. The results of the LAV II project have moved us markedly closer to the ultimate goals which are developing reliable prognostics, realizing true CBM, providing greater situational awareness at every level, and increasing operational availability across the fleet.

Light Armored Vehicle (LAV) Sense & Respond Support System – Phase III

[NCMS Project 140431, Final Report 5/10]

LAV III was the third phase of the PM-LAV strategy to embrace Logistic Modernization and build on knowledge gained during the LAV Condition-Based Maintenance (CBM) Life Cycle Logistics Support Tool project. Asset health monitoring and the required support infrastructure were refined to enable scalable and web-based access to the end user. Sense & Respond saw the maturation of the Joint Asset Management Information Support System (JAMISS) as a tool designed to enable presentation of vehicle data in a coherent fashion in a scalable format for the end user. LAV III validated the “Best in Breed” selection of hardware, software and firmware designed to meet the PM’s requirements for a system designed around flexibility and reliability in the end-to-end Enterprise architecture environment.

Light Armored Vehicle (LAV) Sense & Respond Logistics – Phase IV

[NCMS Project 140438, Final Report 10/11]

During this project the CTMA team worked to expand the concept of asset health monitoring; build an understanding of what data, and how much data is useful; explore means of translating data to knowledge; and disseminating that knowledge to those who need it, in a usable format. The project was unexpectedly stopped prior to completion “for the convenience of the government” causing

inconclusive results and incomplete deliverables through no fault of the CTMA team. Although the project was truncated, significant progress was made in many of the technologies that will be necessary to enable CBM+ and Autonomic Logistics.

Logistics Master Data Management Proof-of-Concept Capabilities-Based Assessment and Data Storage & Utilization Strategy

[NCMS Project 140485, Final Report 12/13]

This CTMA project determined the capabilities required to store the data, identified the personnel and organizational requirements needed to support data warehouse requirements, and the proof-of-concept identified and validated the requirements for mining and visualizing the data stored in the proposed data warehouse.

Low Heat Input Mobile Manufacturing and Repair Systems with Thin Wall Structures with PMD™ Flat Wire Deposition Process – Phase I

[NCMS Project 140355. Final Report 7/05]

The team developed, built, and tested for basic functionality a prototype Mobile-PMD™ system for repair and reclaiming damaged large thin wall engine or large curved surface components. This technology is geared towards larger area repair and portability. The initial tests of Phase I Mobile-PMD™ process prove the feasibility of the system of performing the intended repair/reinforcement operations on large components with suitable mechanical and metallurgical characteristics.

MAGTF Logistics Support Systems (MLS2) Interoperability Demonstration and Capabilities-Based Assessment

[NCMS Project 140486, Final Report 12/13]

The introduction of an integration strategy for MLS2 maximizes training, mission readiness, sustainment, combat readiness and logistical support for deployed MAGTFs. By focusing on capabilities, rather than functions or systems, the strategy defined is able to provide a holistic approach for providing logistics support to the MAGTF.

Maintenance and Supply Accountability and Process Efficiencies – Marine Corps User Experience and Systems Operational Improvement for GCSS-MC

[NCMS Project 140704, Final Report 2/15]

The goal of this project was to assist the Operational Advisory Group (OAG) in identifying areas of concern, creating a way ahead, and devising improvements upon the systems, processes and procedures associated with Global Combat Service Support Marine Corps (GCSS-MC) as identified by HQMC to include but not exclusive to combat service support operations in CONUS and deployed environments. The actions of the project included the identification of technology, training, processes, policy and skill sets needed to increase effectiveness and efficiency in the Marine Corps Maintenance and Supply Operations.

Manual Arc Welding Control

[NCMS Project 140315, Final Report 3/01]

In a project recently supported by the National Center for Manufacturing Sciences (NCMS), the enabling technology for weld flaw avoidance was successfully developed and transitioned into a commercial product. The cost-sharing Commercial Technologies for Maintenance Activities (CTMA) program has brought new and needed welding control technology to the Albany depot. Control leads to reduced costs and process cycle times by reducing flaws and rework. The technology has been adapted for uses in the Albany weld shop to not only reduce costs, but also to train welders and provide a source of documentation required by the depot to meet ISO-9000 audit requirements.

MARFORRES Material Readiness Analysis and Logistics Information Management

[NCMS Project 140713, Final Report 2/15]

The focus of the effort was to improve the Marine Forces Reserve inventory accuracy including data entry along with providing greater visibility of inventory status and readiness throughout the Forces. A new tool was developed to track, evaluate and analyze ground equipment and personnel data. While training was ongoing, the dashboard tool was developed with seven of the 11 readiness metrics, refined and tested in collaboration with Marine Forces Reserve G-4 and G-8 Information Management/Knowledge Management.

