



Acquisition Research Program:
Creating Synergy for Informed Change

Joint Robotics Repair & Fielding

Mr. Paul Varian

JRRF Division Chief

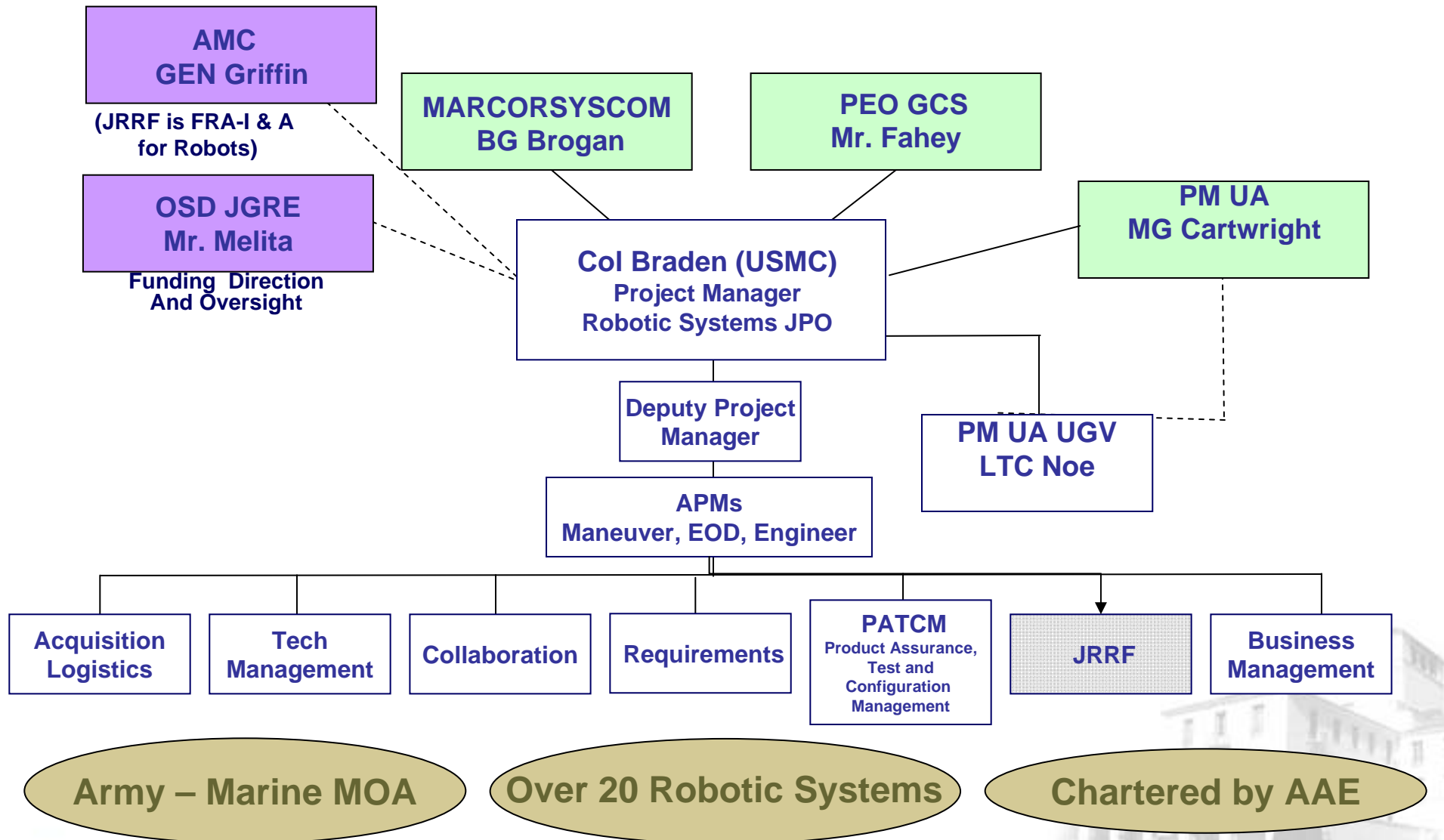
Robotic Systems Joint Project Office



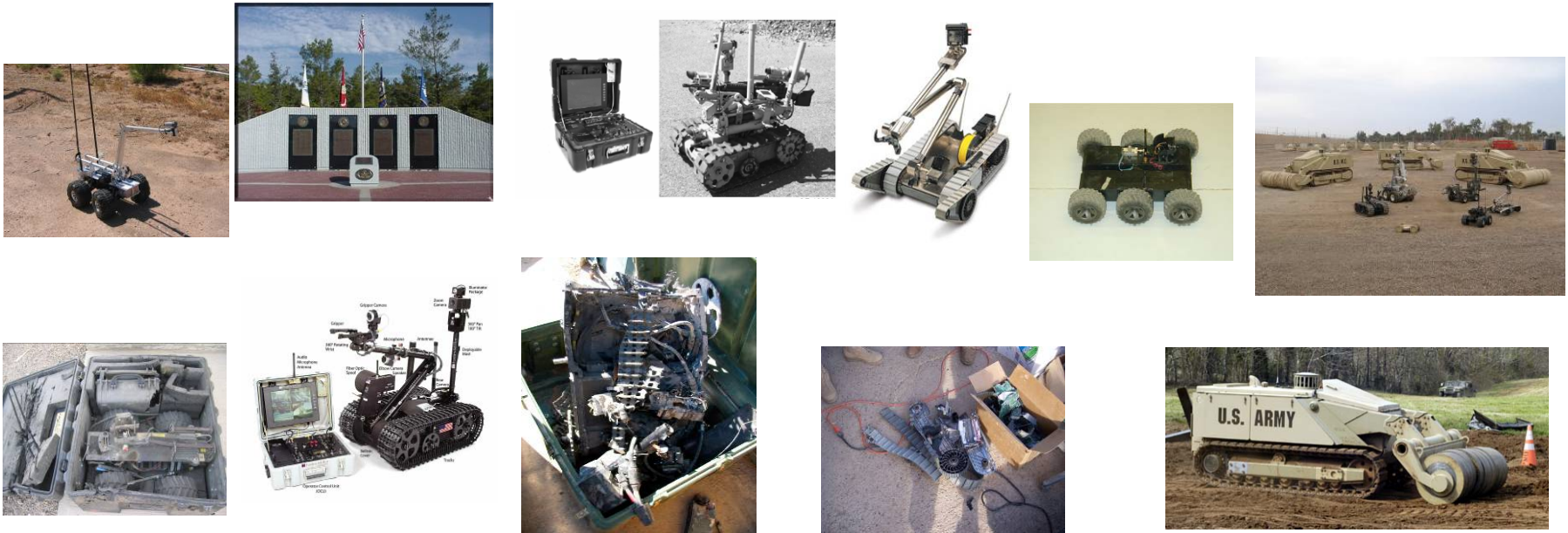
15 May 2008
Mr. Paul Varian



Robotic Systems Joint Project Office



Joint Robot Repair Fielding (JRRF)



- Provide in-Theater Support for Joint Service Theater Provided Equipment (TPE) Ground Robots.
- Single “Belly Button” for OIF/OEF Training, Sustainment, Assessment, and Accountability
 - 162 Bots (2004) - 1800 Bots (2005) - 4300 bots (Now) - 6000+ est'd (2008)
- Pre-Deployment Training Sites JRRTs and Mobile Training Teams – *Joint Reserves (61%)*
- 4 Hour Robot Turn-Around Standard – *Leveraging “Joint Float Pool Concept”*
- Web-Accessible Real-time Supply Chain Management with integrated IUID – *Key step toward sense and respond logistics*
 - Accountability - Parts Reordering - Reliability Tracking - Trouble Desk Info



2007 Measures of Effectiveness (OIF/OEF)

# of Missions	# of Found & Cleared IEDs	# of Destroyed Robots
25,000 +	15,037	150

- **26,000 Robot Maintenance Actions**
- **Find and Clear Rate is Approximately 61%**
- **SOP is to Employ a Ground Robot first**
- **Bomb Suits Only used When Terrain Prevents Robot Employment**

Training at 0900 hours



The robot "crew member" 6 hours later



JRRF-Iraq (Camp Victory)



Approaches to Logistics

Yesterday (Mass-Based)



- More is better
- Mountains of stuff measured in days of supply
- Uses massive inventory to hedge against uncertainty in demand and supply
- Mass begets mass and slows everything down

Prime Metric:
Days of Supply

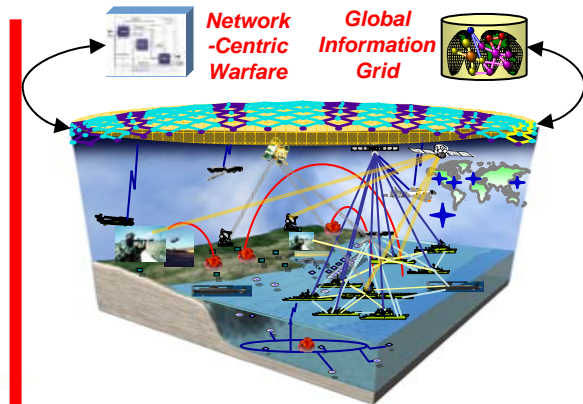
Today (Just-in-Time)



- On-time is better
- Inventory is reduced to a minimum and kept moving
- Uses precise demand prediction and static optimization to purge uncertainty
- Works great, except when it doesn't

Prime Metric:
Flow Time

Tomorrow (Sense and Respond)

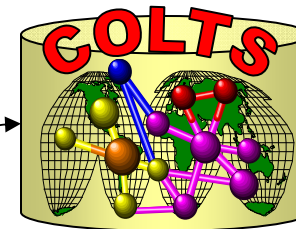


- Adaptive is better
- Inventory is dynamically positioned throughout
- Uses transportation flexibility and robust IT to handle uncertainty
- Initial S&R models look promising
- Supports distributed, adaptive ops

