A premier corporate university serving DoD Acquisition, Technology, and Logistics

A BLUEPRINT FOR SUCCESS
IUID and RFID Implementation Training

West Region
Item Unique Item Identification (IUID) vs Radio Frequency Identification (RFID)

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First Some Stuff on Supply Chain

- What it is
- SCOR Model
- How IUID and RFID Fit
Supply Chain Management: The Basics &
Item Unique Item Identification (IUID) &
Radio Frequency Indentification (RFID)

Supply Chain Management: What is it?
How can I use it?
Where can I learn more about it?
I don’t know what the hell logistics (or Supply Chain Management) is ... But I want some of it!

CINC US Fleet, Chief of Naval Operations, Advisor to President Roosevelt - Admiral E. J. King

Traditional Support Elements

- Maintenance Planning
- Manpower & Personnel
- Supply Support
- Support Equipment
- Training & Support
- Technical Data
- Computer Resources Support
- Facilities
- Packaging, Handling, Storage, & Transportation
What Weapon System Is It?

F-16 Weapon System Includes ...
IPT Teamwork

Logistics Transformation

Objectives

- Project and sustain the force with minimal footprint
- Implement performance-based logistics to compress the supply chains and improve readiness for major weapon systems
- Reduce cycle times to industry standards
Supply Chains – What are they?

- Supply Chain – Refers to the flow of materials, information, funds, and services from raw material suppliers through factories and warehouses and retail outlets to the end customers
- A Supply Chain also includes – the organizations and processes that manufacture and deliver those products, information, and services to the end customers

SUPPLY CHAIN MANAGEMENT

Process of planning, implementing and controlling the efficient, cost effective flow and storage of raw materials, inventory, finished goods, and related information from point of origin to point of consumption.
The Essence of Supply Chain Management

The seamless integration and management of:
- Materiel movement
- Information flows
- Financial transactions
- Across all nodes of the supply chain and with all supply chain partners

It differs from traditional logistics management:
- Focus on processes (plan, source, make/repair, deliver, return) instead of function (e.g., supply, maintenance, transportation and procurement)
- Focus on all organizations in the supply chain (cuts across all partners) instead of just your organization

Supply Chain Management

The management of all internal and external processes or functions necessary to satisfy a customer's order from raw material through conversion/manufacturing through shipment.
Supply Chain Management

The management of internal logistics functions and the relationships between your enterprise and its customers and suppliers

Supply Chain Operations Reference (SCOR) Model

- The SCOR Model captures and documents the STEPS, FUNCTIONS, PROCESSES, BEST PRACTICES, and METRICS of SCM
- Within each Function/Process, it offers best practices and strategies that may be used to improve the DoD supply chain
- Those best practices and strategies are shown in the following charts, and are useful in understanding the critical issues and challenges of effective SCM.
Supply Chain Operations Reference (SCOR) Model

- Commercial model adopted by DoD
- Maintained by Supply Chain Council
- Horizontal view (Supply Chain Partners): from customers’ customers to suppliers’ suppliers

DoD SCOR Model

DoD equivalent processes at bottom
Effective SCM requires integration of Material, Information, and Financial Transactions

The SCOR Model Equates to DoD Processes and Functions

SCOR Tools Applicable to DoD

- **Best Practices**
  - Drawn largely from private sector, but include innovative DoD initiatives

- **Strategies**
  - Detail various approaches to structuring and managing the supply chain to increase efficiency
Best Practices

SCOR “PLAN” – DoD “Forecast”

- Demand-based forecasting versus Requirements forecasting
  - Capture demand at point of use
- Vendor Managed Inventory
  - Let Vendor worry about forecasting and maintaining adequate inventory levels and bearing the cost of same
- Forecasting software (APS, CPFR)

Best Practices

SCOR “Source” – DoD “Procure”

- Strategic sourcing: segmenting items
- Prime Vendor – consolidate “buy” responsibility
- E-Commerce tools
- Performance-based Contracting
- Collaborative (special) supplier relationships
- PBL: Outsource wholesale item mgmt
Best Practices

SCOR “Make” – DoD “Repair”

- Demand-based Repair: PULL based vs. PUSH based
- Repair cycle time reduction (reengineer, remove steps, implement new technology)
- Segment critical vs. non-critical items; don’t treat all items the same
- Information integration
  - Repair right items, not wrong items
  - Advance warning of long lead-time parts deficiencies
  - Allows pro-active actions to mitigate

Best Practices

SCOR “Deliver” – DoD “Distribution”

- Customize Delivery:
  - Direct Vendor Delivery
  - Premium Transportation
- In-Transit Asset Visibility (ITAV)
  - Track, trace, dynamic rerouting
- Implement Metrics
  - Customer Wait Time
  - Logistics Response Time
Best Practices
SCOR “Return” – DoD “Retrograde”

- In-transit visibility (ITAV)
  - Track, trace
- Disincentivize ‘hoarding’ of carcasses (for cannibalization)
  - Reduced credits for “stripped” carcasses
  - Zero credit for extended non-return
- Improve return transportation cycle time

The Warfighter Perspective

“Someday I want Federal Express to ask us how we do business.”

Lt. General Richard Kelly
Deputy Commandant, Installations and Logistics, USMC
Supply Chain Best Practices
Condensed Summary

| PLAN         | Demand based forecasting vs. requirements Forecasting
|             | Vendor managed inventory
|             | Forecasting software
| SOURCE       | Strategic sourcing – segmenting items
|             | Prime Vendor; e-commerce tools
|             | Performance-based contracting; collaborative relationships
| MAKE/REPAIR  | Demand-based repair (PULL based vs. PUSH based)
|             | Repair Cycle Time reduction
|             | Segment critical vs. non-critical items
|             | Information integration
| DELIVER      | Customized delivery: Direct Vendor Delivery, Premium Trans.
|             | In-transit visibility (ITAV)
|             | Implement tracking metrics (CWT, LRT)
| RETURN       | In-transit visibility (ITAV)
|             | Disincentivize hoarding of reparable carcasses for rob-back
|             | Improve return transportation cycle time

Supply Chain Management

- DoD’s supply chain is characterized by inefficiencies – multiple handoffs, lack of end-to-end visibility, etc.
- SCM, and the SCOR Model, provide many best practices and processes that can be of value in DoD SCM
- PBL facilitates SCM best practices by optimizing for the customer – the weapon system, vice internal DoD supply processes
One Caution - Organizational Culture

New Concept + Old Organization = Dysfunctional Old Organization

TLCSM/PBL/SCM Sub-Optimized…No Transformation!

Overview

**IUID**
- Genesis
- Architecture/Life Cycle/Business Rules
- Wide Area Workflow
- Implementation Plan
- Reference Sources

**RFID**
- History
- System Design
- Specturm
- Benefits/Applications
"I think the industry has sold itself on a program that offers so little return that it simply won’t be worth the trouble and expense"

A Midwest Grocery Chain Executive discussing the potential of the barcode in 1975

Déjà vu All Over Again ?...

Troy, Ohio

Marsh’s Supermarket

June 26, 1974

67¢

Bar Codes Transformed Retail Sales and Inventory Management
Facing new challenges...

- Rapidly moving force on a dynamic battlefield
- Demand for better information on assets
- Need for more effective visibility and management of inventory

- Improve business processes now
- Improve confidence
- Influence the direction and cost of technology development
- Drive the standards to work for us
- Facilitate the implementation of Unique Identification (UID)

THE NEW TERMINOLOGY

- **UID** – Unique Identification
- **IUID** – Item Unique Identification
- **UII** – Unique Identification Item
- **RFID** – Radio Frequency Identification
- **CMB** – Contact Memory Button
Automated Identification Technology Suite

- Linear Bar Code
- Smart Card/CAC
- 2D Symbol
- CMB (Contact Memory Button)
- OMC (Optical Memory Card)
- STS (Satellite-Tracking Systems)
- RFID - Active
- RFID - Passive

Automated Information Technology (AIT)
DoDD 5000.2

Para 3.9.2.4.1: PMs shall optimize operational readiness through affordable, integrated, embedded diagnostics and prognostics, and embedded training and testing; serialized item management; automatic identification technology (AIT); and iterative technology refreshment.
The Genesis of UII

- GAO concerned with DOD management of its inventory of equipment.

- Finding: DOD’s inventory exceeded its war reserve or current operating requirements, but lacked key spare parts (particularly aviation spares) due to a lack of adequate accountability over material shipments or effective monitoring of defective spare parts.

GAO-02-477G (Mar 02): Executive Guide, Best Practices in Achieving Consistent, Accurate Physical Counts of Inventory and Related Property

UID Program-Integrated Situational Awareness of People, Places and Things

<table>
<thead>
<tr>
<th>Today -- No UIIs</th>
<th>To Be State -- UIIs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No integrated planning view</strong></td>
<td><strong>Integrated planning view</strong></td>
</tr>
</tbody>
</table>

Force Module Planning

- People
- Real Property

Requirements: Capability to integrate force structure planning for identifying and constituting deployable combined force modules.
- Who is available?
- With what equipment?
- Where are they now?
- How long can we support them?

Deployment and constitution options can be continuously evaluated.

Required items identified, pre-positioned and tracked with RFID.

People and things can be identified to sites and facilities for rapid deployment response.

Questions

Questions answered
DoD Vision for Item Unique Identification (IUID)

To implement a policy establishing a strategic imperative for uniquely identifying tangible items relying to the maximum extent practical on international standards and commercial item markings and while not imposing unique government data requirements.

Uniquely identified (UID) tangible items will facilitate item tracking in DoD business systems and provide reliable and accurate data for management, financial, accountability and asset management purposes.

Effective 1 January 04 Mandatory for Solicitations

UID

“Unique identification is the ability to physically distinguish one item from another…We view a unique identifier as a set of data for assets that:

- is globally unique and unambiguous
- ensures data integrity and data quality throughout life
- supports multi-faceted business applications and users”
UID: What makes it so Special?

UID...
- Provides “The Key” to discovery and correlation of item, real property and human resource information so …
  - DoD can consistently locate, control and value assets anywhere and anytime
- Enables globally accessible and secure enterprise data
- Registries enable creation of UID mission critical services to
  - Translate legacy data for existing DoD systems
  - Enable access for operational support
  - Enable joint paperless management

UII: What Is It?

In today’s world, many items we buy have identification on them that indicate the manufacturer or distributor of the product and the product type.

Two identical cans of Coke from the same bottling plant will show the same data on the Universal Product Code (UPC)

Some items also have a serial number that differentiates one item from another identical item (e.g., the 24th engine off the assembly line is different from the 1024th)

Serial numbers are unique, but not outside of their enterprise – the serial number assigned by XYZ Manufacturer could be the same as one assigned by ABC Company.

By combining enterprise identification, item class and serialization, a globally unique item identifier is created that differentiates each item from other items

Each item has its own globally unique identifier (UID)
Unique Item Identifier (UII) is . . .

UII is . . .

. . . the set of data for tangible assets that is globally unique and unambiguous, ensures data integrity and data quality throughout life, and supports multifaceted business applications and users.

EID
(12V)194532636
Orig. Part No.
(1P)1234
Serial No.
(S)786950

UII in the Supply Chain

*Serialized within the part number using DUNS

UID = Unique Identifier; EI = Enterprise Identifier
PN = Part Number; SN = Serial Number

UN19453263620802803896 (Optional)
UNO00535303210H001006392 (Optional)
UNO869072802161438020890 (Optional)
UNO8394810721982861105742

**UN = Issuing Agency Code for DUNS
What you see:

- Can contain 100 times the data as the same space in a barcode
- Can be read omni-directionally
- Can be damaged but still return accurate data
- Can be scaled up or down to fit within available marking space

What the Reader sees:

\[ \text{R}_S^{\text{DDG}}_S \text{MFR 0CVA5}_S^G \text{SER 786950}_R^E \text{0}_T \]

The Main Direct Part Marking Processes

- Dot Peen
- Electro
- Chemi
- Etch
- Laser

Source: Rolls-Royce, Nat Russhard
Source of UII Qualifying Criteria

Department of Defense (DoD) Instruction 5000.64, *Defense Property Accountability*, requires that accountability records be established for all property (property, plant and equipment) with a unit acquisition cost of $5,000 or more, and items that are sensitive or classified, or items furnished to third parties, regardless of acquisition cost.

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### Defining the Scope of an UII

<table>
<thead>
<tr>
<th>A UII Is</th>
<th>A UII Is Not</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ A Data Element</td>
<td>✓ A Device for Communicating Data, such as Radio Frequency Identification (RFID) Tags, Contact Memory Buttons, Linear Bar Codes, or 2-D Data Matrices</td>
</tr>
<tr>
<td>✓ A Unique Identifier for an Item</td>
<td>✓ A Replacement for the National Stock Number</td>
</tr>
<tr>
<td>✓ Globally Unique</td>
<td>✓ Intelligent Data that Yields Information About the Item</td>
</tr>
<tr>
<td>✓ Unambiguous</td>
<td>✓ Transferable from one item to another</td>
</tr>
<tr>
<td>✓ Permanent</td>
<td>✓ The enabler for business intelligence</td>
</tr>
<tr>
<td>✓ Created by Concatenating Specific Data Elements</td>
<td>✓</td>
</tr>
</tbody>
</table>

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Created by [Concatenating Specific Data Elements]

The enabler for business intelligence

A Replacement for the National Stock Number

Intelligent Data that Yields Information About the Item

Transferable from one item to another
UID Policy Overview

- Policy memorandum released on July 29th 2003 established IUID as a mandatory DoD requirement on all solicitations issued on or after January 1, 2004.
- IUID is required for all property items delivered to the Government if:
  - Acquisition cost is more than $5,000
  - Items with an acquisition cost below $5,000, when identified by the requiring activity as DoD serially managed, mission essential, or controlled inventory
  - Items with an acquisition cost below $5,000 as determined by the requiring activity
  - Regardless of value, any DoD serially managed subassembly, component or part embedded within an item and the “parent” item in which it is embedded
- Wide Area Workflow (WAWF) is the preferred method for capturing IUID data and will be a mandatory payment requirement no later than January 1, 2005.

Key Direction from UID Policy Updates

- Apply IUID to legacy items in inventory and operational use
- All program and item managers plan for and implement IUID
  - ACAT 1D programs submit plans by June 2005
  - All others to MDAs by January 2006
- Plans should target FY2007 as the point by which:
  - All existing serialized assets will be entered in UID registry
  - UII marking capabilities established such that marking can commence when equipment is returned for maintenance
- Government Furnished Property (GFP) must meet UID policy requirement effective 1 Jan 2006
Key Direction from UID Policy Updates  
(Continued)

- DUSD (Logistics and Material Readiness) develop UID implementation plan for organic depot maintenance operations
- DCMA negotiate corporate/facility strategies with top 30 DoD suppliers
- DCMA issue UII quality assurance plan
- AT&L work with Services/Agencies to modernize infrastructure, reengineer business processes, revise Automated Information Systems (AIS)

Evolutionary Approach to Legacy IUID
USD (AT&L) Memorandum 12 May 2005

- Guidance for review of IUID implementation at milestone reviews
- Establishes requirements for applying IUID to DoD property in the possession of contractors (PIPC);
  - Property should only be accountable in one property accountability system at a time
  - Acquisition value will be recorded and updated in the IUID Registry
    - Eliminate DD form 1662 DoD Property in the Custody of Contractors
    - IUID Registry will
      - Not be a property accountability system but provide audit trail of property in current and previous accountability systems.
      - Maintain master IUID data
      - Be updated with key transaction events but not maintain detailed transactional data
- Develop interfaces between IUID Registry and component specific property systems
- Add IUID to logistics policies and integration with serialized item tracking.
- Clarifications in Attachments

What is the UII Life Cycle?

Dispose – DoD/GSA records the “termination” of the UII at time of item disposal

Use – Functional stakeholders use UII as a primary or alternate key in the AIS to access or update item information based on its UII

Capture – DoD establishes the “birth” record of the UII by capturing the machine/human readable component data elements to create the UII in the AIT/AIS

Require – DoD contracts reflect the requirement for part marks to include UII data elements for all items which require unique identification

Create/Generate – Industry suppliers/manufacturers throughout supply chain assign and apply UII data elements and ensure the uniqueness of the component data elements
Items Requiring UIIs or Equivalents

- Acquisition cost is $5,000 or more

- DoD serially managed, mission essential or controlled inventory piece of equipment or a reparable item, or a consumable item or material where permanent identification is required

Solicitation Prep/Contract Award

- The UII requirement for part marking flows down to suppliers

- Assigning final valuation usually occurs at the level of the prime contract.

- If UII is required on a new contract, major modification, or reprocurement of equipment (such as spare parts), the RFP must include:
  
  - The DFARS clause 252.211-7003, Item Identification and Valuation
  - MIL-STD-130M
  - DID for imbedded UIDs (optional)
IUID and RFID Implementation Training

Data Item Description
Information needed to prepare a DD Form 1423 Contract Data Requirements List (CDRL) for embedded UIFs by tailoring the data item description for Bar Code Identification Report (DI-MGMT-80177A)

Create and Generate the UIF

The components that make up the UIF are identified in the table below. Each enterprise has two options for creating the UIF.

<table>
<thead>
<tr>
<th>UII Construct #1</th>
<th>UII Construct #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on current enterprise configurations</td>
<td>If items are serialized within the Enterprise</td>
</tr>
<tr>
<td>If items are serialized within Part, Lot or Batch Number</td>
<td></td>
</tr>
<tr>
<td><strong>UIF is derived by concatenating the data elements IN ORDER:</strong></td>
<td><strong>Issuing Agency Code</strong>&lt;br&gt;<strong>Enterprise ID</strong>&lt;br&gt;<strong>Serial Number</strong></td>
</tr>
<tr>
<td><strong>Issuing Agency Code</strong>&lt;br&gt;<strong>Enterprise ID</strong>&lt;br&gt;<strong>Serial Number</strong></td>
<td><strong>Issuing Agency Code</strong>&lt;br&gt;<strong>Enterprise ID</strong>&lt;br&gt;<strong>Serial Number</strong></td>
</tr>
<tr>
<td>Data Identified on Assets Not Part of the UIF (Separate Identifier)</td>
<td>Current Part Number **</td>
</tr>
<tr>
<td><strong>The Issuing Agency Code (IAC) represents the registration authority that issued the enterprise identifier (e.g., Dye and Brooks Inc., RAIN-U.S.). The IAC can be derived from the data elements for the enterprise identifier and does not need to be validated on the item.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>In instances where the original part number changes with幸 configurations (also known as part numbers) and the current part number may be included on the item as a separate data element for tracking purposes.</strong></td>
<td></td>
</tr>
</tbody>
</table>
Create/Generate a UII

The enterprise that puts the mark on an item is responsible for guaranteeing that the serial number assigned to the item is unique to that item.

Placement of the UII

Data elements for unique identification will be placed on qualifying items in accordance with the standard practice of MIL-STD-130, Identification Marking of U.S. Military Property. (Note: current version is “M”)

Once delivered, the UII and valuation remain the same for the life of the end-item. UIIs cannot be reused, even if the item is destroyed.
Applying the Ull

- Vendor-Applied-at-Source: Marking applied when item is manufactured
- Opportunity-Based Item Application: Can be done in the field or factory, wherever it is convenient to gain access to items either on an end item or available in a storage facility (phase maintenance, scheduled servicing, depot rebuild or overhaul processes, and work-order processes during modification)
- Seek-and-Apply: Used for particular items held within service, either at the end item or in storage. This strategy is dependent on establishing the location and availability of items before deployment of application equipment and teams. This approach is dependent upon good legacy data, and will demand greater overhead of coordinated effort to effect access to the assets.
- Gated: The interception of items as they transit specific gates within the supply chain. After identification, the situation can be resolved by diverting the item back to the vendor for application, provision of an application capability at the specific supply gate, or diversion of the item to a centralized application facility.

Use of Commercial Identifiers

- Commercial identifier can be considered for use as a DoD UID equivalent if it meets these criteria:
  - Must contain an enterprise identifier
  - Must uniquely identify an individual item within an enterprise identifier, product or part number
  - Must have an existing Data Identifier (DI) or Application Identifier (AI) listed in ANSI MH10.8.2, Data Identifier and Application Identifier Standard

- Some examples of commercial unique identifiers meeting these criteria are:
  - Global Individual Asset Identifier (GIAI) for serially-managed assets
  - Global Returnable Asset Identifier (GRAI) for returnable assets
  - ISO Vehicle Identification Number (VIN) for vehicles
  - Electronic Serial Number (ESN) for cellular telephones only.
Capture: IUID Registry
Wide Area Workflow (WAWF)

- IUID Registry is the central repository for IUID information and serves as an acquisition gateway to identify:
  - What the item is
  - How and when it was acquired
  - The initial value of the item
  - Current custody (government or contractor)
  - How it is marked

- Supports full lifecycle visibility for tangible items, integrating financial, maintenance, and accountability systems.

- Maintained by the Defense Logistics Information Service (DLIS), Battle Creek.
Capture: What Data is Included in IUID Registry

- Pedigree
  - Acquisition Contract Information
  - Original Part Number
  - Shipment and Delivery Information
- Valuation
  - Initial Acquisition Value
  - Changes in Valuation
- Accountability
  - Contractor Custody Information
  - Acceptance Data
  - Contract Data
- Configuration
  - Embedded Items
  - Item Markings
  - Part Number Changes

- Registry is located on the internet at https://www.bpn.gov/iuid.
- Users must register to obtain login credentials and access rights to controlled access portion
- Must be a government employee or a U.S. Government Contractor with approval from a DoD Program Manager or equivalent.
- Prior to registering in IUID Registry, commercial manufacturers and government manufacturing activities must be registered with the Central Contractor Registration (CCR) system at https://www.bpn.gov/ccr/scripts/index.html

Other UII Business Rules addressed in UII Guide

- What to do when:
  - items are missing the data elements required to construct the UII
  - legacy items that cannot be uniquely identified using UII Construct #1 or #2 or a UID equivalent
  - Original part number cannot be precisely determined
  - Items considered tangible personal property owned by the Government are in the possession of a contractor
UII Marking by DoD

- There will be non-recurring costs to make the appropriate changes to drawings and marking instructions for legacy spare parts, in accordance with MIL-STD-130M requirements.

- It may be desirable for the DOD-requiring activity to mark items when received rather than require the vendor to mark until the vendor’s internal capabilities are established. The requiring activity must ensure that DOD activities can guarantee that the UII information they use is unambiguous and globally unique through life.

The Virtual Unique Item Identifier (UII)

- Enables the data base entry of a UII and its associated pedigree data, while postponing the physical marking of the item with a two-dimensional data matrix symbol to a more advantageous time based on logistic and economic considerations.

- Used for DoD-owned legacy personal property items, which are:
  - Items and embedded items that have already been produced and deployed for use, or placed in inventory or storage pending issue for use, and
  - DoD resident equipment and spares in the possession of contractors.
UID (UII) Implementation Plan *

- Provide references including service UII CONOPs, Instructions, Relevant Service UII Policy documents (Most recent draft for those documents in development) and prime contractor(s) Single Process Initiatives if available
- Describe the overall UII Implementation Strategy to include
  - Marking
  - Current and future contracts
  - Legacy items
  - Depot Manufactured items and plant equipment
- Technical documentation strategy to minimize the non-recurring costs for marking,
- Describe the business strategy for implementing UII
- Identify UII related opportunities to improve or enhance business processes.
- List Metrics
  - Exit Criteria
  - Measures of Success

* Template on UID Home Page

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Key Responsibilities for IUID Implementation

- **Program Managers** will identify items embedded in end items that require unique identification, including embedded subassemblies, components and parts. These embedded items will identified in a Contract Data Requirements List (CDRL) or Exhibit.

- **Contracting Officers** shall include the clause at 252.211-7003, Item Identification and Valuation, in all solicitations and contracts that require delivery of items.

- All items delivered to the Department will be delivered under a contract line item and the Department’s acquisition cost of each item will be identified under a contract line item or sub-line item

- **Contractors** are required to provide unique item identification, or a DoD recognized unique identification equivalent, for all items delivered with an acquisition cost of $5,000 or more and as designated by the requiring activity for items less than $5,000.

- Under the clause at 252.211-7003, marking of items shall be in accord with MIL-STD-130L, Identification Marking of U.S. Military Property.
Unique Item Identification
Reference Sources

Unique Identification (UID)
Capturing business intelligence through technology

What’s New At UID?
The May 2016 edition of our e-Newsletter is now available. Current and past editions are accessible on the Implementation home page under the Training and Related Links menu.

An updated version of the ‘Tech Guide to Unique Identification’ is now available. Updated on June 1, 2016, this replaces version 3.0 from June 7, 2010.