Marine Corps Distribution IT Portfolio Notional Solution and Proof-of-Concept

[NCMS Project 140489, Final Report 12/13]

The project assisted in identifying and refining the Marine Corps logistics community's IT requirements as well as buying down the Marine Corps requirements and acquisition risk. The tasks defined in this project improve operating forces and supporting establishment distribution systems, application, processes and asset visibility positively impacting weapon system readiness.

Marine Corps Enterprise Accountability and Visibility Processes

[NCMS Project 140484, Final Report 6/16]

Dated, redundant, and/or obsolete policies, inefficient processes across ground equipment management, inefficient sustainment strategies, and ill-informed programming inputs for the Marine Corps were identified leading to modifications of Marine Corps policies and practices for holding responsible and accountable officers to prescribed standards for equipment accountability.

Marine Corps Financial Improvement and Audit Readiness (FIAR) of Operating Materials and Supplies (OM&S)

[NCMS Project 140705, Final Report 4/15]

Property accountability for any organization having worldwide assets is complicated and there is no exception for the Marine Corps. This project allowed direct service support to the Marine Corps to close weapon systems control gaps while increasing overall accountability and visibility.

Marine Corps Ground Maintenance and Sustainment Processes

[NCMS Project 140712, Final Report 12/15]

The Columbia Group and the NCMS worked closely with the Marine Corps Requirements Oversight Committee (MROC) to consolidate and extend the achievements of TLM to the Enterprise Ground Equipment Management (EGEM) program. CPI techniques, coupled with the transition to the EGEM program initiatives, were used wherever possible to identify trade space opportunities, gaps and redundancies that hamper effective weapons system design, development, fielding, operations and sustainment.

Marine Corps Logistics Portfolio – Information Technology Portfolio Baseline and Proof of Concept

[NCMS Project 140714, Final Report 2/15]

The project team used a multi-step process to get baseline statistics on the Log IT systems and applications to uncover both redundancies and gaps in the capability coverage, and to create a vision for future Log IT management that shows what could be possible given proper tools and information. The results derived from this project will allow the Marine Corps visibility into the portfolio at levels far beyond any effort to date.

Marine Corps Logistics Portfolio Consolidation Proof-of-Concept Business Case Analysis and Demonstration

[NCMS Project 140488, Final Report 12/13]

The project solidly established the foundation and framework to baseline the current Marine Corps LOG IT Portfolio. This will allow the Marine Corps to optimize its LOG IT Portfolio which will lead to increased agility to respond to changing requirements and to reduce LOG IT system sustainment costs.

Marine Corps Total Life Cycle Management Support – Phase I & II

[NCMS Project 140458/140473, Final Report 12/13]

Support was provided to perform gap analysis, improve process flows, conduct forums to develop cross-functional governance, and undertake projects to analyze specific problem areas to recommend solutions for the Marine Corps to effectively support development of the proposed “Middle Weight” Corps.

Master Data Management (MDM) Solution Alternatives Development – Proof-of-Concept “Marine Corps Big Data”

[NCMS Project 140715, Final Report 6/15]

Marine Corps Warfighting Publication (MCWP) 4-1, Logistics Operations, describes the doctrinal concept of a “shared data environment” as a key and fundamental way in which information technology must support command and control logistics. The shared data environment promotes functional integration of activities that focus on accomplishing a particular mission or enabling a specific process. The CTMA initiative centered on discovery and identification of “Big Data” requirements within the Logistics Data Strategy to get the Marine Corps data environment in order for an enterprise construct.

Metal Finishing Development Program – Phase I & II

[NCMS Project 140422, Final Report 2/14]

A comprehensive computer-based training program (The Basics of Hard Chrome Plating) was designed to educate and train the depot metal finishing workforce in basic electroplating and other metal finishing processes. Three supplemental modules were also developed: Electroplating Electro-Chemistry Bath Simulator, Current Density Calculator and Electroplater Troubleshooting Guide. The ease-of-access and availability to the training and online reference materials by the shop floor artisans has been an invaluable tool.

