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5d. PROJECT NUMBER

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Washington, DC 20001 -0001

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14. ABSTRACT
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Standing Committee on Defense Materials, Manufacturing and Infrastructure

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a. REPORT	b. ABSTRACT	c. THIS PAGE			James Lancaster
UU	UU	UU	UU		19b. TELEPHONE NUMBER: 202-334-1936

Report Title

Final Report: Standing Committee on Defense Materials, Manufacturing and Infrastructure

ABSTRACT

See Attachment

Enter List of papers submitted or published that acknowledge ARO support from the start of the project to the date of this printing. List the papers, including journal references, in the following categories:

(a) Papers published in peer-reviewed journals (N/A for none)

Received Paper

TOTAL:

Number of Papers published in peer-reviewed journals:

(b) Papers published in non-peer-reviewed journals (N/A for none)

Received Paper

TOTAL:

Number of Papers published in non peer-reviewed journals:

(c) Presentations

Number of Presentations: 0.00

Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Non Peer-Reviewed Conference Proceeding publications (other than abstracts):

Peer-Reviewed Conference Proceeding publications (other than abstracts):

Received Paper

TOTAL:

Number of Peer-Reviewed Conference Proceeding publications (other than abstracts):

(d) Manuscripts

Received Paper

TOTAL:

Number of Manuscripts:

Books

Received Book

TOTAL:

Received	Book Chapter

TOTAL:

Patents Submitted

Patents Awarded

Awards

Graduate Students

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Names of Post Doctorates

NAME	PERCENT_SUPPORTED
James Lancaster	0.06
Erik Ssvedberg	0.26
FTE Equivalent:	**0.32**
Total Number:	**2**

Names of Faculty Supported

NAME	PERCENT_SUPPORTED
FTE Equivalent:	
Total Number:	

Names of Under Graduate students supported

NAME	PERCENT_SUPPORTED	Discipline
Henry Ko	0.08	
Neeraj Gorkhaly	0.06	
Heather Lozowski	0.19	
Joespeh Palmer	0.16	
FTE Equivalent:	**0.49**	
Total Number:	**4**	

Student Metrics

This section only applies to graduating undergraduates supported by this agreement in this reporting period

The number of undergraduates funded by this agreement who graduated during this period: 0.00

The number of undergraduates funded by this agreement who graduated during this period with a degree in science, mathematics, engineering, or technology fields:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and will continue to pursue a graduate or Ph.D. degree in science, mathematics, engineering, or technology fields:..... 0.00

Number of graduating undergraduates who achieved a 3.5 GPA to 4.0 (4.0 max scale):..... 0.00

Number of graduating undergraduates funded by a DoD funded Center of Excellence grant for Education, Research and Engineering:..... 0.00

The number of undergraduates funded by your agreement who graduated during this period and intend to work for the Department of Defense 0.00

The number of undergraduates funded by your agreement who graduated during this period and will receive scholarships or fellowships for further studies in science, mathematics, engineering or technology fields: 0.00

Names of Personnel receiving masters degrees

NAME
Total Number:

Names of personnel receiving PHDs

NAME
Total Number:

Names of other research staff

NAME	PERCENT_SUPPORTED
Cathy Gruber	0.03
FTE Equivalent:	**0.03**
Total Number:	**1**

Sub Contractors (DD882)

Inventions (DD882)

Scientific Progress

See Attachment

Technology Transfer

FINAL TECHNICAL PROGRESS REPORT

Standing Committee on Defense Materials, Manufacturing, and Infrastructure

Final Progress Reporting
Proposal Number: 60599-MS
Agreement Number: W911NF-11-C-0212

Period October 1, 2011 – September 30, 2016

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

Standing Committee on Defense Materials, Manufacturing, and Infrastructure

Statement of Task: The National Research Council has established a standing committee to convene periodic meetings to discuss topics concerning defense materials, manufacturing, and infrastructure. In meetings to be held approximately three times per year with sponsors and selected speakers, the committee will become informed of emerging issues, discuss planning and program development efforts, and serve as a focal point for potential ad hoc studies and other activities. The committee and its sponsors will jointly agree to the topic, and the invited speakers, for each individual meeting.

Project Context and Issues: The Department of Defense will need to address a range of systems-based, complex problems in the coming years. This standing committee will address significant issues regarding materials, manufacturing, and infrastructure-related activities. Such issues require a technical basis in order to explore the emerging scientific and technological opportunities and to inform policy decisions. Issues to be discussed will emanate from a military focus on personnel, platforms, facilities and manufacturing/industrial base, with transfer of relevant technologies to the commercial sector as appropriate. These issues will require an understanding of the interactions among materials, manufacturing and infrastructure which include, but are not limited to: maintaining technological superiority; creating energy efficient, high performance and sustainable platforms; assuring a safe, healthy, and energy efficient infrastructure; securing the safety of facilities and ports and assessing the critical availability and timeliness of the processes that provide defense materials, parts, and products. Informed approaches to addressing these issues, although assessed from a defense focus, will enable the nation to more effectively sustain technological leadership, as well as to maintain safety of people within federal and private facilities, enhance the infrastructure, and improve the manufacturing base.

Project Audiences and Impact: The audience will be agency sponsors and others interested in the individual meeting topics. The project will be a continuing interactive relationship between the standing committee and the sponsors and provide the basis for prospective studies and other activities at the National Research Council. The activity will not produce any reports or result in any advice or recommendation.

Standing Committee: The standing committee members will have expertise in materials, systems engineering, supply chain logistics, infrastructure, manufacturing; defense-centered industrial base, facilities and operations, defense procurement, and technology transfer. They will engage in planning, program development, and (as appropriate) oversight of activities under its auspices. The standing committee will operate under the aegis of the National Materials Advisory Board (NMAB) with support from the Board on Manufacturing and Engineering Design (BMED), and the Board on Infrastructure and the Constructed Environment (BICE). The standing committee members and their biographies follow.

Activities;

Since the first inaugural meeting on Nov. 4th in 2010 more than 14 workshops have been planned.

During this period from Oct. 2011 until September 2016, 11 workshops have been successfully planned and executed.

The list of all workshops is found below.

Prior to this period:
Meeting 1, Nov. 4, 2010, D.C., **Inaugural meeting, idea sharing**
Meeting 2, Mar. 31, 2011, D.C., **Critical Materials**
Meeting 3, Jul. 21, 2011, W.H., **21st Century Advanced Manufacturing**

During this period:
Meeting 4, Jan. 18, 2012, D.C., **R&D for Resilient and Sustainable Installations & FOB's**
Meeting 5, Jul. 23, 2012, D.C., **Mat. & Manuf. Capabilities for Sust. Defense Systems**
Meeting 6, Dec. 5, 2012, D.C., **Novel Processes on the Verge of Industrial Modernization**
Meeting 7, Aug. 1, 2013, D.C., **Limited Affordable Low-Volume Manufacturing**
Meeting 8, Feb. 5, 2014, D.C., **Big Data in Materials Research and Development**
Meeting 9, Aug. 6, 2014, D.C., **Materials State Awareness**
Meeting L, Dec. 8, 2014, D.C., **Combat Vehicle Weight Reduction by Mat. Substitution**
Meeting 10, Mar. 25, 2015, D.C., **Globalization of Defense Materials and Manufacturing**
Meeting 11, Aug. 24, 2015, D.C., **21st Century Paradigm Change in Perf. & Design Metrics**
Meeting 12, Feb. 10,, 2016, D.C., **Emerging and timely capabilities and research objectives**
Meeting 13, May 19, 2016, D.C., **Manufacturing Capabilities for Critical Infrastructure**

For the future period:
Meeting 14, TBD, 2016, D.C., **Gaps in Integrating ICME with Manufacturing**

Below are the detailed descriptions of these 11 workshops.

Financial Status;

The present spending cap for this project is $1,500,001.00, of which $1,446,826.00 has been awarded Actual, cumulative, and outstanding expenses through September 30, 2016 are $0, $1,442,672 and $3,616 respectively. Approximately 99.96%* of the funds have been expended.

* Percentage expended calculation: (cumulative + outstanding expenses / awarded amount)

During the month of May, 2016 the DMMI standing committee held the following meeting.

Workshop on:
Predictive Service Life Modeling Paradigms for Aging Critical Infrastructure

Keck Center Washington D.C. May 19-20
500 Fifth Street, NW Washington D.C. 20001

This workshop will look at Robust predictive service life modeling approaches which will be critical for risk-based management of critical aging infrastructure on Military bases and in the U.S. such as dams, bridges, airfields, pavements, and tunnels.

Predictive Service Life Modeling Paradigms for Aging Critical Infrastructure

In the summer of 1990 the 24th Infantry Division (Mechanized), located at Fort Stewart, Georgia was suddenly tasked to deploy to Operation Desert Shield when Saddam Hussein invaded Kuwait. Fort Stewart is located south of Savannah, Georgia and deploys through the port of Savannah and the Hunter Army Airfield. It is connected by Interstate 95 and a rail line to the air and sea ports. During the deployment numerous shortcomings were noted in the rail facilities, roads and bridges, ammunition storage, and airfield infrastructure. In the last 25 years, the US Department of Defense has moved a significant number of facilities from overseas locations to the US and deployed regularly around the world. The people, equipment, and infrastructure has been stressed by these deployments and will continue to be stressed as we envision the future world environment. People and equipment are continuously monitored through multiple organizations and instruments, but the physical infrastructure where they live, train, and deploy receives little attention until it fails or is shown to be inadequate.