Prime Metric:
Speed/Quality of Effects



Today's RSJPO approach
to COLTS sustainment
Tomorrow's Logistics
Knowledge-enabled, demand driven
Sense and Respond



Global Information

Interoperable joint
communications to the
tactical level

IUID & RFID +
COLTS = TAV

Real-time WEB based
WO's, TMs', TB's, and
history data facilitate the
S&R objectives

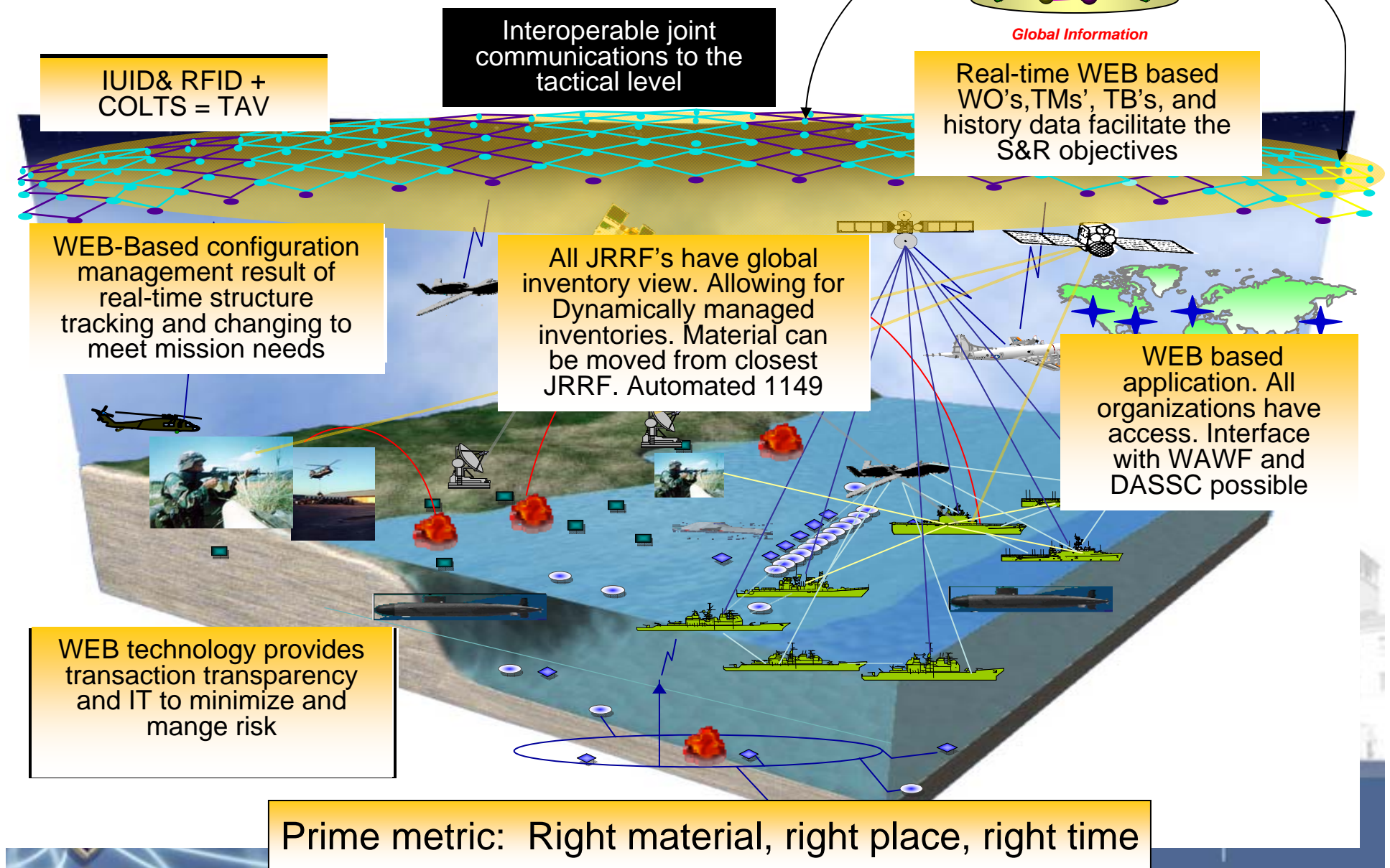
WEB-Based configuration
management result of
real-time structure
tracking and changing to
meet mission needs

All JRRF's have global
inventory view. Allowing for
Dynamically managed
inventories. Material can
be moved from closest
JRRF. Automated 1149

WEB based
application. All
organizations have
access. Interface
with WAWF and
DASSC possible

WEB technology provides
transaction transparency
and IT to minimize and
manage risk

Prime metric: Right material, right place, right time



It's all about Performance Based Logistics (PBL)

The Current (DAU) Definition:

PBL primary tenets are documentation of WAR-FIGHTER performance requirements as measurable metrics.

A fraction of the measurable metrics:

Operational Availability, Operational Reliability, Cost per Unit Usage, Total life cycle cost, Logistics Footprint, Logistics Response Time,

YADA, YADA, YADA



What Joint Robotics Repair & Fielding Is Doing

1. Define the **WAR-FIGHTER** : As the private or crew member in the heat of it.

2. Understand what is important to the **WAR-FIGHTER**:

Time

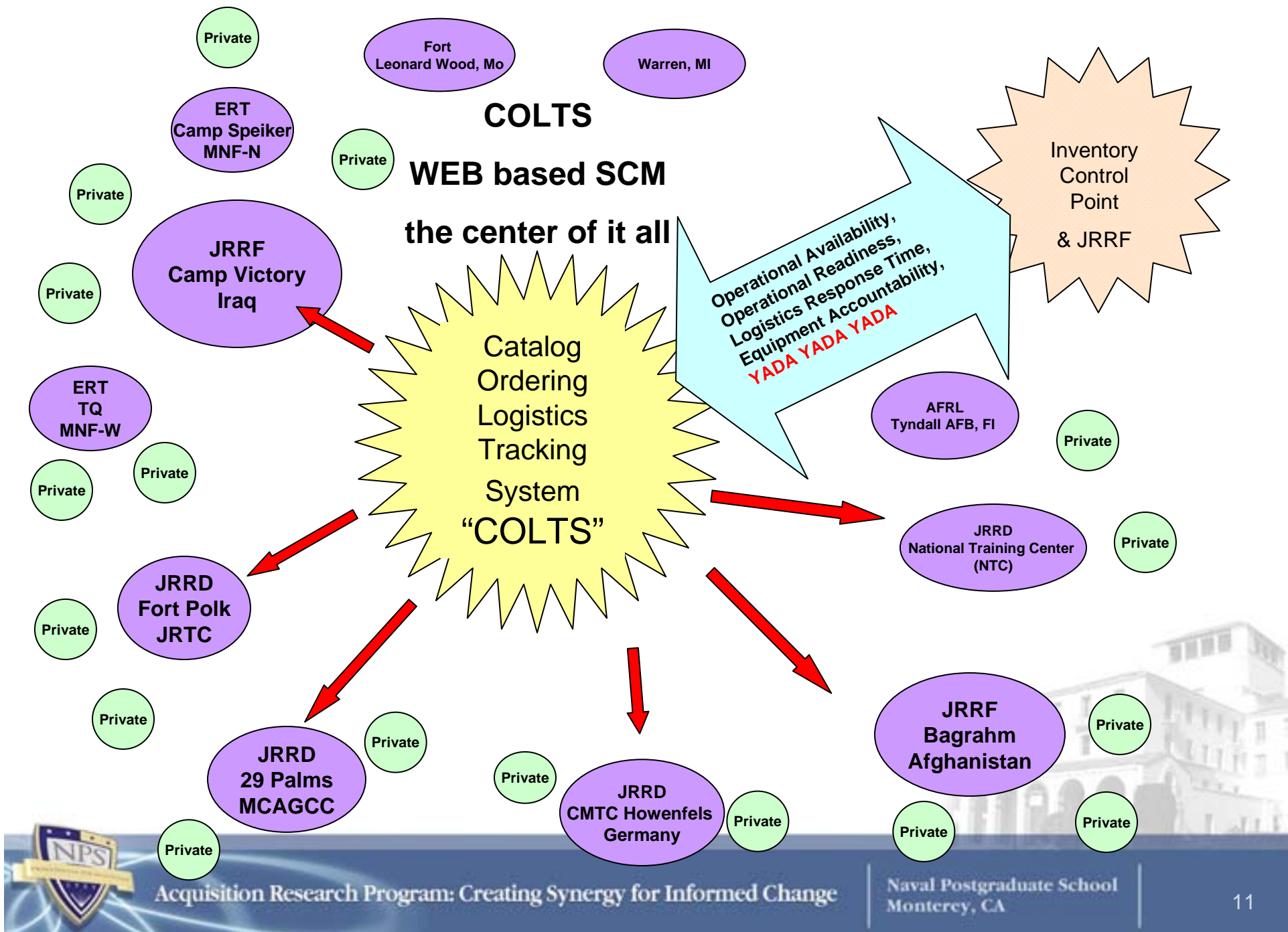
Equipment that works

Time

3. Define PBL in a term the **WAR-FIGHTER** understands.

We structure our support to be reactive to the private or crew member in the heat of it. The WAR-FIGHTER receives a robot in 4 hours or less. PERIOD





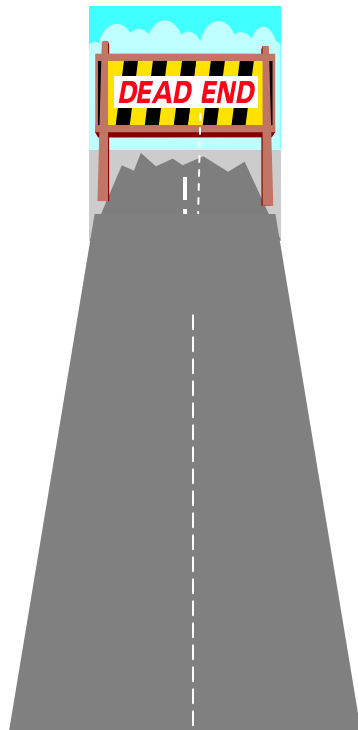
JRRF WEB Based-Supply Chain Management (SCM) System



Data (**IUID**) Don't just generate the data

USE the data

COLTS Supply Chain Management



Implementing IUID without an integrated Supply Chain Management System is a Dead End.

