

Digital Depot

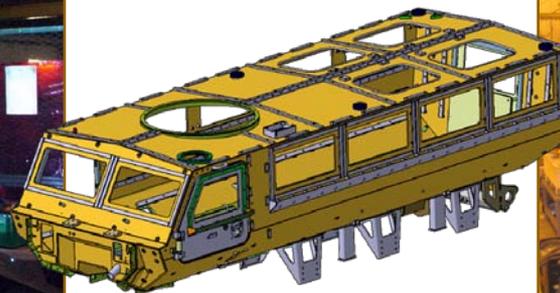
DMC 2010



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- Future Possibilities

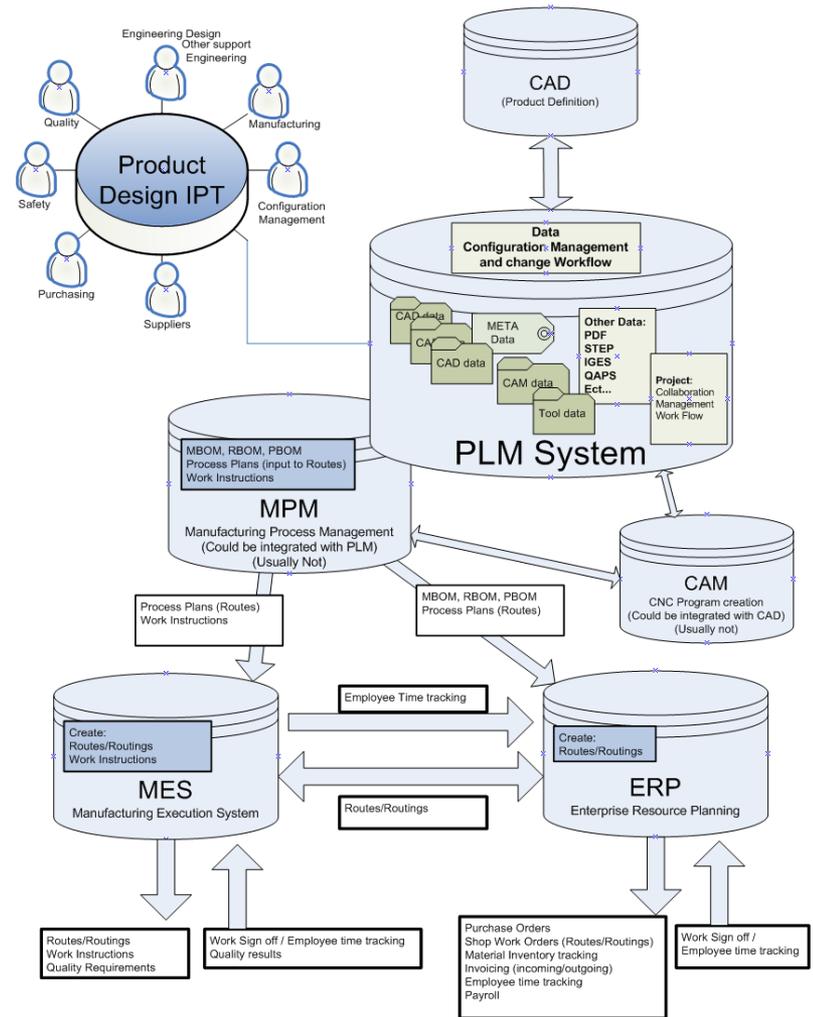
MBE (Model Based Enterprise)

A fully integrated and collaborative environment founded on 3D product definition detail and shared across the enterprise; to enable rapid, seamless, and affordable deployment of products from concept to disposal.



Software

- MBE uses various types software depending on the lifecycle state.
- DoD maintenance facilities typically use CAD, CAM and ERP software already, sometimes PLM software is also used.
- Digital Depot Projects introduce MPM software for use at the facilities.



Manufacturing Planning Processes

- Outputs of our Process Planning activities
 - MBOM, PBOM, RBOM LBOM
 - Lists of items that need to be procured (purchased or produced)
 - Process Plan Sequences
 - Purchase or produce decision (make/buy)
 - Determine/Verify/Analyze processes (Producibility, flow)
 - Prepare plan for entry as a routing
 - Determine and acquire required resources (workspace, workforce, tooling, equipment)
 - Routs (Routings) for LMP (MRP)
 - Enter process plans to MRP and MES systems in the form of routings
(books or packets that Route (accompany) components through the manufacturing process)
 - Work Instructions
 - Create detailed step by step instructions for process plans
 - Manufacturing drawings/models (as required)