Mine Resistant Ambush Protected (MRAP) Predictive Analysis Support

[NCMS Project 140477, Final Report 7/12]

The Total Life Cycle Systems Management Assessment Software Tool (TLCM-AT™) is a high-resolution, discrete event, stochastic simulation platform designed specifically for representing the full-system life cycle of vehicle fleets. It was utilized for this project to determine provisioning needs for a fleet of vehicles during specific operations and scenarios.

Model-Based Definition for Aircraft Launch, Recovery, and Support Equipment

[NCMS Project 140502, Final Report 11/13]

This project established new processes utilizing only 3D data versus the traditional two-dimensional (2D) representations of the 3D data. The new 3D Technical Data Package (TDP) conveyed the design intent to the manufacturing artisans with significantly greater fidelity.

Modernization of Nickel Electroplating at Depots

[NCMS Project 140425, Final Report 5/10]

The latest in a series of four projects involving implementation of revolutionary commercial electroplating methods that results in improved product quality and major cost savings at military depots. The initial three projects successfully applied approaches to hard chrome plating, while this project successfully extended the concept to nickel electroplating. During the project, innovative masking and nickel electroplating methods were designed and tested on aircraft parts requiring refurbishment.

Modernizing Technical Data Packages – Phase I

[NCMS Project 140429, Final Report 6/09]

The project scope concentrated on developing a methodology with limited capabilities for the ISMLT (Intelligent system for Modernizing of Legacy Tech-Data) prototype. The project led to development of unique software tools that showcased the capability of “stitching” together raster drawings and extracting shapes out of the raster images.

Multi Axis Simulation Table Environmental Enclosure (MASTEE)

[NCMS Project 140464, Final Report 5/13]

When this project began, the U.S. Army Tank Automotive Research, Development and Engineering Center (TARDEC) had in its Physical Simulation Laboratory (PSL) a Multi-Axis Simulation Table (MAST) capable of emulating shock and vibration conditions at levels exceeding anticipated OCO conditions. It did not, however, have an integrated environmental chamber capable of fully emulating the environment. This project was launched to correct that deficiency. The Multi-Axis Simulation Table Environmental Enclosure (MASTEE) designed is roughly a six-foot cube, designed to hold complete electronics systems and test them under extremes of environment, vibration, and shock.

Multi-Beam Laser Additive Manufacturing (MB LAM) for Efficient Part Manufacture and Repair

[NCMS Project 140480, Final Report 5/14]

A unique multi-beam laser additive manufacturing system has been designed, built, tested and demonstrated using powder materials and substrates of interest to the depots. The technology is based on two low power beams, each precisely controllable and with a minimum heat input incorporating the latest high-brightness diode laser technology.

Naval History and Heritage Command (NHHHC) Display Aircraft Inspection Initiative

[NCMS Project 140720, Final Report 12/15]

During Phase I, the team (includes a Wounded Warrior) successfully pioneered the initial development of an aircraft static display inspection program for NHHHC by defining the requirements, developing the program instruction, inspection and quality assurance (QA) processes, and a training program. A pilot program was initiated in the State of Florida validating all processes and tools previously developed and established a condition baseline for the loaned fleet of aircraft.

Next Generation Inspection Systems – Phase III

[NCMS Project 150501, Final Report 12/07]

The project targeted the need to replace manual operations with automated dimensional measurement, and numerical control machining, for the repair of compressor airfoils. Machining studies were performed to develop tooling and machining approaches. A five-axis machining center

was built and successfully tested. Long delays were experienced in attempting to resolve data transformation problems and the project was terminated.

Operation Enduring Freedom (OEF) Warfighter Maintenance and Implementation and Operations Support

[NCMS Project 140492, Final Report 11/13]

Assistance was provided to the Operational Advisory Group in identifying areas of concern, creating a way ahead, and devising improvements upon the systems, processes and procedures associated with Global Combat Service Support Marine Corps (GCSS-MC) as identified by Headquarters Marine Corps (HQMC) to include but not exclusive to combat service support operations in CONUS and deployed environments. The focus was improved performance, capabilities, functionality, and user understanding of GCSS-MC in its current and future state as it relates to maintenance and supply activities, directives, policies, and operations.

OptiCAM and I-POMX Phase I – Point-of-Maintenance Execution Tools for Optical Model Generation and Process Automation

[NCMS Project 140331, Final Report 8/04]

Whether it is a crucial broken part where no computer model or even drawings are available, or a maintenance technician in a tight airframe crawlspace needing information to diagnose a new problem just identified, the problem is timely access to technical data. The OptiCAM/I-POMX project focused on two seemingly disparate functions; 3D imaging for reverse engineering applications (OptiCAM) and the integration of a powerful tool for mobile access to an information system that can deliver work control documents and technical data to the point-of-maintenance (I-POMX).