But you will have met DoD requirements!

Your immediate gain will be

- ... No Savings
- ... No immediately usable data
- ... No incentive to comply
- ... **No vendor "buy in"**

The challenge is to find a way to implement IUID with your supply chain management system.

...RSJPO is using integrating IUID and our SCM



Making the Data work for you

Mandate and Goals

Under Secretary of Defense (USD) and Army's Product Manager, Joint Automatic Identification Technology (PMJAIT) require compliance with policy mandates for Unique Identification (UID) and Radio Frequency Identification (RFID) technologies for Supply Chain Management:

Mandate and Goals

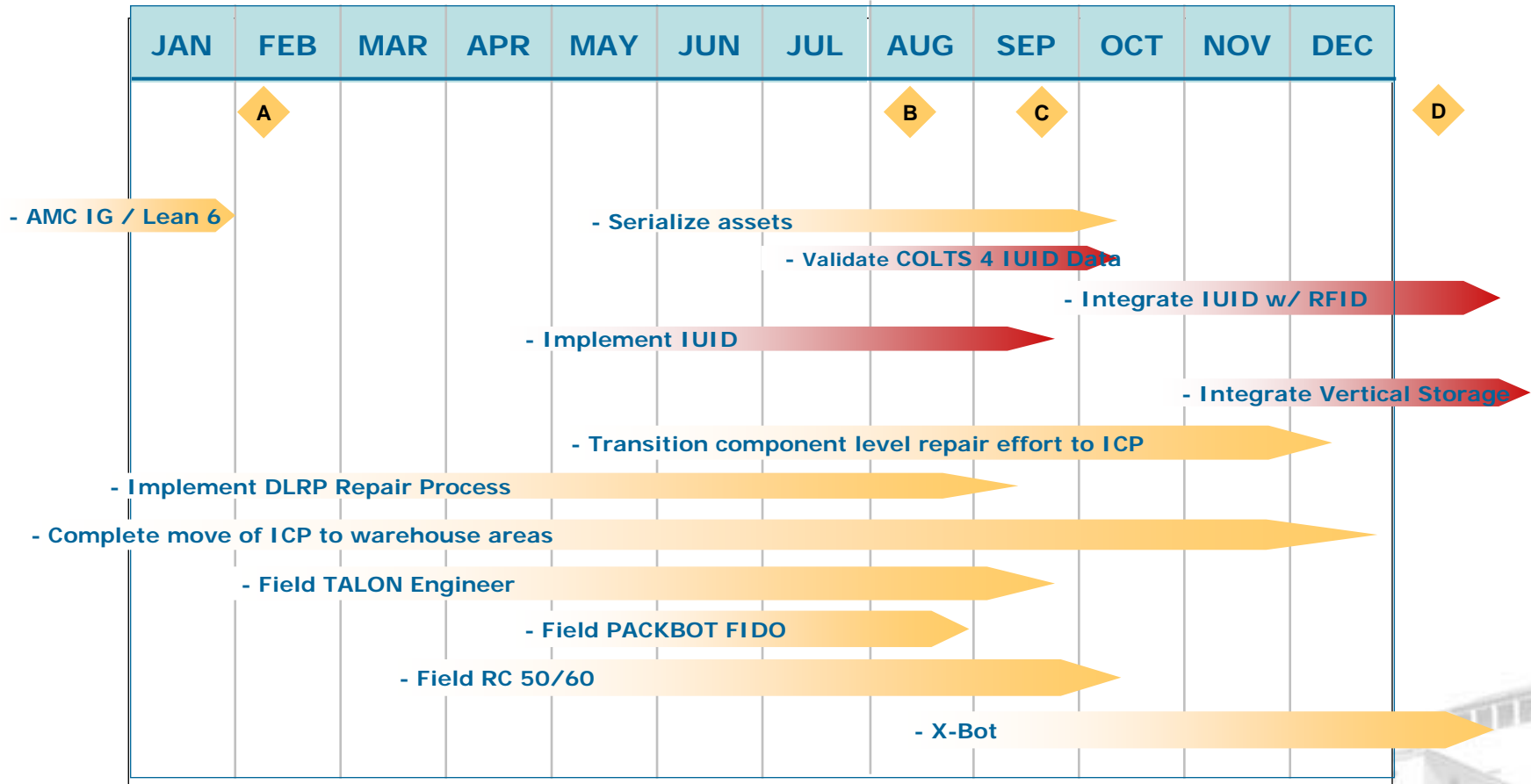
Under Secretary of Defense (USD) and Army's Product Manager, Joint Automatic Identification Technology (PMJAIT) require compliance with policy mandates for Unique Identification (UID) and Radio Frequency Identification (RFID) technologies for Supply Chain Management: Maximize efficiencies of life-cycle asset management with integration of UID/ RFID throughout DoD. Leverage technology to improve the ability to get the customer the right materiel, at the right time, and in the right condition. Critical to the End-to-End War fighter Support Initiative.

- Maximize efficiencies of life-cycle asset management with integration of UID/ RFID throughout DoD.
- Leverage technology to improve the ability to get the customer the right materiel, at the right time, and in the right condition
- Critical to the End-to-End War fighter Support Initiative.

Integrated Solution
IUID and RFID Technologies
With SCM



RSJPO Huntsville ICP 2007 Initiatives

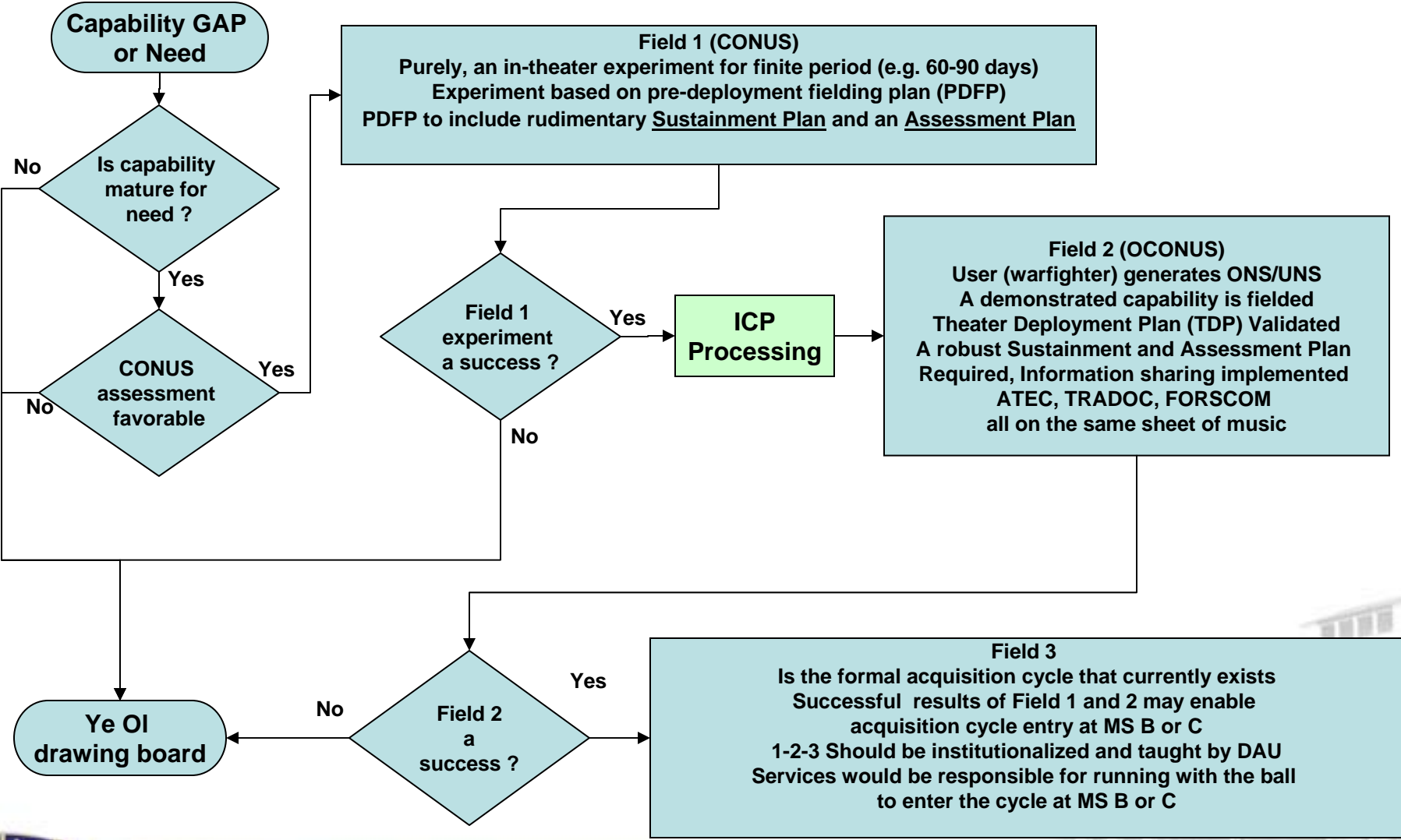


Milestones
 A: Survive AMC IG & Lean 6
 B: Transition to COLTS 4.4
 C: Fully implement IUID
 D: Combine RFID w/IUID