Proposed changes to the OFARs to review requirements for reporting of Government property in the possession of DoD contractors was posted March 21, 2016 to Federal Register: http://www.asmc.org/blogs/artefacts/dodd-3030-ofar-changes-tracks-32534-

The proposed rule replaces existing DoD Form L482 reporting requirements with requirements for UID data. By electronically submitting it, the item unique identification (UID) registry, the UID data applicable to the Government property in the contractor’s possession. This will

Benefits of UID are numerous

• Item visibility regardless of platform or "owner"
• Lower item management costs
• Item data necessary for top-level
Welcome to the new monthly e-bulletin from the Unique Identification Program Office. The purpose of this bulletin is to provide news, updates, and information about the implementation of the Unique Item Identification (UID) Program.

May 2006 UID e-newsletter

Ratification Draft NATO Standardization Agreement 2299 Approved!

On April 20, 2006, the NATO Asset Tracking Intensive Working Group (ASTWG) approved a ratification draft of STANAG 2299, "Unique Identification (UID) of Items." This draft was developed by the ACTWG Technical Panel that developed the STANAG 2290 for presentation to the ASTWG. The Panel gave its unanimous support to issuing STANAG 2290 for NATO ratification. It is expected that the prerequisite for ratification will be achieved in the near future, and that it will become a ratified STANAG that enables all member countries to implement the NATO's standards.

April UID Forum in Providence, Rhode Island a Success!

The UID Program Office would like to thank the forum attendees and all who participated in the event.

implementation & Educational Tools

A variety of resources are available to assist organizations with their implementation of UID.

IUID and RFID Implementation Training

Welcome to the IUID and RFID Implementation Training. This training has been designed to provide hands-on experience with the implementation of unique identification technology throughout DoD and its supply chain.

- Defense Suppliers
- Program Managers
- Maintenance Depots
- Global Warfighters

Visit our website for more information and resources.
Other Information Tools

- **DoD Guide to Uniquely Identifying Items**: Outlines the UID process, business rules, and UID constructs.

- **UID 101**: This guide explores all aspects of this initiative and is intended to provide an understanding of how DoD program offices and commercial businesses can successfully implement the Unique Identification (UID) policy.

- **Guidelines for the Virtual Unique Item Identifier (UII)**: This document describes the virtual unique item identifier (UII) concept, the processes for assigning and registering virtual UIIs, and the prospective marking of items that have virtual UIIs.

- **Guidelines for Engineering, Manufacturing, and Maintenance Documentation Requirements for UID implementation**: Provides suggested methods for minimizing the non-recurring engineering costs associated with incorporating marking requirements for DoD unique identification into engineering drawings, manufacturing instructions, and maintenance work records.

Contact Information

For further information or questions, please contact:

- Ms. LeAntha Sumpter at LeAntha.Sumpter@osd.mil or at (703) 681-7564
- Mr. Robert Leibrandt at Robert.Leibrandt@osd.mil or at (703) 695-1099

DoD Guide to Uniquely Identifying Items and other relevant UID materials including policy memos can be found at

http://www.acq.osd.mil/dpap/UID/
Does anyone have a paper manifest for this?

RFID History

RFID is referred to as the next generation barcode.
A Functional RFID System Includes

- **Active:**
  - RF in the 400MHz, 900MHz, and 2.45GHz ranges
  - Range: Generally 300+ Feet
  - Used predominantly in transportation systems (rail, toll systems, trucking)
  - Characteristics: Tag with internal power cell mounted to item. Does not transmit all of the time. Data capacity varies.

- **Passive:**
  - RF in the LF, HF, UHF 858-960 MHz range. Protocols - uses back scatter technology
  - Range: Typically measured in inches or meters.
  - Used predominantly in retail systems.
  - Characteristics: Small tag with license plate data – limited data capacities.

Attributes of RFID

- A form of electronic labeling - read/write capability
- Interrogated at a distance - hands free & “On-the-Fly”
- Non-line-of-sight between reader/scanner and tagged item
- Can contain large quantities of unique digital info
- Greater placement flexibility on or in an item
- Virtually low maintenance
- Extremely low error rate
- Data cannot easily be copied
- Can be interfaced with other micro sensors
RFID benefits cut across both functional and value chain boundaries

<table>
<thead>
<tr>
<th>Key Benefits From Business Initiatives</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factory</strong></td>
</tr>
<tr>
<td>• Plant Inventory Accuracy (Finished Goods)</td>
</tr>
<tr>
<td>• Automatic and Verified Shipment Data Reported to Finance and Inventory Systems.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
RFID means a world with billions of ant-sized, five-cent computers

- Highly mobile
- Contain personal information
- Subject to surreptitious scanning
- Again, no cryptography...
- Access control difficult to achieve
- Data privacy difficult to achieve

**RFID is an enabler, it cannot fix fundamentally bad processes**
Why RFID? Bar Codes not going away

- Eliminates human error
- Improve data accuracy
- Asset visibility
- Performs in rugged, harsh environments
- Dynamic multi-block Read/Write capability
- Facilitate source data collection
- Simultaneous reading & identification of multiple tags in field

- Where line of site/communications are questionable
- Where read/write is required
- Where unattended scanning is desired
- Static information
- Replacing Manual Procedures
- Tags can be re-used in read/write environment

RFID is critical to DOD Logistics Transformation!
Passive RFID in the DOD Supply Chain

- Tagged items/cases/pallets shipped from suppliers
- Shipment/order data to DOD
  - Advanced Ship Notice (ASN) Required
- Shipment/order data captured in DOD Data Environment
- Will accept SSCC, SGTIN, DOD data construct
- RFID tag read on arrival at DOD Receiving Point
- Use EPCglobal compliant Class 0 & 1
- Tag read generates Transaction of Record
  (Receipt, Acceptance, Close-out, Payment, Inventory, etc.)

The focus is on case/carton and pallet

---

Passive RFID is an enabler to create an Integrated DOD Supply Chain

Cases/Pallets are labeled with passive RFID tags. Cases are associated to pallet

Cases/Pallets are read as they are received and new shipments are labeled. Orders are verified for accuracy

Cases/Pallets are associated with Active RFID to provide TAV.

Data is timely and accurate via network of linked readers allowing asset visibility along the entire supply chain

Manufacturers/Suppliers

Distribution Centers/Depots/TDCs

Commercial/Military Carriers

TMO/Supply/Theater Depots

Customer

Timely and Accurate Data

When shipments are reconfigured a new RFID Tag is created for the pallet and associated with cases on that pallet

The cases/pallets are automatically received with few disputes and info is shared with the AISs. Reconfigured shipments receive a new RFID Tag.

Customers have visibility of requisitions and are confident in the status provided by the system

---

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Passive RFID Implementation for DOD Suppliers

January 1, 2005
Classes of Supply:
- II, VI, IX, I (PORs/MREs)
Level of Tagging:
- Shipping Containers, Palletized Unit Loads, Exterior Containers
Ship to locations:
- San Joaquin, Susquehanna

DFAR – new contracts after 1 OCT 04

January 1, 2006
Classes of Supply:
- Begin All Classes
Level of Tagging:
- Shipping Containers, Palletized Unit Loads, Exterior Containers
Ship to locations:
- Strategic CONUS DLA Depots, TRANSCOM Facilities & Service Maintenance Facilities

January 1, 2007
Classes of Supply:
- All Classes
Level of Tagging:
- Shipping Containers, Palletized Unit Loads, Exterior Containers, UID Item Unit Pack
Ship to locations:
- All Locations

Passive RFID Requirements

- Tagged cases and pallets shipped to DOD receiving points beginning 1 Jan 2005
- All AIT peripherals must be RFID capable, and all AIS’s be RFID capable commencing FY 07
- Tagged packaging for items that require a Unique Identification (UID) shipped to DOD receiving points beginning 1 Jan 2007
- Tags will use EPC-technology specifications
  - Accept SGTIN, SSCC, DOD data constructs
  - Currently available:
    - Class 0  64 & 96 (read only) bit tags
    - Class 1  64 & 96 (read/write) bit tags
  - When available: UHF Generation 2 EPC tags

No “Silver Bullet” with RFID
Long-Term RFID Benefits

*Setting the foundation for future supply chain improvements…TODAY!*

- DOD Business Processes
  - Facilitates Hands-Off Data Capture
  - Improves Data Accuracy
  - Enhances Asset Visibility
- Downstream Derivative Improvements
  - Optimizes Transport/Lift Utilization
  - Reduces Logistics Footprint
  - Improves Manpower Utilization
  - Improves Force Tracking
  - Improves Logistics Processing Time
  - Enhances Interoperability with Industry

Challenges Ahead

- State of the technology
  - Read ranges
  - Security/Privacy
- Economic Issues
- Regulatory Issues
  - States, FDA, EPA, FCC
- Standards
  - Air Interface Protocols
  - Frequencies
  - Data formats/constructs
- AIS & Data Architecture
- Education & Training
- Phasing of implementation
- Business systems integration

*RFID – Future Reality…unlocking the potential*
Back to the Future

"I think the industry has sold itself on a program that offers so little return that it simply won’t be worth the trouble and expense"

discussing the potential of the barcode in 1975*

**“Scanning Hits a Snag,” Progressive Grocer, December 1975, p. 47**

UID-RFID Policy Relationship

According to current DoD Policy, RFID tags that carry data are required to be attached to packages at multiple levels, including item packages, cases, and pallets. Unique Identifiers are required to be attached or directly marked on items using a data matrix to carry the UID data elements.
### UID vs RFID

<table>
<thead>
<tr>
<th></th>
<th>UID</th>
<th>RFID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marking</td>
<td>Item</td>
<td>Packaging</td>
</tr>
<tr>
<td>Technology</td>
<td>2D Data Matrix</td>
<td>EPC RFID tag</td>
</tr>
<tr>
<td>Purpose</td>
<td>Life cycle data visibility</td>
<td>Supply chain receipt/track</td>
</tr>
<tr>
<td>Threshold</td>
<td>&gt;$5000, some exceptions</td>
<td>NONE</td>
</tr>
<tr>
<td>Implementation</td>
<td>January 1, 2004</td>
<td>January 1, 2005</td>
</tr>
</tbody>
</table>

Separate initiatives  
Different technologies  
Different business rules

### UID-RFID Data Relationship

#### End Item Database Data (15)
- UII (Concatenated)
- Descriptive Data
  - UII Data Elements (3)
  - Issuing Agency Code
  - UID Type
  - Item Description
  - Unit of measure
- Acquisition Data
  - Contractor
  - Contract Number
  - CLIN/SLIN/ELIN
  - Price
  - Acceptance Code (identifies acceptor)
  - Acceptance Date
  - Ship to code

#### Embedded Items of End Items (10)
- UII (Concatenated)
- Descriptive Data
  - UII Data Elements (5)
  - Item Description
  - Unit of measure
- Parent UII as of delivery date
- GFP flag
Change?, Ha!

“I’ve learned three things about new programs:

• Never oppose them; if you do you will get fired.
• Never do any work on them.
• In three months you will never hear about them again.

I’ve been here 23 years, and I’ve seen 23 of these things come and 23 of them go.”

(Auto Supplier Supervisor)
Success Requirements for a Journey

Leadership ← Commitment

The challenges of implementation:

- UID principles are sound - “a focused application of sound logic”
- The challenge is implementing them - and sustaining the transformation
- Transforming thinking into behavior and action is complex
- Every journey is unique

Big Question?

How do you implement and sustain transformational change initiated by your organization’s leadership?
Enterprise Leader Establishes and Communicates the Vision

Groups that lack vision

Groups with vision

Creative Tension

Fostering Learning

- Effective learning combines formal education and training with on the job practice and experience

**Educational Objectives**
1. Knowledge
2. Comprehension
3. Application
4. Analysis
5. Synthesis
6. Evaluation


Involve All The Stakeholders

Any group or individual who can affect or is affected by the achievements of the organization’s objective

* Source: Freeman, Strategic Management: A Stakeholder Perspective, Pitman, 1984
Role of Enterprise Leader

- Develop enterprise level goals and metrics that encourage and promote IUID implementation
- Identify and support Change Agents
- Promote leadership and risk taking at all levels
- Empower teams and individuals
- Remove barriers
- LEAD!!!

IUID implementation requires effective leadership

Barriers Inhibit Adopting New Concepts

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Roadblocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIH, Politics</td>
<td>Resistance To Change, Mixed Signals, Lack of Trust, Skepticism, Lack of Commitment, Inconsistent Direction</td>
</tr>
</tbody>
</table>

Changed Work Practices

Philosophies, Concepts, Theories
Knowledge, Understanding, Skills
Breakthrough Barriers

Philosophies
Concepts
Theories

Knowledge
Understanding

Skills

Barriers

Changed Work Practices

Short Term Cycle

Create & Refine
Transformation Plan

- Identify & prioritize activities
- Commit resources
- Provide education and training
Provide Education and Training

- Prepare and motivate people
  - Train workers in tools and appropriate skills
  - Create common understanding of need to change to Lean

- Employee involvement
  - Decision-making and system development happens at the appropriate level
  - Trained and truly empowered people

- Share information and manage expectations

- Identify and empower champions, particularly operations managers
  - Remove roadblocks (i.e., people, layout, systems)
  - Make it both directive yet empowering
Short Term Cycle

Focus on Continuous Improvement

- Monitor IUID progress
- Nurture the progress
- Refine the plan
- Capture and adopt new knowledge

Sustaining IUID

- IUID must be self sustaining
- Invest in the process
- Invest in humans and machines to change methods
- Neglected processes need to repaired to bring reliability
- Do not use to reduce head count
- Do not be in the business for next month’s P&L statement, change takes a while
Take Aways

- Effective implementation of IUID requires
  - Aligning action with strategy
  - Focus on value streams
  - Leadership and organizational change
  - Training and empowering the workforce
  - Tracking metrics
  - Plan-Do-Check-Act cycles at multiple levels
  - Sustaining commitment

- What you have learned today prepares you to actively participate in improvement projects in your organization
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For a quick reference to common questions look for the “Why, What and How Guy.”
Introduction

This guide is designed to provide an opportunity for the Department of Defense (DoD) Components, Military Services, and industry to gain insight into the Departments initiative on improving asset management through uniquely identifying property, plant and equipment, operating materials and supplies. This guide explores all aspects of this initiative and is intended to provide an understanding of how DoD program offices and commercial businesses can successfully implement the Unique Identification (UID) policy in support of the Department’s mission. The guide will examine the relationship between the legislative and regulatory environment motivating this program, the policy, implementation, business rules, marking, and valuation process.

The definition below forms the basis of the discussion about the DoD Unique Identification program.

Unique Identification is the set of data for tangible assets that is globally unique and unambiguous, ensures data integrity and data quality throughout life, and supports multi-faceted business applications and users.

Regulatory Environment

The need for Congress, Federal managers, and other decision makers to make informed decisions about future funding, oversight of Federal programs involving inventory, and operational readiness continues to challenge Federal departments and agencies to provide useful, reliable, and timely inventory data, which is still not available for daily management needs. The Unique Identification Program began as one of the Department of Defense’s solutions for addressing the deficiency in complying with the Chief Financial Officers Act of 1990. The CFO Act and subsequent acts such as the Government Performance and Results Act of 1993, Government Reform Act of 1994 and the Federal Financial Management Improvement Act of 1996 were designed to:

1) improve financial management;
2) promote accountability and reduce costs; and
3) emphasize results-oriented management.

These laws set expectations for agencies to develop and deploy modern financial management systems, produce sound cost and operating performance information, and design results oriented reports on the government’s financial position by integrating budget, accounting, and program information. Federal departments and agencies work hard to address the requirements of these laws.

The last several years, the General Accounting Office (GAO) has been critical of the Department’s accountability and control over property, plant and equipment. They have highlighted the problems with the inability of many of the Department's property systems to properly support the warfighter’s need for asset visibility and logistics support. As a result, the Department initiated a business transformation.

DoD’s Business Enterprise Architecture

To ensure compliance with appropriate laws, regulations, policies, and standards, as well as to provide additional detail to govern DoD business operations, the Department’s Business Enterprise Architecture was designed to assist the transformation. The architecture is a tool that identifies the Department's business processes and helps identify, plan for and implement opportunities to improve them. The Department envisions using the architecture and transition plan to help move the Department to its future business environment in an effective, efficient and timely manner, while minimizing the impact of the transition on current operations, organizations and personnel. The framework is intended to ensure that the architectures developed by the DoD are:

1. Integrated and interoperable across joint and multi-national organizational boundaries; and
2. Comparable across the Department's business operations, systems, and technical architecture environments

This is the desired end state driving the Unique Identification (UID) program. The Unique Identification Program Office was created to implement UID Policy as related to tangible items. UID will facilitate item tracking in DoD business systems and provide reliable and accurate data for program management and accountability purposes. Michael Wynne, Acting Under Secretary of Defense (Acquisition, Technology, and Logistics), announced the new policy on July 29, 2003.
Unique Identification Program

The Unique Identification (UID) Program is the foundation for enabling DoD to reach established goals and objectives by enhanced total asset visibility, improved lifecycle item management and accountability, and clean financial audits.

![Unique Identification Program Diagram]

Figure 1: UID Role – Business Enterprise Architecture

Figure 1 illustrates UID’s role in the Business Enterprise Architecture. With the ability to distinguish one item from another, UID ensures data integrity and data quality throughout life, and supports multi-faceted business applications and users. This will enable the achievement a globally interoperable network-centric architecture for the integrated management and valuation of items.

Unique identification of items will help achieve:

- Integration of item data across the Department of Defense (hereafter referred to as the Department), and Federal and industry asset management systems, as envisioned by the DoD.

“...In every troop deployment this century, DoD has been plagued by a major difficulty—the inability to see assets as they flow into a theater and are in storage. This situation has led to direct and significant degradation in operational readiness. When assets in the pipeline are not visible, they are difficult to manage. Property is lost, customers submit duplicate requisitions, superfluous material chokes the transportation system, and the cycle continues. Assets at the retail level that are not visible and, therefore, not available for redistribution, further compound the degradation of operational readiness.” Joint Total Asset Visibility Strategic Plan, January 1999, Joint Total Asset Visibility Office, DoD.
Financial Management Enterprise Architecture (FMEA), to include improved data quality and global interoperability and rationalization of systems and infrastructure.

- Improved item management and accountability.
- Improved asset visibility and life cycle management.
- Clean audit opinions on item portions of DoD financial statements.

**The Policy and Regulations**

**Policy**

On July 29, 2003, Michael Wynne, the Acting Under Secretary of Defense (Acquisition, Technology and Logistics) (OUSD(AT&L)) signed the "Policy for Unique Identification (UID) of Tangible Items - New Equipment, Major Modifications, and Reprocurements of Equipment and Spares." This policy makes UID a mandatory DoD requirement on all solicitations issued on or after Jan. 1, 2004.

**Chronology of the Unique Identification Policy:**

<table>
<thead>
<tr>
<th>UID Implementation</th>
<th>Announcement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unique Identification is mandatory for all DoD solicitations issued on or after Jan. 1, 2004</td>
<td>USD (AT&amp;L) Memo of July 29, 2003</td>
</tr>
<tr>
<td>Existing Government Furnished Property provided to contractors is exempt from the UID policy until Jan. 1, 2005 when the policy becomes mandatory for all Government Furnished Property incorporated into an end item.</td>
<td>USD (AT&amp;L) Memo of July 29, 2003</td>
</tr>
<tr>
<td>UID Policy Update, outlining a number of clarifications and further detail on the UID policy</td>
<td>USD (AT&amp;L) Memo of November 26, 2003</td>
</tr>
<tr>
<td>Revision of Update of UID Policy, clarifies the use of Issuing Agency Codes for UID</td>
<td>USD (AT&amp;L) Memo of December 22, 2003</td>
</tr>
</tbody>
</table>

The policy memorandums define step-by-step procedures to determine what items need to be marked and also states “Existing government furnished property provided to contractors is exempt from this policy until Jan 1, 2005 when the policy becomes mandatory for all government furnished property
incorporated into an end item.” For all additional policy updates, please visit the UID web site at www.acq.osd.mil/uid.

**Acquisition Regulation**

The Defense Federal Acquisition Regulation Supplement (DFARS) contains the rules used by DoD and suppliers to DoD to comply with UID policy when solicitations are issued.

The Federal Acquisition Regulation (FAR) is the body of regulations which is the primary source of authority governing the government procurement process. The Defense Federal Acquisition Regulation Supplement (DFARS) is a supplement to the FAR which includes clauses particular to DoD contract procurement. The interim rule for item identification and valuation is contained in DFARS Clause 252.211-7003. DoD contracting officers are required to include the clause in all solicitations, defining items necessary for identification and valuation. Refer to Figure 3 on page 9 for instructions on what items to UID.

It is anticipated that situations might arise where vendors of commercial products may not be prepared to comply with DoD UID requirements within the cost constraints and time frames required for product deliveries. Should this occur, DoD requiring activities may consider implementing a strategy under which the DoD would either: (1) furnish product UID labels to the commercial vendors for application to products before shipment, or (2) contract with third parties to furnish and apply the UID labels after product delivery from the commercial vendors. This strategy should only be implemented if cost advantages would accrue to the Department.

**When was this policy implemented?**

**Answer**

January 1, 2004 for all new DoD solicitations and orders.

What does this policy mean to me?

**Contractor:** UID is required to do business with DoD.

**Department Program Office:** UID requirements must be incorporated into all new solicitation and orders.
The UID enables traceability of the item throughout its life within the DoD inventory system. Figure 2 illustrates the UID lifecycle and the business rules at each phase. Business rules illustrated on the next page have been developed to determine when an item is to be marked.

**What Items To UID**

The unique identification of items is driven by an integrated set of logistics, acquisition and financial requirements to track and identify item information. Figure 3 contains a decision tree defining the business rules for determining what items should be uniquely identified. The DoD program office issuing the solicitation is responsible for identifying items for UID.
All solicitations, contracts or delivery orders for tangible items delivered to the Government will require unique item identification or a DoD recognized unique identification equivalent, if:

1. Unit acquisition cost is over $5,000.
2. Serially managed.
4. Controlled inventory.
5. A consumable item or material where permanent identification is necessary.

As illustrated in the decision tree in Figure 3, all end items unit acquisition cost of $5,000 and over require a UID. If the Government’s unit acquisition cost is under $5,000, the DoD program office must first decide whether or not the end item is equipment, reparable, material or consumable?

1. If the item is equipment or a reparable and determined to be serially managed, mission essential, or controlled inventory then the item will require a UID.

2. If the item is a material that does not change form or if it is a consumable item, then the requiring activity determines if a UID is required.

Figure 3. The Decision Tree to Uniquely Identifying Items Under $5000

Commercial item identification examples are the Universal Product Code and Health Industry Bar Code.
Guidance regarding the identification of embedded items is continuing to be developed. Please refer to [www.osd.acq.mil/uid](http://www.osd.acq.mil/uid) for additional guidance.

**Unique Identification Mark**

**2D Data Matrix**

Unique identification is a set of data for assets that is globally unique and unambiguous, ensures data integrity and data quality throughout life, and supports multi-faceted business applications and users. The technology used to mark an item is 2D Data Matrix ECC 200 Symbol.

Data Matrix is a two-dimensional barcode which can store from 1 to about 2,000 characters. The symbol is square or rectangular and can range from 0.001 inch per side up to 14 inches per side.

Data Matrix supplements the first and second generation bar codes used to track packages by expanding automated data collection into the manufacturing, operations, repair and overhaul environments. The Data Matrix can be applied in three ways as long as it remains permanent through the life and not damaged or destroyed in use:

1. Embedded directly to the item surface;
2. Through a plate affixed to the item surface; or

---

Who is responsible for determining what items require a UID?

**Answer**

The contracting office issuing the solicitation should reference DFARS 252.211.7003 and define and list the items requiring identification and/or valuation.

The portion of the clause addressing the decision tree is DFARS 252.211.7003 © (c) **Unique item identification.**

(1) The Contractor shall provide DoD unique item identification, or a DoD recognized unique identification equivalent, for—

(i) All items for which the Government's unit acquisition cost is $5,000 or more; and

(ii) The following items for which the Government's unit acquisition cost is less than $5,000:

<table>
<thead>
<tr>
<th>Contract Line, Subline, or Exhibit Line Item Number</th>
<th>Item Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Note Contracting Office Must Fill In</td>
<td></td>
</tr>
</tbody>
</table>

---

[www.acq.osd.mil/uid](http://www.acq.osd.mil/uid)
3. Attaching a label.

Some of the benefits of using 2D Data Matrix Technology verses a standard barcode are as follows:
- Can contain 100 times the data as the same space in a barcode;
- Can be read omni-directionally;
- Can be damaged but still return accurate data;
- Can be scaled up or down to fit within available marking space.

Data Matrix symbols require a 2D scanner; they cannot be read using an ordinary linear barcode laser scanner.

The data matrix will contain data represented in a uniquely identified code assigned to an individual item. The code can represent an already existing commercial item marking or can be constructed using DoD acceptable identification requirements.