OptiCAM/I-POMX Phase II – Point-of-Maintenance Execution Tools for Optical Model Generation and Process Automation using Condition-Based Monitoring

[NCMS Project 140331, Final Report 12/05]

The OptiCAM portion of this project made significant advancements during Phase II. Scan accuracy was improved from 0.025 to 0.012 inches and the reverse engineering process itself was significantly improved. The I-POMX system was enhanced for the pilot by adding software that allowed a user to disconnect from the network, perform work using a local database as if he/she remained connected, and then automatically synchronizing both local and network databases on reconnection to the network.

Optical Generation of 3D Models for Computer-Aided Manufacturing (OptiCAM) – Phases III & IV

[NCMS Project 140409, Final Report 2/10]

With weapons systems held in service well beyond their originally intended lifetime, parts fail or wear to the point of rendering the system mission incapable. Depots often find themselves needing to make replacements. All too often the technical data for a needed part is either missing or incomplete. For those cases, the depot must reverse engineer the part, constructing a Technical Data Package sufficient to manufacture the part. The project achieved three goals: Portable, rugged and low cost but accurate scanner; Easy transformation of “Cloud of Points” to 3D solid model; Development of a complete Reverse Engineering environment.

Platform as a Service (PaaS) Enterprise Logistics Data Warehouse Review and Evaluation Proof of Concept

[NCMS Project 140719, Final Report 2/16]

A systematic approach was taken to implementing a PaaS to replace five legacy logistics systems. A Business Case Analysis (BCA) considered the return on investment (ROI) as improvements or total

replacement of stovepiped point-to-point legacy systems are made through the adoption of a PaaS integration platform. The demonstration portion of the project concluded in an integration demonstration and a final demonstration during the Marine Corps Expeditionary Logistics (ExLog) Wargame VIII in August 2014.

Portable/Handheld Oil Assessment Devices – Phase I

[NCMS Project 140414, Final Report 6/09]

A lack of immediate knowledge about oil quality leads to heavy costs when oil is changed either too soon or too late. Changing oil at the right time can only be done if the physicochemical properties can be determined accurately and precisely at the time the condition merits it. The objective of this project was to develop a commercialized product marketable to both DoD and the private sector. Successful development of a field-ready, commercialized, marketable portable/handheld oil assessment device suitable for real-time oil assessment by mechanics in the field was a project result.

Portable Large Shape Inspection System

[NCMS Project 140397, Final Report 6/07]

The project resulted in development of a commercial metrology guide scanning system that has been successfully installed for production applications. The commercial scanning system is based on the use of Accordion Fringe Interferometry (AFI). The chief advantage of AFI over conventional scanning approaches is that AFI allows simple, lightweight high-performance scanning systems to be produced that can be used to scan a broad range of surfaces under a range of shop lighting conditions.

Process Substitution Methodology for the Repair of Composite Materials

[NCMS Project 140318, Final Report 9/03]

The Process Substitution Methodology project for composite materials provided immediate benefit to the Department of Defense (DoD) war fighting capability during missions in Afghanistan, Kosovo and Iraq. The primary goal of this project was to develop and install the basic tools required to support material state management approach upon which the substitution methodology is based. The rapid revision of the processes that allowed for expansion of the Predator mission is just one example of how this technology can be applied. The material state management approach provides production personnel and support engineers with visibility on the effects of changes in process on the cure rate and cures state of the composite.

Product Life Cycle Management (PLM) for Aircraft Sustainment and Support – Phase I & II

[NCMS Project 140482, Final Report 11/14]

In today's Fleet Readiness Centers (FRCs), the lack of a single controlled environment for required technical information challenges their capability to maintain and service aircraft. The result of this project was an enhanced maintenance and logistics process which naturally created significantly shorter lead times, provided data to stakeholders in an organized format and ultimately supports the Navy's goal for fleet readiness.

Product Lifecycle Management (PLM) for Aircraft Sustainment and Support – Phase IIIA and IIIB

[NCMS Project 140729/819, Final Report 6/16]

The V-22 at FRC East was chosen as the platform to be enveloped into the Teamcenter PLM configuration management process expanding the digital data flow from engineering to manufacturing and down to the physical numerical controlled (NC) machine tools. The project

illustrated how PLM minimizes the current risks associated to manufacturing the repair parts for aircraft sustainment and availability.