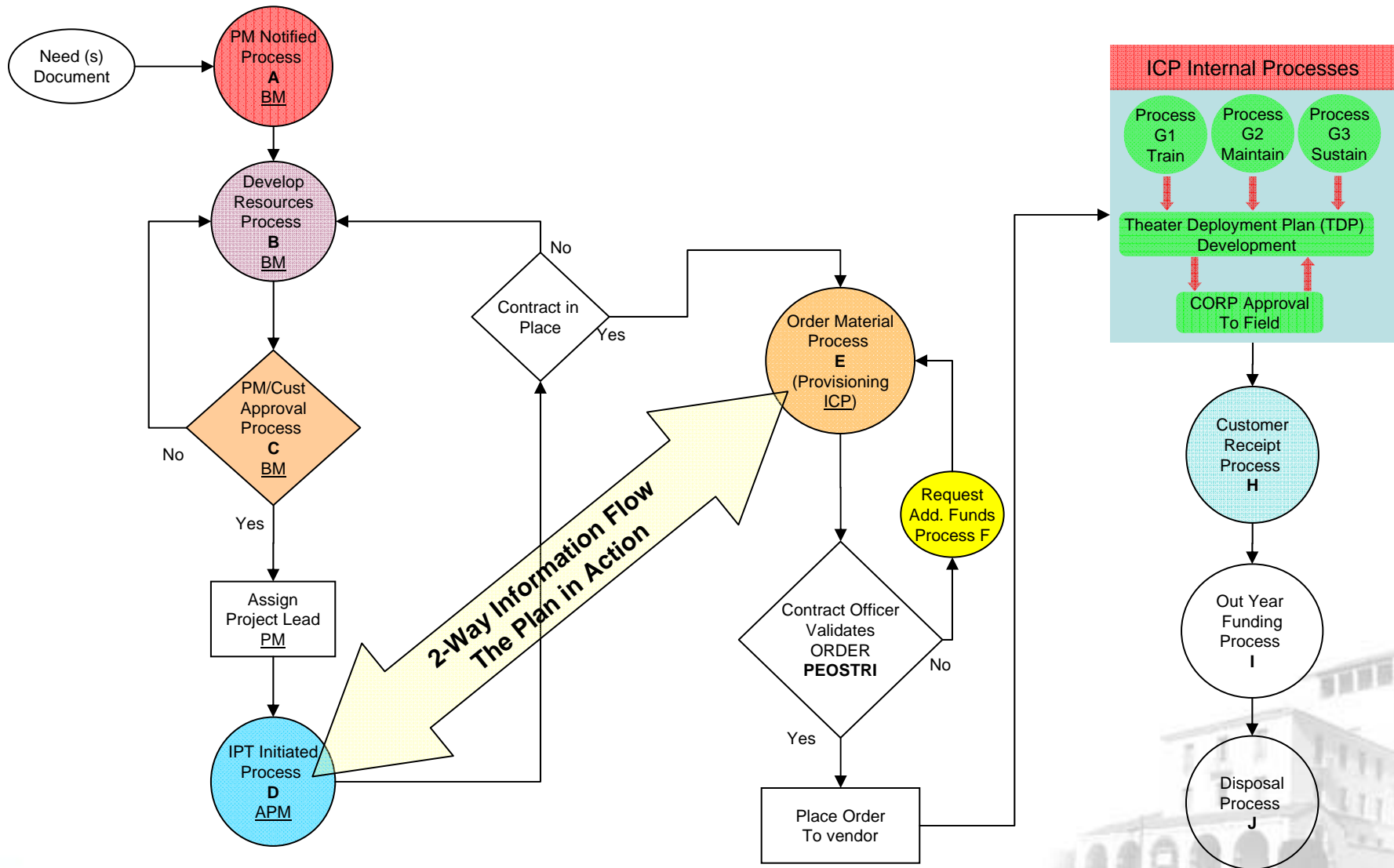
Significant Actions
 1: Transition to serialized accounting & SIM utilizing IUID as the common thread
 2: Implement DLRP Process
 3: Continue aggressive fielding and support
 4: IUID and COLTS integration completed in less than 5 months



