Future Maintenance Operations

Moderator
Mr. Dennis West
Deputy Commander for Fleet Readiness Centers, Naval Air Systems Command
Mr. Dennis West
Deputy Commander for Fleet Readiness Centers, Naval Air Systems Command

RDML Mark Whitney
Deputy Commander, Logistics, Maintenance and Industrial Operations, Naval Sea Systems Command

Mr. Mike Madden
Executive Deputy, Marine Corps Logistics Command

Mr. Jeff Allen
Executive Director, Air Force Sustainment Center, Air Force Material Command

Mr. Larry Muzzelo
Director, Software Engineering Center, Communications Electronics Command

Ms. Tricia Unger
Director of Performance Based Logistics Program, Honeywell Defense & Space
Systems Supported by DOD Maintenance

- 361,400 tactical vehicles
- Support equipment
- 31,900 Combat Vehicles
- 886 Strategic Missiles
- Communications/electronics equipment
- 239 ships
- Other systems
- 16,900 Aircraft
What’s it Taking?

Approx. 584,000 Field Level Maintainers

Approx. 75,000 Depot Level Personnel

1000’s of Private Sector Companies

- 479 Inter. Maintenance Activities
- 21 Software Maintenance Activities
- 17 Depot Level Activities

Approximately a $75 Billion Enterprise
The Problem

- Decreasing Readiness
- Growing Pressure on Budget
- Constant/Growing and Shifting Demand
- Changing Technologies
- Aging Equipment
- Aging Facilities
- Aging Workforce
Questions We Must Ask

- Are our current sustainment systems effective?
- Can we continue to afford our sustainment systems?
- Is this the best way to maintain our weapons systems?
- Is our commercial industrial base healthy?
- Is our organic industrial base healthy?
Challenges

- Technology identification and insertion
- Technology development for maintenance
- Overall maintenance strategies
- Separately managed maintenance systems by service
- Maintenance level as a certification vice location
- Maintenance management on a global scale
- Personnel training both Civ and military
- Deference to readiness
- Capability and capacity management across services
- Common maintenance production systems
- Event based maintenance
- Common training systems
- Site competition
- Technology and capability investment
- Common processes
- Digital thread
- Additive manufacturing
- Software maintenance and smart systems
- Partnerships
- SRM Investments
- Model based decision making
- Logistics automation
COMFRC Vision 2025

November 2014

- Presented By: Mr. Dennis West
**Current COMFRC Capability Locations**

### Functions | Sites
--- | ---
Fixed Wing | 24
Vertical Lift | 25
Deployed Support | 32
SE/ALRE | 35
Manufacturing | 5
Admin/Services | 39
Components | 39
Engines | 32

**MARINE**
- Fixed Wing
- Vertical Lift
- Deployed Support
- SE/ALRE
- Manufacturing
- Admin/Services
- Components
- Engines

**NAVY**
- Fixed Wing
- Vertical Lift
- Deployed Support
- SE/ALRE
- Manufacturing
- Admin/Services
- Components
- Engines
Optimize Capability & Capacity

Redundant/Inflexible Capability

Focused Capability
Rapid, Affordable, Globally Focused Organization

Slow, Inefficient, stove-piped organization

- Redundant / Inflexible Capability
  - Site-Based Reactive Workload Management
  - Local Capacity
- Inefficient (Slow)
  - Manual
  - Scheduled Long Term
  - Local Directed
- Civilian Level III Trained
  - Military Level II Trained
  - Three Different Training Systems
  - Level of Maintenance is a Place
- Multiple Financial Corpora
  - Multiple Rates for Same Work
  - Local Investments
  - Inability to use Workforce Interchangeably
- Redundant Overhead
  - Excess Rate Burden
  - Different Processes

Optimize Capability & Capacity

- Focused Capability
- Throughput Driven Workload Management
- Global Capacity

Global Maintenance Management

- Efficient High Velocity
- Automated Tracking
- Event Based (Short Term)
- Globally Integrated

Workforce Proficiency

- Military & Civilian Trained Together
- Use of all sites for training
- One Training System
- Maintenance is a Level of Certifications

Financial Model

- Single Financial Corpus
- One Customer Rate
- Global Investments
- Flexible Interchangeable Workforce