Product Lifecycle Management (PLM) for Six-Sigma Quality – Phase I

[NCMS Project 140365, Final Report 2/05]

Current life cycle data management processes dictate manual handoffs, delegations, and follow-through, which is a compromise in terms of productivity entitlement and lead to quality oversights. Industry is struggling to demonstrate a successful marriage of CAD engineering definition with the complete manufacturing process data in a PDM environment. The project piloted the integration of three technologies that together provide a means of automatically extracting all engineering requirements (GD& T plus specification and standards references) from UG-NX drawings and storing them under configuration management in the Teamcenter™ PLM system. The result can take management of characteristics (engineering requirements) from the 3 to the 6 Sigma level, virtually eliminating quality escapes.

Product Lifecycle Management (PLM) for Six-Sigma Quality – Phase II

[NCMS Project 140368, Final Report 3/08]

This project addressed major opportunities for improving the way in which product design data is linked to Quality Plan and Manufacturing Information throughout the Supply Chain and product lifecycle from initial design to depot maintenance. The work done during project execution to under the depot requirements sets the stage for broader deployment of the product lifecycle management (PLM) tools that were successfully demonstrated. Based on the pilot results, the total quality and productivity-related savings opportunity for an OEM is estimated to be between \$11-13M per year.

Rapid Access to Readiness-Essential (RARE) Parts through Rapid Manufacturing and Repair (RM&R) – Phases II-IV

[NCMS Project 140367, Final Report 12/14]

This Rapid Access to Readiness-Essential (RARE) Parts program recognized the importance of additive manufacturing to the DoD and its organic and industrial maintenance base and built an active industry-government network that has a nationwide scope and reach. It has been meeting the challenges of bringing this capability to maturation and adoption within the DoD, with its public-private partnership's sharing information about the number and type of rapid production systems within the U.S., where these systems are located (i.e. industry, government, academia) and skills in the form of lessons-learned with respect to equipment installation, user training, materials properties databases, three-dimensional digital file creation, parts certification and inspection. Over 126 parts were fabricated in the contiguous RARE Parts program with a \$7.12M in annual cost savings as compared to acquisition costs or legacy production costs, and up to 90% cost savings per part. As well 1,479 weeks cumulative time savings over part acquisition time and quoted delivery schedules, or legacy production time (based on a 40-hour week), up to 80% time savings per part. Over the course of this program 16 machines were installed in participating DoD maintenance facilities and another 12 in collaborating industry partners' facilities during multiple phases. Additionally, DoD members purchased and installed an additional 22 machines during the course of the program.

Rapid Development and Sustainment

[NCMS Project 140825, Final Report 11/16]

This initiative was designed to identify an alternative strategy, processes, and recommend policy changes that would align DoD processes more closely to industry best practices and enable the government to take advantage of efficiencies already proven by industry. The team developed a

strategy document presenting a design for the maturation of Enterprise Ground Equipment Sustainment Innovation Cell (EGESIC) data collection areas that was developed as a proof-of-concept in collaboration with Hendrick Motorsports.

Rapid Manufacturing & Repair (RM&R) Technologies – Phase II

[NCMS Project 140367, Final Report 8/09]

Additive technologies allow part design freedoms not possible with traditional fabrication methods. Complex-multiple part configurations can be constructed in a single build, thus allowing reduction in the numbers of component parts needing assembly. Forty parts were fabricated and 17 provided sufficient data on cost and readiness benefits resulting in \$2.03M annual cost avoidance and up to 80% in time savings.

Rapid Prototyping Technology Advancement (RPTA) for Maintenance Activities

[NCMS Project 140207, Final Report 7/03]

The 4-year Rapid Prototyping Technology Advancement (RPTA) project transferred skills, inserted technologies, and increased the use of RP in DoD maintenance depots. Activities included conducting pilot demonstrations and case studies using RP technologies installed in both industry and DoD depot locations. Benefits to participating DoD depots included knowledge transfer, part design simplification, material and process improvements, lead time and man-hour reductions in part repair/replacement and associated cost avoidance. Over 30 case studies documented savings in excess of 600 man-days and \$2.2 million.

Rapid Response Computer-Aided Manufacturing of Printed Wiring Boards (RRCAM)

[NCMS Project 160215, Final Report 12/01]

The objective of this program is to demonstrate and install a computer-automated alternative to the conventional plate-and-etch technology for producing printed wiring boards. The process is based on newly developed metallo-organic decomposition chemistry for direct, additive metallization of holes and printing of circuit traces. The new technology, named Parmod[®], has been used to prepare demonstration circuits with pure copper conductors on laminate substrates which are believed to be the equivalent of conventional plate-and-etch circuits.