There are three types of Service Life: a) Technical; b) Functional; and c) Economic. Service Life modeling requires: a) Defining performance requirements; b) Assessing current deterioration; c) Predicting future deterioration; d) Identifying MR&R alternatives; e) Assessing effect from MR&R alternatives on Service Life; f) Assessing LCCA of MR&R alternatives; g) Assessing sustainability performance of MR&R alternatives; h) Assessing Resiliency performance of MR&R alternatives; and i) Performing multi-objective optimization.

This workshop will have a focus on highways, waterways, and railways.

Thursday May 19, 2016

The National Academies Keck Center, 500 5th Street, NW – Room KECK 208, Washington, DC

OPEN SESSION

8:00 Working Breakfast

8:30 Welcome, Meeting Objective, Introductions – **CHAIR Mike McGrath**

Introduction and Keynote

8:40 **Speaker, Peter Matthews**, Joint Distribution Analysis Center within the U.S. Transportation Command
Presentation title: *Department of Defense Programs for National Defense - Highways, Railroads and Seaports*

Topic 1: Highway Infrastructure

9:40 **Speaker David H. Timm**, Auburn University
Presentation title: *Pavements & Modeling Service Life*

10:20 Break

10:40 **Speaker, Richard Weyers,** Virginia Tech
Presentation title: *Modeling the Chloride Induced Corrosion Service Life of Steel Reinforced Concrete Structures: applied to bridge decks.*

11:20 **Speaker Victor Li**, University of Michigan
Presentation title: *Breakthrough in self-healing damage-tolerant concrete technology for resilient infrastructure*

12:00 Lunch

Topic 2: Waterways Infrastructure

1:00 **Speaker**, **Edward E. Belk, Jr PE**, US Army Corps of Engineers
Presentation title: *US Army Corps of Engineers Civil Works Infrastructure Portfolio Management*

1:40 **Mihan McKenna**, US Army Engineer Research and Development Center
Presentation title: *Unraveling Structural Infrasound: understanding the science for persistent remote monitoring of critical infrastructure*

2:20 Break

2:40 **Robert Moser**, US Army Engineer Research and Development Center
Presentation title: *Addressing Aging Water Resources Infrastructure Challenges with Forensics, Service Life Modeling, and Advanced Materials.*

3:20 **Reed Mosher,** US Army Engineer Research and Development Center
Presentation title: *Hurricane Katrina -Levee and Floodwall Performance*

4:00 Wrap up and final comments

4:20 Adjourn meeting day 1

Friday May 20, 2016

The National Academies Keck Center, 500 5th Street, NW – Room KECK 208, Washington, DC

OPEN SESSION

8:00 Working Breakfast

8:30 Welcome, what we heard yesterday and what's coming today–
Paul Kern, the Cohen Group

Topic 3: Railways Infrastructure

9:00 **Mehdi Ahmadian**, Virginia Tech
Presentation title: *Integration of Real-time Condition Monitoring Systems for Maintaining and Sustaining Railroad Infrastructure*

10:20 Break

10:40 **Michael Grussing**, US Army Engineer Research and Development Center
Presentation title: *Risk-based Facility Management Approach for Building Component Condition, Reliability, and Service Life prediction using a Discrete Markov Process*

11:20 **Speaker, Michael Hendry**, university of Alberta (Video Link)
Presentation title: *The use of continuous vertical track deflection measurements to map subgrade condition along a railway line: Methodology and Implications.*

12:00 Lunch

1:00 **Panel Discussion and wrap-up** – path forward, what are the gaps and how to overcome challenges

Panelists: Robert Moser, US Army Corps of Engineers
Panelists: Stephen Gaj, The Federal Highway Administration
Panelists: Victor Li, University of Michigan
Panelists: Peter Matthews, Joint Distribution Analysis Center within the U.S. Transportation Command
Lead: Jesus de la Garza, Virginia Polytechnic Institute and State University

2:30 Adjourn meeting day 2

2:50 Post discussion DMMI and Reliance

3:30 Adjourn fully.

During the month of February, 2016 the DMMI standing committee has held DMMI #12 on the 10^{th}-11^{th}, it was entitled:

Workshop on
Emerging and timely capabilities and research objectives: High Entropy Materials, Ultra-strong Molecules, and Nanoelectronics

Keck Center Washington D.C. February 10-11 (Wednesday-Thursday)
500 Fifth Street, NW Washington D.C. 20001

This workshop will look at issues in materials such as: High Entropy Materials, Ultra-strong Molecules and Nanoelectronics.

Emerging and timely capabilities and research objectives: Ultra-strong Molecules

High Entropy Materials: Discovered in Taiwan in 2003, high entropy alloys typically contain five or more metals, each with a composition of more than 5% (but usually less than 35%). These material systems have recently become a focus of active research because of their potential for being lighter weight than other metal alloys while exhibiting desirable combinations of properties such as high strength, high fracture toughness and corrosion resistance. They often have simple crystal structures (face centered or body centered cubic) that are stabilized by a high entropy of mixing. While global research on these materials is starting to rapidly accelerate, much remains to be discovered including a mapping (and prediction) of the compositional – temperature – time space of their existence, the study and optimization of mechanical, transport, and magnetic properties and their corrosion behavior. Many companies are just beginning to assess the commercial prospects for these materials, while their potentially significant defense applications remain largely unexplored.

Ultra-strong Molecules: Strong sp3 backbone bonded polymer molecules, with a structure that is organized across multiple length scales (atoms to structure), have many applications. For example, they form the basis for a host of textile fibers and composite materials. Some are able to support dynamically imposed stresses and have become important for growing uses in ballistic protection systems where they can significantly improve mass efficiencies (though often at the expense of a reduced volumetric efficiency). Recent breakthroughs have enabled 2D graphene molecules (with sp2 bonds that exceed that of sp3 molecules) and many similar strongly bonded molecules with specific strengths and moduli as much as an order of magnitude higher than polymeric analogs. These discoveries now offer a potentially transformational capability to the DoD. However, much of the most interesting research appears to be occurring outside the CONUS.

Nanoelectronics: The predictions of Gordon Moore's scaling law for microelectronics have been achieved and today the most advanced devices are being assembled with feature sizes that are a few tens of nanometers in dimension. While the capabilities of the logic and memories made this way are incredible compared with those of 10 years ago, the rapid pace of evolution has many implications for the DoD. These include efforts to ensure radiation hardness, the reliability of devices whose failure times are dropping into that of the anticipated lifetime of DOD platforms and subsystems, and the difficulty of designing and deploying complex systems that can rapidly adapt and exploit the leading edge capability. The complexities are likely to grow over time since future devices are expected to make increased use of a "bottoms-up" fabrication approach that involves the assembly of nanoscopic components.

Wednesday, February 10, 2016

The National Academies Keck Center, 500 5th Street, NW – Room KECK K208, Washington, DC

OPEN SESSION

8:00 Working Breakfast

8:30 Welcome, Meeting Objective, Introductions - **CHAIR**

Topic 1: Ultra-strong Molecules

8:40 **Speaker, Vikram Deshpande**, U. of Cambridge
Presentation title: *Fibers*

9:20 **Speaker, Satish Kumar**, Georgia Tech
Presentation title: *What limits the strength of fibers? Molecules or processing?*

10:00 **Speaker, James Hone**, Columbia University
Presentation title: *Graphene*

10:40 Break

11:00 **Speaker, Xiaoyu "Rayne" Zheng,** Virginia Tech
Presentation title: *Scalable Metamaterials*

11:40 Lunch

Topic 2: High Entropy Materials

12:20 **Speaker**, **Daniel Miracle**, AFRL
Presentation title: *An assessment of the high entropy field*

1:00 **Speaker**, **Michael Widom**, Carnegie Mellon University
Presentation title: *Ab Initio Calculations*

1:40 **Speaker**, **Peter Liaw**, University of Tennessee
Presentation title: *Deviation from high-entropy configurations in the atomic distributions of a multi-principal-element alloy*

2:20 Break

2:40 **Speaker, Michael Gao**, DOE-Oregon
Presentation title: *Thermodynamics*

3:20 **Panel Discussion – High Entropy Materials**

Panelists: Long-Qing Chen, Pennsylvania state U.
Panelists: Karin Dahmen, U. of Illinois
Panelists: Zi-Kui Liu, Pennsylvania state U.
Lead: Haydn Wadley, UVA and DMMI Vice-Chair

4:20 Adjourn

Thursday, February 11, 2016

The National Academies Keck Center, 500 5th Street, NW – Room KECK K208, Washington, DC

OPEN SESSION

8:00 Working Breakfast

8:30 Welcome, what we heard yesterday - **CHAIR**

Topic 3: Nanoelectronics

8:40 **Speaker, Tom Theis**, Semiconductor Research Corp.
Presentation title: *Top Down.*

9:20 **Speaker, Todd Younkin**, Intel
Presentation title: *Nano regime.*

10:00 Break

10:20 **Speaker, Gerhard Klimeck**, Purdue University
Presentation title: *Myth busting knowledge generation and transfer with nanoHUB and NEMO*

11:00 **Speaker, Haiyan Wang**, Texas A&M University
Presentation title: *Self-assembled Nanocomposites for Multifunctionalities —Current and Future*

11:40 Lunch

12:40 **Panel Discussion and wrap-up – Nanoelectronics**

Panelists: Curt Richter, NIST
Panelists: Luigi Colombo, TI
Panelists: Joan Marie Redwing, Pennsylvania State U.
Lead: Robert Pohanka, NNCO (retired) and DMMI Member

1:40 Adjourn meeting

1:40 Break

2:00 Post discussion DMMI and Reliance

3:00 Adjourn fully.