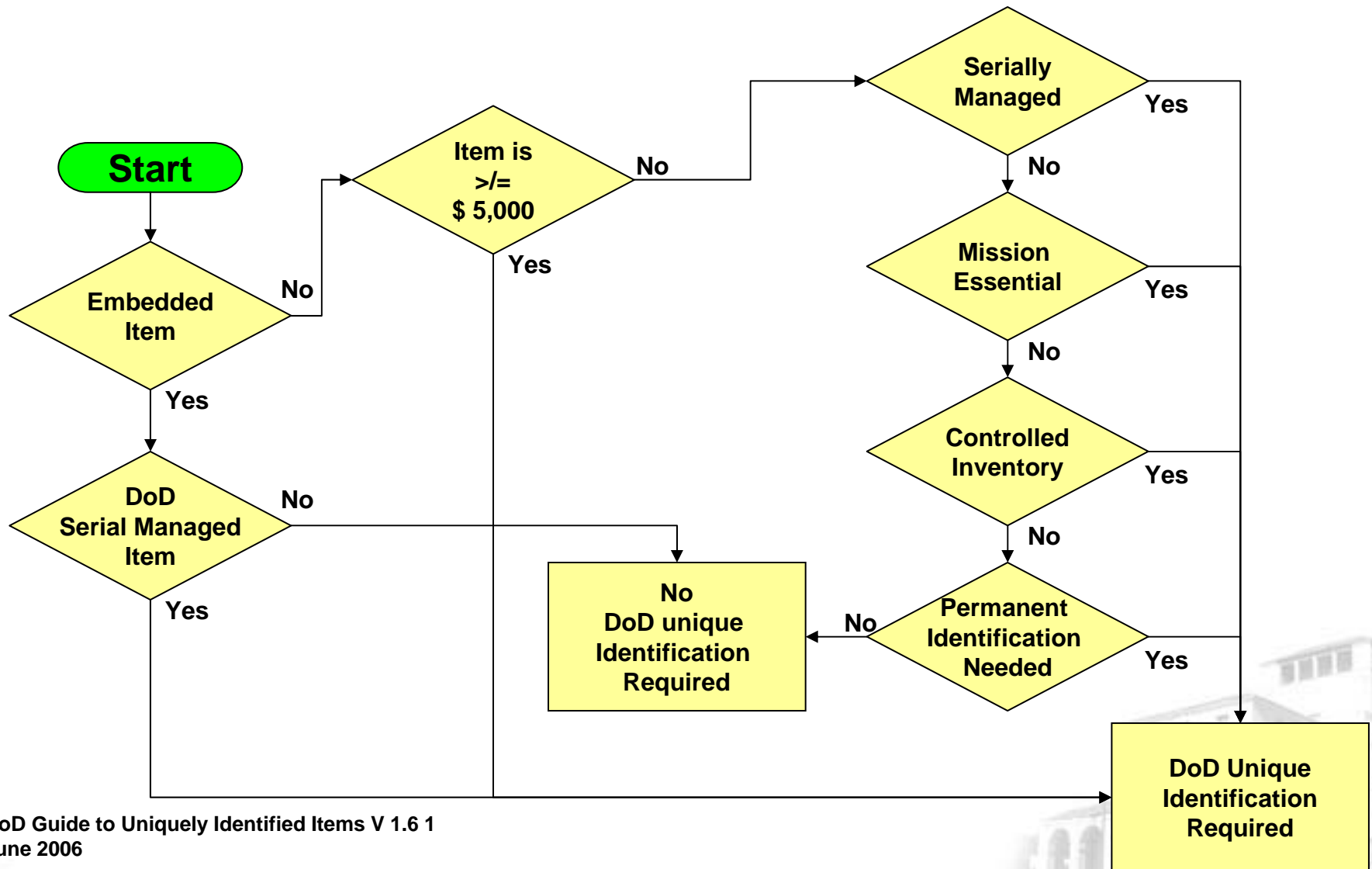
1,2,3, Process Flow



The JRRF from 40,000 feet



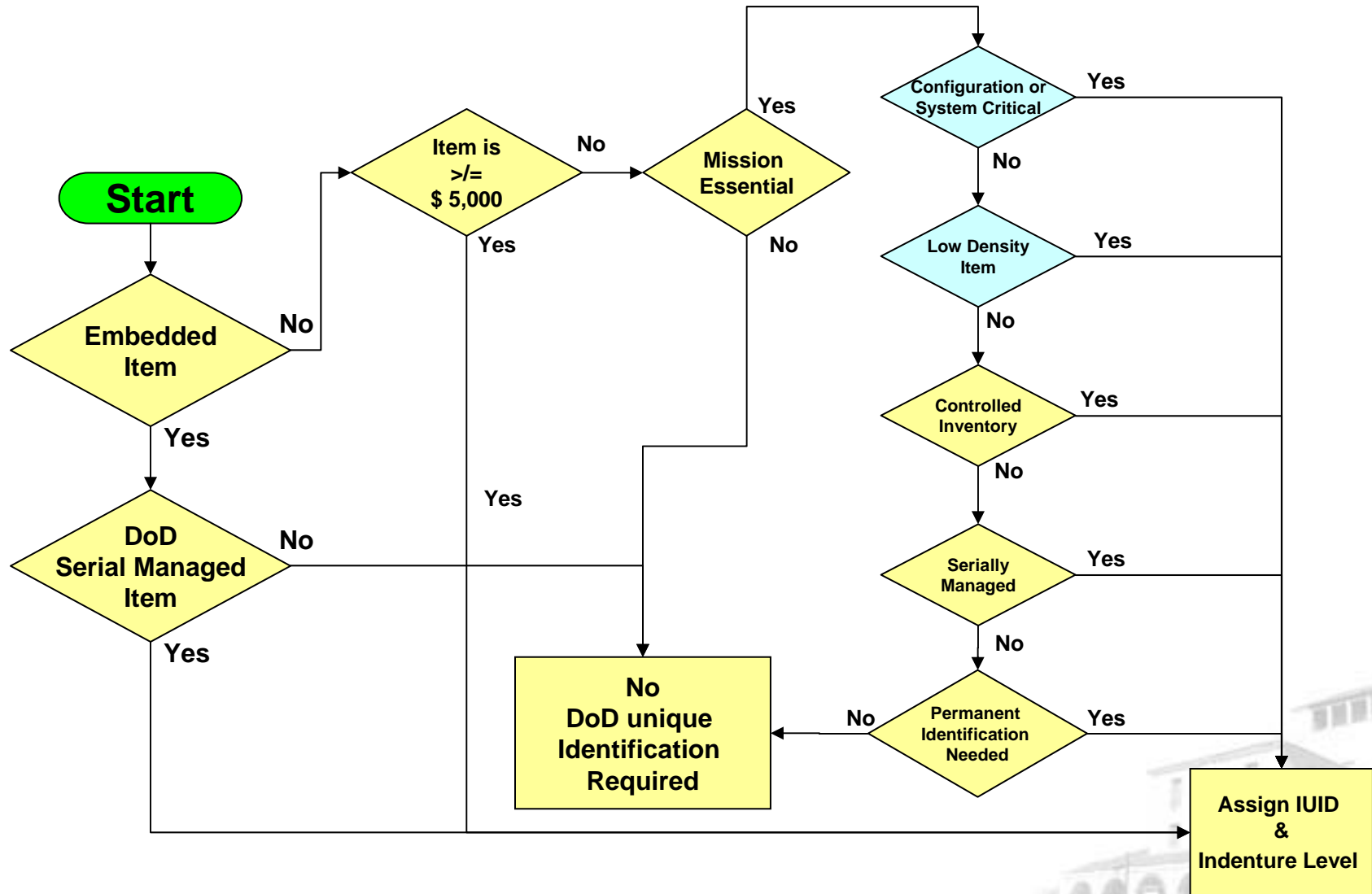
IUID Decision Flow Process



DoD Guide to Uniquely Identified Items V 1.6 1
June 2006



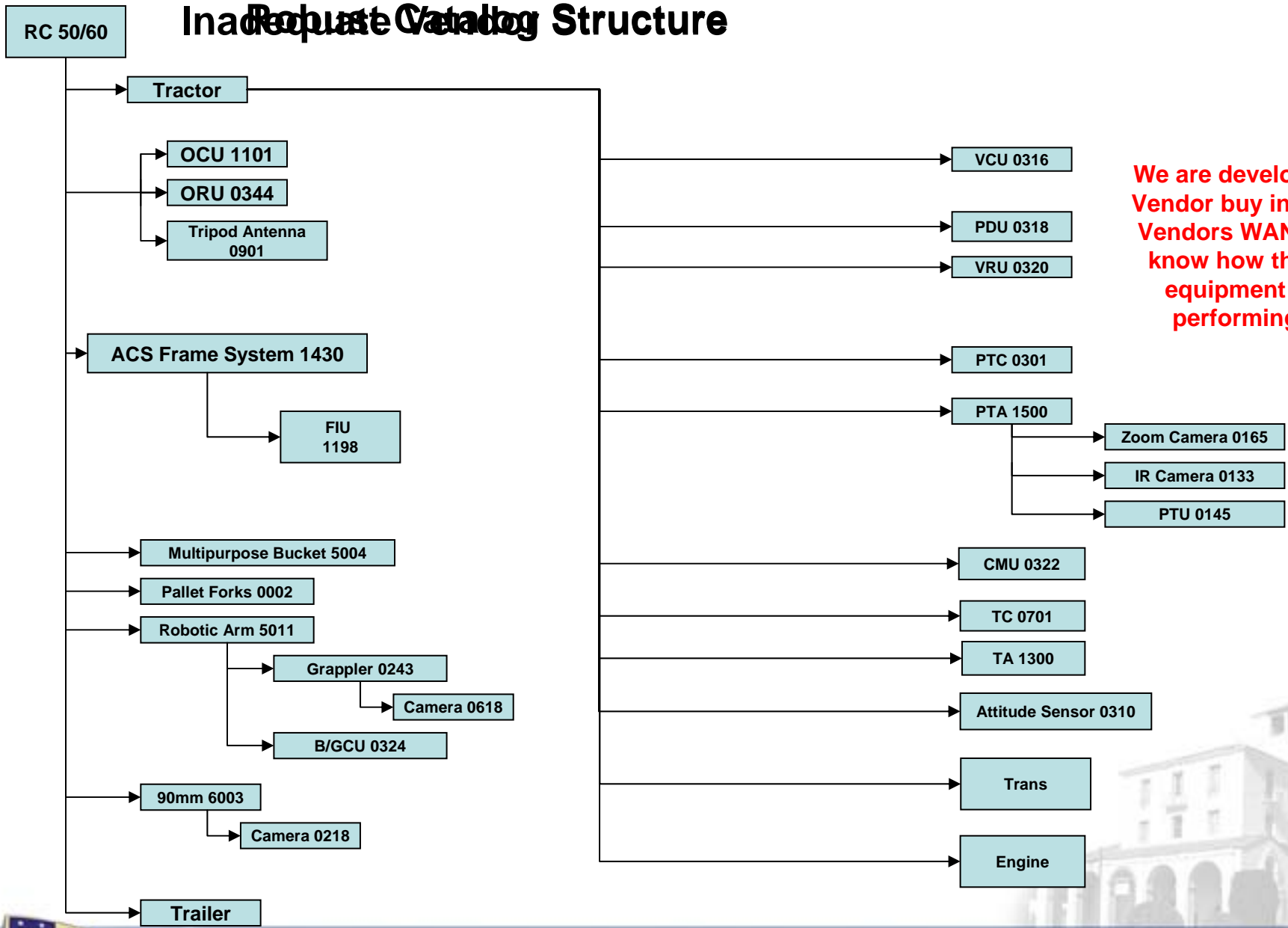
COLTS Catalog build process



RSJPO COLTS Catalog Build Decision Matrix



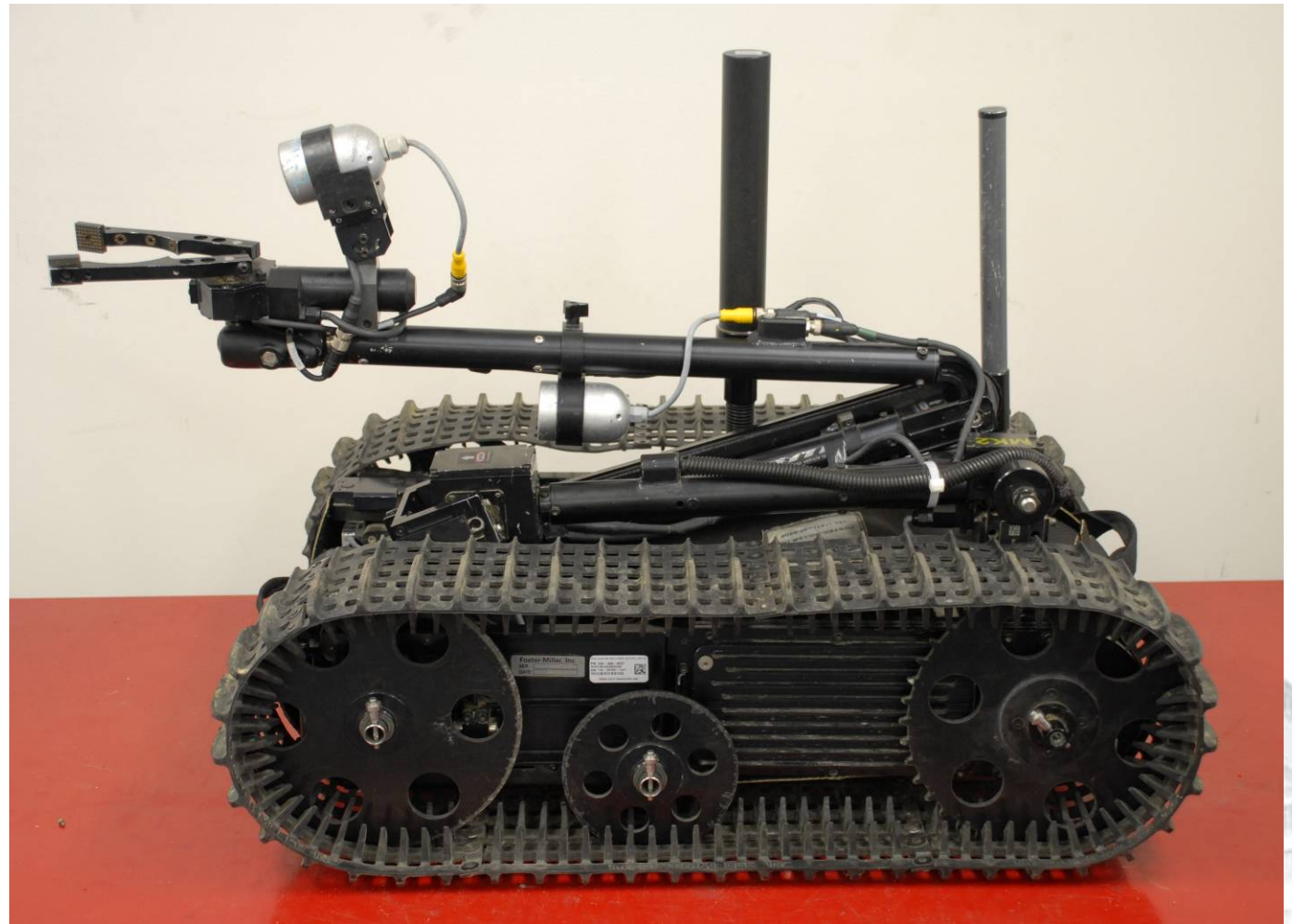
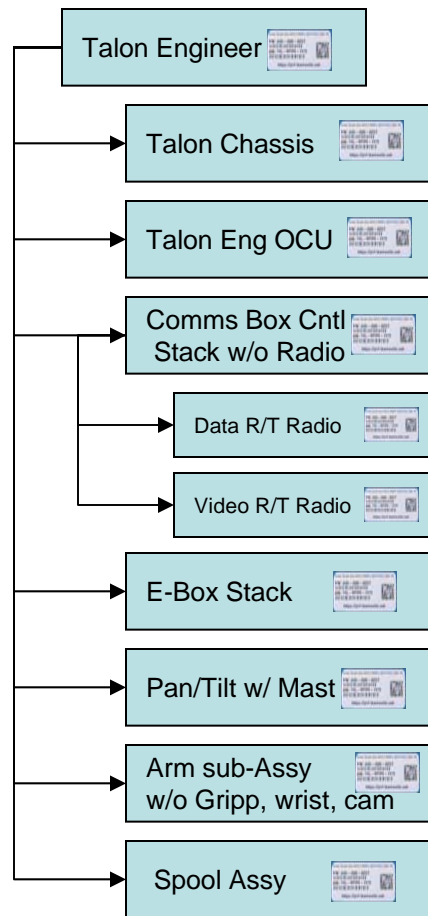
Inadequate Vendor Structure



We are developing Vendor buy in. The Vendors WANT to know how there equipment is performing.