Services

- Singular Services System
- Lower Rates
- Common Processes

Engineering Logistics Services

- Title
- Title
- Title

COMFRC Big Rocks/Threads

2014

2025
RDML Mark Whitney

Deputy Commander, Logistics, Maintenance and Industrial Operations

Naval Sea Systems Command
## The Problems and NAVSEA Solutions

<table>
<thead>
<tr>
<th>Problem</th>
<th>ADDITIVE MANUFACTURING USE FOR SHIP MAINTENANCE</th>
<th>CTD PROGRAM</th>
<th>YARD TUBE VIDEOS</th>
<th>CVN 78 TECHNOLOGIES AND DESIGN FEATURES</th>
<th>CBM+ PROCESSES</th>
<th>FUTURE OF PMS TOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreasing Readiness</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Growing Pressure on Budget</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Constant/Growing and Shifting Demand</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Changing Technologies</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Aging Equipment</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Aging Facilities</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Aging Workforce</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Additive Manufacturing Use for Ship Maintenance

Current Programs
“Moonshine” and Rapid Prototyping Labs transform mechanic & engineer needs into solutions.

Primary Uses of AM

1. Geometric fit checks
2. Rapid Prototyping

Current Technologies Being Used
FDM, Vat polymerization, Binder Jetting
CTD Program: Moving from the classroom to the waterfront & Shops, (SME) owned Skills development of workforce

- The Continuous Training and Development (CTD) Program transforms the way we develop workers to a program that emphasizes on-the-job, hands on training, on the deck-plate, and or in a structured shop environment using mock-ups.

- PURPOSE: Accelerate knowledge Transfer – People learn faster by doing;
  - Tell me I may forget, -Show me I will remember, -Let me do it – I will understand!

- Safe to Fail environment, enhancing skill and proficiency.
Production “CTD” Continuous Training and Development Program

- Transitions from Periodicity based driven class room training requirements, to individual assessment and needs, with emphasis to hands on learning.
- Eliminates one shoe fits all lecture based training, targeting individualized Skill/proficiency needs.
- Practical training with embedded problems and challenges with actual shipboard job examples (use of mock-ups, tools, technical work documents, and material) beginning to end. (job planning thru certification of work)

Basic Skills (Boot Camp) training for new employees, tools, methods, and safety specific implemented end of CY-2013.

- ~ 3 to 4 weeks structured hands on basic trade skills training administered prior to assignment of working shipboard.
- Immediate impacts to new employee ability and proficiency when assigned to shipboard crews executing maintenance work, enhancing, accelerating “OJT” development.

Special Emphasis/Critical Skills (Nuclear & Non-Nuclear)

- Utilizing Mock-ups, inside shop to develop higher end Journey level skills.
- Shipboard “OJT” done by assigning “SME’s” to in process work, providing deck-plate mentoring and reinforcement of shop skills training.
Yard Tube Videos - Centrally Managed - locally streamed across 4 Naval Shipyards.

- Went live on 3/17/14, includes shipyard geographic hubs ~ 400 videos and growing.
- Four to five minute videos (like you tube) on job specific techniques, and processes.
- Captures tacit knowledge/technique for accomplishment, used for “JIT” refresher and existing training, will be accessible via E-TWD

Types of Videos (Sampling):

Safety
- Confined Space Entry (Tanks/Voids)
- Arc Flash Protection
- Respirator Usage
- Energy Control LO/TO

Industrial Processes:
- Ball Valve – Disassembly/Clean/Inspect
- Joint Insert Brazing
Types of Videos (Sampling) Continued:

**Industrial Processes**

- Chain Hoist Inspection and Operation
- NDT X-Ray Inspection - Visual and eqpt usage
- EHF Inspection and Installation
- Freeze Seal Installations
- Hydrostatic Test Stand Operations
- Fiber Optic Cable Connector assembly
- 3D Laser Scanners
- Cleanliness Closures/FME Plugs
- Lock wiring
- Mechanical Joint Make-up
- TLI - Testing
- Pipe Hangar Installation
- Pipe Cutting
- Nuclear Repair Processes
- Hydraulic Valve Actuators
- Multi-Pin Plug Fabrication
CVN 78 TECHNOLOGIES AND DESIGN FEATURES

**Integrated Island**
- Smaller Island Re-Positioned Aft & Outboard
- Mast with Clamp Antenna
- Joint Precision Approach and Landing System

**New Propulsion/Electric Plant**
- All Electric Aux Services
- Zonal Electrical Distribution System
- New Propulsion Plants

