Network Centric Manufacturing (NCM)

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U.S Army's Armament Research, Development & Engineering Center (ARDEC)
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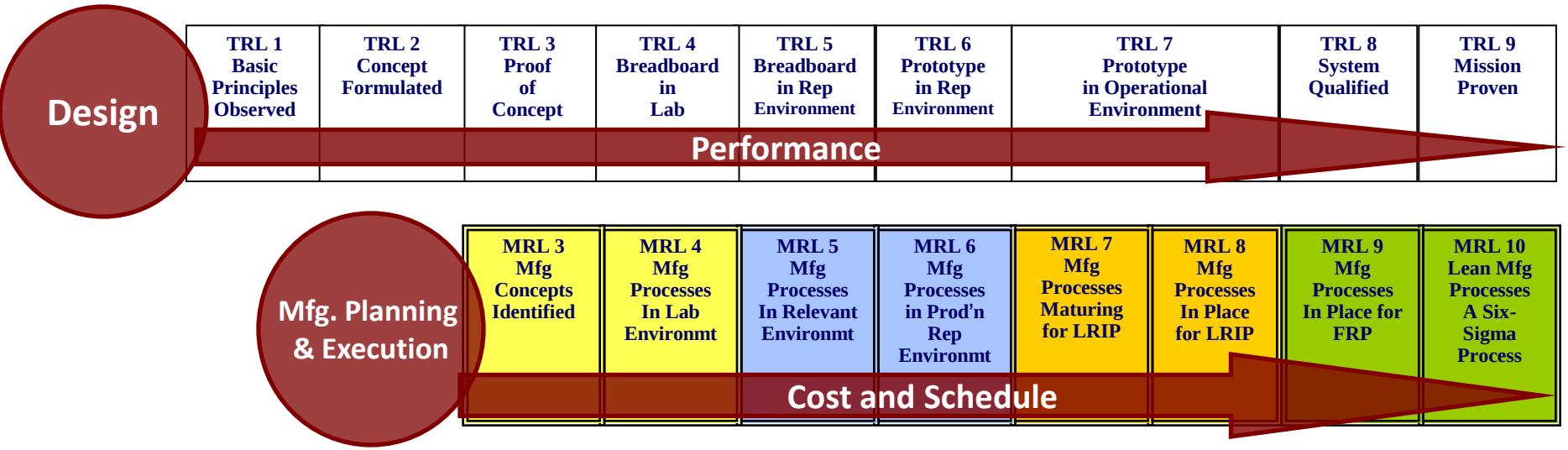
Technology Discussion
Problem & Solution

Issue: DoD system acquisition programs are not fully capitalizing on a knowledge-based acquisition approach and are likely to experience a cascade of negative effects on cost and schedule

Solution: OSD Global Vision addresses the results of GAO report and ensures a "single digital thread":

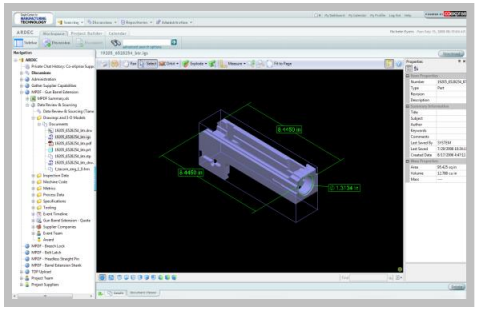
- Knowledge-based acquisition approach that is universally accessible, scalable, transferrable & sustainable
- Knowledge that is connected, captured and available in each lifecycle phase – design, manufacturing planning & execution – including end of life



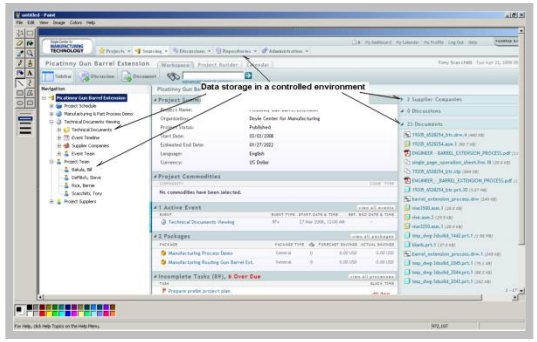
Re-Define Product Data to include more than just design data:

- Design Data
- + Manufacturing Data (components & assemblies)
- + Sustainment Data (Digital TMs & TBs)

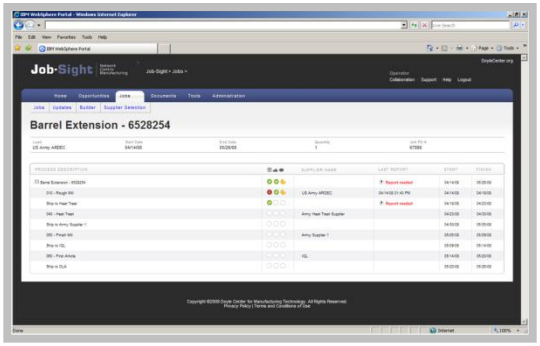
OSD NCM Pilot: "Proving the theory" M2 Barrel Extensions