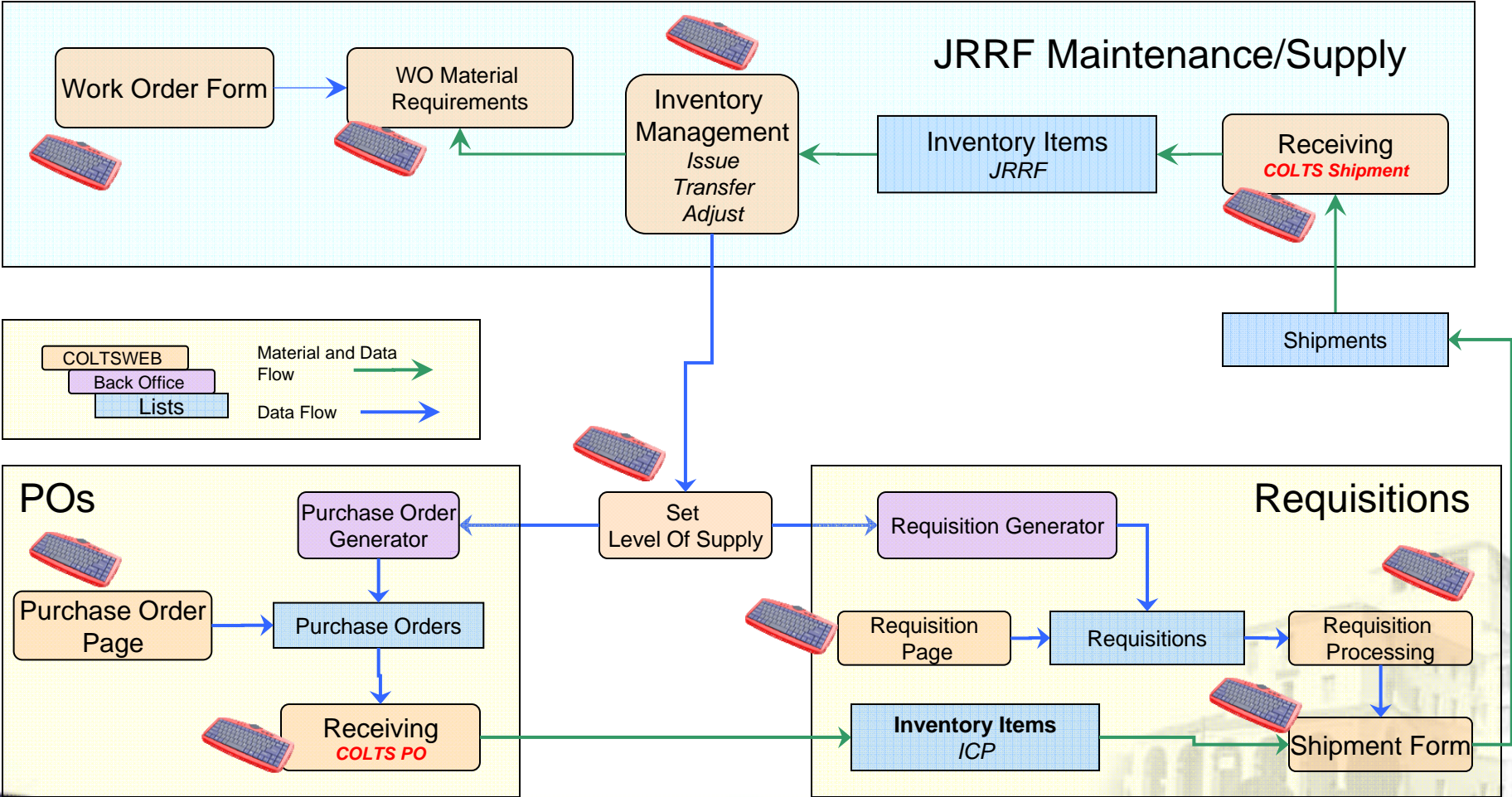


TALON 3B (Engineer and EOD Bot of Choice)



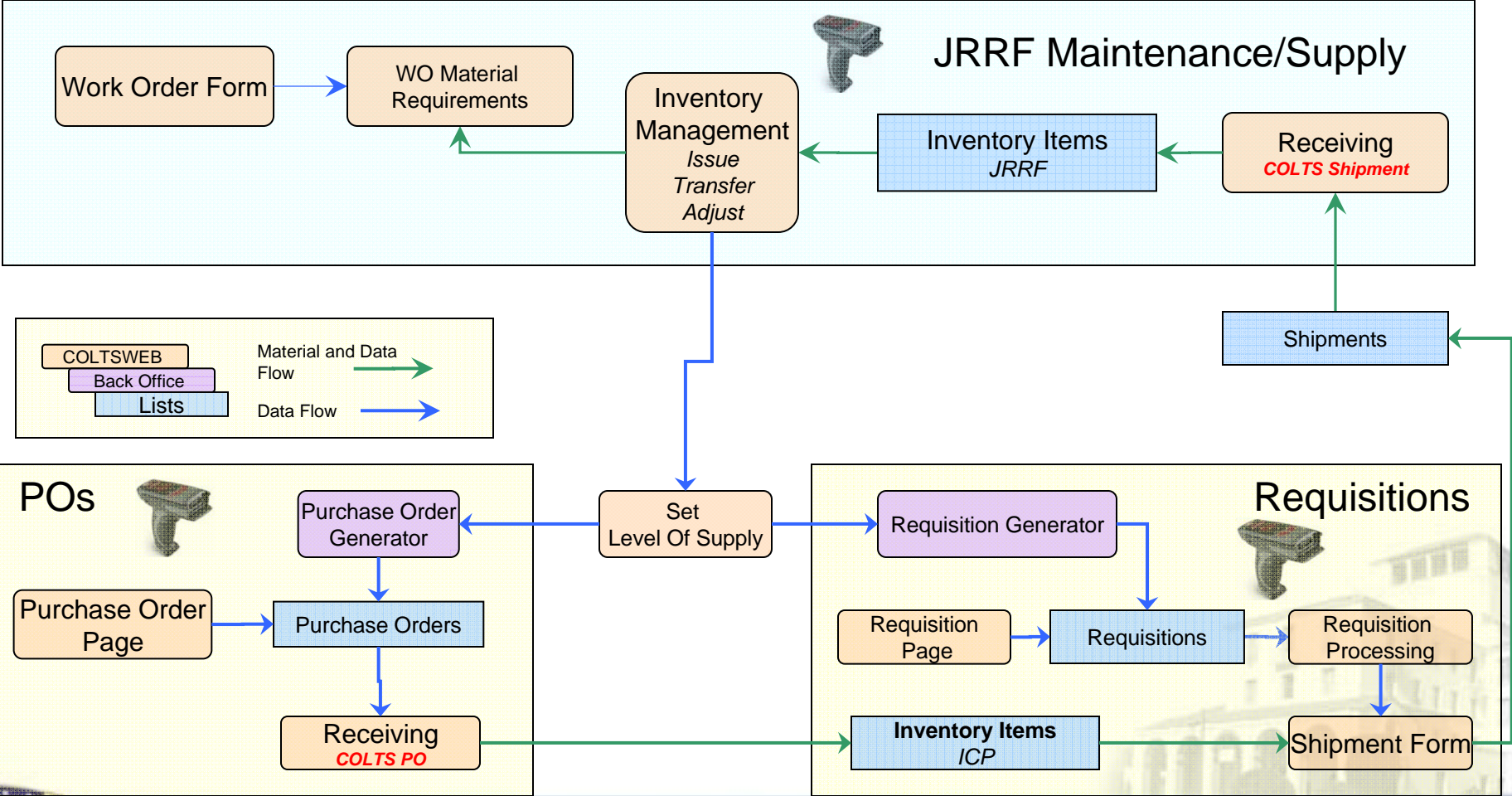
JRRF Prior to IUID integration

Each Keyboard represents opportunity for error



JRRF Prior to IUID integration

Each Scanner represent a process streamlined and error elimination.