**Improved Weapon & Material Handling**
- Advanced Weapons Elevators
- Heavy Underway Replenishment
- Plasma Arc Waste Destruction System
- Evolved Sea Sparrow Missile

**Enhanced Flight Deck**
- Enlarged Flight Deck Footprint
- "Pit Stop" Advanced Arresting Gear
- Aircraft Elevators (3) Stbd Sponson
- Redesign
- #4 Catapult Unrestricted

**Enhanced Survivability**
- Electromagnetic Aircraft Launching System (4)
- Underwater Protection

**Improved Ship Self Defense**
- Joint Precision Approach and Landing System
- Advanced Arresting Gear
- Aviation Preservation
- Integrated Island
- Improved Survivability
- Enhanced Ship Self Defense
Positioning the Marine Corps’ Depot for the Future
“If I could comprehensively predict the future I would be buying lottery tickets right now...”
Approach

- What we learned during the war
- Planning for the end of the war
- Appreciating the long view
What We Learned During the War

• Capability plus agility outweighs location
• Prudent business risk was key
• USMC needs an organic depot capability
Planning for the End of the War

• Anticipated the cyclic downturn always prevalent after war (Decision making DNA)
• Strengthened requirements determination process to be ready for the lean times
• Initiated strategic action to take costs out of the equation well before the end
Enduring Requirements Determination Process

- Marine Corps ground depot maintenance requirements are developed/reviewed annually through the Enterprise Lifecycle Maintenance Planning (ELMP) process
  - **Input**: data used to generate requirements validated by enterprise stakeholders
  - **Output**: requirements validated by DC, I&L and used for POM programming/budgeting

**Stakeholder roles:**

- **I&L**
  - Depot Maintenance Requirements development guidance
  - Validate requirements

- **P&R**
  - POM guidance
  - Budget submission

- **PP&O**
  - Prioritization w/in resource constraints

- **CD&I**
  - Acquisition Objective (AAQ)
  - Core systems/quantities
  - Item exit dates

- **LOGCOM**
  - Requirements/cost estimates
  - Executive Agent/workload planning & distribution
  - Organic production plants

- **SYSCOM/PEO-LS**
  - Lifecycle sustainment strategies
  - Statements of work

*Logistics Solutions for the Warfighter*
Depot Consolidation

- Consolidated two 50 year old depots on opposite coasts into a single command
- Achieved $65M in savings over the POM-14 FYDP reduced overhead
- Targeted standardized and specialized production for future savings
Appreciating the Long View

- A clear strategic forecast... (October 2014)“the endless war”...Secretary Hagel forecast that the U.S. would continue to grapple with overseas threat for the foreseeable future. "Tyranny, terrorism, the challenges and threats to our country ... is going to be with us,"

- Solid USMC enterprise level guidance
  - Expeditionary Force 21
  - Ground Combat Tactical Vehicle Strategy
  - Enterprise Ground Equipment Management (EGEM) Construct
Expeditionary Force 21

• Tells me...
  − Expeditionary in nature: fast, austere and lethal
  − Operating Forces will deploy where there is no infrastructure and be a force biased for action
  − Stepping lightly in all areas of support and infrastructure
  − Maintain equipment in forward areas with organic assets
  − Today’s Crisis with Today’s Force...Today
Enterprise Ground Equipment Management (EGEM)

- EGEM is a cross-organizational/functional framework to achieve Marine Corps wide unity of effort in managing equipment levels and maintenance plans. This will allow the Marine Corps to cut costs, meet operational requirements, and have gear on hand for a 186K force.

- Utilizing the EGEM construct, key actions in support of equipment management will include:
  - T/E review /AAO refinement for the 182K/186.6K optimal force
  - Identification of retention requirement/criteria for "cadre" units
  - Equipment storage COAs for leadership decision
Approach to the Future...

- Maintain robust capability and agility to support Expeditionary Force-21 requirements
  - Workforce development that continues to provide deep expertise to the institution
- Exploit enterprise level constructs and strategies to refine the future requirement
- Partner and strategically reach out for help as needed
- Drive down cost at every opportunity
Questions?
Air Force Sustainment Center Complex of the Future

Mr. Jeffrey C. Allen

Generating airpower and achieving “Art of the Possible”

Keep ‘em flying ... it’s what we do!
“Art of the Possible is about reaching beyond today’s limitations to grasp previously unimagined heights of performance. **It is about challenging each other to recognize opportunities, eliminate constraints, improve processes, and optimize resources to achieve world-record results.** It isn’t about working harder, cutting corners or jeopardizing workplace safety; but about expanding our visions of what is truly possible and refusing to settle for marginal improvements”.