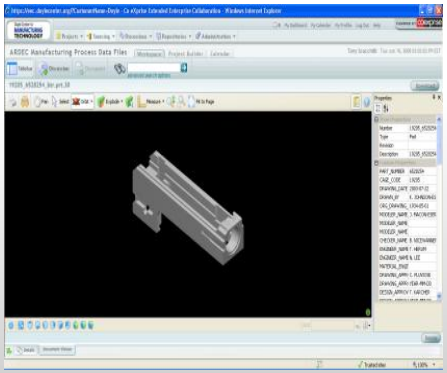
Develop "Modern" Product Definition



Create Qualified Supply Chain



Deploy product definitions to qualified vendors

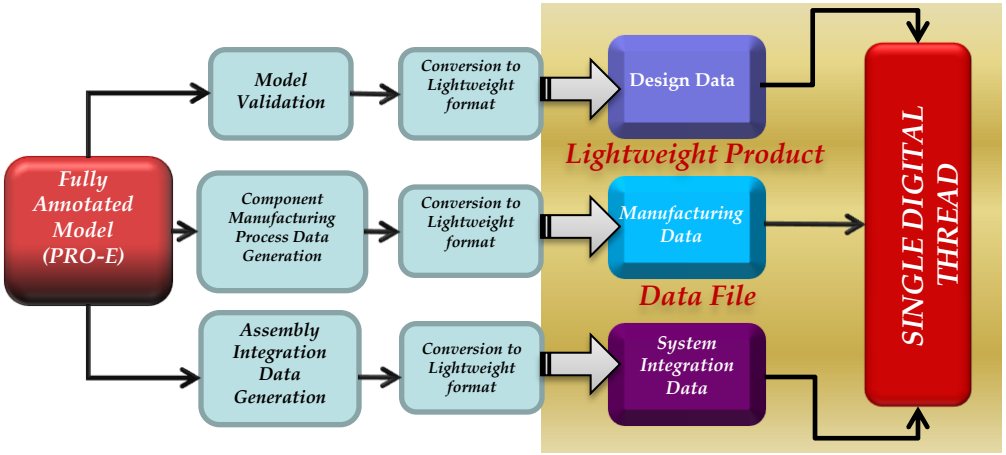


Time-to-field

reduced by 59%

$1.2M production cost savings (3600 parts)

Network Centric Manufacturing



"Product Data is more than just 2D prints"

Purpose: ***To increase the speed to market of mission critical military systems by more effectively capturing, validating, storing, and transitioning product data to the industrial base.***

Results/Products:

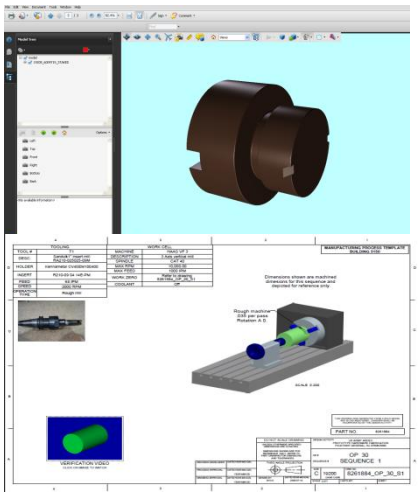
- ***Robust, well integrated business process.***
- ***Knowledge management system capable of storing all the elements of product data.***
- ***Updated & validated Product Data Files (PDF) for mission critical armament systems.***

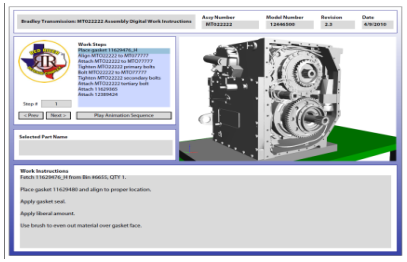
(Warfighter) Payoff:

- ***Upgraded & more responsive supply chains.***
- ***Improved ability for DLA to stand up supply chains for "hard to manufacture" military components.***
- ***Push button spare parts supply system for ASV- CAS and CROWS products.***

Schedule & Cost

	FY 09	FY 10	FY 11
Assess Existing MBE Technology	Milestone A		
Develop NCPM process			
Validate NCPM process		Milestone B	
Transition NCPM process to stakeholders			Milestone C





Utilizing 3D Product data in a generic, free to access format is a game changer…

Technology Discussion
2D vs. 3D: Distinctions & Definitions

2D PDF and C4: Current Army Document of Record

3D Official: 3D model is official. 2D drawing driven by model

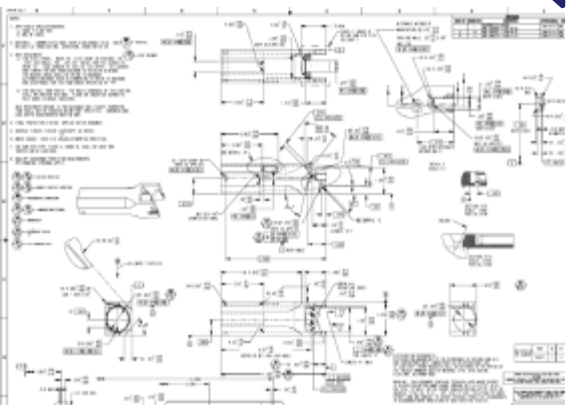
3D Fully Annotated: Complete Model Based Definition with supporting Lightweight viewable (i.e. Adobe 9.0 file)