Process planning at the depots

- Army Depots use outdated methods
- Same planning methods that were used 50 years ago
- Sometimes TDP does not exist
- Disassemble and reassemble vehicles while documenting the processes
- Best guess efforts usually require re-thinking to implement best solution



Photos courtesy of LEAD

Lean efforts applied to manufacturing

- After initial production start
- Improves Layout
- Improves factory flow
- Requires investment to implement
- Multiple Lean events require multiple investments

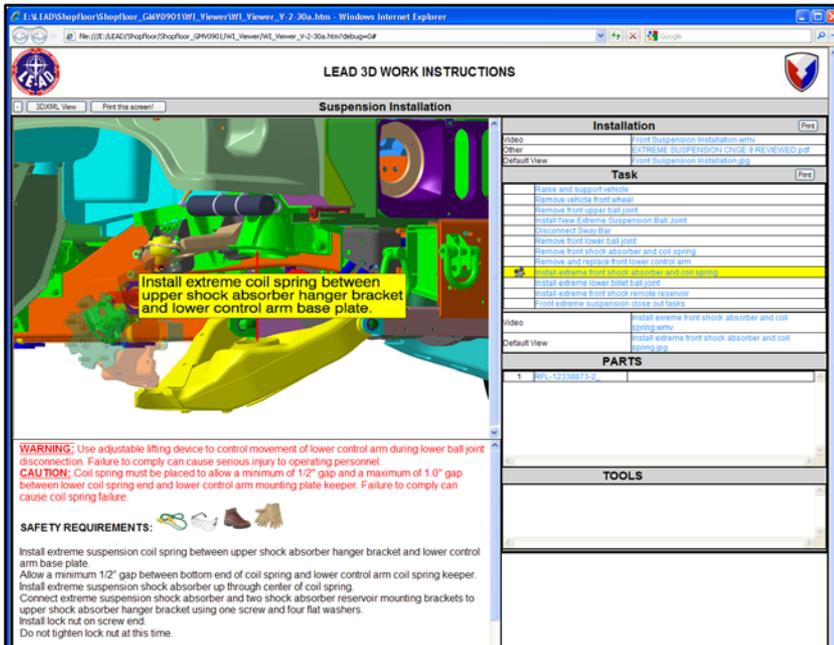


Photos courtesy of LEAD

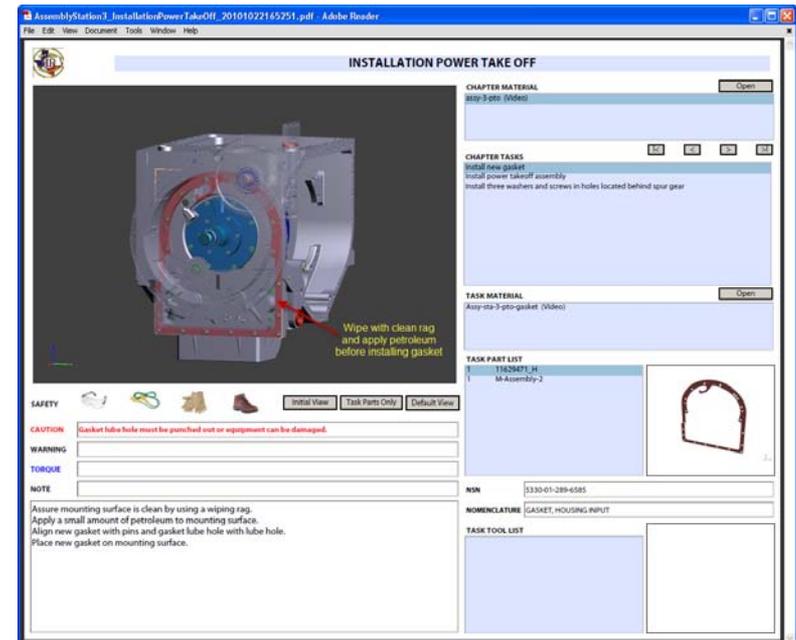
- By transitioning MBE methods, software, supporting hardware and knowledgebase into the organic Army facilities we are improving these organizations ability to respond to the Warfighter's need for the quick fielding or return of vital equipment being repaired.

Description of Digital Depot projects

Digital Depot Projects are focused on transition of MBE technology usages into the DoD maintenance facilities (Depots, Logistics Centers and Shipyards); the most visible aspect of this is in the form of shop Work Instructions. Work Instructions are one output from Process Planning activities.