- Lt Gen Bruce A. Litchfield, AFSC Commander

**Integrity - Service - Excellence**
Cost-Effective Readiness

• In the Past: Focus on speed & production throughput

• Now: Readiness costs are rising
  – Sustainment costs growing at an unsustainable rate
  – Costs are driving the size of the force
  – Force size determines our ability to fly, fight, & win

• Going Forward: Need to focus on Cost-Effectiveness
  – I.e., more readiness at Same Cost or same readiness at less cost

“We have two choices: Accept the costs and reduce capability or change the way we do business”
- Lt. Gen. Bruce A. Litchfield, Commander, AFSC

Integrity - Service - Excellence
AFSC Cost Effectiveness Focus: The Complex of the Future (CoF)

- The “Art of the Possible” for future depot operations
- Addresses National and USAF study recommendations ref: improved sustainment
- Attacks disconnects between emerging Depot & Supply Chain strategic needs and technology research, development, maturation & insertion activities (i.e. resource prioritization)
Question:
Do You Recognize an Art of the Possible Technology Need When You See It?
DISTRIBUTION A. Approved for public release: distribution unlimited. Ref HAFB 13-08-11AMXG_041; 72ABW-2013-0069
CoF “Attributes” (Requirements)

1. 100% Data Availability
2. 100% Parts Availability
3. Safe & Environmentally Compliant
4. Efficient Depot Operations
5. Effective Workforce
6. 100% Process Control
7. Intelligent Sustainment Network
8. Software Sustainment
Current Status

• Represents a 30 year framework for a depot development planning & modernization program for the depot and supply chain enterprise
  – Establishes technology insertion & investment priorities across AFSC
  – Collaboration with AFSC, AFRL, AFLCMC, & AFNWC
  – Complex of the Future version 1.2 released 1 Oct 2014
  – CoF 2.0 and execution roadmaps: Summer of 2015

• Socializing with USAF stakeholders, industry, and academia
  ▪ Continued collaboration with Flight Line of the Future

• Complex of the Future
  – POC: Edward Ayer, AFSC/EN Technical Director, Edward.Ayer@us.af.mil

Seeking Good Ideas From All Sources to Achieve Cost-Effective Readiness

Integrity - Service - Excellence
- **100% data integration and availability** - All data sources are digital
- **Digital thread** connects the process operations
- **100% parts availability** compresses production time and improves depot agility
- **100% process control** with minimal variance in process output because MARS measures, checks, and calibrates position BEFORE a hole is drilled
- **Efficient depot** with accurate scheduling/forecasting - on-time every time
- **Safe, environmentally compliant, energy efficient**
- **Effective workforce** - eliminates non-value added labor/material from transfer template process
  - 75% reduction in overall labor
  - 50-75% reduction in span time to replace a component
- **Intelligent sustainment network** uses common tools/processes across ALC repair operations and can share workload among locations to support surge and back-up
- Adds flexibility and modularity to the “Art of the Possible” as systems can be configured to a product mix and/or upgraded over time using COTS components
- Commonality – All laser tracker guided systems will measure the same regardless of ALC
“Some” Tools & Resources for Implementing Complex of the Future

Small Business Innovation Research (SBIR) / Small Business Technology Transfer (STTR) / Rapid Innovation Funding (RIF)

AF Life Cycle Mgt Center Program Investments

Equipment Capital Improvement Program

Air Logistics Complex Facility Maintenance & Repair
Why Complex of the Future

Build tomorrow’s goals

• Art-of-the-Possible Cost-Effective Readiness

• State of the art depots maintaining legacy and cutting edge aircraft

• Fostering an environment of USAF, industry, and academia collaboration

• Collaboration and innovation are the keys to meeting the Cost-Effective sustainment needs of the Air Force

Integrity - Service - Excellence
Questions?
We are AFSC
Future of Maintenance Operations

November 18, 2014

Mr. Larry Muzzelo
Director, CECOM Software Engineering Center
Hardware vs Software Fixes