Recent Alternatives to Chromate Conversion Coatings

[NCMS Project 170604, Final Report 4/02]

This study extends and updates an earlier NCMS study completed in 1995. This new study compares the performance of 18 conversion coatings, including 17 chromate-free alternatives and 1 chromate-based control, from seven suppliers, on six aluminum alloys. Data from side-by-side testing is provided for three typical tests: salt spray corrosion resistance, contact electrical resistance, and paint adhesion.

Reducing Opacity Using an Alternative “Green” Cutting Fuel MagneGas™ & Cold Cutting Technology at Puget Sound Naval Shipyard & Intermediate Maintenance Facility (PSNS & IMF)

[NCMS Project 140494, Final Report 7/15]

Oxy-fuel gas cutting is currently the most commonly used method for large-scale metal cutting and preparation operations, e.g., shipbreaking. While this method is both cost-effective and efficient as a manual operation, it also creates large quantities of visible emissions. An abbreviated design of experiments demonstration was conducted to study MagneGas™ as an alternative.

Replacement for Hexavalent Chromium in Surface Finishing Processes (Tri-Chrome)

[NCMS Project 140377, Final Report 5/06]

For many years, researchers have sought chromium-free substitutes for hexavalent chromium processes, driven by toxicity concerns. However, there remain many applications for which no suitable substitute for hard chromium has yet been developed, and for which there is no immediate prospect of a replacement. These processes remain in use, despite well over a decade of attempts at replacement. Most process engineers are convinced that hard chromium plating is going to remain a necessity for some time to come. This project was based on the recent development of a new trivalent chromium electroplating process that will provide an alternative to the use of hexavalent chromium to achieve hard functional coatings. The project objective was to optimize the new process to meet military and industrial specifications and evaluate its performance.

Retrograde Part Identification Using 2nd Generation Permanent Marking Techniques (Parts ID)

[NCMS Project 140327, Final Report 12/04]

Direct part marking is in widespread use in commercial aerospace, automotive, electronics, semiconductor, and pharmaceutical industries. The Data Matrix (ISO 16022) is the dominant barcode symbology used to place a permanent machine-readable code directly into material surfaces i.e., not using labels or tags. The challenge was to determine which marking method is acceptable for material types, so that the resulting symbology will survive (remain readable) after enduring harsh environments and therefore last the life of the part.

Robotic Automated Coating Removal Systems (RACRS)

[NCMS Project 140446, Final Report 7/12]

Developed performance specifications for an enhanced version of the Automated Rotor Blade Stripping System and a concept of operations for fully stripping a V-22 fuselage using laser/robotic technologies.

Robotic Painting Optimization for Military Vehicles

[NCMS Project 140323, Final Report 4/07]

Chemical agent resistant coatings (CARC) camouflage application to military land-vehicles is currently a labor-intensive process that requires the applied of a single-color base coat, followed by manually drawing the camouflage pattern in chalk to allow the application of the final two colors. The project approach involved combining vision and robot technologies to advance the state-of-the-art using an interface between the vision system and the robot. The project was designed to first assess the feasibility of the approach and to demonstrate the concept, prior to launching into a full-scale robotic painting implementation

Robotic Systems Joint Program Office (RSJPO) – Interoperability for Micro Robot Weight Class Unmanned Ground Systems

[NCMS Project 140468, Final Report 12/13]

The RSJPO launched a program to reduce the deficiencies through development and application of an Interoperability Profile (IOP) standard. An IOP-compliant system decouples operator control unit (OCU) and UGV development.

Robotic Systems Joint Program Office (RSJPO) – Interoperability for Tactical Robot Control

[NCMS Project 140467, Final Report 12/13]

The project demonstrated two government-owned operator control unit applications controlling two separately developed IOP v0-compliant UGV, with the implication that either of the demonstrated applications is capable of controlling any IOP compliant UGV.

Shareable Operational Resource Tool (SORT)

[NCMS Project 140469, Final Report 4/13]

When U.S. and Allied Forces deploy to operations and exercises, additional/redundant equipment and sustainment items are continually deployed with little ability to cross-service support from friendly forces in theatre. The Shareable Operational Resource Tool (SORT) provides a web-based capability for facilitating coalition planning, execution and drawdown for shared visibility of offered national items and services.