LEAD Work Instruction Example



RRAD Work Instruction Example

RRAD, LEAD Digital Depot projects

- Both projects introduced DELMIA MPM software to production planning
- MBOM output to ERP system (LMP) was desired, not achieved
- Route output to ERP system (LMP) desired, not achieved
- Physical process analysis achieved
- Statistical process analysis achieved (not strong competency)
- Work Instruction creation achieved (high competency)
- RRAD pilot project; Bradley Fighting Vehicle transmission rebuild
- LEAD pilot project; GMV-S (HMMWV for special forces)

OSD Digital Depot

- The OSD Digital Depot project was conceived to prepare for implementation of MBE pilot projects at Depot maintenance organizations DoD wide.
- Goals
 - 1) Survey DoD facilities, determine MBE reuse capabilities.
 - 2) Determine common practices across facilities.
 - 3) Determine which software tools are used in common practices.
 - 4) Demonstrate the application of several software tools that facilitate reuse of MBE.
 - 5) Create a roadmap that describes which software tools would be used under various circumstances.

OSD Digital Depot

- Site visits, MBE Assessment Matrix Created
 - Cherry Point Marine Corps Air Station
 - Albany Marine Corps Logistics Base
 - Warner Robins Air Logistics Center
 - Corpus Christi Army Depot
 - Tobyhanna Army Depot
 - Picatinny Arsenal
 - Rock Island Arsenal
 - Letterkenny Army Depot
 - Red River Army Depot

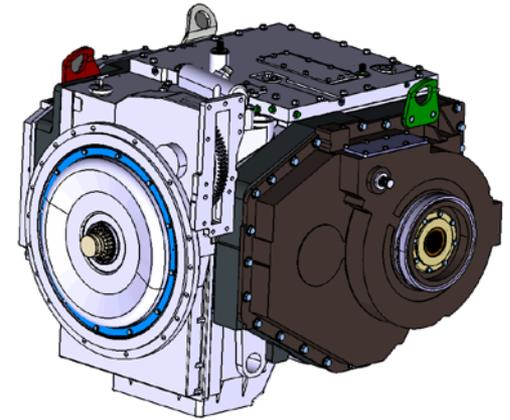


Digital Depot MBE Assessment Matrix
 Questions are targeted to help a Digital Depot implementation team prepare for a pilot project in the event that installation is selected for a pilot project. MBE assessment in this case is how much reuse of data the installation is able to accomplish before a project. This will aid in the determination of what tools and skillsets need to be deployed.

	Marine Corps Logistics Base Albany	Warner Robins Air Logistics Center	Corpus Christi Army Depot	Tobyhanna Army Depot	Cherry Point Navy Air Station	Picatinny Arsenal	Rock Island Arsenal	Letterkenny Army Depot	Red River Army Depot
7 Does your organization currently use CAD/CAM/PLM/MPM/MES/ERP or ERP									
CAD (Computer Aided Design)									
a. PRO-E (PTC Windfire)									
b. UG 18 or earlier									
c. VDAI									
d. CATIA									
e. Auto Desk (ACAD, Inventor)									
f. Solid Edge									
g. Solid Works									
h. Other									
CAM (Computer Aided Machining)									
a. PRO-E (PTC Windfire)									
b. UG 18 or earlier									
c. VDAI									
d. CATIA									
e. MasterCAM									
f. Gibbs CAM									
g. Surf CAM									
h. Other									

Use Case Scenario & Demonstration

- Siemens Team Center and Tecnomatix
- Dassault Systems ENOVIA and DELMIA
- PTC Windchill and MPM Link
- ANARK & Lattice 3D



PDF Work Instructions

- The most visible aspect of each Digital Depot pilot project has been the work instructions generated from reusing the MBE.
- Each project has improved on the technology of how the Work Instruction is built and extracted from the MPM software.
- This project made significant improvements on usability, portability and size.

PDF Work Instructions

The screenshot shows a 3D CAD model of a vehicle's front suspension assembly. A yellow callout box highlights a specific task: "Install extreme coil spring between upper shock absorber hanger bracket and lower control arm base plate." The interface includes a task list on the right, a parts list, and safety warnings. A red arrow points from this interface towards the PDF version on the right.

LEAD 3D WORK INSTRUCTIONS

Suspension Installation

Installation

Task

- 1. Install extreme coil spring between upper shock absorber hanger bracket and lower control arm base plate.

SAFETY REQUIREMENTS:

- Install extreme suspension coil spring between upper shock absorber hanger bracket and lower control arm base plate.
- Allow a minimum 1/2" gap between bottom end of coil spring and lower control arm coil spring keeper.
- Install extreme suspension shock absorber up through center of coil spring.
- Connect extreme suspension shock absorber and two shock absorber reservoir mounting brackets to upper shock absorber hanger bracket using one screw and four flat washers.
- Install lock nut on screw end.
- Do not tighten lock nut at this time.