During the month of September 2015 the DMMI standing committee held the workshop titled 21st Century Paradigm Change in Performance and Design Metrics. The meeting was conducted on September 24-25. And the following is the brief agenda for the workshop.

Thursday, September 24, 2015

The National Academies Keck Center, 500 5th Street, NW – Room KECK 105, Washington, DC

OPEN SESSION

8:00 Working Breakfast

8:30 Welcome, Meeting Objective, Introductions - **Mike McGrath**

Introduction

9:00 **Speaker Kristen Baldwin**, AT&L/ASD(R&E)
Presentation title: *Engineering Complex Defense Systems.*

Topic 1: Modeling Frameworks That Fit the Defense Materials, Design and Manufacturing Tradespace

9:40 **Speaker, Paul Collopy,** University of Alabama in Huntsville
Presentation title: *System Development Speed and National Security.*

10:20 Break

10:40 **Speaker, Simon Goerger**, ARMY
Presentation title: *the Army and modeling.*

11:20 **Speaker, Steve Cornford**, JPL-NASA
Presentation title: *NASA and manufacturing in a modeling framework*

12:00 Lunch

1:00 **Speaker, Galip Ulsoy,** University of Michigan
Presentation title: *Reconfigurable Manufacturing.*

1:40 **Speaker, Pamela Kobryn**, AFRL
Presentation title: *Aircraft Digital Thread: An Emerging Framework for Lifecycle Management*

2:20 **Speaker, Rosario A. Gerhardt**, Georgia Tech
Presentation title: M*aterials based characterization in the digital thread*

3:00 Break

3:20 **Panel Discussion – Uncertainty and Change Propagation in Modeling**

Panelists: Jay Martin, ARL, Penn State University
Panelists: Saigopal Nelaturi, Palo Alto Research Center
Panelists: Rosario A. Gerhardt, Georgia Tech
Panelists: Pamela Kobryn, AFRL
Lead: Valerie Browning, ValTech Solutions, LLC

5:00 Adjourn

Friday, September 25, 2015

The National Academies Keck Center, 500 5th Street, NW – Room KECK 105, Washington, DC

OPEN SESSION

8:00 Working Breakfast

8:30 Welcome, what we heard yesterday - **Mike McGrath**

Topic 2: Changing the Design Paradigm

9:00 **Speaker, James Guest**, Johns Hopkins
Presentation title: *Linking Design and Manufacturing through Topology Optimization*

9:40 **Speaker Raul Radovitzky**, MIT
Presentation title: *Extreme scale simulation of complex material response*

10:20 Break

10:40 **Speaker**, **Johan deKleer**, Palo Alto Research Center
Presentation title: *Designing with Self Awareness.*

11:20 **Speaker Matthew.R. Begley**, University of California, Santa Barbara
Presentation title: *High through-put analysis and design of multilayered material systems*

12:00 Lunch

1:00 **Speaker**, **Kyu Cho**, ARL
Presentation title: *Expeditionary Manufacturing: Opportunities and Challenges*

1:40 **Panel Discussion and wrap-up – High Leverage on Cost, Schedule, Performance and Adaptability Metrics**

Panelists: Steve McKnight, Virginia Tech
Panelists: Theresa Kotanchek, CEO, Evolved Analytics LLC
Panelists: Ray O Johnson, Lockheed Martin (Retired)
Lead: Paul Kern, The Cohen Group

3:10 Adjourn meeting

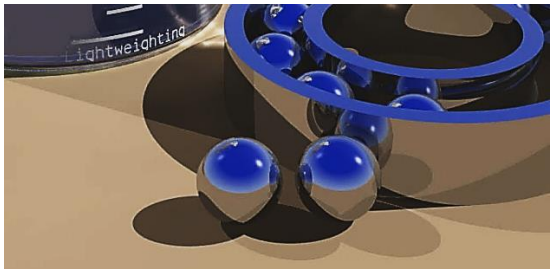
3:20 Post discussion DMMI and Reliance only

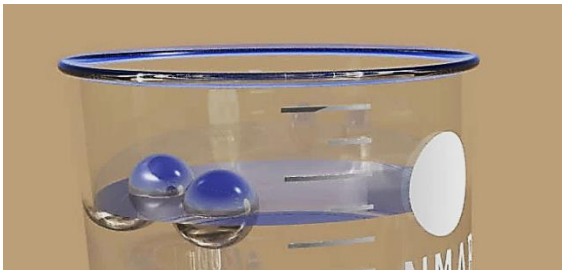
4:00 Adjourn fully.

During the month of December 2014 the DMMI standing committee held the following workshop.

Workshop on:
Combat Vehicle Weight Reduction by Materials Substitution

Washington D.C. December 8-9 (Monday-Tuesday)
The National Academies KECK Center, located at 500 5th Street, N.W.





This 2-day public workshop will discuss future advances in weight reduction by materials substitution for vehicles, including, but not limited to topics such as; Armor, Structure, Automotive Parts, and Armaments. Vehicle weight reduction is an effective strategy for improving fuel consumption in civilian vehicles. For combat vehicles, it presents not only an important opportunity to reduce fuel use and associated logistics, but also important advantages in transport and mobility on the battlefield. This workshop will focus on materials substitution as a means towards weight reduction. It will examine possibilities for weight reduction in the vehicle structure, power train and running gear, and armor and armaments, while meeting system level performance and life cycle sustainment requirements it will also investigate the feasibility of weight reduction goals in the 50-60% range by the 2030-2040 timeframe principally by engineering methods using materials substitution.

The workshop is divided into three main topics:

- Armor issues;
- Structure and Automotive issues and;
- System Effects and Testing

Potential sub-topics include the development of new metal alloys, ceramics, glass materials and composites, with attention to engineering approaches to take advantage of the new materials. It is not the intent of this workshop to address the full systems engineering trade space for a

lightweight force, but rather to focus on contributions to light-weighting engineering enabled by advances in materials substitution.

Day 1, December 8 (Monday), Keck 101

8:00 Working Breakfast
8:30 Welcome **Mike McGrath**,
8:45 Meeting Objective

Introduction

9:15 **Robert Carter** and **Erik Polsen**, U.S. Army Research Laboratory and US Army TARDEC
Presentation title: *Combat Vehicle Weight Reduction, an introduction.*

Topic 1: Armor

9:40 **K.T. Ramesh**, Hopkins Extreme Materials Institute
Presentation title: *The Science of Materials in Extreme Dynamic Environments.*

10:20 Break

10:40 **Rod Heiple,** Alcoa
Presentation title: *Alcoa, lighter, faster and stronger.*

11:20 **Vikram Deshpande,** Cambridge
Presentation title: *Mechanical behaviour of protection materials*

12:00 Lunch

Topic 2: Structure and Automotive issues

1:00 **Bill Mullins,** Navy sponsor of the LM^{3}I
Presentation title: *The Lightweight and Modern Metals Manufacturing Innovation (LM^{3}I) – Institute.*

1:40 **Dianne Chong,** Boeing
Presentation title: *Joining of dissimilar materials and manufacturing constraints during design.*

2:20 **Slade Gardner,** Lockheed Martin
Presentation title: *Advanced Manufacturing case studies*

3:00 **Eric Nyberg,** Pacific Northwest National Laboratory
Presentation title: *Automotive Light Weighting R&D*

Implications for: Armor / Structure and Automotive issues, A Panel

3:40 **Panelists: Tom Kurfess,** Georgia Institute of Technology
Panelists: Mick Maher, DARPA
Panelists: Eric Nyberg, Pacific Northwest National Laboratory
Lead: Bob Schafrik

4:40 Adjourn

Day 2, December 9 (Tuesday), Keck 101

8:00 Working Breakfast
8:30 Welcome, what we heard yesterday

Topic 3: System Effects and Testing

8:40 **Mike Peretti**, GE
Presentation title: *Design optimization that takes manufacturing process constraints into consideration*

9:20 **Olivier L. de Weck**, Massachusetts Institute of Technology
Presentation title: *Lightweighting system propagation effects in the air and on the road.*

10:00 Break

10:20 **Jorge Ledo**, National Center for Adv. Manuf. (NCAM), LSU College of Eng.
Presentation title: *Case Study: Space Shuttle External Tank - Weight Reduction Design Evolution.*

11:00 **Michel Barsoum,** Drexel University
Presentation title: *From MAX to MXene: From 3D to 2D*

11:40 Lunch

In Closing

12:40 **Robert Carter** and **Erik Polsen**, U.S. Army Research Laboratory and US Army TARDEC
Presentation title: *Weight Reduction, a web of complex constraints.*

1:10 **Haydn Wadley**, University of Virginia
Wrap up discussion of workshop.