**Commercial Identifiers**

The policy relies to the maximum extent practical on DoD recognized equivalent commercial item markings and does not impose unique government data requirements. Generally, a commercial identifier can be considered for use as a DoD UID equivalent if it meets these criteria:

1. Must contain an enterprise identifier,
2. Must uniquely identify an individual item within an enterprise identifier, product or part number, and
3. Must have an existing Data Identifier (DI) or Application Identifier (AI) listed in ANSI MH10.8.2, Data Identifier and Application Identifier Standard.

Some examples of commercial unique identifiers meeting these criteria that are recognized as unique identification equivalents are

1. The EAN.UCC Global Individual Asset Identifier (GIAI) for serially-managed assets,
2. The EAN.UCC Global Returnable Asset Identifier (GRAI) for returnable assets,
3. The ISO Vehicle Identification Number (VIN) for vehicles, and
4. The Electronic Serial Number (ESN) for cellular telephones only.

**Constructed Unique Identification**

If no DoD recognized commercial unique identifier standard exists then a UID may be constructed in conformance with the DoD's "collaborative solution". The collaborative solution is a method for creating interoperability among the data semantics of perData Identifiers, Application Identifiers and Text Element Identifiers used by ANSI MH10.8.2, EAN.UCC and Air Transport Association.
(ATA) respectively. This is accomplished by embedding the data semantics in ISO 15434 syntax. Serialization can be accomplished in one of the following two ways:

1. Unique Identification Construct 1, Serialization within the Enterprise
2. Unique Identification Construct 2, Serialization within the Original Part Number

**Construct 1: Serialization within the Enterprise Identifier**

For items that are serialized within the enterprise identifier, unique identification is achieved by a combination of the issuing agency code, enterprise identifier and the serial number, which must be unique within the enterprise identifier. The unique serial number within the enterprise identifier is a combination of numbers or letters assigned by the enterprise to an item that provides for the differentiation of that item from any other like or unlike item and is never used again within the enterprise identifier. The data elements of enterprise identifier and unique serial number within the enterprise identifier provide the permanent identification for the life cycle of the item.

**Construct 2: Serialization Within the Part Number**

For items that are serialized within the part number, unique identification is achieved by a combination of the issuing agency code, enterprise identifier, the original part number, and the serial number. The original part number is a combination of numbers and letters assigned by the enterprise at asset creation to a class of items with the same form, fit, function, and interface. The serial number within the part number is a combination of numbers and letters assigned by the enterprise to an item that provides for the differentiation of that item from any other like item. The data elements of enterprise identifier, original part number and serial number within the original part number provide the permanent identification for the life cycle of the item.
Issuing Agency Codes for Use in Unique Identification

Table 1 contains a list of ISO issuing agency codes (IACs) assigned. At the current time, IACs exist for five most commonly used enterprise identifiers.

<table>
<thead>
<tr>
<th>Issuing Agency Code</th>
<th>Issuing Agency</th>
<th>Enterprise Identifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 9</td>
<td>EAN-International</td>
<td>EAN.UCC</td>
</tr>
<tr>
<td>LB</td>
<td>Telcordia Technologies, Inc</td>
<td>ANSI T1.220</td>
</tr>
<tr>
<td>UN</td>
<td>Dun &amp; Bradstreet</td>
<td>DUNS</td>
</tr>
<tr>
<td>D</td>
<td>Allied Committee 135</td>
<td>CAGE</td>
</tr>
<tr>
<td>LH</td>
<td>European Health Industry Business</td>
<td>EHIBCC</td>
</tr>
</tbody>
</table>

Table 1: Issuing Agency Codes

Table 2 reveals how unique identification is constructed from the elements placed on the item and the business rules. When deriving the concatenated unique identification, the data qualifiers are eliminated from the final number. Data qualifier means a specified character (or string of characters) that immediately precedes a data field that defines the general category or intended use of the data that follows.

<table>
<thead>
<tr>
<th>Based on current enterprise configurations</th>
<th>UID Construct #1</th>
<th>UID Construct #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>UID is derived by concatenating the data elements IN ORDER:</td>
<td>Issuing Agency Code* Enterprised ID Serial Number</td>
<td>Issuing Agency Code* Enterprised ID Original Part Number Serial Number</td>
</tr>
<tr>
<td>Data Identified on Assets Not Part of the UID (Separate Identifier)</td>
<td>Current Part Number**</td>
<td>Current Part Number**</td>
</tr>
</tbody>
</table>

*The Issuing Agency Code (IAC) represents the registration authority that issued the enterprise identifier (e.g., Dun and Bradstreet, EAN.UCC). The IAC can be derived from the data qualifier for the enterprise identifier and does not need to be marked on the item.

**In instances where the original part number changes with new configurations (also known as part number roll), the current part number may be included on the item as a separate data element for traceability purposes.

Table 2. Unique Identification (UID) Construct Business Rule
Data elements for unique identification (enterprise identifier, serial number and, for Construct 2 only, original part number) will be placed on qualifying items in accordance with the standard practice of MIL-STD-130, Identification Marking of U.S. Military Property. For a greater understanding of the marking methods, please refer to the UID Guide to Uniquely Identifying Items v1.4.

An end item may include embedded items, such as subassemblies, components and parts. The prime contractor will pass down appropriate specifications, including the UID marking requirements, to the tiered vendors for subcontracted subassemblies, components and parts. Spares may be purchased directly from the vendors or through the prime contractor. UID-qualifying spare items (subassemblies, components and parts) have to be marked appropriately with the UID data elements. So, when the prime delivers the end item—that is one UID. The spares are delivered with their own UIDs. The Government will of ask the prime to deliver a list of all UIDs for UID-qualifying embedded items in the end item.

DoD program offices and industry partners continue to share best practices on UID part marking that minimizes financial and physical impact. The UID Program Office has ongoing working groups that meet with DoD stakeholders in order to share approaches. For more information, please go to www.acq.osd.mil/uid.

Reader Technology

As stated earlier, the data matrix symbol requires a 2D scanner; they cannot be read using an ordinary linear barcode laser scanner. Automatic Identification Technology (AIT) is the basic building block in the Defense Department’s efforts to provide timely asset visibility. AIT gives the Department the capability to document and control items over the UID Lifecycle.

The AIT reader will accurately and reliably machine read the data elements and output a UID. The data will be transmitted to a DoD automated information system. The data can then be used as a primary or alternate key across DoD databases.
Accounting and Valuation of Items

The first part of this guide focused on the UID program, implementation and item marking. The final section of this guide will focus on the accounting and valuation process. The purposes of the DFARS clause is to both uniquely identify and value items to provide better asset accountability and valuation through the UID life cycle mentioned in Figure 2 on page 8. A number of DoD Directives provide internal guidance on DoD Program responsibilities related to properly accounting and valuating items. The DoD Directives can be found in Appendix A.

Accountability of items begins when equipment, reparable, materials and consumables are acquired through purchase, lease, or other means.

1. DoD Instruction 5000.64 requires that accountability records be established for all property (i.e., property, plant and equipment) purchased, having a unit acquisition cost of $5,000 or more, and items that are classified or sensitive, or items located at third parties, regardless of acquisition cost.

2. For material covered under DoD 4140.1-R publication, accountability records are established for all material received, regardless of cost.

All property delivered to the Government must be delivered on a contract line item, subline item or exhibit line item. The acquisition cost of each item entering the Government property inventory is captured on the contract line item (CLIN), subline (SLIN), or exhibit line (ELIN) item.

Both the unique identification and value of items delivered under the contract need to be reflected in the DoD property accountability and management information systems. The valuation of property is addressed in DoD Instruction 5000.64 and states that unit acquisition cost should be the basis for valuation of property. The contract type determines the proper method of calculating acquisition cost.

1. For fixed price contracts, the unit acquisition cost for items to be delivered is the fixed price paid by the Government.

2. For cost type contracts, the unit acquisition cost for items to be delivered is the contractor’s estimated cost at the time the item is delivered.

For a greater understanding of the valuation methods, please refer to the UID Guide to Uniquely Identifying Items v1.4.
Wide Area Work Flow and the UID Registry

Wide Area Work Flow—Receipt and Acceptance (WAWF-RA) will be the standardized data capture mechanism for transmitting UID data from contractors to DoD for new acquisitions of tangible items. WAWF-RA is a Paperless Contracting DoD-wide application designed to eliminate paper from the receipt and acceptance process of the DoD contracting lifecycle. A secure, web-based application, WAWF-RA enables authorized Defense contractors and DoD personnel to create, capture, and process receipt, acceptance, and payment-related documentation and to access contract related documents electronically. The UID-capable version of WAWF-RA (v3.0.4) was placed in production in May 2004 and is in the pilot phase for UID capture with several vendors. The UID capture function of WAWF-RA will soon be available to all vendors.

For more information on WAWF, please visit the WAWF training site at http://www.wawftraining.com.

Wide Area Work Flow is a means of transmitting UID data elements into the UID Registry. The UID registry is the ultimate repository where all UID data will be captured. The UID registry will serve as an acquisition gateway to:

- Identify what the item is;
- Identify who owns the item originally;
- Identify the initial value of the item;
- Identify procuring activity and acceptance timing;
- Intersect with other systems (e.g., property management, logistics, inventory management)

Data Elements in the UID Registry

The contractor, at time of delivery, is responsible for providing the following information:

1. Item Description
2. Unique identification, consisting of—
   (i) Concatenated DoD unique item identification; or
   (ii) DoD recognized unique identification equivalent
3. Unique item identifier type
4. Issuing agency code (if DoD unique item identifier is used)
5. Enterprise identifier (if DoD unique item identifier is used)
6. Original part number
7. Serial number
8. Unit of measure
9. Government’s unit acquisition cost
10. Ship-to code
11. Contractor’s CAGE code or DUNS number
12. Contract number
13. Contract line, subline, or exhibit line item number
(14) Acceptance code
(15) Shipment Date

Most of those data elements listed will be captured in the UID Registry.

**Summary**

This Guide provides a broad overview of the UID Program. It is designed to expose DoD program offices and contractors to the implementation process and enhance understanding of the:

- Legislative and Regulatory Relationship;
- DoD Business Transformation Process;
- UID Policy;
- UID Implementation;
- Business Rules;
- Marking;
- Valuation Process;
- Wide Area Work Flow; and
- UID Registry.

While overhauling DoD business processes will be challenging, DoD is committed to this transformation to provide the warfighter and key decision makers with the information they need when they need it.

*Transformation is not an event – it is a process. There is no point at which the Defense Department will move from being “untransformed” to “transformed.” Our goal is to set in motion a process and a culture that will keep the United States several steps ahead of potential adversaries.*

*Secretary Rumsfeld*

*May 14, 2003*

The desirable end state that DoD envisions through DoD’s Business Enterprise Architecture is the integration of item data across DoD, Federal and industry asset management systems, as to include improved data quality and global interoperability and rationalization of systems and infrastructure.

Unique identification of items will help achieve that goal by:

- Improved item management and accountability.
- Improved asset visibility and life cycle management.
- Clean audit opinions on item portions - Property, Plant and Equipment; Inventory; and Operating Materials and Supplies - of DoD financial statements.

With ongoing cooperation between DoD program offices and contractors, strides are continually being made to ease the transition. For further information or questions, please visit our website at [www.acq.osd.mil/uid](http://www.acq.osd.mil/uid) or e-mail us at info@uniqueid.org.
UID background materials, previous UID policy memos, and implementation guidelines are available at www.acq.osd.mil/uid.
Appendix A: Referenced Directives for the UID Program

The DoD Directives System was established to provide a single, uniform system of DoD issuances and directive-type memorandums used to convey DoD policies, responsibilities, and procedures. The DoD Directives System provides for the orderly processing, approval, publication, distribution, internal review, and records management of DoD Directives, DoD Instructions, and DoD Publications. The DoD Directives System also includes the Office of the Secretary of Defense (OSD) Federal Register System.

DoD Directive:

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## Appendix B: Industry References

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Department of Defense Guide to Uniquely Identifying Items

Assuring Valuation, Accountability and Control of Government Property

Version 1.6
June 1, 2006

Office of the Deputy Under Secretary of Defense
(Acquisition, Technology & Logistics)
This Version 1.6 of the Guide to Uniquely Identifying Items replaces all previous versions.

Summary of Changes from Version 1.5 (Dated June 6, 2005) to Version 1.6:

a. Terminology and references associated with the DoD Business Enterprise Architecture were updated.

b. A note on using a Contract Data Requirements List for item unique identification (IUID) data was replaced with the appropriate language from Defense Federal Acquisition Regulation Supplement (DFARS) 252.211-7003.

c. Chapter 3 was revised. The new Chapter 3 expands the discussion of IUID requirements. A new Chapter 4 was created from sections of the prior Chapter 3 that address the methodology for uniqueness and relevant implementation considerations. Content changes were incorporated:

- To further clarify IUID requirements of the contract clause DFARS 252.211-7003.
- To provide additional guidance and information regarding unit acquisition cost threshold, DoD serially managed, mission essential, controlled inventory, embedded items and other qualifying reasons for IUID.
- To clarify that legacy items include items undergoing maintenance, repair or overhaul.
- To update the name of EAN.UCC to GS1.
- To provide additional guidance regarding applicability of virtual unique item identifiers (UIIs).
- To clarify and expand references to the enterprise identifier NCAGE.
- To include human-readable information, in addition to other AIT media, as a data source.
- To clarify that the specified Data Matrix type is ECC 200 which uses Reed-Solomon error correction.
• To emphasize that unserialized Global Returnable Asset Identifiers are unacceptable for IUID.

d. The definition for Military Mission Essentiality replaced the definition for Mission Essential in Appendix A.

e. Appendix B references were updated. A reminder to check for revisions to documents was added.

f. Appendix C was updated to version 3.5c of the Business Rules with additional information on use of lot or batch numbers.

g. Appendix D incorporated the DI 7L and the TEI LTN, and expanded the data element description for 18S, USN and UST in Table 5. Data Qualifiers and replaced Figure 6. Concatenated Unique Item Identifier (UII) Construction to expand the illustration of UIIs by format and construct. The example for using data identifiers in UII Construct #1 was expanded to illustrate the inclusion of discrete data elements with the concatenated UII in accordance with Business Rule #2.

h. Appendix E was updated.

i. Changes for compatibility with the changes reflected above, as well as various typographical, grammatical and format corrections, were made throughout.
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Chapter 1
The Environment

THE GOVERNMENT PROPERTY MANAGEMENT CHALLENGE

The Government Accountability Office (GAO) aptly describes the challenge faced by today’s managers of Federal Government property: “GAO and other auditors have repeatedly found that the federal government lacks complete and reliable information for reported inventory and other property and equipment, and can not determine that all assets are reported, verify the existence of inventory, or substantiate the amount of reported inventory and property. These longstanding problems with visibility and accountability are a major impediment to the federal government achieving the goals of legislation for financial reporting and accountability. Further, the lack of reliable information impairs the government’s ability to (1) know the quantity, location, condition, and value of assets it owns, (2) safeguard its assets from physical deterioration, theft, loss, or mismanagement, (3) prevent unnecessary storage and maintenance costs or purchase of assets already on hand, and (4) determine the full costs of government programs that use these assets. Consequently, the risk is high that the Congress, managers of federal agencies, and other decision makers are not receiving accurate information for making informed decisions about future funding, oversight of federal programs involving inventory, and operational readiness”.


2 Ibid, page 5: The GAO observes that “In the 1990s, the Congress passed the Chief Financial Officers Act of 1990 and subsequent related legislation, the Government Management Reform Act of 1994, the Government Performance and Results Act of 1993, and the Federal Financial Management Improvement Act of 1996. The intent of these acts is to (1) improve financial management, (2) promote accountability and reduce costs, and (3) emphasize results-oriented management. For the government’s major departments and agencies, these laws (1) established chief financial officer positions, (2) required annual audited financial statements, and (3) set expectations for agencies to develop and deploy modern financial management systems, produce sound cost and operating performance information, and design results-oriented reports on the government’s financial position by integrating budget, accounting, and program information. Federal departments and agencies work hard to address the requirements of these laws but are challenged to provide useful, reliable, and timely inventory data, which is still not available for daily management needs.”
The Environment

The Definition of Items

For the purposes of this guide, an item is a single hardware article or a single unit formed by a grouping of subassemblies, components, or constituent parts.³

The Objectives

Department of Defense (DoD) Instruction 5000.64, Defense Property Accountability, requires that accountability records be established for all property (property, plant and equipment) with a unit acquisition cost of $5,000 or more, and items that are sensitive or classified, or items furnished to third parties, regardless of acquisition cost. Property records and/or systems are to provide a complete trail of all transactions, suitable for audit.⁴

DoD 4140.1-R requires accountability and inventory control requirements for all property and materiel received in the wholesale supply system.

A key component of effective property management is to use sound, modern business practices.

In terms of achieving the desirable end state of integrated management of items, the collective DoD goal shared by all functional processes involved in property management is to uniquely identify items, while relying to the maximum extent possible on international standards and commercial item markings and not imposing unique Government requirements. Unique identification of items will help achieve:

- Integration of item data across the Department of Defense (hereafter referred to as the Department), and Federal and industry asset management systems, as envisioned by the DoD Business Enterprise Architecture (BEA)⁵, to include improved data quality and global interoperability and rationalization of systems and infrastructure.
- Improved item management and accountability.

³ DFARS 252.211-7003(a).
⁴ The Instruction states that property accountability systems and records should include data elements such as part number, national stock number, serial numbers, bar codes, or other unique identifiers (e.g., hull, building, aircraft tail numbers, vehicle registration, disposal turn-in document number, as may be appropriate and necessary).
⁵ On March 15, 2006, the DoD Business Transformation Agency (BTA) released the Business Enterprise Architecture (BEA 3.1), which defines the processes, roles, data structures, information flows, business rules, and standards required to guide improvements in the Core Business Missions (CBMs) of the Department.
The Environment

- Improved asset visibility and life cycle management.
- Clean audit opinions on item portions\(^6\) of DoD financial statements.

ITEM MANAGEMENT

The acquisition, production, maintenance, storage, and distribution of items require complete and accurate asset records to be effective, and to ensure mission readiness. Such records are also necessary for operational efficiency and improved visibility, as well as for sound financial management. Physical controls and accountability over items reduce the risk of (1) undetected theft and loss, (2) unexpected shortages of critical items, and (3) unnecessary purchases of items already on hand.

THE PLAYERS

The principal functional stakeholders in item management are Engineering Management; Acquisition Management; Property, Plant and Equipment Accountability; Logistics Management and Accountability, and Financial Management. Asset visibility is crosscutting to these five functions. Their interests involve the following:

Engineering Management. DoD Directive 5000.1, Defense Acquisition System, requires that acquisition programs be managed through the application of a systems engineering approach that optimizes total system performance and minimizes total ownership costs. A modular, open-systems approach is employed, where feasible. For purposes of item management, engineering plays a crucial role in the documentation of technical data that defines items and the configuration management of these items throughout their useful life.

Acquisition Management. The Federal Acquisition Regulation (FAR) Part 45, Government Property, prescribes policies for furnishing Government property to contractors including the use, maintenance, management and reporting of Government-furnished property and contractor-acquired property, and for the return, delivery, or disposal of Government-furnished property and contractor-acquired property.

\(^6\) These financial statement portions are (1) Property, Plant and Equipment and (2) Operating Materials and Supplies.
Property, Plant and Equipment Accountability.  
DoD Instruction 5000.64\textsuperscript{7} provides a comprehensive framework for DoD property accountability policies, procedures, and practices; and assists DoD property managers, accounting and financial officers, and other officials in understanding their roles and responsibilities relating to property accountability. It establishes accountability policy for property, plant, and equipment (PP&E); and contains concepts useful for asset management throughout the Department, particularly for property in the possession of individual military units and end-users. It excludes property and materiel for which accountability and inventory control requirements are prescribed in DoD 4140.1-R and DoD 4000.25-2-M.\textsuperscript{8} 

Logistics Management and Accountability.  DoD Directive 4140.1, Materiel Management Policy, specifies policies for materiel management. It is the Department’s policy that:

- Materiel management is responsive to customer requirements during peacetime and war.
- Acquisition, transportation, storage, and maintenance costs are considered in materiel management decisions.
- Standard data systems are used to implement materiel management functions.
- The secondary item inventory is sized to minimize the Department's investment while providing the inventory needed to support peacetime and war requirements
- Materiel control and asset visibility are maintained for the secondary item inventory.

DoD 4000.25-M, Defense Logistics Management System (DLMS) Manual, prescribes logistics management policy, responsibilities, procedures, rules, and electronic data communications standards for the conduct of logistics operations in the functional areas of supply, transportation, acquisition (contract administration), maintenance, and finance.\textsuperscript{9} 

\textsuperscript{7}It integrates the broad requirements of the Federal Property and Administrative Services Act of 1949, as amended (Act of 30 June 1949, 63 Stat. 372), and the Chief Financial Officers (CFO) Act of 1990 into an overarching property accountability policy for property, plant and equipment. Complements the accounting and financial reporting requirements contained in DoD 7000.14-R.

\textsuperscript{8} Military Standard Transaction Reporting and Accounting Procedures (MILSTRAP).

\textsuperscript{9}The DLMS is a system governing logistics functional business management standards and practices rather than an automated information system.
Financial Management. DoD Instruction 7000.14, Defense Financial Management Regulation, specifies that all DoD Components shall use a single DoD-wide financial management regulation for accounting, budgeting, finance, and financial management education and training. That regulation is DoD 7000.14-R. It directs financial management requirements, systems, and functions for all appropriated, non-appropriated, working capital, revolving, and trust fund activities. In addition, it directs statutory and regulatory financial reporting requirements.

Joint Total Asset Visibility. Joint total asset visibility is the capability that provides Combatant Commanders, the Military Services, and the Defense Agencies with timely and accurate information on the location; movement; status; and identity of units, personnel, equipment, and supplies.  

PROCESSES, ACTIVITIES AND ACTIONS

Item management involves many functional processes, activities and actions, all focused on operations involving items. These operations must be integrated and flow smoothly so that the needs of warfighters for items are satisfied when and where they occur. The functional processes, activities and actions impacting item management are arrayed in Table 1 in summary format to show how they are related and dependant.

---

10 “In every troop deployment this century, DoD has been plagued by a major difficulty—the inability to see assets as they flow into a theater and are in storage. This situation has led to direct and significant degradation in operational readiness. When assets in the pipeline are not visible, they are difficult to manage. Property is lost, customers submit duplicate requisitions, superfluous materiel chokes the transportation system, and the cycle continues. Assets at the retail level that are not visible and, therefore, not available for redistribution, further compound the degradation of operational readiness.” Joint Total Asset Visibility Strategic Plan, January 1999, Joint Total Asset Visibility Office, DoD.
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Table 1. Functional Processes Impacting Item Management
Chapter 2
The Need to Uniquely Identify Items

**Differentiating Items Throughout the Supply Chain**

The Department must, of necessity, uniquely identify the items to which it takes title to provide for better asset accountability, valuation and life cycle management. Unique identification provides the Department the opportunity to differentiate an individual item from all others. Unique identification of items provides the Department with the source data to facilitate accomplishment of the following:

- Improve the acquisition of equipment and performance based logistics services for the warfighter,
- Capture timely, accurate and reliable data on items (i.e., equipment, reparables, materials, and consumables),
- Improve life-cycle asset management, and
- Track items in the Department and industry systems for operational, logistic\(^{11}\) and financial accountability purposes.

**Accounting for Acquired Items**

Accountability of items begins when hardware (equipment and reparables), and supplies (materials and consumables) are acquired through purchase, lease, or other means, including transfer or fabrication, whether the hardware and supplies are already in existence or must be created, developed, demonstrated and evaluated.\(^{12}\) DoD Instruction 5000.64 requires that accountability records be established for all property (i.e., property, plant and equipment) purchased, having a unit acquisition cost of over $5,000 or more, and items that are classified or sensitive, or items located at third parties, regardless of acquisition cost.\(^{13}\) Property accountability records and systems should follow DoD Instruction 5000.64 exactly: to include the use of part number, cost, national stock number, serial numbers, bar codes, or other unique identifiers (e.g., hull, building numbers, aircraft tail numbers, vehicle registration, disposal turn-

\(^{11}\) DoD 4140.1-R, May 2003, chapter 5, section C5.7.3, addresses Unique Item tracking policy for logistics.

\(^{12}\) See American Society for Testing and Materials Standard E-2135-02, Standard Terminology for Property and Asset Management.