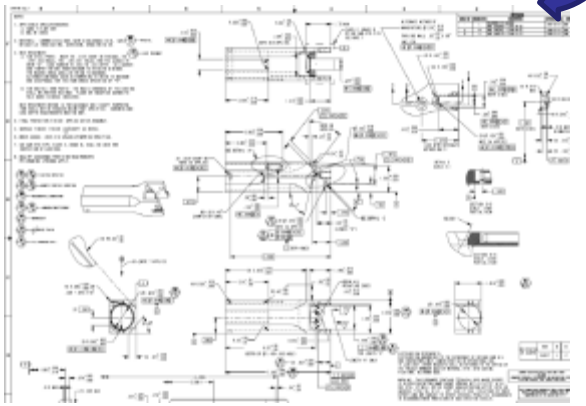
Congressional NCPM

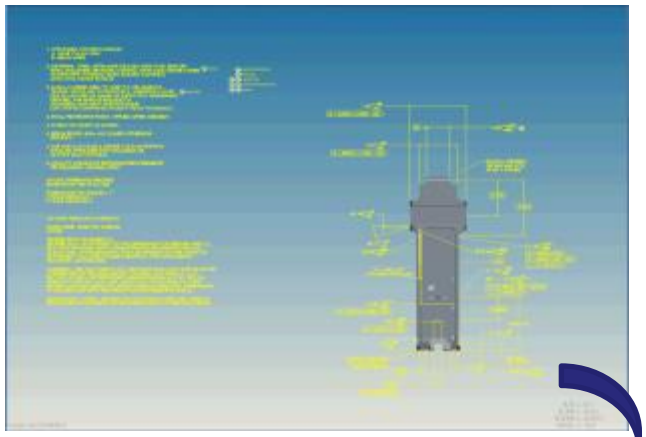
OSD MANTECH

Drawing & model not linked

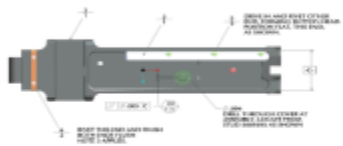
Drawing is driven by model







Complete MBD with 3D viewable (Adobe)



Technology Discussion
Enhancing the 2D Drawing

- Native CAD data is converted and compiled to create a lightweight representative viewable
- *i.e. Adobe 9.0 3D PDF*
- Derived .STP file can be fed directly into CAM packages

REVISIONS	
MODEL REV	B
DRAWING REV	K
DESCRIPTION	NOR L0852044 / 2008-11-06
DATE	2008-11-24
APPROVED	AMW

US ARMY
SPRINGFIELD ARMORY
SPRINGFIELD, MASSACHUSETTS

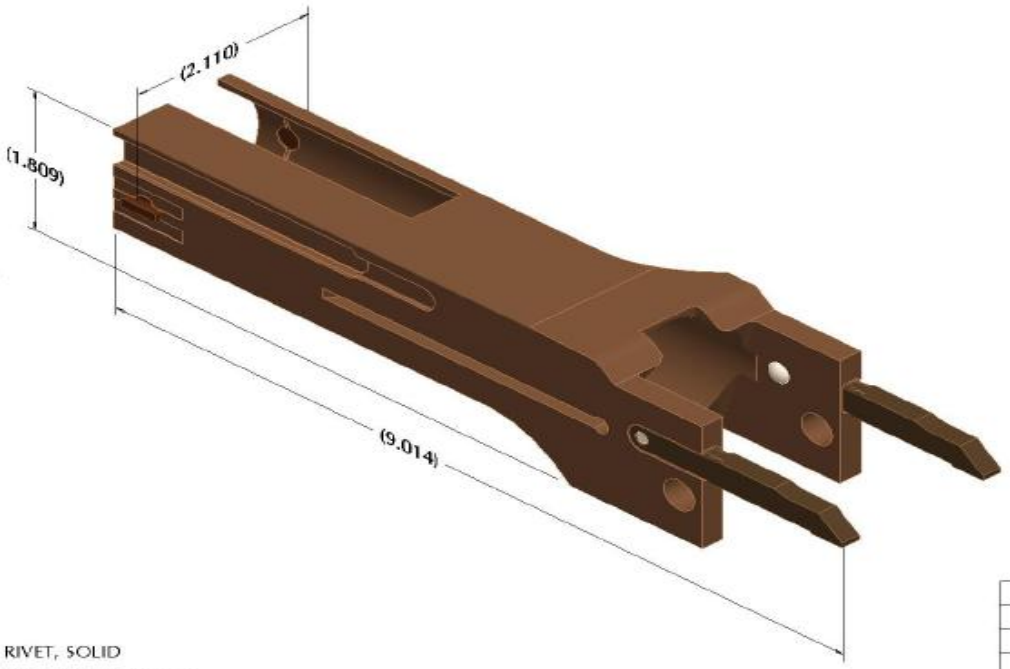
MODEL NUMBER:

CAGE CODE: 19205

NOMENCLATURE: BODY ASSEMBLY, BARREL BUFFER

TITLE BLOCK INFORMATION
DRAWN BY: K. JOHNSON-ESERV
DRAWN DATE: 1953-09-27
CHECKER: B. NICEWANNER
ENGINEER 1: C. PLUVIOSE
ENGINEER 2: J. PELTZ
QA ENGINEER: B. MESSER
MATERIAL ENGINEER:
DRAWING APPROVAL: L. BRUNTON
DRAWING APPROVAL DATE: 2007-02-22
DESIGN APPROVAL: T. KARCHER
DESIGN APPROVAL DATE: 2007-02-22

UNIT WEIGHT: 2.557 LBS.



ITEM #	QTY.	CAGE	PART #	NOMENCLATURE	REMARK
4	2	19205	5009283	RIVET, SOLID	
3	2	19205	6009715	GUIDE, BARREL BUFFER	
2	2	19205	6009712	DEPRESSOR, BREECH LOCK	
1	1	19205	7266834	BODY, BARREL BUFFER	

Fully Annotated Model (PRO-E)

- Lightweight Viewable
- .STP *Max, Normalized, Min*

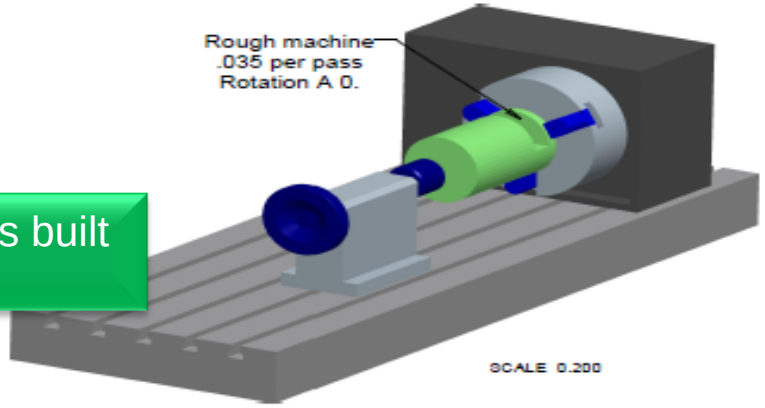
Technology Discussion
Manufacturing Process Data Files

TOOLING	
TOOL #	T1
DESC.	Sandvik1" insert mill RA210-025025-09M
HOLDER	Kennametal CV40EM100400
INSERT	R210-09 04 14E-PM
FEED	65 IPM
SPEED	2000 RPM
OPERATION TYPE	Rough mill

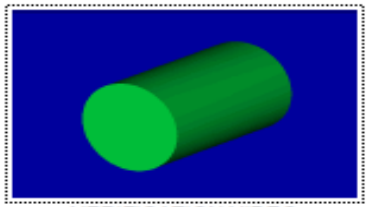
WORK CELL	
MACHINE	HAAS VF 3
DESCRIPTION	3 Axis vertical mill
SPINDLE	CAT 40
MAX RPM	10,000.00
MAX FEED	1000 IPM
WORK ZERO	Refer to drawing 8261884_OP_20_S1
COOLANT	Off

MANUFACTURING PROCESS TEMPLATE
BUILDING 3150

Dimensions shown are machined dimesions for this sequence and depicted for reference only.



- Contains all data relating to how a part is built
- *Output is an Adobe 9.0 file.*