1:40 Adjourn workshop
1:40 Planning of future meeting (DMMI and Sponsors)
3:00 Full Adjourn

During August 2014 the DMMI standing committee held the Workshop on: Materials State Awareness, the program looks as follows:

Defense Materials Manufacturing and Infrastructure (DMMI)
Workshop on:
Materials State Awareness

Washington D.C. August 6-7 (Wednesday-Thursday)
National Academy of Sciences Building, 2101 Constitution Ave., N.W.

Materials state awareness seeks to quantify the current state of a material and/or damage with statistical metrics of accuracy located in individual systems, structures, or components, and is the heart of condition-based maintenance strategies. In principle, such quantitative evaluation should be based on knowledge of the initial state, damage or failure processes, operational environment, and nondestructive evaluation (NDE) assessment of state. However, most frequently the initial state is not known and the assessment must be done from an unknown reference state. Achieving this goal requires the integration of information from a variety of disciplines, including the mechanics of materials, materials science, engineering mechanics, and NDE engineering. Data interpretation and analysis will play a key role, including the integration of advanced analytics and statistical measures of accuracy and precision. This workshop on materials state awareness will focus around three topics:

Topic 1: Advances in Metrology and Experimental Methods

Topic 2: Advances in Physics Based Models for Assessment

Topic 3: Advances in Databases and Diagnostic Technologies

As such, this workshop agenda will include topics such as:

- 3D characterization at multi-scales, what is the next step in tomography.
- New methods for inversion of NDE measurements to provide material/damage state
- From imaging of electron wave functions, through atoms and nanostructures to mesoscale granular structures and macro engineering scale.
- Metrology; advanced materials property measurement techniques.
- Materials Qualification.
- Modeling to predict material state evolution.
- Condition based Maintenance.

- New science in non-destructive evaluation of complex microstructures.

Day 1, August 6 (Wednesday), Keck 201

8:00 Working Breakfast
8:30 Welcome
8:45 Meeting Objective

Introduction

9:15 **James Malas**, Universal Technology Corporation
Presentation title: *The DoD / NRC Materials State Awareness Collaboration*

Topic 1: Advances in metrology and Experimental Methods

9:40 **Philip Withers**, University of Manchester
Presentation title: *Correlative tomography in materials science*

10:20 Break

10:40 **Jan Achenbach**, Northwestern University
Presentation title: *QNDE and SHM for State Awareness of Materials and Structures*

11:20 **Kevin Hemker**, Johns Hopkins University
Presentation title: *Supporting the development of physics-based models – an experimentalist's perspective*

12:00 Lunch

Topic 2: Advances in Physics Based Models for Assessment

1:00 **Darby Luscher**, Los Alamos National Laboratory
Presentation title: *Physics-based mesoscale modeling of materials in extreme environments*

1:40 **Joannie Chin,** National Institute of Standards and Technology
Presentation title: *Predicting the Service Lives and Durability of Engineered Materials and Systems*

2:20 **Prasun Majumdar**, University of South Carolina
Presentation title: *Measurement of Material State Change and Physics Based Prediction*

Implications for: Qualification of New Materials, Processes and Products

3:00 **Dale Ball**, Lockheed Martin
Presentation title: *The Emerging Role of ICME and ICSE in Airframe Design Analysis*

3:40 **Discussion** on Qualification of New Materials, Processes and Products
Lead: Bob Schafrik and **Valerie Browning**

4:40 Adjourn
5:30 Working Dinner

Day 2, August 7 (Thursday), Keck 201

8:00 Working Breakfast
8:30 Welcome, what we heard yesterday

Topic 3: Advances in Databases and Diagnostic Technologies

8:40 **Abdel Bayoumi**, University of South Carolina
Presentation title: *CBM+: A Smart Predictive Approach to Better Design*

9:20 **Susan Sinnott,** University of Florida
Presentation title: *Advanced approaches for material design and discovery*

10:00 Break

10:20 **James Warren**, National Institute of Standards and Technology
Presentation: *The MGI, the Materials Innovation Infrastructure, and it's relevance to materials state awareness*

11:00 **Ed Hindle**, *General Electric Aviation.*
Presentation: *Implications for: Condition Based Maintenance and Life Extension Decisions*

11:40 Lunch

Implications for: Condition Based Maintenance and Life Extension Decisions

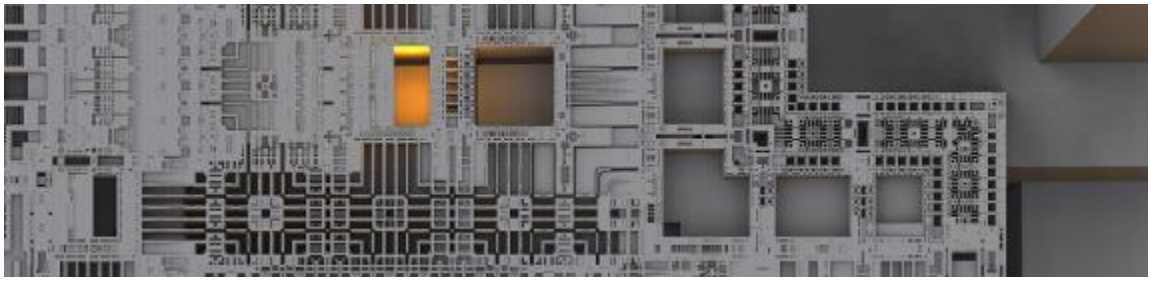
12:40 **Steve Freiman**, Freiman Consulting, Inc.
Presentation: *A New Statistical Method of Assuring Reliability*

1:10 **Eric Lindgren,** *Air Force Research Laboratory.*
Presentation: *AFRL Perspective on Damage/Materials Characterization and CBM/Life Prediction.*

1:40 **Discussion** on Condition Based Maintenance and Life Extension Decisions
Lead: Jesus de la Garza and **Bob Latiff**

2:40 Adjourn workshop
2:40 Planning
3:00 Full Adjourn

During February 2014 the DMMI standing committee has executed the eight DMMI meeting took take place in D.C. on February 5-6, 2014. The title of the workshop was Big Data in Materials Research and Development.



Defense Materials Manufacturing and Infrastructure (DMMI)

Workshop on:
Big Data in Materials Research and Development

Washington D.C. February 5-6 (Wednesday-Thursday)
National Academy of Sciences Building, 2101 Constitution Ave., N.W.

This workshop will not necessarily look at all the aspects of big-data as seen in popular media today. If there were "two halves" to big data they could be described as: data collection and data analysis. This workshop will focus on the first half, data collection, with an eye towards how the materials research and development community can address their critical issues. Data collection for materials research and development might not be that simple as for other applications where the format and the data is set, limited and does not change much. However, materials research and development data comes in many forms ranging from streams of sensor data during processing to image data from analytical instruments and everything in between. What meta-data that should be associated with all this information and how to best curate it is still open for debate.

During this workshop we will hear from experts in fields where large amounts of data have been part of daily life for a long time. We will also hear from key speakers in the materials field.

Wednesday, February 5, 2014
National Academy of Sciences Building, 2101 Constitution Ave., N.W. – Room 125, Washington, DC

OPEN SESSION

8:00 a.m. – 8:30 a.m.	*Working Breakfast*
8:30 a.m. – 8:45 a.m.	***Welcome, what is DMMI*** Dr. Mike McGrath, *Chairman DMMI Standing Committee*
8:45 a.m. – 9:00 a.m.	***Meeting Objectives***

Dr. Robert Schafrik, *Vice-Chairman DMMI Standing Committee*

Introduction to Big Data

9:00 a.m. – 9:20 a.m.	***Frontiers in Massive Data Analysis, and their Implementation*** Speaker: Mr. Daniel Crichton, Calif. Inst. of Tech., Jet Prop. Lab.
9:20 a.m. – 9:40 a.m.	***Q&A***
9:40 a.m. – 10:00 a.m.	***IBM and big data*** Speaker: Dr. Jed W. Pitera, IBM Research - Almaden
10:00 a.m. – 10:20 a.m.	***Q&A***
10:20 a.m. – 10:40 a.m.	*Break*
10:40 a.m. – 11:00 a.m.	***Dig Data for Bio Security*** Speaker: Dr. Dave Shepherd, DHS
11:00 a.m. – 11:20 a.m.	***Q&A***
11:20 a.m. – 12:00 p.m.	***Topic 1 discussion.*** Discussion Leaders: Denise Swink and Jesus de la Garza
12:00 p.m. – 1:00 p.m.	*Lunch*

Big Data Issues in Materials R&D

1:00 p.m. – 1:20 p.m.	***Physics in Big Data*** Speaker: Dr. Thom Mason, Oak Ridge
1:20 p.m. – 1:40 p.m.	***Q&A***
1:40 p.m. – 2:00 p.m.	***MGI and Big Data formats*** Speaker: Dr. Chuck Ward, Air Force (MGI)
2:00 p.m. – 2:20 p.m.	***Q&A***
2:20 p.m. – 2:40 p.m.	***GE's Implementation of ICME for Materials Data*** Speaker: Dr. Rusty Irving, GE
2:40 p.m. – 3:00 p.m.	***Q&A***
3:00 p.m. – 3:20 p.m.	*Break*
3:20 p.m. – 4:00 p.m.	***Topic 2 discussion*** Discussion Leaders: Paul Kern and Haydn Wadley