IUID Pedigree Data Input

Enter Contact Information, Defaults and Output

COLTS 4.40 - MTRS

File Navigator Tools Window Help

UID Manager

Contact Information

Name: Gerald Perlmutter
 EMail: gerry@avantix.com
 Organization: RS JPO
 Phone: 619.697.1166

Defaults

Enterprise Id: 9999
 Issuing Agency Cd: UN -- DUNS
 UID Type: UID2
 UID Medium Code: 2D COMPLIANT

Output

Generate UID:
 Max Rows: 100 "0" If All Rows
 Export Registry File:

Print Run Close

Site Stock Table:

Site Stock	Site Name	Part Number	Descrip
DEPOT	2ND EOD COMPANY	DSI-500-0369	FIRE SET
DEPOT	2ND EOD COMPANY	DSI-500-0398	FIBER OPTIC SF
DEPOT	2ND EOD COMPANY	DSI-500-0406	Arm Assembly
DEPOT	2ND EOD COMPANY	DSI-500-0406	ARM ASSEMBLY
DEPOT	2ND EOD COMPANY	RDSI-04209	MK 2 BATTERY
DEPOT	2ND EOD COMPANY	RDSI-04209	MK 2 BATTERY
DEPOT	ARMY-184TH ORD BN	10159	BATTERY CHAF
DEPOT	ARMY-184TH ORD BN	10159	BATTERY CHAF
DEPOT	ARMY-184TH ORD BN	10159	BATTERY CHAF
DEPOT	ARMY-184TH ORD BN	10159	BATTERY CHAF
DEPOT	ARMY-184TH ORD BN	10159	BATTERY CHAF
DEPOT	ARMY-184TH ORD BN	10159	BATTERY CHAF
DEPOT	ARMY-184TH ORD BN	12130	CHASSIS (VEHIC
DEPOT	ARMY-184TH ORD BN	12130	CHASSIS (VEHIC
DEPOT	ARMY-184TH ORD BN	12130	CHASSIS (VEHIC
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DEPOT	ARMY-184TH ORD BN	12130	CHASSIS (VEHIC
DEPOT	ARMY-184TH ORD BN	12130	CHASSIS (VEHIC
DEPOT	ARMY-184TH ORD BN	12131	OCS Assembly
DEPOT	ARMY-184TH ORD BN	12131	OCS ASSEMBLY
DEPOT	ARMY-184TH ORD BN	12131	OCS ASSEMBLY
DEPOT	ARMY-184TH ORD BN	12131	OCS ASSEMBLY
DEPOT	ARMY-184TH ORD BN	12131	OCS ASSEMBLY
DEPOT	ARMY-184TH ORD BN	12131	OCS ASSEMBLY
DEPOT	ARMY-184TH ORD BN	12131	OCS ASSEMBLY
DEPOT	ARMY-184TH ORD BN	12131	OCS ASSEMBLY
DEPOT	ARMY-184TH ORD BN	12131	OCS ASSEMBLY
DEPOT	ARMY-184TH ORD BN	12131	OCS ASSEMBLY
DEPOT	ARMY-184TH ORD BN	12131	OCS ASSEMBLY
DEPOT	ARMY-184TH ORD BN	12131	OCS ASSEMBLY
DEPOT	ARMY-184TH ORD BN	4975	Manipulator (Arm
DEPOT	ARMY-184TH ORD BN	4975	MANIPULATOR
DEPOT	ARMY-184TH ORD BN	4975	MANIPULATOR
DEPOT	ARMY-184TH ORD BN	4975	MANIPULATOR
DEPOT	ARMY-184TH ORD BN	4975	MANIPULATOR
DEPOT	ARMY-184TH ORD BN	4975	MANIPULATOR
DEPOT	ARMY-184TH ORD BN	4975	MANIPULATOR
DEPOT	ARMY-184TH ORD BN	4975	MANIPULATOR
DEPOT	ARMY-184TH ORD BN	4975	MANIPULATOR
DEPOT	ARMY-184TH ORD BN	4975	MANIPULATOR
DEPOT	ARMY-184TH ORD BN	8073	FIBER OPTIC CA
DEPOT	ARMY-184TH ORD BN	8073	FIBER OPTIC CA
DEPOT	ARMY-184TH ORD BN	8073	FIBER OPTIC CA
DEPOT	ARMY-184TH ORD BN	8073	FIBER OPTIC CA
DEPOT	ARMY-184TH ORD BN	8073	FIBER OPTIC CA
DEPOT	ARMY-184TH ORD BN	8073	FIBER OPTIC CA
DEPOT	ARMY-184TH ORD BN	8073	FIBER OPTIC CA
DEPOT	ARMY-184TH ORD BN	8073	FIBER OPTIC CA
DEPOT	ARMY-184TH ORD BN	8073	FIBER OPTIC CA
DEPOT	ARMY-184TH ORD BN	8073	FIBER OPTIC CA

Views: Active Assets


App: MTRS Security: ■ COLTS 4.40.1025




IUID Printing options

Print


Suggested Low Cost Printer Suite



Universal Laser
Tesa Tape and metal label plates
~ \$20,000 equipment
14 cents each



Printronix
4" X 2" labels and RFID tags
~ \$ 5,000 equipment
15 cents each



Zebra
2" X 1" Mylar labels
~ \$3,000 equipment
4 cents each



IUID Data Verification Process

Verify

The screenshot displays the COLTS 4.40 - MTRS software interface. On the left, the 'UID Manager' window shows contact information for Gerald Perlmutter and a table of assets. The table lists various depot locations and their associated parts and descriptions. On the right, the 'Asset UID Grade' dialog box is open, showing details for a specific asset (Part Number: DSI-500-0227, S/N: 1661) and its grade (DPM4/13/639/30T). The dialog also includes a 'Details' tab with various parameters and their values, such as 'Axial Non-Uniform' (A, +0.009) and 'Cell Contrast' (A, +0.812). A 'Scan successful' message is visible in the dialog.

UID Manager Table:

Site Stock	Site Name	Part Number	Description
DEPOT	2ND EOD COMPANY	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-184TH ORD BN	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-184TH ORD BN	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-184TH ORD BN	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-192D ORD BN	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-1ST MARINE	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-277TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-319TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-362D ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-387TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-38TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-430TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-47TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-47TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-47TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-47TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-47TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-501ST ORD BN	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-53RD ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-53RD ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-53RD ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-59TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-59TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-59TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-59TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-62D ORD CO EOD	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-62D ORD CO EOD	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-666TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-702A ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-702D ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-703D ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-703D ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-703D ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-703D ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-705TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-706TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE
DEPOT	ARMY-706TH ORD CO	DSI-500-0227	MK2 ROBOT VEHICLE

Asset UID Grade Dialog:

Part Number: DSI-500-0227 S/N: 1661
 IUID: UN999999999999DSI-500-02271661
 Description: MK2 ROBOT VEHICLE
 Scan successful

Details:

Grade	Parameter Value
	Date Graded: 8/28/2007 11:51:04 AM
	Device Type: COGNEX DM7500
	UID Grade: DPM4/13/639/30T
	Angle Distortion:
A	Axial Non-Uniform: +0.009
A	Cell Contrast: +0.812
	Cell Growth Horiz: +19.547
	Cell Growth Vertical: +19.505
A	Cell Modulation:
A	Fixed Pattern Dmg:
A	Grid Non-Uniform: +0.084
A	Min Reflect: 81
A	Reference Decode:
A	Unused ECC: +1.000



IUID Marking Instructions

Step Six: Secure Label

MTRS Part

Part Number: DSI-500-0227
Supplier Name: FOSTER-MILLER CAGE: 08KG1
Description: MK2 ROBOT VEHICLE
System: MK2 MOD0
Cognizance Code: FSC: NIIN:
UID Type: UID IAC: UID EID:
Catalog Price: 131900 UM: Each
Hazardous Code: Shelf Life Code: Shelf Life Action Code:
Sch B Exp Cd:
Serialized: Can Req: Inactive:
Exclude From Tracked Configurations: Controlled: Mission Critical:

Alternates **IUID Label Placement** Additional Fields

IUID Figure:

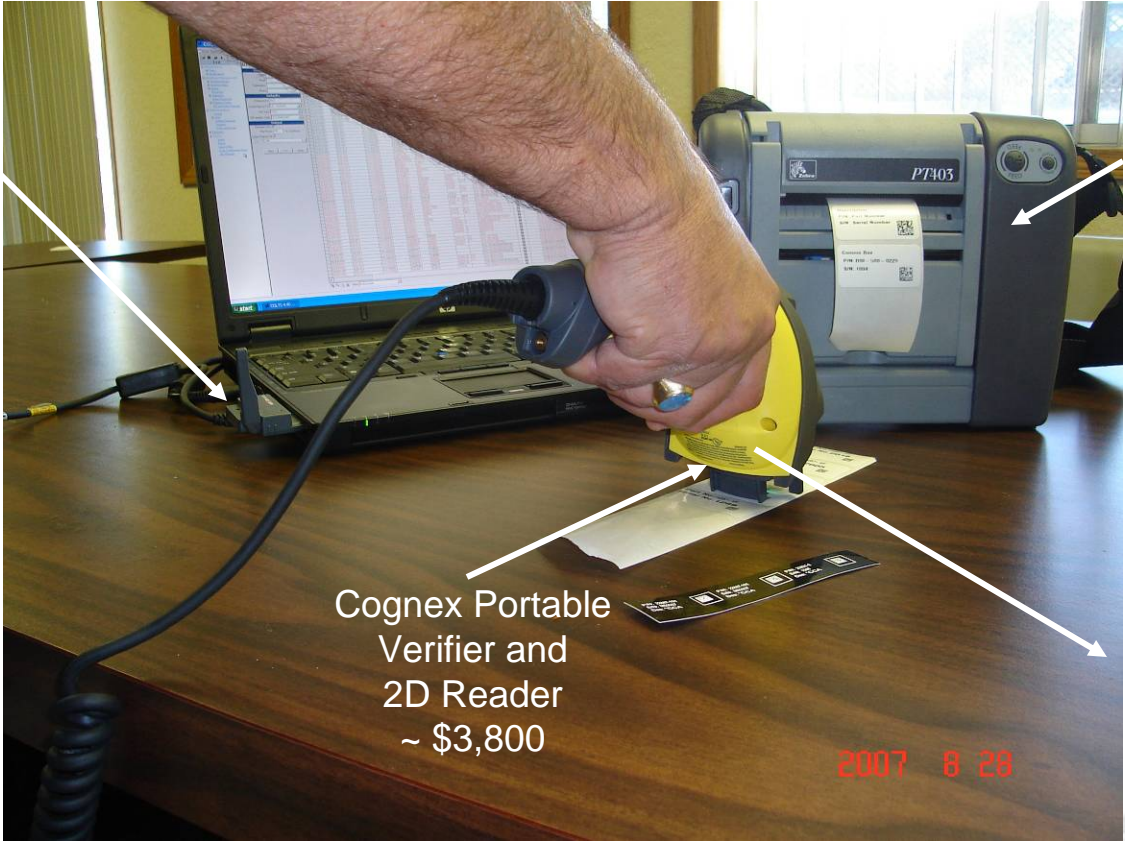
Labeling Instructions: Place the label on left side of R... below top track