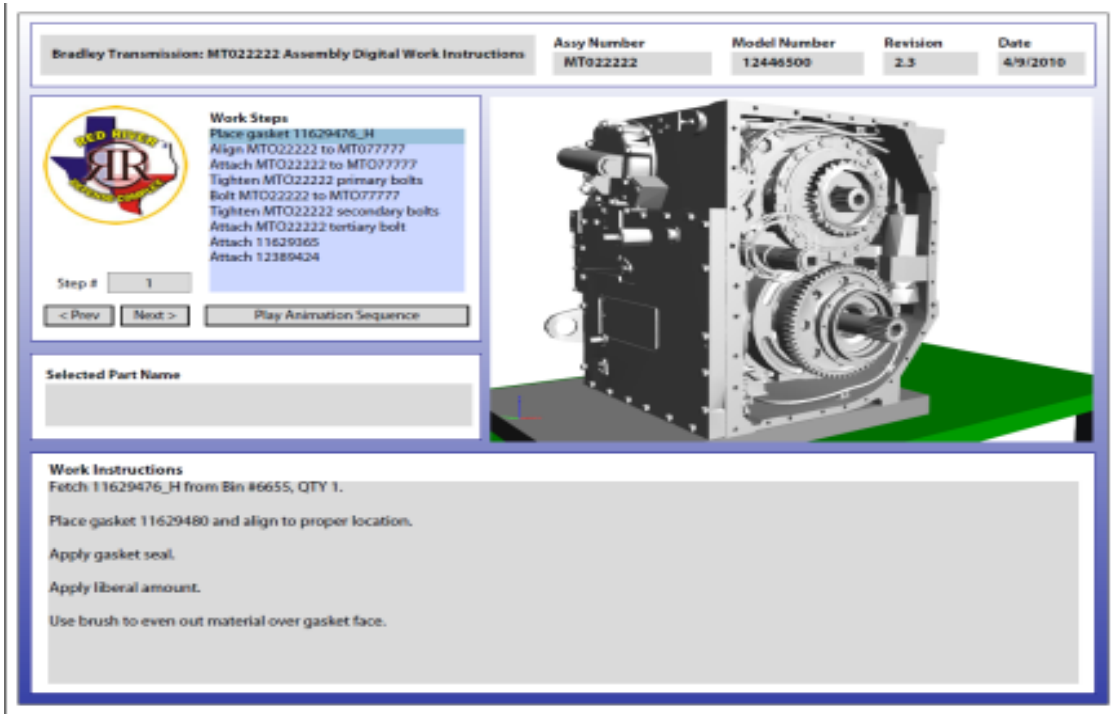


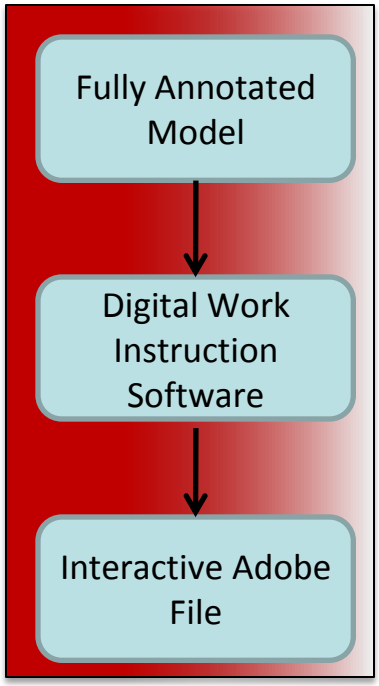
VERIFICATION VIDEO
CLICK ON IMAGE TO WATCH

.STP file → NC Simulation Software → MPDF output in Adobe format

PROCESS DEVELOPER	DATE(YEAR-MO-DA)	THIRD ANGLE PROJECTION	SEQUENCE # SEQUENCE 1
PROCESS APPROVAL	DATE(YEAR-MO-DA) YEAR-MM-DD		SIZE C · CAGE CODE 19200 · DWG NO. 8261884_OP_30_S1
DRAWING APPROVAL	DATE(YEAR-MO-DA) YEAR-MM-DD	DRAWN BY M.N.N · DATE(YEAR-MO-DA) 2009-07-10	SCALE 0.077 · UNITS WT. · SHEET

Technology Discussion
Digitizing Assembly Work Instructions





- .STP Models can be directly imported for use at ESAs/Depots for Production Planning processes
- Depots typically remodel parts if not provided by ESA/OEM

Technology Discussion
Other Applications of the 3DPDF

DIGITAL INSPECTION DOCs

PART SUBMISSION WARRANT

ANARK

PART MANUFACTURING INFORMATION

Part Name: Differential casting
Part Number: 00256982
Safety and/or Government Regulation: YES / NO
Drawing Change Level: --
Additional Changes: Changed draft
Drawing Number: 0058
Engineering Change#: 000

SUPPLIER MANUFACTURING INFORMATION

Supplier Name: Chris Garcia Casting
Supplier Code: 36589
Address: 1434 Spruce Street
City: Boulder
State: CO
Zip Code: 80302

SUBMISSION INFORMATION

Dimensional / Material/Functional / Appearance
Customer: General Motors
Buyer: Pam Smith

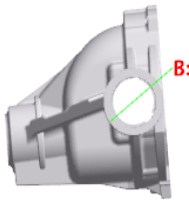
REASON FOR SUBMISSION

Please Select Reason: Change in Part Processing

REQUESTED SUBMISSION LEVEL (Check one)

Submission Level: Level 5: Warrant with product samples and complet

Delivered Part



Part Specifications

Specified	Measured
A: Width = 15.83 +/- 0.03 in	15.84
B: Axle Bore Dia = 3.94 +/- 0.01 in	3.94
C: Driveshaft Bore Dia = 3.93 +/- 0.01 in	3.93
D:	
E:	
F:	
G:	
H:	

SUBMISSION RESULTS

Dimensional measurements / Material and functional tests / Appearance Criteria / Statistical Process Package

These results meet all drawing and specification requirements: YES / NO

Declaration

I hereby affirm that the samples represented by this warrant are representative of our parts, have been made to the applicable Production Approval Process Manual 3rd Edition. I have noted any deviations from this declaration below.