Big Data Issues in Manufacturing

4:00 p.m. – 4:20 p.m.	***The Smart Manufacturing Leadership Coalition and Big Data*** Speaker: Dr. Jim Davis, UCLA
4:20 p.m. – 4:40 p.m.	***ManTech and Big Data*** Speaker: Ms. Adele Ratcliff, Office of the Secretary of Defense
4:40 p.m. – 5:00 p.m.	***Q&A***
5:00 p.m.	*Adjourn*

Thursday, February 6, 2014

National Academy of Sciences Building, 2101 Constitution Ave., N.W. – Room 125, Washington, DC

OPEN SESSION

8:00 a.m. – 8:30 a.m.	*Working Breakfast*
8:30 a.m. – 8:40 a.m.	***Welcome, what we heard yesterday*** Dr. Mike McGrath, *Chairman*

Continued: Manufacturing Issues in Big Data

8:40 a.m. – 9:00 a.m.	***Data needs to support ICME development in DARPA Open Manufacturing*** Speaker: Dr. Jesse Margiotta, DARPA
9:00 a.m. – 9:20 a.m.	***Q&A***
9:20 a.m. – 9:40 a.m.	***MSAT/MAPTIS data archiving and process and material data Schema*** Speaker: Dr. Wayne Ziegler, ARL
9:40 a.m. – 10:00 a.m.	***Q&A***
10:00 a.m. – 10:20 a.m.	*Break*
10:20 a.m. – 11:00 p.m.	***Topic 3 discussion*** Discussion Leaders: Valerie Browning and Ward Plummer

The Way Ahead

11:00 a.m. – 12:00 p.m.	***The way ahead*** The light weight metals institute Speaker: Dr. Julie Christodoulou, Office of Naval Research The direction of policy Speaker: Dr. Michael Stebbins, OSTP Discussion Leaders: Mike McGrath and Robert Schafrik
12:00 p.m. – 1:00 p.m.	*Lunch*
1:00 p.m. – 2:00 p.m.	***Continued discussion about the way ahead and wrap up*** Discussion Leaders: Mike McGrath and Robert Schafrik
2:00 p.m.	*Adjourn open session*
2:00 p.m. – 2:10 p.m.	*Break*

CLOSED SESSION

2:10 p.m. – 3:00 p.m.	***DMMI planning session*** Dr. Mike McGrath, *Chairman*

During **August** 1-2, 2013 the seventh meeting was held. **Title**: *Limited Affordable Low-Volume Manufacturing: A Workshop*

Limited Affordable Low-Volume Manufacturing

Meeting Context and Issues:

In the earliest manufacturing processes, goods were created by skilled craftsmen relatively expensively, one by one. Naturally the demand for cheaper products inevitably led to numerous productivity innovations, culminating in factories utilizing large-scale production processes. Today, there are often situations where there only is a need to produce 1,000, 100, or even 10 specific, critical parts at a time. Low-volume manufacturing is fairly common in the medical device industry, for instance, as new concepts are tested in pilot markets or in trials before larger volumes are necessary. However, manufacturing processes and design options become limited as the costs of tooling and setup become a significant component of product cost. For high-quantity production, the initial fixed cost investment can be amortized across a large number of parts. For low-volume production, though, fixed costs can overwhelm the variable part cost trade-off. In such cases, desired functionality, quantity, part cost, and delivery schedule can be traded off to achieve a required level of affordability. Sometimes the specification of commercial off-the-shelf parts can be a solution but this strategy can be at the expense of desired part functionality. While low-volume manufacturing has its challenges, it does provide a path to achieving all desired part functionality. By using processes suited to small batch manufacturing, prototype and production components can be made without loss in capability. This enables early performance testing and preliminary verification and validation exercises, reducing the surprises that can show up in first article builds. It also provides a clear path for satisfying future supportability needs.

Low-volume manufacturing

Computer Integrated Manufacturing (CIM) is recognized as an effective platform for increasing manufacturing competitiveness. Computer Aided Process Planning is an essential key for achieving CIM. The integration of design, computer aided process planning (CAPP) and production planning and control (PPC) is becoming essential especially in a concurrent engineering environment where many product life cycle factors are of concern. Flexible Manufacturing Systems (FMS), i.e., systems which most efficiently can handle a changing product mix and low volume production have proven their effectiveness. A typical FMS today consists of several machine tools and support systems which control the entire manufacturing process from starting material to finished goods. Support systems include: information management, tool management and material handling as well as the manual operations of forming and assembly.

Use of commercial off-the-shelf (COTS) items

In 2001 DoD issued version 1.0 of the commercial item handbook, designed to be a practical reference tool for use in commercial item acquisitions. Today, more than ever, commercial manufacturing processes and products offer advanced technology, price, and performance advantages when used in defense applications. However, with this usage there is a loss of DoD insight into product details, such as information on each step of the manufacturing process, relevant specifications, and a loss of control over configuration changes and parts/process obsolescence. This poses both business and technical risks for DoD.

Commercial manufacturing services

Beyond COTS, an additional concern for DoD is that the expected contraction in the defense market will shrink the number of defense-unique suppliers, especially at lower tiers in defense supply chains. One mitigating strategy is to foster a dual use supplier base that manufactures custom products for both commercial and defense applications. A 2002 NRC report[1] noted that companies engaged in commercial manufacturing are technically capable of making custom products for DoD in the same production facility and with the same engineering and manufacturing workforce that supports their commercial customers, but cultural and business barriers had to be overcome. Some technical barriers also needed to be addressed. These same issues are relevant today.

Thursday, August 1, 2013

The National Academies Keck Center, 500 5th Street, NW – Room KECK 101, Washington, DC

CLOSED SESSION

8:00 a.m. – 8:30 a.m.	*Working Breakfast*
8:30 a.m. – 9:30 a.m.	***DMMI preparations for the workshop*** Dr. Robert Latiff, *Chairman DMMI Standing Committee*

OPEN SESSION

DMMI / Reliance Discussion

9:30 a.m. – 10:20 a.m.	***Welcome and introduction*** Dr. Robert Latiff, *Chairman DMMI Standing Committee*
10:20 a.m. – 10:40 a.m.	*Break*
10:40 a.m. – 12:00 p.m.	***Open discussion on current Reliance areas of interest***
12:00 p.m. – 1:00 p.m.	*Lunch*

Presentations

1:00 p.m. – 1:20 p.m.	***Low volume manufacturing operation using additive processes*** Speaker: Dr. Dale R Carlson, General Manager for Technology Strategy, GE Aviation
1:20 p.m. – 1:40 p.m.	***Q&A***
1:40 p.m. – 2:00 p.m.	***Additive manufacturing as a disruptive technology*** Speaker: Dr. Kenan Jarboe, President of Athena Alliance
2:00 p.m. – 2:20 p.m.	***Q&A***
2:20 p.m. – 2:40 p.m.	***Complex, High Performance Electronics Design & Development as Controllable and Well Controlled Processes*** Speaker: Dr. David Johnson WPAFB
2:40 p.m. – 3:00 p.m.	***Q&A***
3:00 p.m. – 3:20 p.m.	*Break*
3:20 p.m. – 3:40 p.m.	***Reducing Total Lead Time with Quick Response Manufacturing*** Speaker: Dr. Bill Ritchie, President, the Tempus Institute
3:40 p.m. – 4:00 p.m.	***Q&A***
4:00 p.m. – 4:40 p.m.	***Discussion: Today's presentations*** Discussion led by DMMI members

4:40 p.m.	*Adjourn*

CLOSED SESSION

5:30 p.m.	*Dinner, DMMI Standing Committee members and Workshop Planners only, Restaurant TBD*

Friday, August 2, 2013

The National Academies Keck Center, 500 5th Street, NW – Room KECK 101, Washington, DC

OPEN SESSION

8:00 a.m. – 8:30 a.m.	*Working Breakfast*
8:30 a.m. – 9:00 a.m.	***Welcome, what we heard yesterday*** Dr. Robert Schafrik, *DMMI*
9:00 a.m. – 9:20 a.m.	***"additive/distributed manufacturing"*** Speaker: Dr. Nayanee Gupta, research staff, STPI
9:20 a.m. – 9:40 a.m.	***Q&A***
9:40 a.m. – 10:00 a.m.	***Unfinished Business – the 2003 NRC Recommendations on Integrating Commercial and Military Manufacturing*** Speaker: Dr. Michael McGrath, ANSER
10:00 a.m. – 10:20 a.m.	***Q&A***
10:20 a.m. – 10:40 a.m.	*Break*
10:40 a.m. – 11:00 a.m.	***How to turn down the Volume*** Speaker: Dr. Eric Schneider, mechanical engineer, Key Tech
11:00 a.m. – 11:20 a.m.	***Q&A***
11:20 a.m. – 12:00 p.m.	***Discussion: Limited Affordable Low-Volume Manufacturing*** Discussion led by DMMI members
12:00 p.m. – 1:00 p.m.	*Lunch*
1:00 p.m. – 2:00 p.m.	***wrap up of workshop*** Dr. Robert Schafrik, *Vice-Chairman of the workshop*
2:00 p.m.	*Adjourn open session*

During December 2012 the DMMI committee held the following workshop:

Novel Processes on the Verge of Industrial Modernization

Wednesday, December 5, 2012

The National Academies Keck Center, 500 5th Street, NW – Room 201, Washington, DC