\(^{13}\) DoDI 5000.64, August 13, 2002, op. cit., paragraph 5.3.1.
The Need to Uniquely Identify Items

in document number, as may be appropriate and necessary), as well as
other data elements.\textsuperscript{14}

For materiel covered under DoD 4140.1-R, accountability records are established for all materiel received, regardless of cost.\textsuperscript{15}

\textbf{CONTRACTOR-ACQUIRED PROPERTY ON COST-REIMBURSEMENT TYPE CONTRACTS}

Title to property whose cost is reimbursable to the contractor passes to and vests in the Government upon: (1) Delivery to the contractor of an item purchased by the contractor and reimbursed as a direct cost under the contract, (2) Issuance of the property for use in contract performance; (3) Commencement of processing of the property or use in contract performance; or (4) Reimbursement of the cost of the property by the Government, whichever occurs first. The Government acquires title to all property purchased or fabricated by the contractor and may take title to Production Special Tooling in accordance with the contract clauses. However, if such items are to be delivered to the Government, they must be delivered under a contract line item or subline item.

\textbf{ESTABLISHING ITEM ACQUISITION COST}

It is essential that contracts contain specific arrangements to capture the acquisition cost of all delivered items because the acquisition cost will form the basis for the entries made in the Department’s financial statements and will determine the degree to which those statements comply with the requirements of the Federal Accounting Standards Advisory Board (FASAB). Ideally, acquisition cost for items would be recorded at the time these items are delivered to the Government.

\textbf{Using Contract Line Items.}

All property delivered to the Government must be delivered on a contract line item (CLIN) or subline item (SLIN). The acquisition cost of each item entering the Government property inventory is captured on the contract line item or subline item.

CLINs, and SLINs are established when the contract is structured prior to award and must be included for all items for which the Government will take delivery, either during the performance or at the completion of the contract. The estimated acquisition cost of property will be identified upon delivery.

\begin{footnotesize}
\begin{enumerate}
\item \textsuperscript{14} Ibid, paragraph 5.3.3 contains the list of all data elements.
\item \textsuperscript{15} See Section C5.3, Item Accountability, Control and Stewardship, DoD 4140.1-R.
\end{enumerate}
\end{footnotesize}
The Need to Uniquely Identify Items

Table 2 shows the preferred approach for identifying the acquisition cost of items delivered under a contract is for the items to be separately priced under CLINs or SLINs. Informational subline items are used to capture the acquisition cost for items to be delivered when separately priced CLINs or SLINs are not practicable. Informational SLINs used only for identification of acquisition cost have to be clearly marked as such so they are not confused with delivery, acceptance, and payment requirements of the contract. When the acquisition costs for like items differ, separate informational SLINs must be used to identify the acquisition cost for each of the items with a different acquisition cost.

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>UII or IUID Equivalent Required</th>
<th>Unit Acquisition Cost (or price) Required</th>
<th>Valuation Method (Contract type)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLIN/SLIN Items requiring UII or IUID Equivalent (Includes items delivered separately as spares).</td>
<td>Yes. All items valued over $5K/unit value. Use DoD decision tree to determine requirements under $5K per unit value.</td>
<td>Yes</td>
<td>Fixed Price- use CLIN/SLIN values. Cost Type-use contractor estimated costs. DoD will address delta $ from final total price.</td>
</tr>
<tr>
<td>Sub items requiring UII or IUID Equivalent contained within CLIN/SLIN delivered items. (LRU/Spares)</td>
<td>Yes. Application of maintenance plan (e.g. lowest repairable or replaceable unit by DoD); No dollar threshold for applicability.¹⁶</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>Other commercially marked items not requiring IUID. (CLIN/SLIN)</td>
<td>No. The DoD shall accept existing commercial markings.</td>
<td>Yes – All delivered items must be valued per unit.</td>
<td>Fixed Price- use CLIN/SLIN values Cost Type-use contractor estimated costs. DoD will address delta $ from final total price.</td>
</tr>
</tbody>
</table>

Table 2. Contract Requirements – Identifying Unit Acquisition Cost

The Contracting Officer will modify a contract to establish separate CLINs/SLINs prior to delivery of items that were not identified as contract deliverables at the time of contract award.

¹⁶DFARS 252.211–7003 requires a contract attachment to list embedded DoD serially managed subassemblies, components, and parts that are to be uniquely identified. The IUID data are reported at the time of delivery, either as part of, or associated with the Material Inspection and Receiving Report.
Valuation of Items for the UUID Registry

Both the unique identification and the value of items that will be delivered under the contract need to be reflected in the Department’s property accountability and management information systems. According to DoD Instruction 5000.64, acquisition cost should be the basis for valuation of property.

For fixed price contracts, the acquisition cost for items to be delivered is the fixed price paid by the Government.

For cost type contracts, the acquisition cost for items to be delivered is the Contractor’s estimated cost at the time the item is delivered.

The acquisition cost of components within delivered items need not be identified. Figure 1 contains an illustration of how CLINs/SLINs would be valued based on whether or not they are delivered separately. It shows the relationships between the components of the supply chain, the items qualifying for unique identification, and the delivery of the concatenated UUI and CLIN/SLIN valuation.

Figure 1. Valuation of Contract Line/Subline Item Numbers
The Need to Uniquely Identify Items

A delivered item may be composed of embedded items, such as subassemblies, components and parts. The prime contractor will pass down appropriate specifications, including the IUID marking requirements, to the tiered vendors for subcontracted subassemblies, components and parts.

Spares may be purchased directly from the vendors or through the prime. IUID-qualifying spare items (subassemblies, components and parts) have to be marked appropriately with the UII data elements.

So, when the prime delivers the complete item—that is one UII. The spares are delivered with their own UIIs. The prime will also be required to mark and register UII data elements for those DoD serially managed embedded items and their parent items in the delivered item.
Chapter 3
Requirements for Item Unique Identification

WHAT IS AN ITEM?
As stated earlier in this guide, an item is a single hardware article or a unit formed by a grouping of subassemblies, components or constituent parts.\textsuperscript{17} In this definition, hardware is a generic term dealing with physical items as distinguished from a capability or function, such as equipment, tools, implements, instruments, devices, sets, fittings, trimmings, assemblies, subassemblies, components and parts.\textsuperscript{18}

DECIDING WHAT ITEMS ARE TO BE IDENTIFIED AS UNIQUE

Items Delivered Under Contracts and Legacy Items in Inventory and Operational Use
The unique identification of items is driven by an integrated set of logistics, acquisition and financial requirements to identify and track item information. Figure 2 contains a decision tree for deciding what items should be uniquely identified for DoD purposes. The decision tree is a graphic representation of the text in DFARS 211.274-2. These criteria apply whether the items are delivered under contract or they are existing legacy items in inventory, in use, or undergoing maintenance, repair or overhaul. Items being delivered under contract must include the contract clause Defense Federal Acquisition Regulation Supplement (DFARS) 252.211-7003 to invoke the IUID requirement. The unique identification of existing legacy items must be implemented separately. The program manager is responsible for having the appropriate items uniquely identified.

\textsuperscript{17} DFARS 252.211-7003(a).
\textsuperscript{18} Joint Publication 1-02, DoD Dictionary.
Items will require item unique identification, or a DoD recognized unique identification equivalent, for all property items delivered to the Government under contract or in inventory or use if one or more of the following criteria apply (each discussed separately):

1. All items for which the Government’s unit acquisition cost is $5,000 or more;
2. Items for which the Government’s unit acquisition cost is less than $5,000, when identified by the requiring activity as DoD serially managed, mission essential or controlled inventory;
3. When the Government’s unit acquisition cost is less than $5,000 and the requiring activity determines that permanent identification is required;
4. Regardless of value, (i) any DoD serially managed subassembly, component, or part embedded within an item and, (ii) the parent item (as defined in DFARS 252.211-7003(a)) that contains the embedded subassembly, component or part.

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19 The requiring activity will make this determination and list the items in the DFARS 252.211-7003 contract clause. For legacy items, the requiring activity will make this determination in order to identify items for legacy item unique identification.
UNIT ACQUISITION COST THRESHOLD

The first criterion establishes the $5,000 value as the unit acquisition cost threshold for item unique identification. All items at this threshold or above are required to have unique identification in accordance with the threshold requirement for establishing property records. Items under $5,000 are not required by DoD Instruction 5000.64 to have property records unless they are sensitive items or classified items or items located at third parties. Similarly, a program manager must examine the other IUID criteria to determine if items below the $5000 threshold require unique identification.

IUID OF ITEMS BELOW THE $5000 THRESHOLD

There are three fundamental characteristics listed in the second criterion to be considered in determining unique identification requirements for items whose unit acquisition cost is less than $5000. They are DoD serially managed, mission essential and controlled inventory.

DoD Serially Managed

A distinction must be made between “serialized items” and “DoD serially managed” items when uniquely identifying embedded items in an item. While DoD may use an item that has been serialized by the manufacturer, DoD may not manage the item by means of its serial number. When DoD elects to serially manage an item it becomes "DoD serially managed". This means it is a tangible item used by DoD, which is designated by a DoD or Service Item Manager to be uniquely tracked, controlled or managed in maintenance, repair and/or supply by means of its serial number.²⁰

DoD serially managed items require UIIs. Serial numbers may be unique within a product or company, but UIIs are globally unique. This permits an item to be uniquely distinguishable in different databases.

A broad variety of items fall into the DoD serially managed category through programs for serial number tracking, serialized item management,

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²⁰ A serial number is an assigned combination of numbers and/or letters to an item instance that separately identifies that item instance from all others.
Requirements for Item Unique Identification

and unique item tracking. Examples of DoD serially managed items may include reparable items down to and including sub-component reparable unit level; life-limited, time-controlled, or items requiring records (e.g., logbooks, aeronautical equipment service records, etc.); and items that require technical directive tracking at the part level.\(^{21}\)

Mission Essential

Item essentiality is a measure of an item's military worth in terms of how its failure would affect the ability of a weapon system, end item, or organization to perform its intended functions. Military mission essentiality is the composite effect of an item on the overall military mission based on the most critical significant application of the item.\(^{22}\) The primary use of military mission essentiality is in supply chain management for determining resource allocations, determining degree of management intensity, and communicating essentiality among the DoD Components. An assessment of mission essentiality should include item essentiality and the degree to which it impacts on the overall military mission.

Class VII Major End Items that are deemed mission essential shall require IUID. For mission essential items in other classes of supply, the program/item manager may elect not to require IUID for an item provided that the item does not qualify for IUID under separate criteria.\(^{23}\) Before excluding items from IUID, program managers must consider whether the use of IUID for an item would cost effectively enhance supply chain management and communication, and when appropriate, seek the advice of affected communities and users. This determination should be available for review by the milestone decision authority.

Controlled Inventory

The DoD employs item accountability, control, and stewardship procedures to ensure that assets are protected against waste, loss, negligence, unauthorized use, misappropriation, and compromise.\(^{24}\) Controlled inventory items are those items that are designated as having characteristics that require that they be identified, accounted for, segregated, or handled in a special manner to ensure their safeguard and integrity. They include classified items (require protection in the interest of national security); sensitive items (require a high degree of protection and control due to statutory requirements or regulations, such as precious metals; items of high value, highly technical, or hazardous nature; and

\(^{21}\) DUSD(Logistics & Material Readiness) Memorandum, September 4, 2002, Serialized Item Management
\(^{22}\) DoD 4140.1-R
\(^{23}\) Mission essential items that are also controlled inventory items may be excluded if the controlled inventory exclusion is also determined to be appropriate.
\(^{24}\) DoD 4140.1-R
small arms); pilferable items (items having a ready resale value or application to personal possession, which are especially subject to theft)\textsuperscript{25}; and safety controlled items.

For controlled inventory items, the program/item manager may elect not to require IUID for an item that is adequately controlled by other means, provided that the item does not qualify for IUID under separate criteria.\textsuperscript{26} Before excluding an item from the Controlled Inventory criterion, program/item managers shall determine whether controlled inventory items are adequately controlled by existing specified inventory controls, such as the tracking of lot/batch numbers or enhanced physical security. In making this determination, program/item managers must examine the controls in place for effectiveness and compliance with other directives, search out concurrences for the chosen course of action from among the affected communities including users, document the determination and make it known to the milestone decision authority.

**OTHER COMPELLING REASONS FOR ITEMS BELOW THE $5000 THRESHOLD**

This criterion provides the authority for the requiring activity to specify items for unique identification based on other rationale. Some items that are under the $5000 threshold and do not qualify for IUID under the stated criteria may benefit from permanent unique identification. The requiring activity that deems it appropriate to provide permanent unique identification for items may require IUID. Government property that will be placed in service in the possession of contractors is an example of items that should be marked with UIIs at the time of acquisition.

**IUID OF EMBEDDED ITEMS REGARDLESS OF VALUE**

Embedded items include subassemblies, components, or parts that are integral to the item being delivered. The embedded items that are serially managed by DoD require IUID. These items must be listed in the contract in order to clearly indicate which items are to be marked. This criterion is applied without regard to the value of the embedded item.

Each uniquely identified embedded item is contained within a higher assembly known as its parent item\textsuperscript{27}. The parent item of a DoD serially managed embedded item is also required to have a UII. This criterion is applied without regard to the value of the parent item.

\textsuperscript{25} DoD 4100.39-M, Volume 10, Table 61

\textsuperscript{26} Controlled inventory items that are also mission essential items may be excluded if the mission essential exclusion is also determined to be appropriate.

\textsuperscript{27} Parent item means the item assembly, intermediate component, or subassembly that has an embedded item with a unique item identifier or DoD recognized IUID equivalent.
The supply management and repair concepts for embedded items and parent items may dictate that multiple tiers of embedded items and parent items are needed for complex systems.

**LEGACY ITEMS IN OPERATIONAL USE AND INVENTORY**

Program and item managers will prepare implementation plans for implementation of IUID on legacy items in operational use, including items undergoing maintenance, repair or overhaul, and in inventory. Only those legacy items determined in these implementation plans to meet the IUID criteria specified in Figure 2 above will require UII marking. All Government property in the contractor's possession will require assignment and registration of a UII, in accordance with the government property accounting rules.

When applying item unique identification to legacy items already in the inventory and operational use\(^{28}\), all items that meet the IUID criteria should be assigned a UII and marked. If serialized items can be uniquely identified by their existing serial numbers and marking, virtual unique item identifiers (UIIs) can be assigned, based on all qualifying criteria, not just DoD serially managed items (see the decision tree in Figure 3).

A virtual UII enables the database entry of a UII and its associated pedigree data, while postponing the physical marking of the legacy item\(^{29}\) with a two-dimensional data matrix symbol to a more advantageous time based on logistic and economic considerations. In addition to legacy items already in the inventory and operational use, DoD resident equipment\(^{30}\) and spares in the possession of contractors may also be assigned virtual UIIs until physical marking of the items is accomplished. The use of virtual UIIs is described in the latest version of the *Guidelines for the Virtual Unique Item Identifier (UII).*\(^{31}\)

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\(^{28}\) This is required by USD(AT&L) Memorandum, dated December 23, 2004, subject: Policy for unique identification (UID) of Tangible Personal Property Legacy Items in Inventory and Operational Use, Including Government Furnished Property (GFP), available for download at [http://www.acq.osd.mil/dpap/UID/policy.htm](http://www.acq.osd.mil/dpap/UID/policy.htm).

\(^{29}\) Virtual UIIs are not used for new items. New items must conform to DFARS 252.211-7003.

\(^{30}\) Resident equipment is government owned property that is usually stationary within a contractor’s facility.

\(^{31}\) This guide is available for download at [http://www.acq.osd.mil/dpap/UID/guides.htm](http://www.acq.osd.mil/dpap/UID/guides.htm).
Requirements for Item Unique Identification

Figure 3. Assigning Virtual Unique Item Identifiers to Legacy Items in Operational Use and Inventory
Chapter 4
Determining Uniqueness of Items

DEFINING THE DATA ELEMENTS FOR THE UNIQUE ITEM IDENTIFIER

What is the Unique Item Identifier (UII)?

The unique item identifier (UII) is defined in two separate contexts:

1. DoD UII Data Set. A UII is a set of data elements marked on an item in a Data Matrix EC200 symbol that is globally unique and unambiguous. For items that are serialized within the enterprise identifier, the UII data set includes the data elements of enterprise identifier and a unique serial number (Construct #1). For items that are serialized within the part, lot or batch number within the enterprise identifier, the UII data set includes the data elements of enterprise identifier, the original part, lot or batch number, and the serial number (Construct #2). In addition to the two constructs comprising multiple data elements, the UII data set may be a fully concatenated UII in a single data element, such as would be defined by the use of data qualifiers 25S or UID, or a DoD recognized IUID equivalent, such as would be defined by the use of data qualifiers I, 22S, 8002, 8003, or 8004.

2. Use. The generic term, UII, has evolved through usage to mean the concatenated UII as a common data base key without regard to the data set construct being used. In this context, the term “UII” may be used to designate concatenated UII Constructs #1 and #2, or the DoD recognized IUID equivalents of Global Individual Asset Identifier (GIAI), Global Returnable Asset Identifier (GRAI) when assets are serialized, Vehicle Identification Number (VIN), or Electronic Serial Number ((ESN), for cell phones only).

The Notion of an Enterprise

The first requirement is enterprise identification. An enterprise is the entity responsible for assigning a UII to an item. For purposes of unique item identification, an enterprise identifier will define each entity location that has its own unique, separate and distinct operation. An enterprise may be an entity such as a manufacturer, supplier, depot, program management office or a third party. An enterprise identifier is a code uniquely assigned to an enterprise by a registered issuing agency. An issuing agency is an organization responsible for assigning a non-repeatable identifier to an enterprise [e.g., Dun & Bradstreet’s Data Universal Numbering System.
Determining Uniqueness of Items

(DUNS) Number, GS1 Company Prefix (formerly Uniform Code Council (UCC)/EAN International (EAN) Company Prefix), Allied Committee 135 Commercial and Government Entity (NCAGE/CAGE) Number, Department of Defense Activity Address Code (DoDAAC), or the Coded Representation of the North American Telecommunications Industry Manufacturers, Suppliers, and Related Service Companies (ANSI T1.220) Number.

Unique Identification of Items

The other key aspect of constructing a UII is the unique identification of each item that the enterprise produces. Unique item identification depends upon a combination of data elements, which is determined by how the enterprise serializes items. There are two acceptable methods of serialization – (1) Serialization within the enterprise identifier, and (2) Serialization within the part, lot or batch number. Serialization within the enterprise identifier occurs when each item is assigned a serial number that is unique among all the items identified under the enterprise identifier and is never used again. The enterprise is responsible for ensuring unique serialization within its enterprise identifier. Serialization within the part, lot or batch number occurs when each item of a particular part, lot or batch number is assigned a unique serial number within the original part, lot or batch number assignment. The enterprise is responsible for ensuring unique serialization within the original part, lot or batch number.

Serialization Within the Enterprise Identifier

For items that are serialized within the enterprise identifier, the concatenated UII is a combination of the issuing agency code\(^{32}\), enterprise identifier and the serial number, which must be unique within the enterprise identifier. The unique serial number within the enterprise identifier is a combination of numbers or letters assigned by the enterprise (e.g., a manufacturer or vendor) to an item that provides for the differentiation of that item from any other like or unlike item and is never used again within the enterprise identifier. The data elements of enterprise identifier and unique serial number within the enterprise identifier provide the permanent identification for the life cycle of the item.\(^{33}\)

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\(^{32}\) The issuing agency code, or IAC, is that assigned by the Registration Authority for ISO/IEC 15459-2, Registration Procedures. The current Registration Authority of ISO/IEC 15459-2 is NEN–Nederlands Normalisatie-instituut. The IAC represents the agency that issued the enterprise identifier. The IAC can be derived from the data qualifier for the enterprise identifier and is not marked on the item.

\(^{33}\) When a UII is encoded in a single data element, such as 25S or UID, the concatenation of the enterprise identifier and unique serial number is accomplished prior to encoding.
Serialization Within the Part, Lot or Batch Number

For items that are serialized within the part, lot or batch number, the concatenated UII is a combination of the issuing agency code, the enterprise identifier, the original part, lot or batch number, and the serial number. The original part number is a combination of numbers and letters assigned by the enterprise (e.g., a manufacturer or vendor) at asset creation to a class of items with the same form, fit, function, and interface. Lot or batch number means an identifying number assigned by the enterprise to a designated group of items, usually referred to as either a lot or a batch, all of which were manufactured under identical conditions. The serial number within the part, lot or batch number is a combination of numbers and letters assigned by the enterprise (e.g., a manufacturer or vendor) to an item that provides for the differentiation of that item from any other like item. The data elements of enterprise identifier, original part, lot or batch number and serial number within the original part, lot or batch number provide the permanent identification for the life cycle of the item.34

Issuing Agency Codes for Use in Item Unique Identification

Table 3 contains a list of issuing agency codes (IACs). At the current time, IACs exist for the six most commonly used enterprise identifiers. These IACs are “0 through 9” for the GS1 Company Prefixes assigned by GS135, “LB” for ANSI T1.220 numbers, “UN” for the DUNS assigned by Dun & Bradstreet, “D” for the CAGE assigned by Allied Committee 135, “LH” for the EHIBCC assigned by the European Health Industry Business Communications Council, and “LD” for the Department of Defense Activity Address Code (DoDAAC).

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34 Each of the UII’s three component data elements, less the IAC, is separately encoded within the data matrix symbol.
35 GS1 was formerly EAN.UCC. Both brand names may be encountered in reference to GS1 System standards, specifications and related terminology during an indeterminate transition period.
Determining Uniqueness of Items

<table>
<thead>
<tr>
<th>Issuing Agency Code</th>
<th>Issuing Agency</th>
<th>Enterprise Identifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 9</td>
<td>GS1 Global Office&lt;sup&gt;36&lt;/sup&gt;</td>
<td>GS1 Company Prefix</td>
</tr>
<tr>
<td>LB</td>
<td>Telcordia Technologies, Inc</td>
<td>ANSI T1.220</td>
</tr>
<tr>
<td>UN</td>
<td>Dun &amp; Bradstreet</td>
<td>DUNS</td>
</tr>
<tr>
<td>D</td>
<td>Allied Committee 135</td>
<td>CAGE</td>
</tr>
<tr>
<td>LH</td>
<td>European Health Industry Business Communications Council</td>
<td>EHIBCC</td>
</tr>
<tr>
<td>LD</td>
<td>Department of Defense</td>
<td>DoDAAC</td>
</tr>
</tbody>
</table>

Table 3. Issuing Agency Codes

INCLUDING UNIQUE ITEM IDENTIFIER (UII) DATA ELEMENTS ON AN ITEM

Derivation of the Concatenated UII

The concatenated UII for an item can be derived from the data elements included on the item by using a business rule (See Appendix C). The automatic identification technology (AIT) device<sup>37</sup> machine-reads the data elements on the item and can output the concatenated UII. Therefore, it is not necessary to include the concatenated UII on the item as a separate data element. It is only required that the data elements required to derive the concatenated UII (enterprise identifier, serial number and, for Construct #2 additionally, original part, lot or batch number) be included on each item.<sup>39</sup> The UII component data elements, at a minimum, shall be contained in a Data Matrix ECC 200 symbol encoded in the syntax of

<sup>36</sup> Formerly EAN-International.

<sup>37</sup> Such devices are readers, scanners and interrogators.

<sup>38</sup> Concatenate means to link together in a series or chain.

<sup>39</sup> Specific data qualifiers are permitted for concatenated UIIs in a single data element. See Appendix D, Table 5.
ISO/IEC 15434 and using the semantics of ISO/IEC 15418\(^{40}\) or ATA Common Support Data Dictionary (CSDD). Data may also be contained in human-readable information and/or other AIT media (e.g., contact memory buttons, linear bar codes, radio frequency identification, etc.) in addition to the Data Matrix ECC 200 symbol. Table 4 shows how the UII is constructed from the data elements placed on the item and the business rule. When deriving the concatenated UII, the data qualifiers are omitted from the concatenated UII.

<table>
<thead>
<tr>
<th>UII Construct #1</th>
<th>UII Construct #2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Based on current enterprise configurations</strong></td>
<td><strong>If items are serialized within the Enterprise</strong></td>
</tr>
<tr>
<td><strong>If items are serialized within Part, Lot or Batch Number</strong></td>
<td></td>
</tr>
<tr>
<td><strong>UII is derived by concatenating the data elements IN ORDER:</strong></td>
<td><strong>Issuing Agency Code</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Enterprise ID</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Serial Number</strong></td>
</tr>
<tr>
<td><strong>Issuing Agency Code</strong></td>
<td><strong>Enterprise ID</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Original Part #</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Serial Number</strong></td>
</tr>
<tr>
<td><strong>Lot or Batch # Serial Number</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Data Identified on Assets Not Part of the UII (Separate Identifier)</strong></td>
<td><strong>Current Part Number</strong></td>
</tr>
<tr>
<td><strong>Current Part Number</strong></td>
<td></td>
</tr>
</tbody>
</table>

\(^{40}\)See Appendix D, The Mechanics of Unique Item Identification, for a detailed explanation of encoding the Data Matrix. The full titles of the standards are: ISO/IEC International Standard 15434, Information Technology–Syntax for High Capacity Automatic Data Capture Media and ISO/IEC International Standard 15418, Information Technology–EAN/UCC Application Identifiers and FACT Data Identifiers and Maintenance (Note that ISO/IEC 15418 refers the user to ANS MH10.8.2 for technical content.)
Determination Uniqueness of Items

exclusive use, rather than attempting to use both constructs within the same enterprise identifier.