Requirements: I further warrant these samples were produced at the production rate of: $1,200.00 /8 hours

DIGITAL BOMs

LATCH ASY DR RH

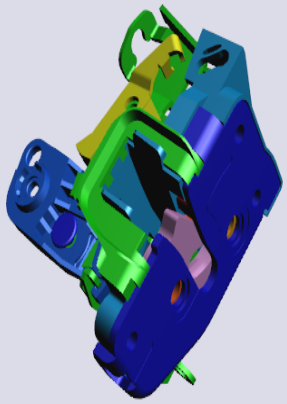
Date 10/7/2009

Supplier Name: Dura
Address: 1434 Spruce Street, Boulder, CO 80302, USA
Phone: 800-555-1212
Plant: Boulder

Platform: Truck Heavy
Program: F-350
Year: 2009

Bill of Materials

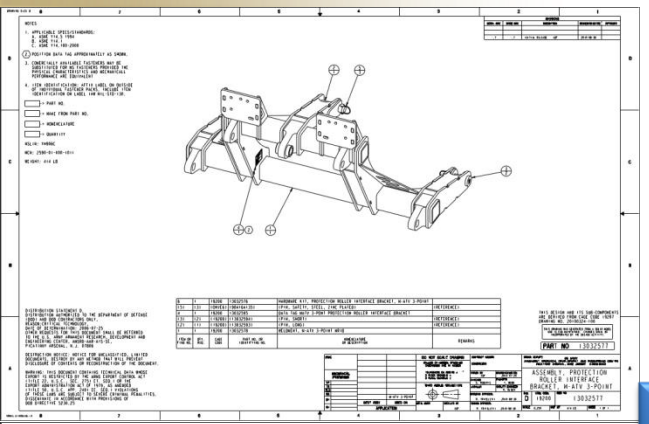
Part Description	Qty
(891208A) PAWL-D21	1
(891210A) ENCAPSULATION_PAWL ASY	1
(A10124) PIN PAWL SHOULDER	1
(F10276) HOUSING SEAL1	1
(F10276) HOUSING SEAL2	1
(F10276) HOUSING-LATCH	1
(921204) RACHET PLASTIC ENCAP	1
(921204) RATCHET	1
BACKPLATE	1
(F10090) LEVER-LINK	1
(959002) LEVER-O_S REL ROD OPR	1
(932504) LEVER-INSIDE RELEASE	1
(F10376) LVR-PLASTIC I_S LK	1
(932302) LEVER-O_S LOCK	1
(A10078) RIVET	1
(911202) FRAME PLATE	1