OPEN SESSION

8:00 a.m. – 8:30 a.m.	*Working Breakfast*
8:30 a.m. – 8:45 a.m.	***Welcome, what is DMMI*** Dr. Robert Latiff, *Chairman DMMI Standing Committee*
8:45 a.m. – 9:00 a.m.	***Meeting Objectives*** Dr. Robert Schafrik, *Chairman of the workshop*

Additive manufacturing

9:00 a.m. – 9:20 a.m.	***Additive Manufacturing at GE*** Speaker: Dr. Prabhjot Singh
9:20 a.m. – 9:40 a.m.	***Q&A***
9:40 a.m. – 10:00 a.m.	***The Center for Innovative Materials processing through Direct Digital Deposition*** Speaker: Richard P. Martukanitz
10:00 a.m. – 10:20 a.m.	***Q&A***
10:20 a.m. – 10:40 a.m.	*Break*
10:40 a.m. – 11:00 a.m.	***Freeform Fabrication*** Speaker: David Bourell
11:00 a.m. – 11:20 a.m.	***Q&A***
11:20 a.m. – 12:00 p.m.	***Additive manufacturing.*** Discussion Leaders: Denise Swink and Robert Latiff
12:00 p.m. – 1:00 p.m.	*Lunch*

Electromagnetic field manipulation of properties

1:00 p.m. – 1:20 p.m.	***High Magnetic Field Processing and Synthesis to Develop the Next Generation of Structural and Functional Materials*** Speaker: Dr. Gerard M. Ludtka
1:20 p.m. – 1:40 p.m.	***Q&A***
1:40 p.m. – 2:00 p.m.	***High Magnetic Fields*** Speaker: Dr. Greg Boebinger
2:00 p.m. – 2:20 p.m.	***Q&A***
2:20 p.m. – 2:40 p.m.	***Field assisted sintering*** Speaker: Robert J. Dowding
2:40 p.m. – 3:00 p.m.	***Q&A***
3:00 p.m. – 3:20 p.m.	*Break*
3:20 p.m. – 4:00 p.m.	***Electromagnetic field manipulation of properties*** Discussion Leaders: Rosario Gerhardt and Rusty Gray

Design of Materials

4:00 p.m. – 4:20 p.m.	***Data Driven Materials Co-Design***

	Speaker: Dr. Krishna Rajan
4:20 p.m. – 4:40 p.m.	***Q&A***
4:40 p.m.	*Adjourn*

Thursday, December 6, 2012

The National Academies Keck Center, 500 5th Street, NW – Room 201, Washington, DC

OPEN SESSION

8:00 a.m. – 8:30 a.m.	*Working Breakfast*
8:30 a.m. – 9:00 a.m.	***Welcome, what we heard yesterday*** Dr. Robert Schafrik, *Chairman of the workshop*
9:00 a.m. – 9:20 a.m.	***Materials by design©*** Speaker: Dr. Gregory B. Olson [NAE]
9:20 a.m. – 9:40 a.m.	***Q&A***
9:40 a.m. – 10:00 a.m.	***Research in Support of Steel Manufacturing*** Speaker: Dr. John Speer
10:00 a.m. – 10:20 a.m.	***Q&A***
10:20 a.m. – 10:40 a.m.	*Break*
10:40 a.m. – 11:20 p.m.	***Design of materials*** Discussion Leaders: Haydn Wadley and Prabhjot Singh
12:00 p.m. – 1:00 p.m.	*Lunch*
1:00 p.m. – 2:00 p.m.	***wrap up*** Dr. Robert Schafrik, *Chairman of the workshop*
2:00 p.m.	*Adjourn open session*

CLOSED SESSION

2:00 p.m. – 3:00 p.m.	***DMMI planning session*** Dr. Robert Latiff, *Chairman DMMI Standing Committee*
3:00 p.m.	*Adjourn closed session*

During July 2012 the DMMI committee held the following workshop:

Materials and Manufacturing Capabilities for Sustaining Defense Systems

Monday, July 23, 2012

The meeting Room 125, The NAS Building at 2101 Constitution Avenue

OPEN SESSION

8:00 a.m. – 8:30 a.m.	*Working Breakfast*
8:30 a.m. – 8:45 a.m.	***Welcome, what is DMMI*** Dr. Robert Latiff, *Chairman DMMI Standing Committee*
8:45 a.m. – 9:00 a.m.	***Meeting Objectives*** Dr. Robert Latiff, *Chairman, DMMI Standing Committee*
9:00 a.m. – 9:30 a.m.	***DOD and Materials Issues*** Speaker: TBA
9:30 a.m. – 9:40 a.m.	***Q&A***
9:40 a.m. – 10:10 a.m.	***AFRL and Materials Issues*** Speaker: Dr. Katherine A. Stevens, Director, Materials and Manufacturing Directorate, AFRL
10:10 a.m. – 10:20 a.m.	***Q&A***
10:20 a.m. – 10:40 a.m.	*Break*
10:40 a.m. – 11:10 a.m.	***The Army and Materials Issues*** Speaker: Dr. Scott Fish, Army Chief Scientist, U.S. Army
11:10 a.m. – 11:20 a.m.	***Q&A***
11:20 a.m. – 12:00 p.m.	***Open discussion related to materials issues, programs to mitigate shortages.*** Discussion Leaders: Michael F. McGrath and Rosario A. Gerhardt
12:00 p.m. – 1:00 p.m.	*Lunch*
1:00 p.m. – 1:30 p.m.	***Materials Shortages and Strategies to Counter Them*** Speaker: Dr. Robert Schafrik, General Manager, GE Aviation
1:30 p.m. – 1:40 p.m.	***Q&A***
1:40 p.m. – 2:10 p.m.	***Sustaining AF Aging Aircraft into the 21st Century.*** Speaker: Dr. Alan Eckbreth, United Technologies Research Center, retired
2:10 p.m. – 2:20 p.m.	***Q&A***
2:20 p.m. – 2:40 p.m.	*Break*
2:40 p.m. – 3:10 p.m.	***The Air Force Diminishing Manufacturing Sources and Material Shortages (DMSMS) Program*** Speaker: Mr. Royce Smith, Tinker AFB
3:10 p.m. – 3:20 p.m.	***Q&A***

3:20 p.m. – 4:00 p.m.	***open discussion related to supply chain, parts obsolescence, certification, sustainment problems*** Discussion Leaders: Robert E. Schafrik and Alan C. Eckbreth
4:00 p.m.	*Adjourn*

Tuesday, July 24, 2012

The meeting Room 125, The NAS Building at 2101 Constitution Avenue

OPEN SESSION

8:00 a.m. – 8:30 a.m.	*Working Breakfast*
8:30 a.m. – 9:00 a.m.	***Welcome, what we heard yesterday*** Dr. Robert Latiff, *Chairman*
9:00 a.m. – 9:30 a.m.	***Speaker on Counterfeiting*** Speaker: TBA
9:30 a.m. – 9:40 a.m.	***Q&A***
9:40 a.m. – 10:10 a.m.	***Counterfeit parts and parts obsolesce*** Speaker: Dr. Dianne Chong, Vice President BR&T Assembly, Factory & Support Technologies, Boeing
10:10 a.m. – 10:20 a.m.	***Q&A***
10:20 a.m. – 10:40 a.m.	*Break*
10:40 a.m. – 11:10 a.m.	***DARPA's TRUST and IRIS program*** Speaker: Dr. Carl McCants, Program Manager DARPA Microsystems Technology Office, DARPA
11:10 a.m. – 11:20 a.m.	***Q&A***
11:20 a.m. – 12:00 p.m.	***open discussion related to counterfeit problems, substandard parts and materials*** Discussion Leaders: Denise F. Swink and t H. Latiff
12:00 p.m. – 1:00 p.m.	*Lunch*
1:00 p.m. – 1:30 p.m.	***Current Issues at Defense Microelectronics Activity (DMEA)*** Speaker: Dr. Daniel M. Marrujo, Microelectronics Engineer, Defense MicroElectronics Activity (DMEA)
1:30 p.m. – 1:40 p.m.	***Q&A***
1:40 p.m. – 2:10 p.m.	***Issues at Center for Devices & Radiological Health Office of Compliance*** Tentative Speaker: Mr. Bryan H. Benesch, Special Assistant to the Director, FDA
2:10 p.m. – 2:20 p.m.	***Q&A***
2:20 p.m. – 2:40 p.m.	*Break*
2:40 p.m. – 3:00 p.m.	***open discussion related to solutions*** Discussion Leader: Steven G. Wax
3:00 p.m.	*Adjourn*

Meeting 4

January 18 - 19, 2012

Washington, D.C.
The Keck Center

Topic: Research and Development for Resilient and Sustainable Installations and Forward Operating Bases

MEETING OBJECTIVES

(1) Identify on-going research into materials, technologies, and systems for the built environment (including shelters, facilities, and critical infrastructure systems), which could be used on military installations (CONUS) and forward operating bases to improve their security, resiliency, and sustainability.

(2) Explore the implications of these materials, technologies, and systems for:

- Providing essential services inside the fence-line.
- Integrating into larger scale infrastructure systems across the fence-line.
- Physical, economic, social, and environmental sustainability.
- Continuity of operations and disaster resiliency.
- Manufacture/construction of components and systems and supply chains.