HTML Work Instruction Output

The screenshot shows a PDF document titled "SUSPENSION INSTALLATION". It features a 3D CAD model of the suspension assembly with a yellow callout box containing the same task as the HTML version: "Install extreme coil spring between upper shock absorber hanger bracket and lower control arm base plate." The PDF includes a table of contents, a list of chapter tasks, a task material list, and safety warnings. A red arrow points from the HTML version towards this PDF version.

SUSPENSION INSTALLATION

CHAPTER MATERIAL

Front Suspension Installation (Video)
EXTREME SUSPENSION CHSE 9-REVIEWED.pdf (Other)

CHAPTER TASKS

- 1. Install extreme coil spring between upper shock absorber hanger bracket and lower control arm base plate.

TASK MATERIAL

Install extreme front shock absorber and coil spring (Video)

TASK PART LIST

- 1. HFL-12338873-2

SAFETY

CAUTION: Coil spring must be placed to allow a minimum of 1/2" gap and a maximum of 1.0" gap between lower coil spring and lower control arm coil spring keeper.

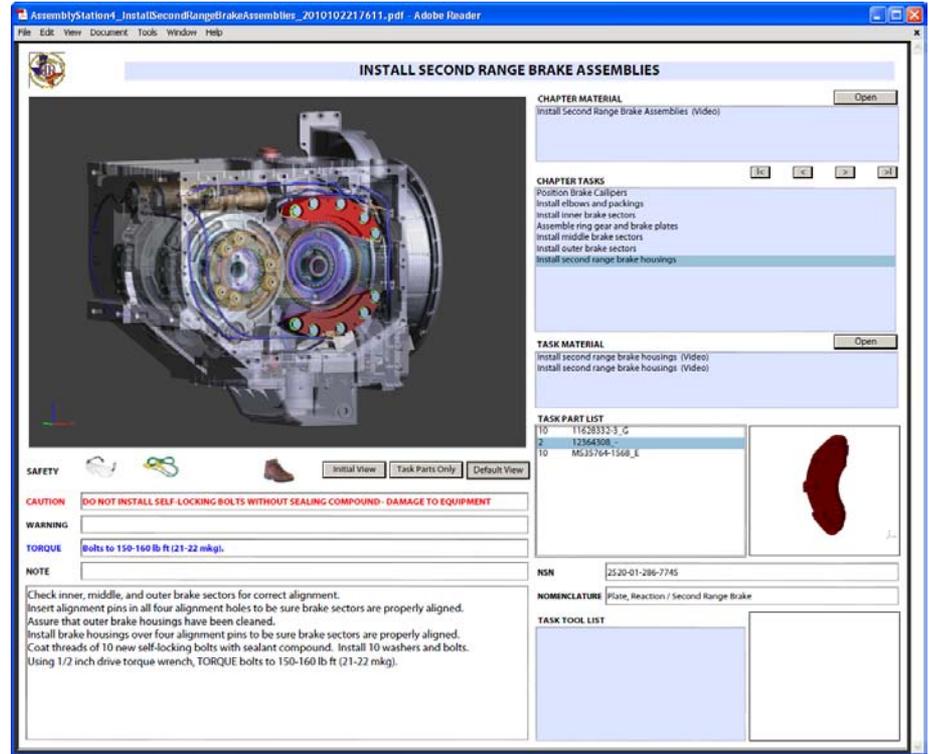
WARNING: Use adjustable lifting device to control movement of lower control arm during lower ball joint disconnection.

NOTE: Install extreme suspension coil spring between upper shock absorber hanger bracket and lower control arm base plate. Allow a minimum 1/2" gap between bottom end of coil spring and lower control arm coil spring keeper. Install extreme suspension shock absorber up through center of coil spring. Connect extreme suspension shock absorber and two shock absorber reservoir mounting brackets to upper shock absorber hanger bracket using one screw and four flat washers. Install lock nut on screw end. Do not tighten lock nut at this time.

PDF Work Instruction Output

PDF Work Instructions

Below is a table that shows two sample comparisons between HTML and PDF work instruction delivery methods. The file count is reduced by a factor of around 100, the file size is reduced by over a factor of 3 compared to the PDF which contains video attachments, and by over a factor of 40 compared to the PDF file which does not contain any video attachments.



	HTML # of Files	Total File Size	PDF size (with Videos)	PDF LIGHT size
Power Take Off	88	42.3MB	11.3MB	1.0MB
Second Range Brake	156	106MB	31.3MB	2.3MB

Source: EOS Solutions Corporation

Future Activities

- Maintain the Software lab at NIST in order to test environments prior to implementation.
- Transition MBE methods to other DoD depot level maintenance facilities.
- Continue to enhance the PDF Work Instruction.
- Develop interfaces for work instructions for other MPM software. (currently output from DELMIA is all that is available)