**Hardware Fix:**
One effort = one solution.

**Software Fix:**
One effort = one solution . . .
. . . times all the items in the field!
Depots of Today
(A Shifting of Maintenance Requirements)

Hardware
- Anticipated decrease between FY08-16
  - 6.7M → 2.6M Direct Labor Hours
  - 4,100 → 1,600 Work Years
  - 5,000 → 2,800 On Board Strength

Software
- FY01 → $110M
- FY08 → $315M
- FY15 → $500M

Organic Depot Workload Trend

We’re at the crossroads
Challenges

HARDWARE DEPOT CHALLENGES:

- Modernization Implications
- Increasing System Reliability
  - Order of Magnitude Reduction in Hardware Direct Labor Hours by FY20 for Representative Systems
- Transformation to Software Intensive Systems

SOFTWARE DEPOT CHALLENGES

- Mission Continues to Grow
- Post Production Software Support (PPSS) Growth Driven by
  - Software Intensive Nature of Systems
  - Increasing # of Systems in PPSS
    ➢ 30+ New Systems FY15-20
- Licenses are a Significant Component of Growth
- IAVM becoming More Critical to Cyber Security
Strategic Factors

- Divestiture
- Transition to Sustainment
- Software Complexity
- Workforce Skills

Organic Depot of the Future
2014 DOD Maintenance Symposium
Future Maintenance Operations Discussion Panel
Ms. Tricia Unger
PBL Program Director, Defense Aftermarket Americas
Future Maintenance Operations

2014 DoD Maintenance Symposium Theme:

Delivering Agile and Affordable Maintenance Capability

Objectives:

1. Support the Warfighter – Ensure System Availability

2. Drive affordability

Strategy:

Align Government and Industry Objectives through the Effective use of Public Private Partnerships
Effective Public-Private Partnerships

Focus on the “WHAT” versus the “HOW”

- Identify the Critical Few Sustainment Metrics
  - Reliability, Availability, Cost Control, Depot Utilization, etc.

- Drive Work-scope Responsibility to the PPPs
  - Industry investment in innovation and development at depots
  - Drive commercial repair practices into Government depots
  - Encourage Lean / Six Sigma Principles and Practices

- Provide Industry Partners Appropriate Level of Control
  
  *Performance Work Statements Exceedingly Prescriptive – Driving Costs and Limiting Innovation*
Effective Public-Private Partnerships

Drive Accountability for PPP Success at Depots

• Reduce variation in Partnership maturity and execution between the Service’s depots

• Process efficiency's / cost reductions required for industry to offer savings to the Government
  - Incentivize depot operations to implementation of process efficiency and improve performance
  - Create a consequence / recourse for depot non-performance

• Educate depot business teams on the importance of creating value to drive growth versus entitlement
Effective Public-Private Partnerships

Nurture a Culture of Efficiency

- Improve visibility of repair, parts usage and cost data for identification of process improvement ideas
- Establish processes to eliminate onerous bureaucracy for getting ideas approved and implemented
- Facilitate rapid adoption into Depot Work Instructions
- Drive Lean / Six Sigma processes to depot shared resources
- Expand the use of On-condition Maintenance to drive cost-savings in repair and replacement practices
Effective Public-Private Partnerships

Eliminate Depot Labor Rate Disincentive

- Depot rate structures and reconciliation to Actuals creates risk for industry partners
  - Industry partners absorbing depot-wide operating results in rates
  - Industry to weigh risks of using Depot in cost-reimbursable PPPs

- Depot Labor rates, applicable to PPPs, should be limited to the specific Government artisans, buildings and resources required to execute under the Partnership

- Equitable adjustment clauses should be used to account for increases/decreases NOT caused by industry partners
Effective Public-Private Partnerships

Embrace Engineering / Technical Changes

• Eliminate unnecessary hurdles / delays of industry-funded product and process improvements

• Establish commonality in approach for concurrence and approval of Class1 & Class 2 Changes
  - Balance requirement of approvals with the impact to the system
  - Streamline engineering change control processes to encourage collaboration between the Depots and Industry
Future Maintenance Operations

Drive Effectiveness of PPP’s:

• Focus on the “WHAT” versus the “HOW”
• Drive Accountability for PPP Success at the Depot
• Nurture a Culture of Efficiency
• Eliminate Depot Labor Rate Disincentive
• Embrace Engineering / Technical Changes