**Concatenated UII Derivation Process**

Figure 4 depicts how the UII for an item is derived and the business rule for generating the UII from the data elements placed on the item. The AIT reader device will machine-read the data elements and output the concatenated UII for onward transmission to the appropriate automated information system (AIS). The decisions of which construct to use (see Table 4) to uniquely identify items, and use of the data qualifiers and associated business rules, are made by the enterprise assigning serialization to the item.

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*Figure 4. Concatenated UII Determination Process*

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41 The identification of the agency issuing the enterprise identifier, or the issuing agency code (IAC), is derived by the AIT device from the data qualifier for the enterprise identifier. The IAC is not placed on the item.
Deciding Where to Place Data Elements for Item Unique Identification on Items

The UII data elements (enterprise identifier, serial number and, for Construct #2 only, original part, lot or batch number) will be placed on qualifying items in accordance with the standard practice of MIL-STD-130, Identification Marking of U.S. Military Property. Commercial-off-the-shelf items that qualify for IUID marking, which are incorporated into end items, will be marked so that a concatenated UII can be derived.

DoD IUID Equivalents

Generally, a commercial identifier can be considered for use as a DoD IUID equivalent\(^\text{42}\) if it meets these criteria: (1) Must contain an enterprise identifier, (2) Must uniquely identify an individual item within an enterprise identifier, product or part, lot or batch number, (3) Must have an existing Data Identifier (DI) or Application Identifier (AI) listed in ANS MH10.8.2, Data Identifier and Application Identifier Standard. In addition, the item marks must comply with Business Rule #14 for Data Matrix ECC 200 symbol marking and Business Rule #17 which requires that DoD IUID equivalents comply with the IUID minimum data carrier requirements.

The DoD recognizes four commercial unique identifiers as item unique identification equivalents. They are:

1. Global Individual Asset Identifier (GIAI) for serially-managed assets.
2. Global Returnable Asset Identifier (GRAI) for returnable assets which must contain a unique serial number for DoD IUID equivalent application. Other variations of the GRAI are unacceptable.
3. ISO Vehicle Identification Number (VIN) for vehicles.
4. Electronic Serial Number (ESN) for cellular telephones only.

Compliant Unique Item Identifier

For DoD purposes, a compliant UII is either a Construct #1, Construct #2, Global Individual Asset Identifier (GIAI), Global Returnable Asset Identifier\(^\text{43}\) (GRAI), Vehicle Identification Number (VIN), or Electronic Serial Number (ESN), for cell phones only), whose data element(s) are encoded in a Data Matrix ECC200 symbol using the ISO/IEC 15434 syntax with ISO/IEC 15418 or ATA CSDD semantics.

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\(^{42}\) Subject to DoD approval.

\(^{43}\) The Global Returnable Asset Identifier (GRAI) must contain a unique serial number for DoD IUID equivalent application. Other variations of the GRAI are unacceptable for IUID.
Considerations for Suppliers

The implementation of IUID requirements means that qualifying items must be marked with machine-readable information (MRI). The Government requiring activity determines an item qualifies for unique identification if it meets the requirements of DFARS 211.274, Item Identification and Valuation. The Government requiring activity identifies these qualifying items in paragraph (c)(1) of DFARS Clause 252.211-7003. The supplier shall place UII data elements (enterprise identifier, serial number and, for serialization within the part, lot or batch number only, original part, lot or batch number) in MRI media on items requiring marking, based on the criteria provided in the latest revision of MIL-STD-130, Identification Marking of U.S. Military Property. The DoD minimum MRI requirement is the Data Matrix ECC200 symbol. It is to be applied either through labeling or direct part marking.

The implementation of part marking to uniquely identify items with MRI may require changes in the supplier’s manufacturing and maintenance processes if these processes have not already been enabled to mark items with MRI. If item designs are final and do not enable MRI marking, changes to enable MRI marking must be incorporated in the engineering drawings and technical data that define the item. Figure 5 illustrates some considerations faced by suppliers in developing a compliant approach to DoD IUID requirements using MRI part marking.

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44 For guidelines on engineering and technical documentation changes to support IUID, see the latest version of the Guidelines for Engineering, Manufacturing and Maintenance Documentation Requirements for Item Unique Identification (IUID) Implementation, at http://www.acq.osd.mil/dpap/UID/guides.htm.
Deciding When to Place Data Elements on the Item to Derive the Unique Item Identifier

Strategies that produce the greatest business advantage for the items at the lowest cost and in the shortest possible time should be considered. The question of how this could be done leads to a conclusion that the probable scenario would be a mixture of vendor-applied-at-source, opportunity-based, seek-and-apply, and gated strategies. Requiring vendor-applied-at-source on future contracts for new equipment, major modifications, and reprocurements of end items and spares is important for sustainment, but has limited impact on a retrospective application program.

**Vendor-Applied-at-Source**

Vendor-applied-at-source provides a relatively cheap and unobtrusive application option for future purchases; however, it will not provide the speed of response necessary to successfully implement a retrospective application program for legacy items.

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Opportunity-Based Item Application

Opportunity-based, or trigger event, item application can be done in the field or factory, wherever it is convenient to gain access to items either on an end item or available in a storage facility. Projected situations or processes where a trigger event occurs include, but not limited to:

(a) Change in location where the item is taken out of service at one accountable entity and moved to another accountable entity to begin service. The item may be marked during this movement process either at the origin or destination, depending on the availability of marking equipment.

(b) Change in status where the item is taken out of service and placed in maintenance or returned to inventory. Maintenance status may include phase maintenance, scheduled servicing, depot rebuild or overhaul processes, and work-order processes during modification. The item should be marked while in maintenance or upon receipt at the inventory point.46

(c) Change in program where the item is shifted from control of one program to another program. The item may be marked by either the losing or gaining program upon the transfer of accountability.47

(d) Change in organizational alignment where the item is moved from the custody of one organization to the custody of another organization, such as transfer of Government property from the custodian back to the DoD. The item should be marked by the organization that is losing custody, unless there is a previous agreement with the receiving organization.

Seek-and-Apply

The seek-and-apply strategy can be used for particular items held within service, either at the end item or in storage. This strategy is dependent on establishing the location and availability of items before deployment of application equipment and teams. The location of items can be determined through the supply chain management information systems and inventory control systems. This approach is dependent upon good legacy data, and will demand greater overhead of coordinated effort to effect access to the assets. By concentrating application efforts, the advantage is faster fielding of configuration management for specific items.

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46 This also applies to contractual maintenance arrangements; but it does not apply to normal contractor maintenance and calibration efforts.

47 This does not apply if the item is under control and accountability of the same entity.
Gated
The interception of items as they transit specific gates within the supply chain can ensure no item enters service without the data elements needed to construct a unique identification. Having identified an item at the gate which requires a unique identification, the situation can be resolved by either diverting the item back to the sender for application, provision of an application capability at the specific supply gate, or diversion of the item to a centralized application facility.

USE OF THE UNIQUE ITEM IDENTIFIERS IN AUTOMATED INFORMATION SYSTEMS
In the Service or Agency material management and supporting automated information systems (AISs) (developed or maintained in compliance with BEA requirements), once the concatenated unique item identifier (UII) is created from the separate data elements placed on the item, the concatenated UII shall not be parsed to determine the original elements, since parsing and recombination of the elements will invariably result in the introduction of errors in the concatenated UII; however the concatenated UII, the enterprise identifier, the serial number and, in the case of Construct #2, the original part, lot or batch number will be captured separately at the time of initial Government receipt and acceptance. The concatenated UII shall be a common data element for item traceability in all computational functions including inventory acceptance, item accountability, storage, issue, receipt, valuation, maintenance, and disposal.

ROLES AND RESPONSIBILITIES FOR PROPERTY RECORDS
DoD Instruction 5000.64 provides a comprehensive framework for DoD property accountability policies, procedures, and practices; and assists DoD property managers, accounting and financial officers, and other officials in understanding their roles and responsibilities relating to property accountability. It establishes accountability policy for property, plant, and equipment (PP&E); and contains concepts useful for asset management throughout the Department, particularly for property in the possession of individual military units and end-users. Section 5.3 addresses accountability records. It excludes property and materiel for

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48It integrates the broad requirements of the Federal Property and Administrative Services Act of 1949, as amended (Act of 30 June 1949, 63 Stat. 372), and the Chief Financial Officers (CFO) Act of 1990 into an overarching property accountability policy. Complements the accounting and financial reporting requirements contained in DoD 7000.14-R.
which accountability and inventory control requirements are prescribed in DoD 4140.1-R and DoD 4000.25-2-M.\textsuperscript{49}

\textsuperscript{49} Military Standard Transaction Reporting and Accounting Procedures (MILSTRAP).
## Appendix A - Definitions

### Key Definitions

<table>
<thead>
<tr>
<th>Word or Phrase</th>
<th>Definition</th>
<th>Source</th>
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<tbody>
<tr>
<td><strong>Automatic identification device</strong></td>
<td>A device, such as a reader or interrogator, used to retrieve data encoded on machine-readable media.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td><strong>Compliant unique item identifier</strong></td>
<td>For DoD purposes, a compliant UII is either a Construct #1, Construct #2, Global Individual Asset Identifier (GIAI), Global Returnable Asset Identifier(^{50}) (GRAI), Vehicle Identification Number (VIN), or Electronic Serial Number ((ESN), for cell phones only), all of which have their data elements encoded in a data matrix in the ISO/IEC 15434 syntax with ISO/IEC 15418 or ATA CSDD semantics.</td>
<td>DoD Guide to Uniquely Identifying Items</td>
</tr>
<tr>
<td><strong>Concatenate</strong></td>
<td>To link together in a series or chain.</td>
<td>Merriam-Webster Online Dictionary</td>
</tr>
<tr>
<td><strong>Concatenated unique item identifier</strong></td>
<td>1. For items that are serialized within the enterprise identifier, the linking together of the unique item identifier data elements in order of the issuing agency code, enterprise identifier, and unique serial number within the enterprise identifier; or 2. For items that are serialized within the original part, lot or batch number, the linking together of the unique item identifier data elements in order of the issuing agency code, enterprise identifier, original part, lot or batch number, and serial number within the original part, lot or batch number.</td>
<td>DFARS 252.211-7003</td>
</tr>
</tbody>
</table>

\(^{50}\) The Global Returnable Asset Identifier (GRAI) must contain a unique serial number for DoD IUID equivalent application. Other variations of the GRAI are unacceptable for IUID.
<table>
<thead>
<tr>
<th>Word or Phrase</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controlled inventory</td>
<td>Those items that are designated as having characteristics that require that they be identified, accounted for, segregated, or handled in a special manner to ensure their safeguard and integrity. Includes classified items (require protection in the interest of national security), sensitive items (require a high degree of protection and control due to statutory requirements or regulations, such as precious metals; items of high value, highly technical, or hazardous nature; and small arms), and pilferable items (items having a ready resale value or application to personal possession, which are especially subject to theft) (See DoD 4100.39-M, Volume 10, Table 61); and safety controlled items.</td>
<td>DoD 4140.1-R</td>
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<td>DoD 4100.39-M</td>
</tr>
<tr>
<td>Custodian</td>
<td>The enterprise that has stewardship accountability of an item, i.e., responsibility for the control of, transfer and movement of, and access to, equipment and material. Custody also includes the maintenance of accountability for equipment and material.</td>
<td>Based on the definition of “custody” from the JCS DoD Dictionary</td>
</tr>
<tr>
<td>Data carrier</td>
<td>The medium selected to record, transport or communicate data. For item unique identification purposes, the data carrier is the Data Matrix symbol.</td>
<td>The American Heritage Dictionary</td>
</tr>
<tr>
<td><strong>Word or Phrase</strong></td>
<td><strong>Definition</strong></td>
<td><strong>Source</strong></td>
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<tr>
<td><strong>Data Matrix</strong></td>
<td>A two-dimensional matrix symbology containing dark and light square data modules. It has a finder pattern of two solid lines and two alternating dark and light lines on the perimeter of the symbol. A two-dimensional imaging device such as a charge-coupled device camera is necessary to scan the symbology. Data Matrix is designed with a fixed level of error correction capability. It supports industry standard escape sequences to define international code pages and special encodation schemes. Data Matrix is used for item marking applications using a wide variety of printing and marking technologies. The data matrix symbol looks like this: The Data Matrix ECC 200 which uses Reed-Solomon error correction is the specified symbol for UII.</td>
<td>ISO/IEC 16022 Information technology - International Symbology Specification - Data Matrix</td>
</tr>
<tr>
<td><strong>Data qualifier</strong></td>
<td>A specified character (or string of characters) that immediately precedes a data field that defines the general category or intended use of the data that follows.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td><strong>DoD item unique identification</strong>&lt;sup&gt;51&lt;/sup&gt;</td>
<td>A system of marking items delivered to the Department of Defense with unique item identifiers that have machine-readable data elements to distinguish an item from all other like and unlike items. Items are marked with a Data Matrix, the contents of which are encoded in the syntax of ISO/IEC 15434 and the semantics of ISO/IEC 15418 or the ATA CSDD&lt;sup&gt;52&lt;/sup&gt;. The Data Matrix contents may be either a Unique Item Identifier (Construct #1 or Construct #2) or a DoD recognized IUID equivalent.</td>
<td>DFARS 252.211-7003</td>
</tr>
</tbody>
</table>

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<sup>51</sup> Formerly known as DoD unique item identification.

<sup>52</sup> Text Element Identifiers are taken from the Air Transport Association Common Support Data Dictionary.
<table>
<thead>
<tr>
<th>Word or Phrase</th>
<th>Definition</th>
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</tr>
</thead>
<tbody>
<tr>
<td>DoD serially managed items</td>
<td>Includes reparable items down to and including sub-component reparable unit level; life-limited, time-controlled, or items requiring records (e.g., logbooks, aeronautical equipment service records, etc.); and items that require technical directive tracking at the part level. A distinction must be made between “serialized items” and “DoD serially managed” items. While DoD may use an item that has been serialized by the manufacturer, DoD may not manage the item by means of its serial number. When DoD elects to serially manage an item it becomes &quot;DoD serially managed&quot;. This means it is a tangible item used by DoD, which is designated by a DoD, or Service Item Manager to be uniquely tracked, controlled or managed in maintenance, repair and/or supply by means of its serial number.</td>
<td>DUSD (Logistics &amp; Material Readiness) Memorandum, September 4, 2002, Serialized Item Management</td>
</tr>
<tr>
<td>DoD recognized unique identification equivalent</td>
<td>A unique identification method for items that is in commercial use and has been recognized by DoD. The IUID equivalents are the Global Individual Asset Identifier (GIAI), Global Returnable Asset Identifier (GRAI), Vehicle Identification Number (VIN), and Electronic Serial Number (ESN), for cell phones only). While the constructs are equivalent, they must be placed on the items in a Data Matrix ECC 200 symbol encoded with ISO 15434 syntax and semantics of ISO 15418 in order to be compliant with DoD IUID policy.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td>Enterprise</td>
<td>The entity (e.g., a manufacturer or vendor) responsible for assigning unique item identifiers to items.</td>
<td>DFARS 252.211-7003</td>
</tr>
</tbody>
</table>

53 A serial number is an assigned combination of numbers and/or letters to an item instance that separately identifies that item instance from all others.

54 The Global Returnable Asset Identifier (GRAI) must contain a unique serial number for DoD IUID equivalent application. Other variations of the GRAI are unacceptable for IUID.
<table>
<thead>
<tr>
<th>Word or Phrase</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise identifier</td>
<td>A code that is uniquely assigned to an enterprise by a registered issuing agency.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td>Equipment</td>
<td>A tangible article of personal property that is complete in-and-of itself, durable, nonexpendable, and needed for the performance of a contract. Equipment generally has an expected service life of one year or more, and does not ordinarily lose its identity or become a component part of another article when put into use. Includes military equipment, support equipment, general-purpose equipment, special test equipment, and special tooling. Includes Class VII, Major End Items, a final combination of end products that is ready for its intended use, that is, launchers, tanks, mobile machine shop, and vehicles, etc. It does not include real property, reparables, consumables or materials.</td>
<td>DoD 4140.1-R</td>
</tr>
<tr>
<td>Innate serialized identity</td>
<td>The essential inherent data elements that are physically and permanently placed on an item at original manufacture, subsequent overhaul, or during operations to distinguish it from all other like items, which can be read from either a human or machine-readable format. For contractors with possession of Government property, this may be the asset identification number they use to track the item.</td>
<td>Adapted from the definition of “innate” and “serial” in the American Heritage Dictionary and the definition of “unique item identifier” listed below.</td>
</tr>
<tr>
<td>Issuing agency</td>
<td>An organization responsible for assigning a non-repeatable identifier to an enterprise (i.e., Dun &amp; Bradstreet's Data Universal Numbering System (DUNS) Number, GS1 (formerly Uniform Code Council (UCC)/EAN International (EAN)) Company Prefix, or Allied Committee 135 Commercial and Government Entity (NCAGE/CAGE) Code).</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td>Issuing agency code</td>
<td>A code that designates an agency with authority to issue unique enterprise identifiers.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td>Word or Phrase</td>
<td>Definition</td>
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</tr>
<tr>
<td>Item</td>
<td>A single hardware article or unit formed by a grouping of subassemblies, components, or constituent parts.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td>Item essentiality</td>
<td>A measure of an item's military worth in terms of how its failure (if a replacement is not immediately available) would affect the ability of a weapon system, end item, or organization to perform its intended functions.</td>
<td>DoD 4140.1-R &amp; AP1.1.65</td>
</tr>
<tr>
<td>Item identification</td>
<td>Sufficient data to establish the essential characteristics of an item that give the item its unique character and differentiate it from other supply items.</td>
<td>DoD 4140.1-R &amp; AP1.1.66</td>
</tr>
<tr>
<td>Legacy items</td>
<td>DoD-owned items and end items that have already been produced and deployed for use, or that have been produced and placed in inventory or storage pending issue for use.</td>
<td>USD (AT&amp;L) Memorandum, dated 23 Dec 04, Policy for Unique Identification (UID) of Tangible Personal Property Legacy Items in Inventory and Operational Use, Including Government Furnished Property (GFP)</td>
</tr>
<tr>
<td>Lot/Batch number</td>
<td>An identifying number assigned by the enterprise to a designated group of items, usually referred to as either a lot or a batch, all of which were manufactured under identical conditions.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td>Machine-readable media</td>
<td>An automatic information technology media, such as bar codes, contact memory buttons, radio frequency identification, or optical memory cards.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td>Marking</td>
<td>The application of legible numbers, letters, labels, tags, symbols, or colors to ensure proper handling and identification during shipment and storage.</td>
<td>DoD 4140.1-R</td>
</tr>
<tr>
<td>Military Mission Essentiality</td>
<td>A code indicating the composite effect of an item on the overall military mission based on the most critical significant application of the item. It shall be used in determining resource allocations, determining degree of management intensity, and communicating essentiality among the DoD Components.</td>
<td>DoD 4140.1-R</td>
</tr>
<tr>
<td>Word or Phrase</td>
<td>Definition</td>
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<tr>
<td>Operating materials and supplies</td>
<td>Personal property to be consumed in normal operations. Excluded are (a) goods that have been acquired for use in constructing real property, (b) stockpile materials, and (c) inventory. (See FMR, Volume 4, Chapter 4, Operating Materials and Supplies and Stockpile Materials, January 1995.)</td>
<td>DoD 7000.14-R</td>
</tr>
<tr>
<td>Original part number</td>
<td>A combination of numbers or letters assigned by the enterprise at asset creation to a class of items with the same form, fit, function, and interface.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td>Parent item</td>
<td>The item assembly, intermediate component or subassembly that has an embedded item with a unique item identifier or DoD recognized unique identification equivalent.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td>Personal property</td>
<td>Property of any kind or any interest therein, except real property.</td>
<td>JCS DoD Dictionary</td>
</tr>
<tr>
<td>Pilferable items</td>
<td>Items that have a ready resale value or application to personal possession and that are, therefore, especially subject to theft. (See DoD 4100.39-M, Volume 10, Table 61)</td>
<td>DoDI 5000.64, E2.1.12.3, DoD 4100.39-M</td>
</tr>
<tr>
<td>Property accountability record</td>
<td>The official record of personal property, including inventory, owned by the Department that is maintained to identify the quantities of items on-hand, unit prices, locations, physical condition, receipt and issue records, authorized stock numbers, item descriptions, and other such information necessary to properly account for materiel and exercise other inventory management responsibilities.</td>
<td>DoD 4140.1R, AP1.1.111</td>
</tr>
<tr>
<td>Registration authority</td>
<td>Refers to the Nederlands Normalisatie-instituut (NEN), Registration Authority for ISO/IEC 15459, which is responsible for assigning codes to issuing agencies with conforming systems for issuance of unique enterprise identifiers.</td>
<td>DFARS 252.211-7003, ISO/IEC 15459</td>
</tr>
<tr>
<td>Word or Phrase</td>
<td>Definition</td>
<td>Source</td>
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<tr>
<td>Sensitive items</td>
<td>Items that require a high degree of protection and control due to statutory requirements or regulations, such as narcotics and drug abuse items; precious metals; items that are of a high value, highly technical, or a hazardous nature; and small arms, ammunition, explosives, and demolition material. (See DoD 4100.39-M, Volume 10, Table 61)</td>
<td>DoDI 5000.64 E2.1.12.2</td>
</tr>
<tr>
<td>Serialization within the enterprise identifier</td>
<td>Each item produced is assigned a serial number that is unique among all the tangible items produced by the enterprise and is never used again. The enterprise is responsible for ensuring unique serialization within the enterprise identifier.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td>Serialization within the part, lot or batch number</td>
<td>Each item of a particular part, lot or batch number is assigned a unique serial number within that part, lot or batch number assignment. The enterprise is responsible for ensuring unique serialization within the part, lot or batch number within the enterprise identifier.</td>
<td>DFARS 252.211-7003</td>
</tr>
<tr>
<td>Word or Phrase</td>
<td>Definition</td>
<td>Source</td>
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</tbody>
</table>
| Unique item identifier      | The unique item identifier (UII) is defined in two separate contexts:  
  1. **DoD UII Data Set.** A UII is a set of data elements marked on an item that is globally unique and unambiguous. For items that are serialized within the enterprise identifier, the UII data set includes the data elements of enterprise identifier and a unique serial number (Construct #1). For items that are serialized within the part, lot or batch number within the enterprise identifier, the UII data set includes the data elements of enterprise identifier, the original part, lot or batch number, and the serial number (Construct #2).  
  2. **Use.** The generic term, UII, has evolved through usage to mean the concatenated UII as a common data base key without regard to the data set construct being used. In this context, the term “UII” may be used to designate concatenated UII Constructs #1 and #2, or the DoD recognized IUID equivalents of Global Individual Asset Identifier (GIAI), Global Returnable Asset Identifier (GRAI), Vehicle Identification Number (VIN), or Electronic Serial Number ((ESN), for cell phones only). | DFARS 252.211-7003          |
| Unique item identifier type | A designator to indicate which method of uniquely identifying a part has been used. The current list of accepted unique item identifier types is maintained at [http://www.acq.osd.mil/dpap/UID](http://www.acq.osd.mil/dpap/UID).                                                                 | DFARS 252.211-7003          |
| Unit acquisition cost       | 1. For fixed-price type line, subline, or exhibit line items, the unit price identified in the contract at the time of delivery; and  
  2. For cost-type line, subline, or exhibit line items, the Contractor's estimated fully burdened unit cost to the Government for each item at the time of delivery.                                                                                           | DFARS 252.211-7003          |
| Virtual unique item identifier | The UII data elements for an item that have been captured in a database, but not yet physically marked on the item.                              | DoD Guide to Virtual Unique Item Identifiers, 29 Dec 04 |
## Appendix B - Where Does the Guidance Exist Today?