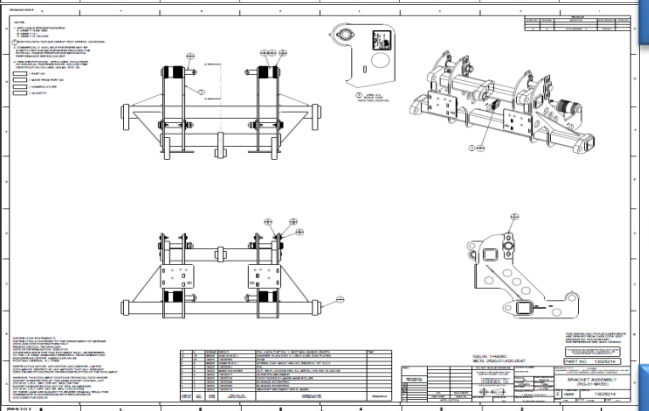


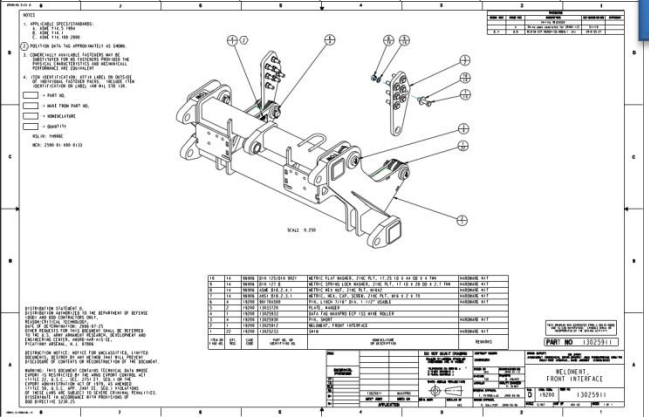
views: Right

Expand / Collapse

Modernizing Technical Data
Protection Roller Interface Brackets

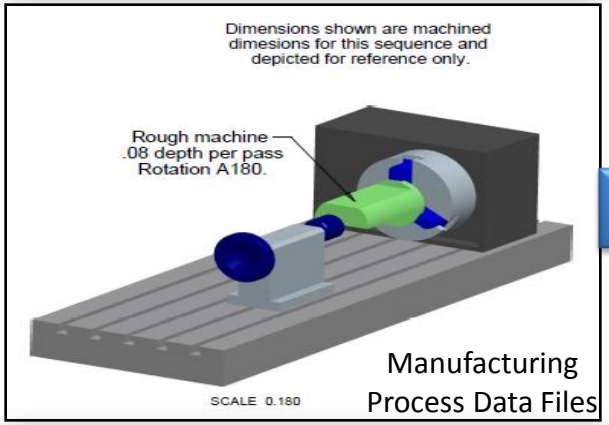




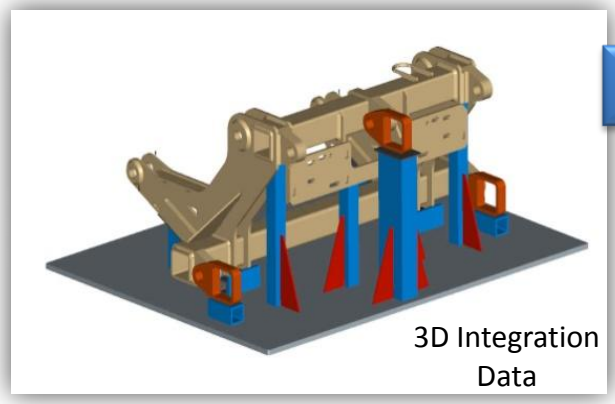


Convert to modern product data package

Lightweight 3D Design



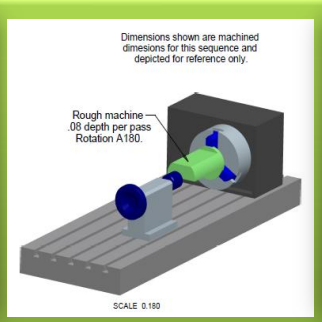
Manufacturing Process Data Files

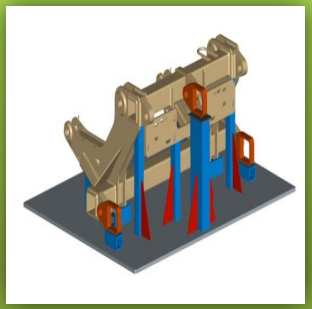


3D Integration Data

- Qualified Supplier 1
- Qualified Supplier 2
- Qualified Supplier 3
- Qualified Supplier 4