Wednesday, January 18, 2012

The meeting Room, K101

OPEN SESSION

8:00 a.m. – 8:30 a.m. *Working Breakfast*

8:30 a.m. – 8:45 a.m. ***Welcome, what is DMMI***
Dr. Robert Latiff, *Chairman*

8:45 a.m. – 9:00 a.m. ***Meeting Objectives***
Sarah Slaughter and Jesus de la Garza, *DMMI Standing Committee*

9:00 a.m. – 9:30 a.m. ***Overview of DoD efforts taking place in labs and being funded in***

universities: Challenges and opportunities
Speaker: Dr. Jeffrey Marqusee, Executive Director,

Strategic Environmental Research and Development Program, OSD

9:30 a.m. – 9:45 a.m. *Q&A period*

9:45 a.m. – 10:15 a.m. *Break*

10:15 a.m. – 12:30 p.m. ***Panel 1: R&D taking place in the military services***
Representatives, Office of Naval Research, or Naval Facilities Engineering Service Center, and Dr. R. Ilker Adiguzel, Director, Construction Engineering Research Laboratory.

12:30 p.m. – 1:30 p.m. *Lunch*

1:30 p.m. – 3:45 p.m. ***Panel 2: R&D taking place in or being funded by other federal agencies***
Proposed Speaker, DHS Science and Technology Directorate
Proposed Speaker, Office of Research and Development, EPA
Proposed Speaker, Director, Engineering Laboratory, NIST
Proposed Speaker, Civil Infrastructure Systems, NSF

During panel 2 *Break when needed*

3:45 p.m. – 4:15 p.m. ***Open discussion***
Dr. Robert Latiff, *Chairman*

4:15 p.m. *Adjourn*

5:00 p.m. *Dinner, DMMI standing committee members*

Thursday, January 19, 2012

The meeting Room, K101

OPEN SESSION

8:00 a.m. – 8:30 a.m. *Working Breakfast*

8:30 a.m. – 8:45 a.m. ***Welcome, day 2***
Dr. Robert Latiff, *Chairman*

8:45 a.m. – 11:30 a.m. ***Panel 3: Synthesis of Discussions and Opportunities***

	Discussion Leaders: Steve Wax, Michael McGrath, Denise Swink and presentation by Sarah Slaughter of DMMI Standing Committee
During panel 3	*Break when needed*
11:30 a.m. – 11:45 a.m.	***Meeting Summary*** Jesus de la Garza and David Nash, *DMMI Standing Committee*
11:45 a.m. – 12:00 p.m.	***Topics for meeting #5*** Dr. Robert Latiff, *Chairman*
12:00 p.m. – 1:00 p.m.	*Working Lunch with continued topic discussion*

CLOSED SESSION

1:00 p.m. – 2:00 p.m.	Closed meeting
2:00 p.m.	*Adjourn*

Appendices:

Appendix 1

Describes the context of the DMMI

Appendix 2

Lists the standing committee members and their short bios.

Appendix 1

Context;

Standing Committee on Defense Materials, Manufacturing, and Infrastructure

Statement of Task: The National Research Council has established a standing committee to convene periodic meetings to discuss topics concerning defense materials, manufacturing, and infrastructure. In meetings to be held approximately three times per year with sponsors and selected speakers, the committee will become informed of emerging issues, discuss planning and program development efforts, and serve as a focal point for potential ad hoc studies and other activities. The committee and its sponsors will jointly agree to the topic, and the invited speakers, for each individual meeting.

Project Context and Issues: The Department of Defense will need to address a range of systems-based, complex problems in the coming years. This standing committee will address significant issues regarding materials, manufacturing, and infrastructure-related activities. Such issues require a technical basis in order to explore the emerging scientific and technological opportunities and to inform policy decisions. Issues to be discussed will emanate from a military focus on personnel, platforms, facilities and manufacturing/industrial base, with transfer of relevant technologies to the commercial sector as appropriate. These issues will require an understanding of the interactions among materials, manufacturing and infrastructure which include, but are not limited to: maintaining technological superiority; creating energy efficient, high performance and sustainable platforms; assuring a safe, healthy, and energy efficient infrastructure; securing the safety of facilities and ports and assessing the critical availability and timeliness of the processes that provide defense materials, parts, and products. Informed approaches to addressing these issues, although assessed from a defense focus, will enable the nation to more effectively sustain technological leadership, as well as to maintain safety of people within federal and private facilities, enhance the infrastructure, and improve the manufacturing base.

Project Audiences and Impact: The audience will be agency sponsors and others interested in the individual meeting topics. The project will be a continuing interactive relationship between the standing committee and the sponsors and provide the basis for prospective studies and other activities at the National Research Council. The activity will not produce any reports or result in any advice or recommendation.

Standing Committee: The standing committee members will have expertise in materials, systems engineering, supply chain logistics, infrastructure, manufacturing; defense-centered industrial base, facilities and operations, defense procurement, and technology transfer. They will engage in planning, program development, and (as appropriate) oversight of activities under its auspices. The standing committee will operate under the aegis of the National Materials Advisory Board (NMAB) with support from the Board on Manufacturing and Engineering Design (BMED), and the Board on Infrastructure and the Constructed Environment (BICE). The standing committee members and their biographies follow.

Appendix 2

Standing committee members, short bios;

Chair:
Michael F. McGrath is Vice President for Systems and Operations Analysis at Analytic Services Inc. (ANSER), a not-for-profit government services organization. He leads ANSER's operations in Science and Technology and Operational Analysis and Management. Dr. McGrath holds a BS in Space Science and Applied Physics and an MS in Aerospace Engineering from Catholic University, and a doctorate in Operations Research from George Washington University. He previously served as the Deputy Assistant Secretary of the Navy for Research, Development, Test and Evaluation (DASN(RDT&E)), where he was a strong proponent for improvements in technology transition, modeling and simulation, and test and evaluation. In prior positions, he served as Vice President for Government Business at the Sarnoff Corporation, ADUSD for Dual Use and Commercial Programs in the Office of the Secretary of Defense (OSD), Assistant Director for Manufacturing at the Defense Systems Research Projects Agency (DARPA-DSO), and Director of the DoD Computer-aided Acquisition and Logistics Support (CALS) program. While at DARPA, he managed the Affordable Multi-Missile Manufacturing Program and the Agile Manufacturing program. He was also heavily involved in DARPA's dual-use Technology Reinvestment Project. His early government career included positions in Logistics Management at Naval Air Systems Command and in Acquisition Management in OSD. He is a member of the National Research Council's National Materials and Manufacturing Board, the Defense Materials, Manufacturing and Infrastructure Committee (DMMI), the Penn State ARL Materials and Manufacturing Advisory Board, and the Georgia Tech Manufacturing Institute Advisory Board.

Vice-Chair:
Robert E. Schafrik [NAE] is currently the General Manager, Materials and Process Engineering Department at GE Aviation and the NMMB board chair. He is responsible for developing advanced materials and processes used in GE's aeronautical turbine engines and their marine and industrial derivatives. He oversees Materials Application Engineering activities supporting GE Aviation's global design engineering, manufacturing, and field support activities. He also operates a state-of-the-art in-house laboratory for advanced materials development, characterization, and failure analysis. Prior to joining GE in November 1997, he served in 2 concurrent positions within the National Research Council, which he joined in 1991: Staff Director, National Materials Advisory Board and Staff Director, Board on Manufacturing and Engineering Design. Under his direction, 33 final reports for studies were issued that addressed significant national issues in materials and manufacturing. Dr. Schafrik also served in the U.S. Air Force in a variety of R&D and system acquisition capacities; he retired as a Lieutenant Colonel, while recently he served as member of the Air Force Scientific Advisory Board, 2009-2013. He has a Ph.D. in metallurgical engineering from Ohio State University, an M.S. in information systems from George Mason University, an M.S. in aerospace engineering from the Air Force Institute of Technology, and a B.S. in metallurgy from Case-Western Reserve University.

Members:
Valerie Browning is an independent consultant and subject matter expert for ValTech Solutions, LLC and a former NMMB board member. She serves as a subject matter expert for a number of DoD and other government activities in the areas of advanced materials and alternative energy.

Prior to forming ValTech Solutions, LLC in December 2007, Dr. Browning served as a Program Manager in the Defense Sciences Office at the Defense Advanced Research Program Agency. During her tenure at DARPA, she assumed full responsibility for the strategic planning, operating management, leadership and development of multiple R&D programs providing innovative technologies in power and energy, radar, telecommunications, and biotechnology for diagnostics, therapeutics and chem./bio warfare defense. Specific programs managed by Dr. Browning include the MetaMaterials, Palm Power, Direct Thermal to Electric Conversion, Negative Index Materials, Robust Portable Power Systems, and BioMagnetic Interfacing Concepts Programs. She also served as the DARPA liaison to the DoD IPT on Energy Security and served as Acting DSO Office Director prior to her departure from government service. In addition to her time at DARPA, Dr. Browning spent 16 of her 24 years of government service as a research physicist at the Naval Research Laboratory. Her primary areas of research were thermoelectric materials, high temperature superconductors and magnetic oxide materials. Upon leaving her government position, Dr. Browning was awarded the Secretary of Defense Award for Outstanding Public Service. She has published over 40 peer review manuscripts including three book chapters. She is active in a number of professional organizations including the American Physical Society, the Materials Research Society, and Sigma Xi. Most recently, Dr. Browning served as co-chair for a 2007 MRS Symposium on magnetic materials and was the Technical Program Committee Chair for the 2008 Fuel Cell Seminar.
Born in South Ruislip, England, Valerie is a 1987 graduate of Virginia Tech where she received her B.S. in physics. She also holds a M.S. in physics from the University of Maryland and a Ph.D. in physics from the Catholic University of America.