Shareable Operational Resources Tool (SORT) Operational Enhancements and Demonstration

[NCMS Project 140703, Final Report 4/16]

The initiative developed capabilities necessary to upgrade SORT (a real-time web portal) to address identified shortfalls. It will result in both improved capability and awareness of SORT as a means to implement Multinational Logistics capabilities in exercises and contingency operations, reducing deployed footprint requirements, strategic lift, and demand for high-priority shipment of items into theater when they exist outside of the traditional supply chain.

Smart Machines Pilot Project – Phase I

[NCMS Project 140385, Final Report 1/06]

Cincinnati Lamb, LLC developed a Field Reliability Evaluation Electronic Log (FREEDOM E-LOG) system to monitor equipment health and process effectiveness of its machine tool installations. It captures data automatically (without human intervention), stores it, processes it, and in some installations automatically sends data to Cincinnati Lamb for archival. It can be tailored to accommodate virtually any factory equipment and/or manufacturing process. The project team piloted the technology in a variety of industrial and depot maintenance applications.

Smart Machines Pilot Project – Phase II & III

[NCMS Project 140389, Final Report 10/12]

The problem addressed in this project was online access to real-time and historical process status and equipment health information. Phase II provided previously unavailable visibility into the status and health of shop floor equipment. Phase III deployed condition monitoring in a production environment on equipment assets making status available over the site enterprise network.

Static Event Detection (SED) Initiative

[NCMS Project 140388, Final Report 8/08]

The objective of this project was to determine the feasibility of developing a Static Event Detector (SED) Health Monitoring System. This system would alert inspectors or equipment operators to an electrostatic discharge (ESD) event that may have inflicted latent or catastrophic damage to critical electronic components resulting in a weapons system's degraded performance. A SED is a device that detects the passage of an electrostatic discharge event. It can be as simple as a fuse or a metal-oxide semiconductor (MOS) device, both are single use devices. A magneto-optic static event detector (MOSED) is a subset of SEDs. It is resettable and thus reusable and is the type of SED developed during this project.

TARDEC Track Test Machine

[NCMS Project 140461, Final Report 12/13]

The Army's physical simulation effort for ground vehicles at the Physical Simulation Laboratory (PSL) and the Tire, Run-Flat, and Road Wheel Simulation Laboratory (TR2SL) regularly tests HMMWVs, MRAPs, Strykers, and trailers, among other vehicles, to validate and verify the durability of whole-vehicle and component systems, such as armor, frames, suspensions, run-flats, tires, and road

wheels. However, the PSL lacked two important capabilities: the ability to perform active testing of electronics at extremes of temperature, humidity, vibration, and shock and also the ability to test track systems such as that of the M1A2 tank at extremes of speed and load. This project through the CTMA program closed the track testing gap by providing PSL with the needed capabilities.

Technology Roadmapping for U.S. Marine Corp Maintenance Depots

[NCMS Project 140369, Final Report 11/03]

The result of this technology roadmapping pilot facilitation at Albany and Barstow proved this methodology of roadmapping was a valuable and useful tool for the long-range planning and sustainment of Maintenance Depots. The pilot demonstrated the ability of technology roadmapping to identify critical customer needs, capabilities, technologies, and skills to meet those needs in the depots. The roadmapping process also identified gaps in meeting those needs, and helped define plans to fill the gaps.

Test Measurement and Diagnostic Equipment (TMDE) Initiative – Phase I & II

[NCMS Project 140731/732, Final Report 6/16]

TMDE is used in the Department of Defense (DoD) to assist in the setup, monitoring, testing, troubleshooting, alignment, repair and rebuild of its products – weapons systems. The output of Phase I of the TMDE initiative defined an effective TMDE for industry and the military through a U.S. Marine Corps demonstration project to identify gaps, vulnerabilities, assess alternatives for improvement, and to validate requirements for an effective enterprise-wide TMDE. Phase II of the initiative focused on an existing program and benefits that could be gained through the integration or adaptation of alternative platforms (hardware) for managing systems. Based on the results of Phase I and II, the solution approaches and recommendations, if adopted, provides a base for both industry and the DoD to benefit from clear TMDE requirements.

Thermal Spray Coatings Booth Equivalency Unit

[NCMS Project 140311, Final Report 9/04]

The Commercial Technologies Maintenance Activities (CTMA) Thermal Spray Booth Equivalency project was launched to address a critical need in the plasma spray coatings industry – variances from booth-to-booth or cell-to-cell for parameters which affect the plasma plume, and hence, the resultant coatings. This project developed a portable booth monitoring system that allowed the user to optimize spray booth conditions and translate these conditions easily to other booths.