Deploying Modern Data Protection Roller Interface Brackets





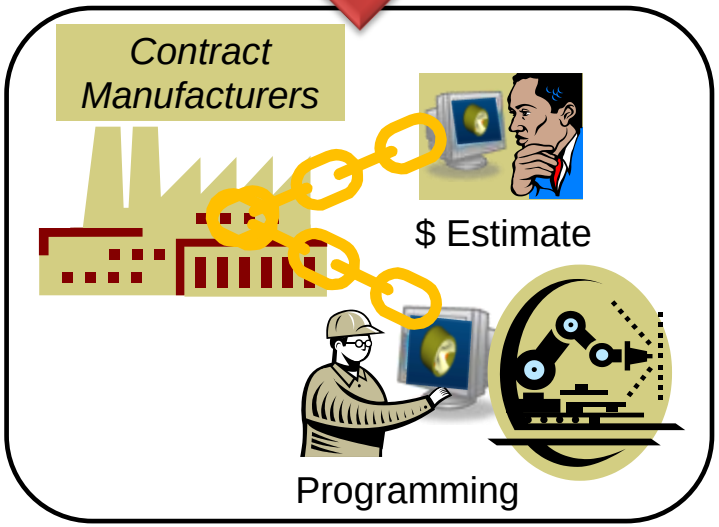
Digital Product Definition

+

Contractual Data

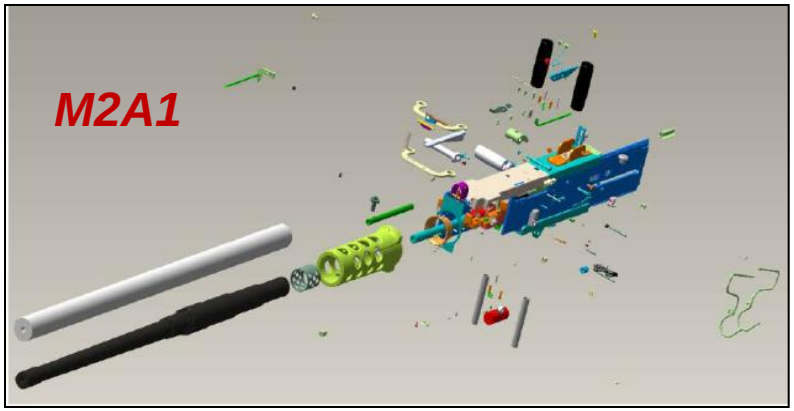
E-SOURCING DATA

Completed Systems



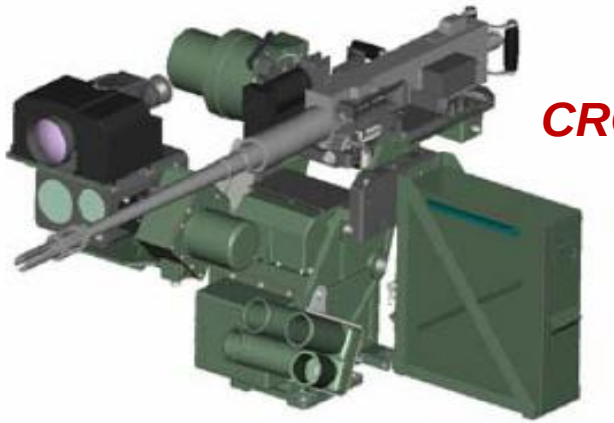
Transitioning NCPM: New Opportunities

M2A1



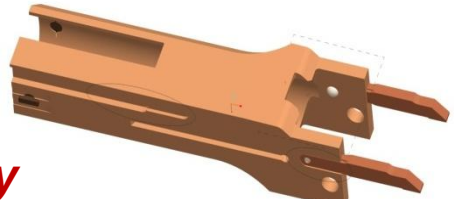
- Fully-Annotated Model w/ Lightweight Design Data (3DPDFs)
- MPDFs for hard to source parts
- Digital Work Instructions for RESET operations.

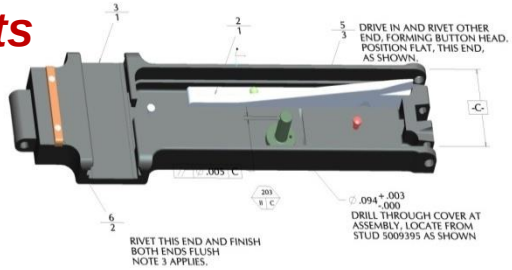
CROWS



- Develop 3D representations of LRUs/SRUs
- Interactive Electronic Technical Manual (IETM)

M2 Legacy Parts





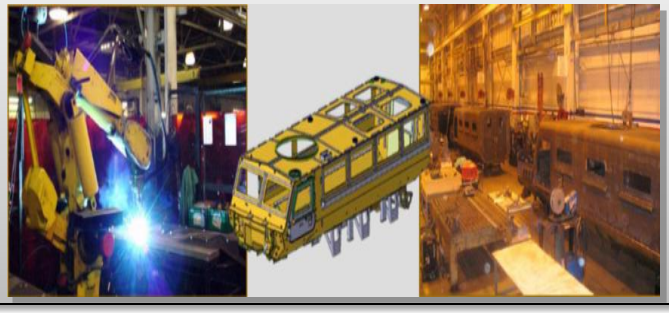
- Create full product data package (PDF format)
- Establish qualified Manufacturing Network
- Deploy modern product data to source components

M3P & Kiowa

DoD Transformational Investment
Integrating the Single Digital Thread

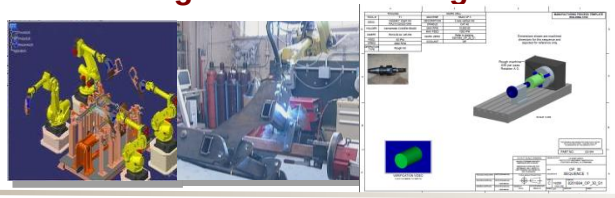
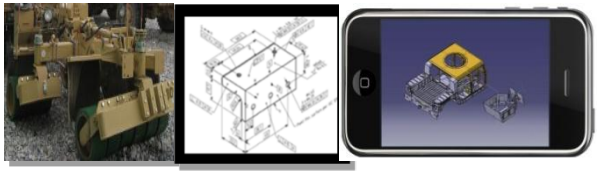
Definition

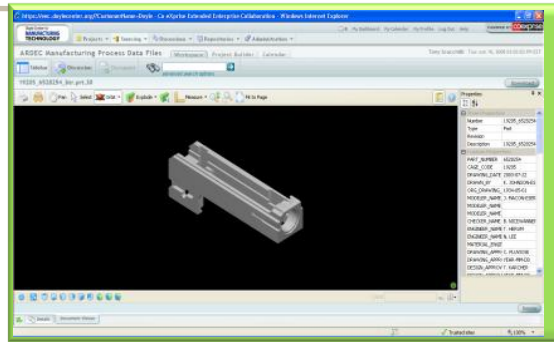
A fully integrated and collaborative environment founded on 3D product definition detail and shared across the enterprise; to enable rapid, seamless, and affordable deployment of products from concept to disposal.



Benefits

- Integrate design and manufacturing processes reducing costs
- Shorten time-to-field for new/revised products
- Increase quality of production process design
- Improve collaboration with stakeholders
- Real-time configuration management processes
- Increase efficiency of spare parts procurement

	Digital Design	Digital Manufacturing	Digital Integration
3D Product Definition	 Specs, E-BOM, M-BOM		
DoD Acquisition Lifecycle	Material Solution	Technology Development	Engineering and Manufacturing Deployment	Production & Deployment	Sustainment
Model Based Enterprise	Model-Based Design & Reuse (CADx)	Intelligent Mfg (Virtual Mfg)	Innovative Mfg Execution (Supply Chains)



Time-to-field reduced by 60%

$1.2M production cost savings (3600 parts)