Save Close



IUID Portable On-Site Suite

Air Card for off site
Citrix connection to
SCM Server
\$60/month



Cognex Portable
Verifier and
2D Reader
~ \$3,800

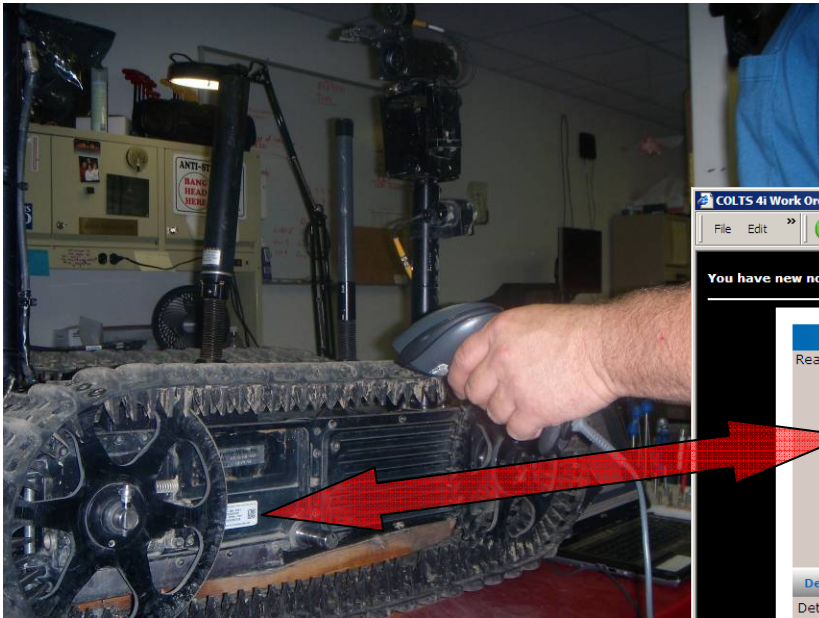
Zebra PT403
Portable Rugged
Printer
2" x 1" Mylar
~ \$1000 each

Note: this Verifier
is NMCI compatible
and does not need
special software.



IUID and Maintenance

Maintenance Management

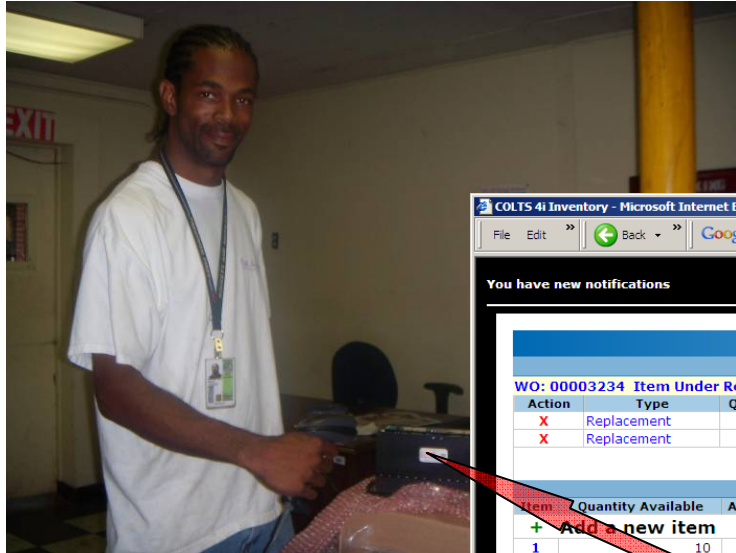
A screenshot of a web browser displaying the 'COLTS 4i Work Order' system. The interface shows a form for creating or viewing a work order. The form includes fields for 'Reason for WO', 'Item Under Repair', 'IUID', 'Part #', 'Serial #', 'Description', and 'Condition'. It also has dropdown menus for 'WO:', 'Site:', 'Status:', and 'Work Order Type:'. The 'Status' is set to 'Ready For Issue' and 'Work Order Type' is 'C--Corrective'. The 'Date Reported' and 'Date Occurred' are both '3/15/2007 4:34:50 AM'. The 'Last Assigned To' is 'Charles.Emery.Burns'. The 'Time To Repair' is '0'. There are 'Save' and 'Close' buttons at the bottom right. A red arrow points from the scanner in the left image to the 'Item Under Repair' field, and another red arrow points from the scanner in the top right image to the 'Reason for WO' field.

One Scan opens a Work Order and transfers equipment for Asset and Property Book Management.



IUID and Supply & Shipping

Shipping, Receiving & Inventory Management



Scan to identify issued inventory, items shipped (DD1149). and Items received.



COLTS 4i Inventory - Microsoft Internet Explorer

You have new notifications

Maintenance Menu Logout Help My Profile

MTRS Inventory

Work Order Material Requirements

WO: 00003234 Item Under Repair: MK2 ROBOT VEHICLE

Action	Type	Qty	Description	Part Number	Serial Number	Req No	Date
X	Replacement	1	E BOX	DSI-500-0257	1469		8/7/2007 7:32:07 AM
X	Replacement	1	E BOX	DSI-500-0257	1478		8/7/2007 7:53:21 AM

Inventory Items

Item	Quantity Available	Alt	Description	Part Number	Supplier Name	Loc Code	Serial Number	Condition Code
+ Add a new item								
1	10		ARM ASSEMBLY	DSI-500-0406	FOSTER-MILLER	MAINT	(10)	
2	8		ARM ASSEMBLY	DSI-500-0406	FOSTER-MILLER	N/A	(8)	
3	12		ARM ASSEMBLY	DSI-500-0406	FOSTER-MILLER	SUPPLY	(12)	
End Of List								

Work Orders at Site

00003234

Part Search

Description	Part Number	Serial Number	IUID	Supplier	System
	dsi-500-0406			Any	Any

List Configuration Options: Site: REP-JRRF_IRAQ, Class: DEPOT

Views: Show Serial Numbers, Work Order View, History View

Search Options: Exact Match, Show Alternates

Scan to identify issued inventory

Scan to ID items shipped & Received (DD1149)



Just the facts (1 Jan 07 – 31 Dec 07)

- COLTS Supply & Maintenance Data
 - 6073 Work orders completed
 - 26,375 maintenance actions
 - 64,419 Inventory events (Parts movement)
 - 78,467 Asset events (Robot actions/movement/repair, etc)
 - 4,816 Items shipped
 - 64 EOD/Engineer robots rebuilt from a destroyed condition. Cost savings approximately 3.2 million dollars.
- AIT, IUID/RFID integration saves the RSJPO time, money and ultimately lives on the battlefield.
 - No more “lost” data due to human error
 - Shorter repair cycle time as a result of IUID “scan in & scan out”
 - More fidelity of data tracked in COLTS due to IUID decision process.
 - Routine logistics processes streamlined with IUID and hand scanner.
 - Configuration management integrated with all SCM actions. SIM is a reality
- Operational rate on all NS-E/COTS supported platforms has been in excess of 98% since Apr 05.
- In excess of 3307 soldiers trained on robotics operation



Return on Investment

- A misplaced hyphen cost \$280K
- IUID enables Serialized Item Maintenance (SIM is a DoD Mandate)
 - IUID Enables real time configuration management
 - IUID Saves repair parts cost
 - Aug 06-Mar 07 \$29M for repair parts on 1 vendor
 - Aug 07-Mar 08 \$ 5M for repair parts on same vendor
- IUID eliminates human induced error
 - Average human has a typing error rate 5.47%. For every 100 key strokes 6 will be wrong



Future Operations; Where we are going

- Vertical storage (Self Issue) (Feb 2008)
 - 100% automated accountability COLTS opens the drawer not the user
 - High use items will be co-located with technicians
 - Tool room functions
- Integrated RFID (Apr 2008)
 - End items will receive active (aRFID) / (pRFID) passive permanent RFID
 - ICP will utilize aRFID / pRFID to streamline operations
- Integrate CBM+ (Conditioned Based Maintenance)
 - We want the robots to tell us (JRRF) when they need service
- Institutionalize the JRRF process for NS-E/COTS sustainment
 - Establish a Joint Service approach
 - Staff and train a Joint Reserve organization to be reactive to mobilization and NS-E/COTS support (Train, Maintain, Supply)
 - Stop inventing the wheel at every conflict. Institutionalize the innovative process



Vertical Storage

COLTS

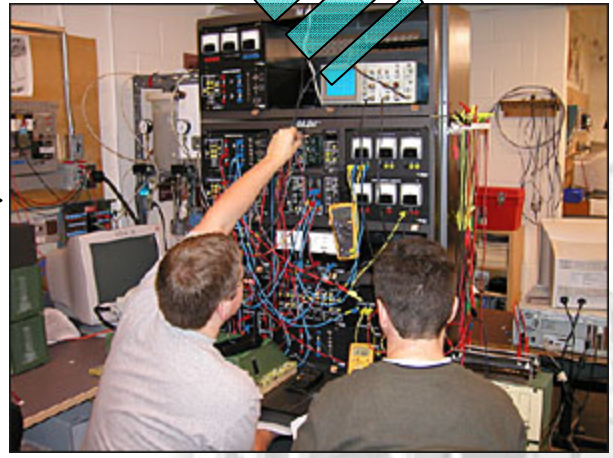


Vertical Storage ONLY opens
By a COLTS request



Request Material
(Tools, Parts, manuals, etc)
through COLTS

100% accountability
High demand parts, tools, manuals
Issued with out



Questions?