Ultrasonic Consolidation of Titanium Alloys for High Performance Aircraft Damage – Phase I

[NCMS Project 140415, Final Report 6/09]

The project focus was to specifically demonstrate the feasibility of electric current augmented ultrasonic consolidation of titanium for the repair of structural components made of titanium alloy (Ti-6-4). The development of a satisfactory tool steel sonotrode became a major hurdle in the accomplishment of the project goals. The specific repair-oriented application explored were: Feature Restoration (Damage Repair) of Metal Airframe Features; Damage Repair of (Forged) Aircraft Structural Components; Pumps, Tubing, Heat Exchangers, Reaction Vessels; and Armor.

Validation of Functional Trivalent Chrome Plating Process – Phase II and IIA

[NCMS Project 140427, Final Report 8/11]

Traditional chromium plating releases a mist of highly corrosive droplets that pose a risk to process operators. Hexavalent chromium has been implicated in long-term health effects, including cancer. In Phase II, an extensive series of tests was performed on samples produced using Faraday's trivalent chrome process. The samples were able to successfully pass several key tests and

performed comparably to hexavalent chrome. In Phase IIA encouraging results were achieved by modifying process plating parameters and select tank additives, a potential increase in platable current density range.

Validation of Functional Trivalent Chrome Plating Process – Phase IIB

[NCMS Project 140427, Final Report 8/13]

Traditional chromium plating releases a mist of highly corrosive droplets that pose a risk to process operators. Hexavalent chromium has been implicated in long-term health effects, including cancer. The objective of Phase IIB was to expand on the knowledge gained in Phases II and IIA and to better understand/expand the effective of additives on the range of current densities that produce a dense, hard, wear resistant chrome coating. Hull Cell experiments were used to assess the range of applicable current densities obtainable with each additive.

Validation of Functional Trivalent Chrome Plating Process – Phase IIC

[NCMS Project 140427, Final Report 5/14]

Building on earlier project phases, the objective of Phase IIC was to complete the experimentation work to optimize the Faraday Technology trivalent chrome process as well as complete the testing and pass standardized tests from industry and the depots and determine the potential of additives to extend the range of current densities that produce a dense hard chrome coating from Faraday's environmentally benign process. The new plating process was able to pass all wear resistance tests.

Virtual Workplace Simulator – Phase I & II

[NCMS Project 140454/140475, Final Report 12/13]

Through the use of simulation technology and physical dynamic interface in the Virtual Workplace Simulator, Pendaran delivered accelerated, problem-based learning to individuals staffed at all levels of the organization. The intense, "live-fire" simulation provided the context for physical, psychological and intellectual experiences that lead to long-term learning retention.

Volumetric Accuracy for Large Machine Tools (VALMT) – Phase I

[NCMS Project 140423, Final Report 9/10]

VALMT pioneered an innovative process in volumetric error compensation for large machine tools. VALMT will save ship and aircraft manufacturers millions of dollars. Machine tool calibrations used to take an entire week. VALMT allows the same process to be performed in a day. The benefits of this technology aren't just time savings; it will allow for more accurate parts, reducing or eliminating expensive re-work during assembly.

Work Process Automation with Automatic Status Reporting

[NCMS Project 120605, Final Report 6/03]

The Automated Work Process Planning project was formed between industry and the Tobyhanna Army Depot (TYAD) to address industry and depot needs to shorten cycle times, reduce out of stock rates while lowering pipeline inventory requirements, provide improved visibility of in process orders and enhance resource planning capabilities. The specific goal was to develop, and demonstrate, a cost effective, automated workflow planning system through development of a business process-driven Information Technology (IT) architecture with the capability to continuously respond to change as tasks are performed. This required the integration of legacy Workflow, PDM and Project Management systems.

ZeroG™ Arm Technology Transfer to DoD Depots to Reduce Injuries and Reduce the Cost of Maintenance

[NCMS Project 140506, Final Report 2/15]

This project conducted a productivity assessment to evaluate the benefits of applying zeroG® technology to assist depot workers as they used a variety of tooling (e.g. sanders, drills, grinders, etc.) that require periods of prolonged use. The assessment reviewed both quantitative measures and qualitative measures of productivity (worker fatigue, ergonomics, etc.). Designed to carry the weight of heavy tools, zeroG® allows the completion of arduous tasks with a higher degree of quality while eliminating most of the physical stress and fatigue experienced by the workforce.