Jesus M. de la Garza is the Vecellio Professor of Construction Engineering and Management in the Charles E. Via Jr. Department of Civil and Environmental Engineering at Virginia Tech, and a BICE board member. Dr. de la Garza has been on the staff of Virginia Tech since 1988. His areas of interest and courses taught include information technology, construction engineering and management, design-construction integration, knowledge-based expert systems, construction performance improvement, cost engineering, and professional and legal issues in engineering. From January 2004 to August 2006, Dr. de la Garza served as the director of Information Technology and Infrastructure Systems program within the Civil and Mechanical Systems Division at the National Science Foundation. He has co-authored more than 40 papers in refereed publications and has received awards for several of his papers. Dr. de la Garza has been an officer on the American Society of Civil Engineers (ASCE) Intelligent Computing Committee. He received his MS and PhD in civil engineering from the University of Illinois. de la Garza helps spearhead a course that brings industry professionals from such companies as Bechtel, Fluor, duPont, Procter & Gamble, and KBR to Virginia Tech's Blacksburg campus to educate students on the best practices being incorporated into the construction field. de la Garza specializes in construction engineering and highway infrastructure management and is a member of the Virginia Tech's Myers-Lawson School of Construction. As director of CHAMPS (Center for Highway Asset Management ProgramS) he has led efforts to identify innovative ways to measure the effectiveness of the performance-based road maintenance contracts that the Virginia Department of Transportation awards. The evaluation for effectiveness focuses primarily on the physical level of service of the interstate. He has also served as program director of the Information Technology and Infrastructure Systems program for the National Science Foundation's Civil and Mechanical Systems Division, and as co-chairman of the academic committee of the CII. He earned his bachelor's of science in civil engineering from Tecnologico de Monterrey in 1978, and his master's and Ph.D. degrees in civil engineering from University of Illinois in 1984 and 1988, respectively.

Paul J. Kern, [NAE] GEN, US Army (Ret) is a Senior Counselor with The Cohen Group. He served as President and Chief Operating Officer of AM General from August 2008 through January 2010 and is currently a Director with iRobot Corporation, and a member of the CoVant Board of Managers. Since retiring from the Army in 2005, he has held the Class of 1950 Chair for Advanced Technology at West Point, was a Vice President for Battelle, and a Director on the Anteon and EDO boards. GEN Kern retired after almost 38 years with the US Army as the Commanding General of the Army Materiel Command. The command of more than 50,000 personnel has worldwide responsibility for supply and maintenance support to the Department of Defense, manages the Army depot system, and conducts research for all the ground and rotary wing equipment. Previously he served four years as the Department of the Army Military Deputy for Research, Development and Acquisition. In 1996-97 he was the Commanding General of the 4th Infantry Division, Mechanized, where they developed the organization, tactics, techniques, and equipment implemented in today's networked force. From 1993 to 1996 he was the Senior Military Assistant for Secretary of Defense Bill Perry. GEN Kern graduated from West Point in 1967 with a Bachelor of Science degree. He holds Master Degrees in Civil and Mechanical Engineering from the University of Michigan and was elected to the National Academy of Engineering in 2006. He was a National Security Fellow at the J.F. Kennedy School, Harvard University and is currently a member of the Defense Science Board.

Robert H. Latiff is President of R. Latiff Associates and a member of NMMB. Previous to this he was Vice President, Chief Engineer and Technology Officer in SAIC's Space and Geospatial Intelligence Business Unit. He retired in 2006 from the US Air Force as a Major General, with his last assignments at the National Reconnaissance Office as the Director for Systems Engineering and as the Director of Advanced Systems and Technology. General Latiff was a career technologist and acquisition officer, managing large and complex systems such as the Cheyenne Mountain Upgrade, the Air Force's airspace management and landing systems, and the Joint Surveillance Target Attack Radar System (JSTARS). He also served as Commander, Cheyenne Mountain Operations Center and Vice Commander, Air Force Electronic Systems Center. Dr Latiff has served as committee member or task force member for the Air Force Studies Board and the Defense Science Board. He is an Adjunct Professor of Applied Information Technology at George Mason University. Dr Latiff holds a MS and PhD in Materials Science and a BS in Physics from the University of Notre Dame.

E. Ward Plummer [NAS] is professor of physics at Louisiana State University. Dr. Plummer came to LSU in 2009 he is a professor of Physics and Astronomy and special assistant to the Vice Chancellor for Research. He received a Bachelor of Arts degree from Lewis and Clark College in 1962 and completed his Ph.D. degree in physics at Cornell University in 1967. In 1973, Plummer joined the Physics Department at the University of Pennsylvania where his work mainly focused on nonlinear optical response from surfaces. In 1988, he was appointed the William Smith Professor of Physics and in 1990 became the director of the NSF-funded Materials Research Laboratory (Laboratory for Research on Structure of Matter). In January 1993, Plummer moved to Tennessee with a joint appointment at The University of Tennessee (Distinguished Professor), Knoxville, and Oak Ridge National Laboratory (Distinguished Scientist). In October 2001, he was awarded the Medard W. Welch Award by the American Vacuum Society (AVS) for his research over the last 10 years. The citation reads, "For the development of novel instrumentation, its use to illuminate new concepts in the surface physics of metals, and the mentoring of promising young scientists." In 2000, Plummer became the Director of the Tennessee Advanced Materials Laboratory (TAML). TAML has since evolved into the Joint Institute for Advanced Materials (JIAM), a multi-million dollar center with state and federal support. Plummer was the director of JIAM until he moved to LSU. He is author of >360 refereed papers and is included in

the list of the 1,000 Most Cited Physicists, a list compiled by the Institute for Scientific Information which is based on papers published between 1981 and 1997.

Denise F. Swink is retired from Federal Service (2004) after 35 years experience spanning a variety of programs at the U.S. Geological Survey, the U.S. Environmental Protection Agency and the U. S. Department of Energy, and is currently serving as a consultant to private sector and non-profit organizations, At the Department of Energy, Ms. Swink held positions as Director, Office of Planning and Environment, Office of Fossil Energy; Deputy Assistant Secretary, Office of Industrial Technologies, Office of Energy Efficiency and Renewable Energy; and Deputy Director and Acting Director, Office of Energy Assurance. The last two decades Ms. Swink held management/supervisory positions, and the last decade she was a member of the Senior Executive Service. Ms. Swink has worked at the highest levels of government, both nationally and internationally, on topics including: fossil energy technology advancement for extraction, transport and utilization of resources; manufacturing productivity and efficiency with emphasis on technology advancement and adoption; electricity infrastructure development; and safety and reliability of the entire energy infrastructure. To enhance the efficiency and competitiveness of industry, Ms. Swink created and lead extensive public/private partnerships (with state and academic) entities to develop strategies promoting innovation, fund and implement plans and monitor results and effectiveness. As the energy infrastructure is the bedrock infrastructure for the reliability of all other critical infrastructures, Ms. Swink has substantial knowledge of interdependencies among infrastructures such as banking and finance, telecommunications, water systems, agriculture and manufacturing operations. She holds an undergraduate degree in Mathematics and Masters Degree in Environmental Sciences. Ms. Swink has been recognized in her career by several industry sponsored awards, the Department of Energy Gold Medal, the U.S Environmental Protection Agency Bronze Award, and the Senior Executive Presidential Rank Award. Ms. Swink is currently, also, a Senior Advisor to the Council On Competitiveness, focusing on building the Business Case for Resilience, much as was done for quality and safety over the past decades.

Haydn N. G. Wadley is the Edgar Starke and University Professor of Materials Science at the University of Virginia in Charlottesville, Virginia and a NMMB board member. He has very broad interests in materials science. His current research explores high temperature thermal protection systems (thermal barrier coatings, liquid metal heat plates for hypersonic vehicle leading edges) and new materials for the mitigation of high intensity dynamic loads. He has addressed many fundamental questions associated with the atomic assembly of nanoscopic materials from the vapor phase, the topological structuring of cellular materials and the processing of high performance composites. These fundamental studies have been used to develop models and numerical simulations that expose the linkages between a materials composition/synthesis and its performance. Some of these models have been coupled with in-situ (ultrasonic and electromagnetic) sensors and nonlinear, feedback control algorithms to implement intelligent process control concepts. He has invented and commercialized several vapor deposition technologies that enable the growth of novel thin films and coatings, and numerous multifunctional cellular materials including those that support stress whilst also serving as impact energy absorbers, heat exchange media, electro-chemical power storage systems or shape morphing structures. He has published 393 papers, co-authored a book on cellular materials, holds 13 US patents, is a fellow of the American Society for Materials and the recipient of several awards. Dr Wadley has spent many years helping the Department of Defense to identify new technology development opportunities in areas as diverse as the exploitation of space and humanitarian relief operations. Haydn Wadley received his bachelor's degree in Chemical Physics and his PhD in Physics from the University of Reading (UK). Prior to joining the University of Virginia in 1988 he was a senior scientist at the National Institute of Standards

and Technology and a leader of its advanced sensors group. He began his research career at the Atomic Energy Research Establishment (Harwell) where he worked on the origins of acoustic emissions in materials and radiation damage mechanisms in refractory metals.