<table>
<thead>
<tr>
<th>Document Reference</th>
<th>Document Name</th>
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<tr>
<td>DFARS 252.211-7003</td>
<td>Defense Federal Acquisition Regulation Supplement</td>
</tr>
<tr>
<td>MIL-STD-129</td>
<td>Military Marking for Shipment &amp; Storage</td>
</tr>
<tr>
<td>MIL-STD-130</td>
<td>Identification Marking of US Military Property</td>
</tr>
<tr>
<td>DoD 4140.1-R</td>
<td>DoD Supply Chain Material Management Regulation</td>
</tr>
<tr>
<td>DoDI 5000.2</td>
<td>Operation of the Defense Acquisition System</td>
</tr>
<tr>
<td>DoDI 5000.64</td>
<td>Defense Property Accountability</td>
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<tr>
<td>DoD 7000.14-R</td>
<td>Financial Management Regulations</td>
</tr>
<tr>
<td>CJCSI 3170.1C</td>
<td>Requirements Generation System</td>
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<tr>
<td>DCMA One Book</td>
<td>DCMA reference material for contractors</td>
</tr>
<tr>
<td>DoD MIL-HDBK-61A (SE)</td>
<td>Configuration Management Guidance</td>
</tr>
<tr>
<td>EIA Standard 836</td>
<td>Configuration Management Data Exchange &amp; Interoperability</td>
</tr>
<tr>
<td>ANSI/EIA 649</td>
<td>National Consensus Standard for Configuration Management</td>
</tr>
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<td>ISO/IEC 15418</td>
<td>Information technology—EAN/UCC Application Identifiers and FACT Data Identifiers and Maintenance</td>
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<tr>
<td>ISO/IEC 15434</td>
<td>Information technology—Transfer Syntax for High Capacity ADC Media</td>
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<tr>
<td>ISO/IEC 15459-2</td>
<td>Information technology—Part 2: Registration Procedures</td>
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<td>ISO/IEC 16022</td>
<td>Information technology—International symbology specification — Data Matrix</td>
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<tr>
<td>ISO/IEC 15415</td>
<td>Information technology—Automatic identification and data capture techniques—Bar code print quality test specification — Two-dimensional symbols</td>
</tr>
<tr>
<td>SAE AS9132</td>
<td>Data Matrix (2D) Coding Quality Requirements for Parts Marking</td>
</tr>
<tr>
<td>ATA CSDD</td>
<td>Common Support Data Dictionary</td>
</tr>
<tr>
<td>ANS MH10.8.2</td>
<td>Data Identifier and Application Identifier Standard</td>
</tr>
</tbody>
</table>

*These documents may have been revised since publication of this guide. Check for the latest version of the reference.*
WHAT ARE BUSINESS RULES?
A Business Rule is a statement that defines or constrains some aspect of the business. It is intended to assert business structure or to control or influence the behavior of the business. Typical Business Rules include definitions of terms, facts relating terms to each other, constraints, and derivations.

IUID BUSINESS RULES
The following section includes the Business Rules for IUID. The Business Rules for IUID are divided into the following implementation categories:

- Contracts and Administration
- Accounting and Finance
- Unique Item Identifier (UII) Construction and Physical Marking for:
  - Items considered part of a new solicitation after January 1, 2004 (i.e., New Items)
  - Items existing under contract, in operational use, or in inventory (i.e., Legacy Items)
  - Items considered tangible personal property owned by the Government in possession of a contractor after January 1, 2005 (i.e., Property Management Items)
- Automated Information System (AIS) Technical Interface

As the IUID implementation progresses, the UID Joint Requirements Implementation Board (JRIB) fully anticipates that there will be additions to these Business Rules and possibly slight modifications. The IUID Business Rules should be considered a work in progress that may not be finalized until the IUID effort is fully implemented.
CONTRACTS AND ADMINISTRATION

1. Within the same Contract Line Item Number (CLIN), there is no need for a contractor to segregate the same items delivered against different Accounting Classification Reference Numbers (ACRN).

2. For FAR Part 12 contracts and subcontracts:
   - The Government can mark the item, or
   - The Government can request the contractor mark the item.

3. Foreign Military Sales (FMS) contracts are not exempt from IUID.

UII CONSTRUCTION AND PHYSICAL MARKING

Items considered part of a new solicitation

Creating and Generating the Concatenated Unique Item Identifier

1. The concatenated UII shall be derived from its discrete, component data elements. The concatenated UII is not required to be marked on the item as a separate data element.

2. If the enterprise chooses to mark the concatenated UII as a discrete data element on the item, the component data elements must also be marked on the item as discrete data elements, in addition to the concatenated UII.

3. Data qualifiers (semantics) will define each machine-readable data element marked on the item.\(^{55}\)

4. If an enterprise serializes items within the enterprise identifier, the concatenated UII shall be derived by combining the following data elements, in order:
   - The issuing agency code (IAC), which shall be derived from the data qualifier for the enterprise identifier if it is not already provided\(^ {56}\)
   - The enterprise identifier, which shall be marked on the item
   - The serial number, which shall be marked on the item
     (Note: This is referred to as UII Construct #1.)

5. If an enterprise serializes items within original part, lot or batch numbers, the concatenated UII shall be derived by combining the following data elements, in order:

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\(^{55}\) See the DoD Guide to Uniquely Identifying Items (Appendix D) for a list of IUID data qualifiers.

\(^{56}\) Enterprise identifiers that are assigned by GS1 contain the IAC prefix. The IAC should not be repeated when forming the concatenated UII.
- The IAC, which shall be derived from the data qualifier for the enterprise identifier if it is not already provided\(^57\)
- The enterprise identifier, which shall be marked on the item
- The original part, lot or batch number, which shall be marked on the item
- The serial number, which shall be marked on the item

(*Note: This is referred to as UII Construct #2.*)

6. The IAC shall be derived from the data qualifier for the enterprise identifier if it is not already provided\(^58\). The IAC is not required to be separately marked on the item.\(^59\)

7. A specific set of data qualifiers will identify which UII Construct should be used to build the concatenated UII or if the concatenated UII is already marked on the item.\(^60\)

8. If UII Construct #2 is used, the enterprise must maintain the original part number on the item for the life of the item.

9. The enterprise is responsible for ensuring that the serial number is unique within the enterprise identifier (for UII Construct #1) or unique within the original part, lot or batch number (for UII Construct #2).

10. The enterprise is responsible for ensuring that the original part number is not duplicated within the enterprise. If the lot/batch number is used to create the UII then the combination of the lot/batch and serial number must be unique within the enterprise.

11. The concatenated UII will not change over the life of the item. Therefore, the component data elements of the concatenated UII will not change over the life of the item.

12. The enterprise identifier of the enterprise that assigned the serial number to the item is the only enterprise identifier in the UII machine-readable code that can use a UII data qualifier for enterprise identifier. Other enterprise identifiers may be contained within the machine-readable code as long as they do not use an EID data qualifier from Table 5.

13. Data elements not required to construct the concatenated UII shall remain discrete but may be contained within the same mark or media as the UII-required elements, as long as all the data elements contained in the mark or media are properly identified with a data qualifier. The UII data elements should appear first in the sequence.

14. The UII component data elements, at a minimum, shall be contained in a Data Matrix ECC 200 symbol, as required by the latest revision of MIL-STD-130.\(^61\)

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\(^{57}\) See footnote 56.
\(^{58}\) See footnote 56.
\(^{59}\) See the *DoD Guide to Uniquely Identifying Items (Table 3)* for a list of IACs.
\(^{60}\) See the *DoD Guide to Uniquely Identifying Items (Appendix D)* for more details on these data qualifiers.
\(^{61}\) See *MIL-STD-130* for additional information on DoD-approved data carriers.
Data may also be contained in human-readable information and/or other AIT media (e.g., contact memory buttons, linear bar codes, radio frequency identification, etc.) in addition to the Data Matrix. The physical marks that contain the UII-required elements shall remain legible until the item is destroyed.

15. Where space is available, human readable information for UII data elements should be marked on the item.

16. High capacity Automatic Identification Technology (AIT) media shall utilize DoD-accepted syntax.

17. There are identification numbers used in the commercial sector that will be considered IUID equivalents. IUID equivalents shall comply with the IUID Business Rule #14 for minimum data carrier requirements.62

Parent-Child Relationships

18. DFARS 211.274-2(a)(4) requires the unique identification, regardless of value, of (i) any DoD serially managed subassembly, component, or part embedded within a delivered item and, (ii) the parent item that contains the embedded subassembly, component or part. For purposes of complying with this requirement, the parent item for the embedded item UII or DoD recognized IUID equivalent will be the higher assembly, intermediate component or subassembly that is itself DoD serially managed.

Metadata Requirements

19. The concatenated UII is a non-parsable field, not to exceed 78 characters in length. Overhead characters, such as syntax and data qualifiers, are eliminated from the string when the concatenated UII is constructed. The source protocols for specific data qualifiers may be more restrictive than the allowable field lengths of these rules. Refer to ANS MH 10.8.2 for AIs and DIs, and to ATA CSDD for TEIs, for specific limitations on field lengths and usage.63

   • The IAC string of characters will not exceed 3 characters.
   • The enterprise identifier string of characters will not exceed 13 characters, excluding the data qualifier.
   • The original part, lot or batch number string of characters (including special characters) will not exceed 32 characters, excluding the data qualifier.

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62 See the DoD Guide to Uniquely Identifying Items for a list of approved IUID equivalents.
63 For example, serial number strings are not to exceed 30 characters however DI S is unlimited in field length, AI 21 is limited to 20 characters, and TEI SER is limited to 15 characters in accordance with their respective protocols.
• The serial number string of characters (including special characters) will not exceed 30 characters, excluding the data qualifier.\(^{64}\)

• The sum of the maximum number of characters for possible concatenated UII data elements is 78. The use of shorter field lengths is encouraged for original part, lot or batch numbers and serial numbers where feasible.

20. The concatenated UII string of data must have worldwide uniqueness (non-repeatable).

21. When constructing the concatenated UII:

• Any spaces contained in the component data elements will be deleted
• All special characters will be deleted from the enterprise identifier
• All special characters, except for dashes (-) and forward slashes (/) will be deleted from the original part number and serial number
• The concatenated UII may only contain uppercase English alphabet characters A through Z, numeric characters 0 through 9, and the special characters “_” and “/”

**Capturing the Unique Item Identifier**

22. For activities after initial delivery, in support of the product life cycle, any entity that collects data about the item must be capable of associating the data with the concatenated UII in accordance with program requirements.

23. If the UII data matrix symbol is unreadable and other AIT media is present, these can be used in a back-up mode to derive the UII. If only the human readable data qualifiers and data elements are adjacent to the symbol, the data elements shall be manually input to derive the concatenated UII using existing Business Rules.

24. Discovery of a duplicate concatenated UII will occur when the Government attempts to register the concatenated UII in the IUID Registry. If a true duplicate exists, the Government will work with the appropriate enterprise(s) to resolve the duplication.

25. In a database, once the concatenated UII is derived, it shall not be parsed to determine the original elements.

26. A database shall be capable of using the concatenated UII or the combination of its component data elements to retrieve the data record associated with the item represented by the concatenated UII.

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\(^{64}\) Leading zeroes in serial numbers are significant characters in the serial number string and in the concatenated UII. Avoiding the use of leading zeroes when creating serial numbers may preclude errors in data entry or data processing applications that do not recognize significant leading zeroes.
Using the Unique Item Identifier

27. The concatenated UII shall not be transferred from one item to another item once assigned and shall not be reused.

Items in operational use or in inventory

28. If an item is missing data elements required to construct the concatenated UII, use the following Rules to create substitute numbers:
   - If the enterprise identifier is missing, use the enterprise identifier of the activity that will physically mark the item. The serial number must comply with Rule #9.
   - If the original part, lot or batch number is missing or cannot be determined, obtain a part, lot or batch number from the in-service engineer or other appropriate authority. (See Business Rule #30)
   - If the serial number is missing, assign a serial number locally or centrally. In this case, the enterprise identifier for the item must be changed to represent the activity that assigned the serial number. The serial number must comply with Rule #9.

29. For legacy items that cannot be uniquely identified using UII Construct #1 or #2 or a DoD recognized IUID equivalent (serialization was not unique within enterprise identifier or original part, lot or batch number), re-serialization to conform to Construct #1 or #2 is preferred.

30. If the original part, lot or batch number cannot be precisely determined, use the following method for establishing an original part, lot or batch number for the purposes of building the concatenated UII:
   - First, use the part, lot or batch number at the time of acquisition, if it can be determined.
   - Second, use the part, lot or batch number marked on the part at the time the UII is created.

Although this may result in the current part, lot or batch number being used as the original part, lot or batch number, the data qualifier for the UII data element must be the original part, lot or batch number (i.e., 1P, PNO, 01, 1T, LTN, LOT, BII, or 10). If the lot /batch number is used to create the UII then the combination of the lot/batch and serial number must be unique within the enterprise. See Business Rule #10.

31. If the item is unidentifiable, a concatenated UII should not be assigned.

32. Once the contract is modified to include the IUID requirements:
   - If the contract is for delivery of new items to the Government, follow IUID Business Rules for items considered part of a new solicitation.
• If the contract is for support involving existing inventory items, the Program Manager will determine whether to follow existing Business Rules for new solicitations, items under contract, items in existing inventory, or some combination thereof.

Items considered tangible personal property owned by the Government in the possession of a contractor

33. Tangible personal property items owned by the Government in the possession of a contractor may use the asset identification number used to track the item as the item's serial number within enterprise identifier.

34. Tangible personal property items owned by the Government in the possession of a contractor will use the enterprise identifier of the enterprise maintaining the serial number of the item.

35. A concatenated UII should be created for tangible personal property items owned by the Government in the possession of a contractor by using UII Construct #1, Construct #2, or a DoD recognized IUID equivalent.

36. A UII is not required to be physically marked on tangible personal property items owned by the Government in the possession of a contractor unless the item is moved or delivered to a different location with a different enterprise identifier.65

37. Tangible personal property initially furnished to the contractor by the Government will use the UII provided by the Government. If none is provided, establish a UII using the criteria in Rules 33-35.

38. Tangible personal property will also require markings or labels indicating Government ownership.

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65 For instructions on assignment of virtual UIIs, see the the latest version of the DoD Guidelines for the Virtual Unique Item Identifier, available at http://www.acq.osd.mil/dpap/UID/guides.htm.
Appendix D - The Mechanics of Item Unique Identification

STRUCTURING THE DATA ELEMENTS FOR ITEM UNIQUE IDENTIFICATION

This Appendix explains how data elements are currently structured using semantics and syntax. The concepts of semantics and syntax, which are used to identify and structure data so it can be read by any AIT device, are explained. Examples of current structures in industrial use are presented for American National Standard (ANS) MH 10.8.2 Data Identifiers (Tables 6 and 7) and GS1 Application Identifiers (Tables 8 and 9). The historic use of Air Transport Association Common Support Data Dictionary Text Element Identifiers (TEIs) is discussed. Since Data Identifiers (ISO/IEC 15434 Format 06) and Application Identifiers (ISO/IEC 15434 Format 05) are already approved by ISO, they are compliant with the collaborative solution. Tables 10, 11 and 12 represent how TEIs would be used in the collaborative solution.

Semantics

For the unique item identifier (UII) data elements to be “machine-readable” by any AIT device, they must be identified by some means such that the reader device can recognize, through its resident software, what data element it is reading. This is accomplished by employing the concept of “semantics”, which is literally “the meaning of language”. For the purposes of constructing machine-readable data elements, semantics take the form of data qualifiers. These data qualifiers have to define each data element placed on the item. Specific data qualifiers are used to tell the AIT devices whether to derive the unique identification by using Construct #1, Construct #2, an already constructed UII format, or an IUID Equivalent. Table 5 shows the different data qualifiers for each of the data elements that are used for determining uniqueness.

66 Formerly EAN.UCC.
67 There are three types of data qualifiers being used: Data Identifiers (DIs) (Format 06), Application Identifiers (AIs) (Format 05), and, within the aerospace industry, Text Element Identifiers (TEIs). ISO/IEC International Standard 15418, Information Technology–EAN/UCC Application Identifiers and FACT Data Identifiers and Maintenance, governs DIs and AIs. Air Transport Association (ATA) Common Support Data Dictionary (CSDD) defines TEIs. ISO/IEC International Standard 15434, Information Technology–Syntax for High Capacity Automatic Data Capture Media, contains formats for using DIs and AIs in syntax encoding. DoD has submitted a request to add TEIs to ISO/IEC 15434.
### Table 5. Data Qualifiers

<table>
<thead>
<tr>
<th>Data Element</th>
<th>DI (Format 06) ISO/IEC 15434</th>
<th>AI (Format 05) ISO/IEC 15434</th>
<th>TEI ATA CSDD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Identifier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAGE/NCAGE</td>
<td>17V</td>
<td>95</td>
<td>CAG, MFR or SPL.</td>
</tr>
<tr>
<td>DUNS</td>
<td>12V</td>
<td></td>
<td>DUN</td>
</tr>
<tr>
<td>GS1 Company Prefix</td>
<td>3V</td>
<td></td>
<td>EUC</td>
</tr>
<tr>
<td>DoDAAC</td>
<td>7L</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Agencies</td>
<td>18V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial Number within Enterprise Identifier</td>
<td></td>
<td></td>
<td>SER or UCN</td>
</tr>
<tr>
<td>Serial Number within Original Part Number</td>
<td>S</td>
<td>21</td>
<td>SEQ</td>
</tr>
<tr>
<td>Original Part Number</td>
<td>1P</td>
<td>01</td>
<td>PNO</td>
</tr>
<tr>
<td>Lot/Batch Number</td>
<td>T</td>
<td>10</td>
<td>LOT, LTN or BII</td>
</tr>
<tr>
<td>Concatenated UIIs</td>
<td>25S</td>
<td>2002</td>
<td>UID</td>
</tr>
<tr>
<td></td>
<td>1S</td>
<td>2003</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22S</td>
<td>2004</td>
<td></td>
</tr>
<tr>
<td>UII not including the IAC (CAGE + Serial Number within CAGE)</td>
<td>18S</td>
<td></td>
<td>USN or UST</td>
</tr>
<tr>
<td>Current Part Number</td>
<td>30P</td>
<td>240</td>
<td>PNR</td>
</tr>
</tbody>
</table>

---

68 Data identifier 18V is the concatenation of the Issuing Agency Code (IAC) + Enterprise Identifier (EID). This data identifier would be used for all other EIDs, which were assigned by an issuing agency that has an assigned IAC but does not have their own specific EID data identifier.

69 MFR – Manufacturer CAGE Code. Identifies the manufacturer, government agency or other organization controlling the design and the part number assignment of the subject part. SPL – Supplier CAGE Code. Identifies the organization assigning a Unique Component Identification Number (UCN), where the organization is not the manufacturer, government agency, or other organization controlling the design of the serialized component.

70 SER – Part Serial Number (Serial Number within Enterprise). The SER is the manufacturer’s serialized identity for an individual part, component or component end item. UCN – Unique Component Identification Number. The UCN is the permanent tracking identity assigned to an in-service part in lieu of the manufacturer’s serial number.

71 25S is a data identifier defined as the identification of a party to a transaction (as identified by data identifier 18V), followed by a supplier assigned serial number (For UII purposes, this has to be unique serialization within the EID that assigns the UII data elements). Thus, for UII purposes, 25S must represent the following string of concatenated elements – IAC + EID + Unique serial number within the EID, which directly corresponds to a concatenated UII using Construct #1.

72 DI I identifies a U.S. Vehicle Identification Number – VIN.

73 DI 22S identifies a cellular mobile telephone electronic serial number.

74 AI 8002 identifies a cellular mobile telephone electronic serial number.
Syntax

The machine-readable symbology for UII is the Data Matrix ECC 200 (ISO/IEC 16022), which uses Reed-Solomon error correction. The symbol is a two-dimensional representation of ASCII characters. To permit translation of the encoded string of ASCII characters, the characters are ordered according to the precise rules of ISO/IEC International Standard 15434, Information Technology—Syntax for High Capacity ADC Media—the “syntax.” Each data string is assembled beginning with a message header consisting of the compliance indicator and a record separator. The compliance indicator is the ASCII code for the three characters [, ), and > which are assembled in that order—[)>>. The record separator that follows the compliance indicator is also an ASCII-coded character but it does not have a printable representation. The convention for depicting the record separator uses $R_S$ to represent the single ASCII-coded character. Because the record separator also appears at the end of the formatted data in the data string, it is known as the format trailer character. There are two other ASCII-coded characters that are used in UII encoding that do not have printable representations. They are the data element separator—$G_S$—and the message trailer character—$E_{OT}$. The hexadecimal and decimal codes for ASCII encoding for $R_S$, $G_S$ and $E_{OT}$ can be obtained from ISO/IEC 15434.

The message header is followed by a two-character format code to identify the semantics of the formatted data elements. The format code, the data qualifiers and the data values in the remainder of the data string are separated using the data element separator—$G_S$—between each element of the formatted data. The formatted data is terminated using the format trailer character—$R_S$—after the last data element, and the data string is terminated using the message trailer character—$E_{OT}$—to indicate the end.

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75 AI 8003 identifies a GRAI.
76 8004 is the application identifier for the Global Individual Asset Identifier (GIAI). The GIAI is up to 30 characters and is a combination of the GS1 Company Prefix and an Individual Asset Reference, which is assigned by the holder of the GS1 Company Prefix.
77 In the case where the EID is the CAGE Code, data identifier 18S may be used. 18S is defined as the concatenation of the CAGE Code (EID) + Unique serial number within the CAGE Code. This is UII Construct 1. This data element does not contain the IAC, which must be added.
78 USN – The concatenation of MFR + SER. UST – The concatenation of SPL + UCN. These elements do not contain the IAC, which must be added.
79 The current part number is not part of the UII. It is an additional data element that may be encoded in the ISO 15434 syntax and placed on the item in a separate data matrix symbol, or, in the case of severe space limitations, it may be encoded in the same data matrix along with the UII data elements (see MIL-STD-130).
80 ADC – Automatic Data Capture.
81 Syntax—the way words are put together to form constructions, such as phrases and sentences. This standard defines the manner in which the data is transferred to the high capacity ADC media from a supplier’s information system and the manner in which the data is transferred to the recipient’s information system.
Once the data elements are identified to the AIT device, the AIT device needs instructions on how to put the data element fields together to define the unique identification for the item.

Figure 6 shows how the concatenated UII is constructed within Format Codes 05, 06 and DD with the various data qualifiers. High capacity AIT devices shall conform to ISO/IEC 15434. This is crucial to unique item identification, since the process of identifying and concatenating the data elements must be unambiguous.

82 Enterprises may have a mark on the item such as a design authority, etc., but that mark will need a different enterprise identifier (EID) data qualifier than the EID data qualifier used for the UII. See business rule number 12 in Appendix C.
### The Mechanics of Unique Item Identification

**Figure 6. Concatenated Unique Item Identifier (UII) Construction**

<table>
<thead>
<tr>
<th>Format Code 05</th>
<th>Required Data Elements</th>
<th>Resultant Concatenated UII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct 1</td>
<td>8004</td>
<td>Constructed IUID equivalent (GIAI)</td>
</tr>
<tr>
<td>(use IUID equivalents)</td>
<td>8003</td>
<td>Constructed IUID equivalent (GRAI)</td>
</tr>
<tr>
<td></td>
<td>8002</td>
<td>Constructed IUID equivalent (ESN)</td>
</tr>
<tr>
<td>Construct 2</td>
<td>01 &amp; 21</td>
<td>01 + 21</td>
</tr>
<tr>
<td></td>
<td>95, 10 &amp; 21</td>
<td>95 + 10 + 21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Format Code 06</th>
<th>Construct 1</th>
<th>Construct 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>18S</td>
<td>3V, 1P &amp; S</td>
<td>3V + 1P + S</td>
</tr>
<tr>
<td>25S</td>
<td>17V, 1P &amp; S</td>
<td>D + 17V + 1P + S</td>
</tr>
<tr>
<td>22S</td>
<td>12V, 1P &amp; S</td>
<td>UN + 12V + 1P + S</td>
</tr>
<tr>
<td>I</td>
<td>7L, 1P &amp; S</td>
<td>LD + 7L + 1P + S</td>
</tr>
<tr>
<td></td>
<td>18V, 1P &amp; S</td>
<td>18V + 1P + S</td>
</tr>
</tbody>
</table>

*Substitute 1T in place of 1P if serialization within the lot/batch number applies*

<table>
<thead>
<tr>
<th>Format Code DD</th>
<th>Construct 1</th>
<th>Construct 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFR &amp; SER</td>
<td>MFR , PNO &amp; SEQ</td>
<td>D + MFR + PNO + SEQ</td>
</tr>
<tr>
<td>CAG &amp; SER</td>
<td>CAG , PNO &amp; SEQ</td>
<td>D + CAG + PNO + SEQ</td>
</tr>
<tr>
<td>DUN &amp; SER</td>
<td>DUN , PNO &amp; SEQ</td>
<td>UN + DUN + PNO + SEQ</td>
</tr>
<tr>
<td>EUC &amp; SER</td>
<td>EUC , PNO &amp; SEQ</td>
<td>EUC + PNO + SEQ</td>
</tr>
<tr>
<td>SPL &amp; UCN</td>
<td>SPL , PNO &amp; SEQ</td>
<td>D + SPL + PNO + SEQ</td>
</tr>
<tr>
<td>CAG &amp; UCN</td>
<td>CAG , PNO &amp; SEQ</td>
<td>D + CAG + PNO + SEQ</td>
</tr>
<tr>
<td>DUN &amp; UCN</td>
<td>DUN , PNO &amp; SEQ</td>
<td>UN + DUN + PNO + SEQ</td>
</tr>
<tr>
<td>EUC &amp; UCN</td>
<td>EUC , PNO &amp; SEQ</td>
<td>EUC + PNO + SEQ</td>
</tr>
<tr>
<td>USN</td>
<td>USN</td>
<td>D + USN</td>
</tr>
<tr>
<td>UST</td>
<td>UST</td>
<td>D + UST</td>
</tr>
<tr>
<td>UID</td>
<td>UID</td>
<td>UID</td>
</tr>
</tbody>
</table>

*Substitute LOT , LTN or BII in place of PNO if serialization within the lot/batch number applies*
EXAMPLES OF SEMANTICS AND SYNTAX CONSTRUCTIONS FOR ITEM UNIQUE IDENTIFICATION

Using ANS MH 10 Data Identifiers

**Construct #1 – Serialization within the Enterprise Identifier.** Table 6 shows an example, using the data from Figure 4, of how the data elements would have to be encoded with data identifiers on the AIT media placed on or with the item for UII Construct #1.

<table>
<thead>
<tr>
<th>Data Element</th>
<th>Data Identifier Format 06</th>
<th>Data Element Value</th>
<th>Encoded Data Element on AIT Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concatenated unique item identifier (including the IAC)</td>
<td>25S</td>
<td>UN077991289 674A36458</td>
<td>25SUN077991289 674A36458</td>
</tr>
<tr>
<td>Concatenated unique item identifier (not including the IAC)</td>
<td>18S</td>
<td>0CVA5674A3 6458</td>
<td>18S0CVA5674A3 6458</td>
</tr>
<tr>
<td>Enterprise Identifier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DUNS</td>
<td>12V</td>
<td>077991289</td>
<td>12V077991289</td>
</tr>
<tr>
<td>CAGE</td>
<td>17V</td>
<td>0CVA5</td>
<td>17V0CVA5</td>
</tr>
<tr>
<td>Serial Number within Enterprise</td>
<td>S</td>
<td>674A36458</td>
<td>S674A36458</td>
</tr>
</tbody>
</table>

Table 6. Example of the Use of Data Identifiers in Construct #1 (Format 06 of ISO/IEC 15434)

The data elements represented by the data qualifiers 12V, 17V and S are not used by the AIT device to form the concatenated UII. The data elements are required in accordance with Business Rule #2 for discrete data elements so that the enterprise identifier and serial number can be read by the AIT device without parsing the concatenated UII string or accessing the IUID Registry.

The UII data elements would be encoded as follows using Format 06 for Data Identifiers of the ISO/IEC 15434 syntax:

\[ \langle \rangle^{R_s}06^G S25SUN077991289674A36458^G S12V077991289^G S674A36458^{R_s}F^o_T \]

or

\[ \langle \rangle^{R_s}06^G S18S0CVA5674A36458^G S17V0CVA5^G S674A36458^{R_s}F^o_T \]

Where:
The Mechanics of Unique Item Identification

\( \text{\text{)}R_s^R \) = The Message Header consisting of a three-character compliance indicator and the Format Trailer Character \( R_s \) to indicate the end of a data format envelope

\( 06 \) = A Format Header which indicates Data Identifiers are being used

\( G_s \) = A Data Element Separator used between data fields

\( 25S \) = Data Identifier for the unique identification including the IAC (IAC + Enterprise Identifier + Serial Number)

\( 18S \) = Data Identifier for unique identification not including the IAC and using CAGE as the Enterprise Identifier (CAGE + Serial Number)

\( \text{UN077991289674A36458} \) = Concatenated UII including the IAC—As defined by the data identifier 25S (the IAC (UN) and DUNS Enterprise Identifier (077991289) and the Serial Number (674A36458))

\( \text{0CVA5674A36458} \) = Concatenated UII not including the IAC—As defined by the data identifier 18S (the CAGE Enterprise Identifier (0CVA5) and the Serial Number (674A36458))

\( 12V \) = Data Identifier for DUNS Code

\( \text{077991289} \) = DUNS Code

\( 17V \) = Data Identifier for CAGE Code

\( \text{0CVA5} \) = CAGE Code

\( S \) = Data Identifier for Serial Number

\( \text{674A36458} \) = Serial Number within the enterprise

\( \text{E0T} \) = A Message Trailer which identifies the end of the message within the data stream

When the AIT device reads the data qualifier for the enterprise identifier, it must have what agency (that is, the Issuing Agency Code) issued the enterprise identifier available in its software. The AIT device can then attach the Issuing Agency Code (IAC) to the beginning of the UII concatenation.

When the AIT device reads the data qualifier for 25S, it will recognize that the data following the 25S is a concatenated UII for Construct #1, including the IAC. When the AIT device reads the data qualifier for 18S, it will recognize that the data following the 18S is a concatenated UII for Construct #1, not including the IAC and will add the IAC for CAGE to form the full concatenated UII.

For this example using ANS MH 10.8.2 Data Identifiers in Format 06 of ISO/IEC 15434, the concatenated UII output from the AIT device, once the overhead and syntax are stripped away, would be \( \text{UN077991289674A36458} \) or \( \text{D0CVA5674A36458} \).
Construct #2 – Serialization within the Original Part, Lot or Batch Number. Table 7 shows an example, using the data from Figure 4, of how the data elements would have to be encoded with data identifiers on the AIT media placed on or with the item for UII Construct #2.

<table>
<thead>
<tr>
<th>Data Element</th>
<th>Data Identifier Format 06</th>
<th>Data Element Value</th>
<th>Encoded Data Element on AIT Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Identifier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• DUNS</td>
<td>12V</td>
<td>077991289</td>
<td>12V077991289</td>
</tr>
<tr>
<td>Original Part Number</td>
<td>1P</td>
<td>4202435</td>
<td>1P4202435</td>
</tr>
<tr>
<td>Serial Number within Original Part Number</td>
<td>S</td>
<td>10936</td>
<td>S10936</td>
</tr>
</tbody>
</table>

Table 7. Example of the Use of Data Identifiers in Construct #2
(Format 06 of ISO/IEC 15434)

Recalling that the UII data elements are to be concatenated in the order Issuing Agency Code/Enterprise Identifier/Original Part, Lot or Batch Number/Serial Number for an enterprise that serializes within the part, lot or batch number, the UII data elements would be encoded as follows using Format 06 for Data Identifiers of the ISO/IEC 15434 syntax:

\[ \text{|}>R_{S}06G_{S}12V077991289G_{S}1P4202435G_{S}S10936R_{S}E_{oT} \]

Where:

\( |>R_{S} \) = The Message Header consisting of a three-character compliance indicator and the Format Trailer Character \( R_{S} \) to indicate the end of a data format envelope

\( 06 \) = A Format Header which indicates Data Identifiers are being used

\( G_{S} \) = A Data Element Separator used between data fields

\( 12V \) = Data Identifier for DUNS Code

\( 077991289 \) = DUNS Code

\( 1P \) = Data Identifier for Part Number assigned by supplier (Original)

\( 4202435 \) = Original Part Number

\( S \) = Data Identifier for Serial Number

\( 10936 \) = Serial Number within original part number

\( E_{oT} \) = A Message Trailer which identifies the end of the message within the data stream

When the AIT device reads the data qualifier for the enterprise identifier, it will have what agency (that is, the Issuing Agency Code) issued the
The Mechanics of Unique Item Identification

enterprise identifier available in its software. The AIT device can then attach the Issuing Agency Code (IAC) to the beginning of the UII concatenation. In this example the IAC for Dun & Bradstreet is “UN”.

For this example using ANS MH 10 Data Identifiers in Format 06 of ISO/IEC 15434, the concatenated UII output from the AIT device, once the overhead and syntax are stripped away and the IAC has been added, would be UN077991289420243510936.

Using GS1 Application Identifiers

Construct #1 – Serialization within the Enterprise Identifier. When using GS1 Application Identifiers for purposes of unique identification, enterprises must use the General GS1 Specifications to construct the DoD IUID equivalent or the UII data elements. Table 8 shows an example of the use of application identifiers in the context of the General GS1 Specifications for UII Construct #1.

<table>
<thead>
<tr>
<th>Data Element</th>
<th>Application Identifier Format 05</th>
<th>Data Element Value</th>
<th>Encoded Data Element on AIT Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concatenated unique item identifier, including the IAC</td>
<td>8004</td>
<td>06141411A0B9C3D6</td>
<td>800406141411A0B9C3D6</td>
</tr>
</tbody>
</table>

Table 8. Example of the Use of Application Identifiers for Construct #1 (Format 05 of ISO/IEC 15434)

For unique item identification, the Global Individual Asset Identifier (GIAI) is considered by the Department to be an IUID equivalent. The data elements considered components of the IUID equivalent (i.e., GS1 Company Prefix, Individual Asset Reference Number) are not required to be marked on the item, unless specifically required by the contract.

Using the General GS1 Specifications, the minimum DoD IUID equivalent data elements would be encoded as follows under Format 05 for Application Identifiers of the ISO/IEC 15434 syntax:

---

83 Formerly EAN.UCC.
84 See [http://www.uc-council.org/ean_ucc_system/index.cfm](http://www.uc-council.org/ean_ucc_system/index.cfm) for information about the GS1 System (formerly EAN.UCC System).
85 Within the General GS1 Specifications, the Global Individual Asset Identifier (GIAI) is considered an IUID equivalent. The application identifier (8004) indicates that the data field contains a GIAI. The GIAI is made up of the GS1 Company Prefix and an individual asset reference number. The holder of the GS1 Company Prefix determines the structure and numbering of the individual asset reference number.
86 A DoD recognized IUID equivalent means a unique item identification method that is in commercial use that can be used to uniquely identify DoD items that are purchased from commercial industries that use the unique identification equivalents.
87 This is an exception to IUID Business Rule #2. See Appendix C.
The Mechanics of Unique Item Identification

\[ \rangle^R_s05^G_s\ 8004061411A0B9C3D6^R_s\ E_{oT} \]

Where:

\( \rangle^R_s \) = The Message Header consisting of a three-character compliance indicator and the Format Trailer Character \( ^R_s \) to indicate the end of a data format envelope

\( 05 \) = A format header which indicates application identifiers are being used

\( ^G_s \) = A Data Element Separator used between data fields

\( 8004 \) = Application Identifier for Global Individual Asset Identifier (GIAI)

\( 06141411A0B9C3D6 \) = GIAI, which is composed of the GS1 Company Prefix including the IAC as the leading character \( (0614141) \) and the Individual Asset Reference Number \( (1A0B9C3D6) \)

\( E_{oT} \) = A Message Trailer which identifies the end of the message within the data stream

For this example using Application Identifiers in Format 05 of ISO/IEC 15434, the DoD IUID equivalent output from the AIT device, using the GIAI as the IUID equivalent, stripping away the overhead and syntax, would be \( 06141411A0B9C3D6^{88} \).

**Construct #2 – Serialization within the Part, Lot or Batch Number.**

Table 9 shows an example of the use of application identifiers in the context of the General GS1 Specifications for UII Construct #2. In this construct, the GTIN™ is treated as the part number.

<table>
<thead>
<tr>
<th>Data Element</th>
<th>Application Identifier Format 05</th>
<th>Data Element Value</th>
<th>Encoded Data Element on AIT Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Number</td>
<td>01</td>
<td>00614141999996</td>
<td>0100614141999996</td>
</tr>
<tr>
<td>Serial Number</td>
<td>21</td>
<td>1A0B9C3D6</td>
<td>211A0B9C3D6</td>
</tr>
</tbody>
</table>

**Table 9. Example of the Use of Application Identifiers for Construct #2 (Format 05 of ISO/IEC 15434)**

Using the General GS1 Specifications, the minimum UII data elements would be encoded as follows under Format 05 for Application Identifiers of the ISO/IEC 15434 syntax:

\[ \rangle^R_s05^G_s\ 0100614141999996^G_s\ 211A0B9C3D6^R_s\ E_{oT} \]

Where:

---

88 Since the IAC is the first digit of the Company Prefix, it is not necessary to add it in forming the concatenated UII.
The Mechanics of Unique Item Identification

\[^{R}\_S^2\] = The Message Header consisting of a three-character compliance indicator and the Format Trailer Character \[^R\_S\] to indicate the end of a data format envelope

**05** = A format header which indicates application identifiers are being used

\[^G\_S\] = A Data Element Separator used between data fields

**01** = Application Identifier for the GTIN™

**00614141999996** = The GTIN™, which is composed of the GS1 Company Prefix including the IAC as the leading character (0614141) and the Product Number (99999), a check digit (6) and leading zeros to a fixed length of 14 digits

**21** = Application Identifier for serial number

**1A0B9C3D6** = The serial number

\[^E\_0\_T\] = A Message Trailer which identifies the end of the message within the data stream

For this example using Application Identifiers in Format 05 of ISO/IEC 15434, the concatenated UII output from the AIT device, stripping away the overhead and syntax would be **006141419999961A0B9C3D6**. \(^{89}\)

**Historic Use of Text Element Identifiers**

Text Element Identifiers (TEIs)\(^{90}\) are the preferred approach of the aerospace industry. The aerospace industry uses CAGE Code (TEI = MFR)\(^{91}\) to identify the manufacturer with serial number (TEI = SER) to provide unique identity of the item. The aerospace industry philosophy is no duplication of serial numbers within an enterprise, regardless of the product, so that a simple combination of enterprise identifier and serial number provides unique identification of that item forever. As revisions are implemented that change the form, fit or function of the part, the aerospace industry changes the part number (TEI = PNR) to reflect those changes. This is called “rolling the part number.”

As aerospace moved TEIs into broader multi-industry use, they determined a need to establish additional TEIs for DUNS Number (TEI = DUN), UCC Company Prefix (TEI = EUC), Serial Number within Part Number (TEI = SEQ), Original Part Number (TEI = PNO), and concatenated UII (TEI = UID) to encode text element identifiers other

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89 Since the IAC is the first digit of the Company Prefix, it is not necessary to add it in forming the concatenated UII.

90 All TEIs are four characters in length, consisting of three letters followed by a space.

91 CAGE Code is also indicated by TEI = CAG. An enterprise identified by CAG need not be the manufacturer.
than Manufacturer (TEI = MFR), Serial Number (TEI = SER) and Current Part Number (TEI = PNR). It was also determined that they needed a separator that would not be used within data, as opposed to the “/” used in ATA Spec 2000, Chapter 9. Finally, it was determined that an unambiguous header/trailer was needed to identify that the data fields represented were in Text Element Identifier form.

The needed non-data separator and unambiguous header/trailer were available in ISO/IEC 15434; Syntax for High Capacity ADC Media, and this gave rise to the Collaborative Solution.

The Collaborative AIT Solution

The DoD has approved the use of ISO/IEC 15418 and ISO/IEC 15434 in its acquisitions. The DoD has established the collaborative solution “DD” format to enable the use of text element identifiers (TEIs) using the syntax of ISO/IEC 15434 until such time as the TEIs needed for unique identification are incorporated as approved semantics in ISO/IEC 15418. Although DoD has approved the use of ISO/IEC 15434, the collaborative solution “DD” format can be used to accommodate the use of only those TEIs needed for unique identification in the ISO/IEC 15434 syntax.

DoD is seeking approval of the International Organization for Standardization to add a new format to ISO/IEC 15434 to support TEIs. The Department values the formal ISO approval process and has submitted a proposal to the U. S. Technical Advisory Group to the ISO/IEC JTC1/SC 31 seeking approval of a new format for the TEI addition. That approval process is lengthy, and, in the interim, a collaborative solution is necessary to create a near-term interoperable environment for IUID enhancements to business intelligence to support coalition operations. This solution uses the structure of ISO/IEC 15434 as the IUID syntax standard and the business rules in Appendix C. If approved, the new format shall be used and replace the interim “DD” format described in this guidance. Items that are marked with the “DD’ format code will not have to be remarked once a permanent ISO/IEC 15434 format code is assigned to TEIs. In addition, in support of the IUID collaborative solution, the Air Transport Association (ATA) Spec 2000

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92 On October 26, 2004, the Air Transport Association (ATA) Spec2000 Coordinating Group approved the following Text Element Identifiers (TEIs) for usage: PNO (Original Part Number), SEQ (Serial Number) within Original Part Number) and UID (Unique Item Identifier). The PNO and SEQ TEIs will allow for the use of UII Construct 2 (i.e., serialization within original part number).

93 ISO/IEC 15434, Syntax for High Capacity ADC Media, specifies a two-digit format header. Numbers 01-09 and 11 are assigned. Numbers 00, 10 and numbers 12-99 are reserved for future use. This means that a format header for text element identifiers of the collaborative solution cannot be assigned a two-digit number without SC 31 approval, since all two digit numbers have been reserved. To enable the collaborative solution utilizing the ISO/IEC 15434 syntax, the Department will use a special DoD-specific format header, designated as “DD”, to indicate TEIs are being used in the collaborative solution.
International Coordinating Group has approved the use of ISO/IEC 15434 syntax with TEIs as an alternative item marking method. Valid TEIs include only those approved by ATA for incorporation in the ATA Common Support Data Dictionary (CSDD) including those not yet published.

Using Text Element Identifiers in the Collaborative Solution

**Construct #1 – Serialization within the Enterprise Identifier by Manufacturer.** Table 10 shows an example of the use of TEIs in the collaborative solution for UII Construct #1 when the manufacturer serializes the item.

<table>
<thead>
<tr>
<th>Data Element</th>
<th>TEIs[^94]</th>
<th>Data Element Value</th>
<th>Encoded Data Element on AIT Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Identifier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• CAGE</td>
<td>MFR</td>
<td>0CVA5</td>
<td>MFR 0CVA5</td>
</tr>
<tr>
<td>Serial Number within Enterprise Identifier</td>
<td>SER</td>
<td>674A36458</td>
<td>SER 674A36458</td>
</tr>
</tbody>
</table>

Table 10. Example of the Use of TEIs in the Collaborative Solution for UII Construct #1, Manufacturer Serialization (DoD Format “DD”)

Recalling that the UII is to be concatenated in the order Issuing Agency Code/Enterprise Identifier/Serial Number for an enterprise that serializes within the enterprise identifier, the UII data elements would be encoded as follows using an interim, DoD-specific, Format DD (see note below) for TEIs utilizing the ISO/IEC 15434 syntax:

\[
[)>R_sDD^G_sMFR 0CVA5^G_sSER 674A36458^R_sE^T
\]

Where:

\[[)>R_s = \text{The Message Header consisting of a three-character compliance indicator and the Format Trailer Character } R_s \text{ to indicate the end of a data format envelope}\]

\[DD = \text{A special DoD-specific format header, which indicates TEIs are being used in the collaborative solution}\]

\[G_s = \text{A Data Element Separator used between data fields}\]

\[MFR = \text{TEI for Manufacturer CAGE code}\]

\[0CVA5 = \text{CAGE Code}\]

[^94]: All TEIs are four characters in length, consisting of three letters followed by a space.
SER = TEI for Serial Number within the Enterprise Identifier

674A36458 = Serial Number within Enterprise Identifier

EoT = A Message Trailer which identifies the end of the message within the data stream

When the AIT device reads the data qualifier for the enterprise identifier, it will have what agency (that is, the Issuing Agency Code) issued the enterprise identifier available in its software. The AIT device can then attach the Issuing Agency Code (IAC) to the beginning of the UII concatenation. In this example the IAC for CAGE is “D”.

For this example using Format DD for TEIs in the ISO/IEC 15434 syntax, the concatenated UII output from the AIT device, once the overhead and syntax are stripped away and the IAC has been added, would be D0CVA5674A36458.

**Construct #1 – Serialization within the Enterprise by an Organization other than the Manufacturer.** Table 11 shows an example of the use of TEIs in the collaborative solution for UII Construct #1 when serialization is done by an organization other than the manufacturer of the item.

<table>
<thead>
<tr>
<th>Data Element</th>
<th>TEIs&lt;sup&gt;95&lt;/sup&gt;</th>
<th>Data Element Value</th>
<th>Encoded Data Element on AIT Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Identifier</td>
<td>SPL</td>
<td>0F3N5</td>
<td>SPL 0F3N5</td>
</tr>
<tr>
<td>• CAGE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serial Number within Enterprise Identifier, other than Manufacturer</td>
<td>UCN</td>
<td>10936</td>
<td>UCN 10936</td>
</tr>
</tbody>
</table>

Table 11. Example of the Use of TEIs in the Collaborative Solution for UII Construct #1, Enterprise other than Manufacturer (DoD Format “DD”)

Recalling that the UII is to be concatenated in the order Issuing Agency Code/Enterprise Identifier/Serial Number for an enterprise that serializes within the enterprise, the UII data elements would be encoded as follows using an interim, DoD-specific, Format DD (see note below) for TEIs utilizing the ISO/IEC 15434 syntax:

\[ (>^{R_s}D^{DD}G_sSPL 0F3N5^G_sUCN 10936^R_sE_oT) \]

Where:

<sup>95</sup> All TEIs are four characters in length, consisting of three letters followed by a space.
The Mechanics of Unique Item Identification

\( \text{[Message Header consisting of a three-character compliance indicator and the Format Trailer Character to indicate the end of a data format envelope}} \)

\( \text{DD} = \text{A special DoD-specific format header, which indicates TEIs are being used in the collaborative solution} \)

\( \text{G_s} = \text{A Data Element Separator used between data fields} \)

\( \text{SPL} = \text{TEI for CAGE code, Enterprise other than Manufacturer} \)

\( 0F3N5 = \text{CAGE Code} \)

\( \text{UCN} = \text{TEI for Unique Component Number assigned by Enterprise other than the Manufacturer} \)

\( 10936 = \text{Unique Component Number} \)

\( E_{OT} = \text{A Message Trailer which identifies the end of the message within the data stream} \)

When the AIT device reads the data qualifier for the enterprise identifier, it will have what agency (that is, the Issuing Agency Code) issued the enterprise identifier available in its software. The AIT device can then attach the Issuing Agency Code (IAC) to the beginning of the UII concatenation. In this example the IAC for CAGE is “D”.

For this example using Format DD for TEIs in the ISO/IEC 15434 syntax, the concatenated UII output from the AIT device, once the overhead and syntax are stripped away and the IAC has been added, would be \( D0F3N510936 \).

**Construct #2 – Serialization within the Original Part, Lot or Batch Number.** Table 12 shows an example of the use of TEIs in the collaborative solution for UII Construct #2 when the manufacturer serializes the item within the original part number.
The Mechanics of Unique Item Identification

<table>
<thead>
<tr>
<th>Data Element</th>
<th>TEIs[^6]</th>
<th>Data Element Value</th>
<th>Encoded Data Element on AIT Media</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Identifier</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• CAGE</td>
<td>CAG[^7]</td>
<td>0CVA5</td>
<td>CAG 0CVA5</td>
</tr>
<tr>
<td>Original Part Number</td>
<td>PNO</td>
<td>4202435</td>
<td>PNO 4202435</td>
</tr>
<tr>
<td>Serial Number within Original Part Number</td>
<td>SEQ</td>
<td>674A36458</td>
<td>SEQ 674A36458</td>
</tr>
</tbody>
</table>

Table 12. Example of the Use of TEIs in the Collaborative Solution for UII Construct #2, Original Part Number Serialization (DoD Format “DD”)

Recalling that the UII is to be concatenated in the order Issuing Agency Code/Enterprise Identifier/Original Part Number/Serial Number for an enterprise that serializes within the original part number, the UII data elements would be encoded as follows using an interim, DoD-specific, Format DD (see note below) for TEIs utilizing the ISO/IEC 15434 syntax:

\[ \text{[]} >^R S \text{DD}^G S \text{CAG} 0\text{CVA5}^G S \text{PNO} 4202435^G S \text{SEQ} 674A36458^R S \text{E}_T \]

Where:

\[ \text{[]} >^R S = \text{The Message Header consisting of a three-character compliance indicator and the Format Trailer Character} \, \text{R}_S \text{to indicate the end of a data format envelope} \]

\[ \text{DD} = \text{A special DoD-specific format header, which indicates TEIs are being used in the collaborative solution} \]

\[ \text{G}_S = \text{A Data Element Separator used between data fields} \]

\[ \text{CAG} = \text{TEI for Manufacturer CAGE code} \]

\[ 0\text{CVA5} = \text{CAGE Code} \]

\[ \text{PNO} = \text{TEI for Original Part Number} \]

\[ 4202435 = \text{Original Part Number} \]

\[ \text{SEQ} = \text{TEI for Serial Number within the Original Part Number} \]

\[ 674A36458 = \text{Serial Number within the Original Part Number} \]

\[ \text{E}_T = \text{A Message Trailer which identifies the end of the message within the data stream} \]

[^6]: All TEIs are four characters in length, consisting of three letters followed by a space.

[^7]: The TEI of MFR may also be used to designate the manufacturer.
The Mechanics of Unique Item Identification

When the AIT device reads the data qualifier for the enterprise identifier, it will have what agency (that is, the Issuing Agency Code) issued the enterprise identifier available in its software. The AIT device can then attach the Issuing Agency Code (IAC) to the beginning of the UII concatenation. In this example the IAC for CAGE is “D”.

For this example using Format DD for TEIs in the ISO/IEC 15434 syntax, the concatenated UII output from the AIT device, once the overhead and syntax are stripped away and the IAC has been added, would be D0CVA54202435674A36458
# Appendix E - Glossary of Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACRN</td>
<td>Accounting Classification Reference Number</td>
</tr>
<tr>
<td>ADC</td>
<td>Automatic Data Capture</td>
</tr>
<tr>
<td>AIS</td>
<td>Automated Information System</td>
</tr>
<tr>
<td>AIT</td>
<td>Automatic Identification Technology</td>
</tr>
<tr>
<td>ANS</td>
<td>American National Standard</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>ANSI/EIA</td>
<td>American National Standards Institute/Electronic Industries Alliance</td>
</tr>
<tr>
<td>ANSI T1.220</td>
<td>North American Telecommunication Industry Manufacturers, Suppliers, and Related Service Companies</td>
</tr>
<tr>
<td>ASC</td>
<td>Accredited Standards Committee</td>
</tr>
<tr>
<td>ATA</td>
<td>Air Transport Association</td>
</tr>
<tr>
<td>BEA</td>
<td>Business Enterprise Architecture</td>
</tr>
<tr>
<td>BII</td>
<td>Text Element Identifier for Batch Number</td>
</tr>
<tr>
<td>CAG</td>
<td>Text Element Identifier for CAGE</td>
</tr>
<tr>
<td>CAGE</td>
<td>Commercial And Government Entity</td>
</tr>
<tr>
<td>CDRL</td>
<td>Contract Data Requirements List</td>
</tr>
<tr>
<td>CFO</td>
<td>Chief Financial Officers</td>
</tr>
<tr>
<td>CJCSI</td>
<td>Chairman of the Joint Chiefs of Staff Instruction</td>
</tr>
<tr>
<td>CLEI</td>
<td>COMMON LANGUAGE® Equipment Identification</td>
</tr>
<tr>
<td>CLIN</td>
<td>Contract Line Item Number</td>
</tr>
<tr>
<td>CSDD</td>
<td>Common Support Data Dictionary published by the ATA</td>
</tr>
<tr>
<td>D</td>
<td>Issuing Agency Code for CAGE Codes</td>
</tr>
<tr>
<td>DCMA</td>
<td>Defense Contract Management Agency</td>
</tr>
<tr>
<td>DFARS</td>
<td>Defense Federal Acquisition Regulation Supplement</td>
</tr>
<tr>
<td>DLMS</td>
<td>Defense Logistics Management System</td>
</tr>
<tr>
<td>DoD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>DoDAAC</td>
<td>Department of Defense Activity Address Code</td>
</tr>
<tr>
<td>DoDD</td>
<td>Department of Defense Directive</td>
</tr>
<tr>
<td>DoDI</td>
<td>Department of Defense Instruction</td>
</tr>
<tr>
<td>DUN</td>
<td>Text Element Identifier for DUNS Number</td>
</tr>
<tr>
<td>DUNS® Number</td>
<td>Dun &amp; Bradstreet Data Universal Numbering System number</td>
</tr>
<tr>
<td>EAN</td>
<td>European Article Numbering</td>
</tr>
<tr>
<td>EAN.UCC</td>
<td>European Article Numbering Uniform Code Council</td>
</tr>
</tbody>
</table>

65
Glossary

EHIBCC  European Health Industry Business Communications Council
EIA    Electronic Industries Alliance
EID    Enterprise Identifier
ESN    Electronic Serial Number
EUC    Text Element Identifier for GS1 Company Prefix

FAR    Federal Acquisition Regulation
FASAB  Federal Accounting Standards Advisory Board
FMR    DoD Financial Management Regulation
FMS    Foreign Military Sales

GAO    Government Accountability Office
GIAI   Global Individual Asset Identifier
GRAI   Global Returnable Asset Identifier
GS1    Global Commerce Standards Organization formerly known as EAN.UCC
GTIN™ Global Trade Item Number™

HIBCC  Health Industry Business Communications Council

IAC    Issuing Agency Code
ID     Identification
IEC    International Electrotechnical Commission
ISO    International Organization for Standardization
ISO/IEC 15418 Information technology—EAN/UCC Applications Identifiers and FACT Data Identifiers and Maintenance
ISO/IEC 15434 Information technology—Transfer Syntax for High Capacity ADC Media
ISO/IEC 15459-2 Information technology—Unique Identifiers—Part 2: Registration Procedures
IUID   Item Unique Identification

JCS    Joint Chiefs of Staff
JRIB   Joint Requirements Implementation Board
JTC 1  ISO/IEC Joint Technical Committee One

LB     Issuing Agency Code for ANSI T1.220 Numbers
LD     Issuing Agency Code for DoDAAC Numbers
LH     Issuing Agency Code for EHIBCC Numbers
LOT    Text Element Identifier for Lot Number within the Original Part Number
LTN    Text Element Identifier for Lot Number within the Enterprise

MFR    Text Element Identifier for CAGE Code of the Manufacturer
MIL HDBK Military Handbook
MIL STD Military Standard
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>MILSTRAP</td>
<td>Military Standard Transaction Reporting and Accounting Procedures</td>
</tr>
<tr>
<td>MH 10</td>
<td>The US Technical Advisory Group to ANSI</td>
</tr>
<tr>
<td>NATO</td>
<td>North Atlantic Treaty Organization</td>
</tr>
<tr>
<td>NCAGE</td>
<td>NATO Commercial And Government Entity</td>
</tr>
<tr>
<td>NEN</td>
<td>Nederlands Normalisatie-instituut</td>
</tr>
<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
</tr>
<tr>
<td>OSD</td>
<td>Office of the Secretary of Defense</td>
</tr>
<tr>
<td>PNO</td>
<td>Text Element Identifier for Original Part Number</td>
</tr>
<tr>
<td>PP&amp;E</td>
<td>Property, Plant and Equipment</td>
</tr>
<tr>
<td>SC 31</td>
<td>ISO Sub Committee 31 (Automatic Data Capture)</td>
</tr>
<tr>
<td>SER</td>
<td>Text Element Identifier for Serial Number assigned by the Manufacturer</td>
</tr>
<tr>
<td>SEQ</td>
<td>Text Element Identifier for Serial Number assigned within the Original Part Number</td>
</tr>
<tr>
<td>SLIN</td>
<td>Sub Line Item Number</td>
</tr>
<tr>
<td>SPL</td>
<td>Text Element Identifier for CAGE Code of Enterprise other than the Manufacturer</td>
</tr>
<tr>
<td>TC</td>
<td>ISO Technical Committee</td>
</tr>
<tr>
<td>TEI</td>
<td>Text Element Identifier</td>
</tr>
<tr>
<td>TG</td>
<td>US TAG Technical Group</td>
</tr>
<tr>
<td>UCC</td>
<td>Uniform Code Council</td>
</tr>
<tr>
<td>UCN</td>
<td>Text Element Identifier for Unique Component Number assigned by Enterprise other than the Manufacturer</td>
</tr>
<tr>
<td>UID</td>
<td>Unique Identification; Text Element Identifier for Concatenated Unique Item Identifier</td>
</tr>
<tr>
<td>UII</td>
<td>Unique Item Identifier</td>
</tr>
<tr>
<td>UN</td>
<td>Issuing Agency Code for DUNS Numbers</td>
</tr>
<tr>
<td>USD (AT&amp;L)</td>
<td>Undersecretary of Defense for Acquisition, Technology and Logistics</td>
</tr>
<tr>
<td>USN</td>
<td>Text Element Identifier of Universal Serial Number formed by Concatenating MFR+SER</td>
</tr>
<tr>
<td>UST</td>
<td>Text Element Identifier of Universal Serial Tracking Number formed by Concatenating SPL+UCN</td>
</tr>
<tr>
<td>US TAG</td>
<td>U.S. Technical Advisory Group</td>
</tr>
<tr>
<td>VIN</td>
<td>Vehicle Identification Number</td>
</tr>
<tr>
<td>WG</td>
<td>ISO Working Group</td>
</tr>
</tbody>
</table>
UNIQUE IDENTIFICATION (UID) IMPLEMENTATION FOR NSWC CORONA - UID PILOT PROJECTS LESSONS LEARNED

NAVAL SURFACE WARFARE CENTER (NSWC) CORONA, CA
DATE: FEBRUARY 14, 2006
# STANDARD Missile and USMC Infantry Gage UID Pilot Programs
## Lessons Learned

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Executive Summary
The Office of the Secretary of Defense (OSD) tasked the Naval Surface Warfare Center (NSWC) Corona to manage two Unique Identification (UID) pilot projects. The first of these pilot projects was for STANDARD Missile and the second for the Infantry Weapon Gage Calibration Program (IWGCP). These two projects’ lessons learned have radically different obstacles to overcome. While STANDARD Missiles have explosives to mark, Gages are inert. Gages are hardened steel and have irregular shapes, whereas missiles have more forgiving surfaces to mark. The UID marks must withstand different environments; STANDARD Missiles are deployed in protective canisters in contrast to the Gages issued to combat Marines. The lessons learned are subsequently diverse.

Key Lessons (The lessons are hyperlinked to detailed narratives.)
ENVIRONMENT
Indirect marking methods are preferred for systems with HERO concerns.
NMCI requires certification for COTS UID software.
Develop server-side software, web applications where possible to avoid NMCI certification.

STATE of TECHNOLOGY
High quality marks are not necessarily expensive to produce.
Reading and verifying poor quality marks requires an expensive reader/verifier.
The software used to read or verify is the most critical aspect of a quality reader/verifier.
Many verifiers use 630 nm light sources in spite of the 660 nm requirement.

PRODUCT EVALUATIONS
Intermec’s™ 751g has many strengths and a few important weaknesses.
Symbol’s™ DS6608-HD2001 is relatively cheap and is plug and play.
RVSI’s Hawkeye™ is a great reader/verifier but is expensive.
Zebra’s S600 Thermal Transfer Label Printer is unsuitable for UID label marking.
“SQL Server 2000” is useful for providing XML files required by the UID Registry.
The Telesis Zenith-10F Laser Marking System is a remarkable tool for laser etching.

IMPLEMENTATION ISSUES
Memorandums of Understandings are needed between the OEM and the government.
Legacy hardware probably needs to be re-serialized.
Marking Legacy hardware has several issues.
Program Office complications can be the most intractable problems to overcome.
The UID Registry needs further development.
UID can provide programs considerable benefits.

Recommendations
Dispel myths regarding UID requirements.
Require the UID Registry to retain all information embedded within the UID mark.
Follow through with planned development of the UID Registry.
Establish an organic Center of Excellence to facilitate UID implementation and reduce duplication of efforts.
STANDARD Missile and USMC Infantry Gage UID Pilot Programs
Lessons Learned

Introduction
This is a final report on two Unique Identification (UID) pilot projects performed under the auspices of the Office of the Secretary of Defense (OSD) by the Naval Surface Warfare Center (NSWC) Corona Division. The purpose of these pilot projects is to demonstrate the application of UID to legacy systems and to develop an appreciation of the collateral benefits of UID.

The objectives and accomplishments of each pilot project are discussed followed by a combined lessons learned section.

Infantry Weapon Gage Calibration Program (IWGCP) Pilot Program
The Navy Special Interface Gage program started with the need for uniform inspection processes for gun barrel bores and their respective projectiles from the manufacturer to the Fleet. Physical interchangeability and mechanical interoperability are critical elements of product quality with far reaching implications for the safety, performance, and cost of weapons systems. The purpose of interchangeability is to ensure that weapon components work together seamlessly in the field of battle without selective assembly or modifications. The Navy Special Interface Gage Program is an integral part of many weapons systems and ensures that interface control requirements are met from program start to finish. The Infantry Weapon Gage Calibration Program maintains gages at NSWC Corona to support the United States Marine Corps.

Wear, distortion, or damage at the interface for any weapon system may cause the weapon to malfunction. The 26,468 gages that Corona maintains for the USMC are distributed on a regular basis to industry and Fleet customers who use them to verify the respective weapon interchangeability requirements are met and to ensure system readiness. To facilitate shipping and handling at Corona, and to mitigate the risk of unauthorized re-serialization of the Marine Corps IWGCP gages by field units, the Marine Corps has asked NSWC Corona Division to laser etch their gages with Data Matrices. As a result, the following tasks were selected for the pilot project:

IWGCP Pilot Project Objectives

<table>
<thead>
<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop the Overall Project Plan</td>
<td>Complete</td>
</tr>
<tr>
<td>Stand up Team</td>
<td>Complete</td>
</tr>
<tr>
<td>Identify Methods For Reading UID Markings On Complex Surfaces And Geometries</td>
<td>Demo pool marked, graded and able to be read</td>
</tr>
<tr>
<td>Develop A Tool To Determine Optimum Gage Pool Size &amp; Gage UID Marking Priority</td>
<td>Flowcharts finalized</td>
</tr>
<tr>
<td>Provide Gage Pool Optimization Analysis</td>
<td>Concept analysis completed, flowcharts finalized</td>
</tr>
<tr>
<td>Establish an Automated Identification Technology (AIT) System to Update the Manual Gage Tracking System (GTS)</td>
<td>Initial changes made, matrices can be read. Access to the GTS is automated at all menu points</td>
</tr>
<tr>
<td>Provide Associated Support For Laser Etcher and Scanners</td>
<td>Software support provided, UID and markings determined</td>
</tr>
</tbody>
</table>
IWGCP Pilot Project Accomplishments

- Developed methods and practices of marking infantry weapon gages. The gages range from flat surfaces to small diameter (0.223 inch) cylinders.

- Acquired the ability to read and verify a UID on irregular and reflective surfaces.

- Determined starting points, (or parameters) to mark 57 different varieties of infantry weapon gages for the 26,468 IWGCP gages.

- Invented a marking technique which ablates layers of paint to reveal the data matrix mark. Determined feasibility of using this technique on parts with delicate handling requirements. Successfully used this technique with five different types of coatings of varying thicknesses.

- Modified IWGCP database to take advantage of scanning the UID marks for data entry, which reduces errors, reduces processing time and enhances data quality.

- Initiated UID marking on 26,468 IWGCP gages.

STANDARD Missile Pilot Project

Currently the STANDARD Missile program identifies assets according to Navy standards. The Navy identification of STANDARD Missile assets has many levels of complexity and the unique identification of an asset is not always as simple as identifying a serial number. To solve this problem the Surface Missile System Maintenance Data System (SMSMDS) tracks the Navy identification of Surface to Air Missile assets according to an internal key that is cross-referenced with the other identification information. SMSMDS was established and designed to capture Surface Missile information from a variety of key sources. These sources include manufacturers and military shore activities. The information collected and the supporting applications are the foundation to Reliability Centered Maintenance (RCM) and Serial Item Management (SIM) of several weapon systems including STANDARD Missile.

Proper identification of an asset is essential to correlating pedigree and reliability prediction of the asset as well as enabling RCM. Identification of STANDARD Missile assets with UID markings and integration of that information into the existing information system, allows the exactness of UID to facilitate the higher data quality needed for both RCM and SIM.

Each time any kind of maintenance action installs, removes, inspects, tests, or services a missile, section or major component, the part number, serial number, and in some cases manufacturer lot must be entered into a computer. Manual key entry is time consuming and susceptible to error, which leads to inventory inaccuracies. These discrepancies require quality checks to ensure the errors are identified and corrected. Correction of inaccurate information results in delays, sometimes non-trivial delays, in data entering the system. In addition, part number and serial number errors prevent the correlation of data from various data sources. For example, linking inventory with reliability prediction tools.

Implementation of UID policy provides a unique identifier for the hardware from manufacturer to expenditure. This improves the accuracy of data, enhances process control and provides for
better configuration control of assets. With more accurate data, the STANDARD missile community will accomplish more accurately:

- Serialized Item Management (SIM)
- Advanced diagnostics
- Prognostics and Asset Health Management
- Reliability modeling

Implementation of UID will enable strategic and tactical decision based reliability modeling, reliability centered maintenance, prognostics, and diagnostics for the system.

There are two phases for this project. Phase I lays the groundwork for the implementation of UID. Phase II is the implementation. Overall project management and coordination is NSWC Corona’s responsibility. Tasking for this project addresses project planning and coordination, policies and procedures, information gathering, contracting, system interface, software development, testing, implementation, and training.

**STANDARD Missile Pilot Project Objectives**

<table>
<thead>
<tr>
<th>Phase I Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop the Overall Project Plan</td>
<td>Complete</td>
</tr>
<tr>
<td>Stand up Team across the community</td>
<td>Complete</td>
</tr>
<tr>
<td>Establish high level UID marking guidelines for STANDARD Missile</td>
<td>Complete</td>
</tr>
<tr>
<td>Develop initial guide for implementing MIL-STD-130L</td>
<td>In review process</td>
</tr>
<tr>
<td>Analyze UID marking requirements at Intermediate and Depot facilities</td>
<td>Complete</td>
</tr>
<tr>
<td>Initiate Procurement of UID marking equipment for selected locations</td>
<td>Awaiting Program Office Approval</td>
</tr>
<tr>
<td>Identify marking equipment training requirements</td>
<td>Awaiting Program Office Approval</td>
</tr>
<tr>
<td>Identify Navy infrastructure issues</td>
<td>Awaiting Program Office Approval</td>
</tr>
<tr>
<td>Identify top-level UID/Database integration requirements</td>
<td>Complete</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase II Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initiate and complete a Proof of Concept Demonstration</td>
<td>Complete</td>
</tr>
<tr>
<td>Deliver UID Making equipment and complete training</td>
<td>Complete</td>
</tr>
<tr>
<td>Modify existing policies and procedures to accommodate UID</td>
<td>Awaiting Program Office Approval</td>
</tr>
<tr>
<td>Implement and track program execution metrics</td>
<td>Awaiting Program Office Approval</td>
</tr>
<tr>
<td>Detail UID/Database integration requirements</td>
<td>Complete</td>
</tr>
<tr>
<td>Identify UID remaining implementation issues</td>
<td>Complete</td>
</tr>
<tr>
<td>Implement and test modifications to the information systems</td>
<td>In Work</td>
</tr>
<tr>
<td>Final Guide for Implementing MIL-STD-130L</td>
<td>Preliminary in review, awaiting additional implementation details</td>
</tr>
</tbody>
</table>
Phase II Task | Status
--- | ---
Determine additional benefits approaches enabled by UID asset tracking | In Work
Final Project report | NLT 30 September, 2006

**STANDARD Missile Pilot Project Accomplishments**

- Uploaded 58,054 “end products” records to the practice registry via File Transfer Protocol (FTP) of Extensible Markup Language (XML) files.
- Uploaded 4,000 “new embedded” records to the practice registry via FTP of XML files.
- Configured and successfully tested the network connection to the real registry.
- Modified the legacy database to render dynamic data reports via the web utilizing scanned UID marks.
- Created a web-based interface with the database which allows dynamically creating data matrices and printing of UID Labels remotely for specific hardware.
- Created a web-based interface which generates the necessary XML files needed for UID Registry updates when virtual UIDs are converted to actual UID marks.
- Created a web-based method of verifying XML files are structured in compliance with the UID Schema 3.0.
- Developed stand alone software to generate data matrix symbols.
- Developed stand alone software to decode data matrix symbols. This software is used to determine the position, keyboard keystroke equivalent, KeyCode, KeyValue, displayed character, and ASCII value for each character encoded in a data matrix symbol. This is valuable in verifying the non-printable characters within a UID mark are present and correct.
- Established a Radio Frequency (RF) network, utilizing the RF and Web-browsing capabilities of the Intermec 751g and a laptop computer. UID marks are able to be scanned and wirelessly connected to a database which provides custom reports to the Intermec 751g.
- Reviewed acquisition contracts and polled the community of interest to determine the list of STANDARD Missile assets requiring UID marking.
- Performed a survey of the Naval Weapon Station Seal Beach STANDARD Missile Intermediate Level Maintenance Facility (ILMF), STANDARD Missile hardware and missile processing.
  - RVSI (now Siemens) provided a report of recommended marking solutions.
  - Raytheon Missile System provided an independent report of recommended marking solutions.
- Performed a feasibility study of the use of UID enabled data. The study developed Bayesian models for diagnosis; models that, with additional work, can be extended to prognosis. The results of the study were documented in a technical paper¹.

Pilot Projects Programmatic Lessons Learned

This section deals with programmatic lessons learned. Like any coordinated activity that cuts across agencies, organizations, companies, most of these lessons learned involve “people” issues. Since UID is just beginning to impact programs, education is needed to overcome initial reactions, myths, and misunderstandings.

- A key decision maker within the STANDARD Missile Program Office transitioned to a different position during the Pilot Project. This transition left the position open to be filled. In absence of government personnel in this position, contractor support personnel very familiar with the Program are heavily relied on for support. The transition did not adequately address the UID Pilot Project, its status, purpose, or agreements made prior to the transition. In retrospect, this transition represented an enormous risk and has proven to be the biggest impediment to progress thus far. A lesson learned, which is hard to overstate, is to anticipate program office changes and expend sufficient effort to ensure smooth transitions of key personnel.

- Currently Raytheon Missile Systems (RMS) provides STANDARD Missiles to the US Navy under contracts requiring the missile to be installed into a Vertical Launch System (VLS) canister. The contract also requires the combination to pass integration testing. The canisters are provided to Raytheon as Government Furnished Equipment (GFE). Coordinating UID requirements across these two separate program offices (STANDARD Missile and VLS) has required more time and effort than initially expected. Exactly how to divide responsibilities for marking a canister with a STANDARD Missile inside are not intrinsically clear.

- UID enhances SIM and Continuous Process Improvement (CPI). Incorporating the UID into the IWGCP process capitalizes on areas where we can optimize and save valuable resources. Also, because UID enhances database integrity and reliability, data analysis is improved.

- The STANDARD Missile Program Office considers knowledge of the complete STANDARD Missile stockpile classified information. Other missile systems do not consider knowledge of their stockpile to be classified information. Since the UID Registry is an unclassified database, the STANDARD Missile Program Office feels that uploading the required UID information would compromise security regulations.

- Misinformation about UID policy abounds. In meetings with STANDARD Missile Program Office personnel, the question was asked whether or not legacy hardware was required to be marked. Several people offered the incorrect, albeit firmly held position, that the legacy hardware did not need to be marked. Given two answers, the Program Office chose to believe the more convenient answer. The time and energy required to set mistakes right is not trivial and is best avoided with effort up front.
UID Specific Lessons Learned
This section deals with the lessons learned that are specific to the requirements, policies, and standards associated with the UID program.

Registry Issues
- The UID Registry is a database hosted in Battlecreek Michigan. It is the repository of all UIDs DoD-wide. A requirement of the UID policy is to upload to the UID Registry a defined set of data specific to each asset on which a UID mark is applied. There are three methods by which data is uploaded: through the Wide Area Workflow, through a World Wide Web interface, or via FTP of XML files. Currently, the only practical way to upload UID information to the Registry for legacy hardware is via FTP of XML files.
- There is some limit to the size of FTP files the UID Registry is capable of handling. A 35 Megabyte file was too large.
- The method for removing records from the UID Registry is not automated. The process would likely be overwhelmed if many (tens of thousands) records were uploaded incorrectly.
- If an asset such as a missile were expended or scrapped, there is no “death record” update available to send to the UID Registry to remove the asset from inventory.
- Checking uploaded information on the UID Registry is very time consuming. Currently the only method for checking the correctness of submitted data is to use their website to look at the details, one record at a time. Checking is therefore, very labor intensive and prone to human errors.
- The Web interface method of uploading data to the UID Registry is limited in that its interface is designed for manual input of data. Manual input is both slow and error prone and diminishes the usefulness of this uploading method.
- A UID is an appropriate string of ASCII characters encoded into a Data Matrix symbol. Any appropriate string of characters will be both universally unique and in compliance with MIL-STD-130M, which specifies two ways of constructing the string of characters. They are named “Construct #1” and “Construct #2”. Within each of these constructs there are specified data qualifiers which further refine exact requirements of the string used to make UIDs. “Construct #1”, data qualifier “25S” was found to be a very useful option for re-serialization. It’s also very useful for minimizing the Data Matrix size. Re-serialization is important when the population of the hardware requiring UID marks has duplication in CAGE code, part number, and serial number. Minimizing the size of the UID Data Matrix is important where marks must be made on very small items or on a surface with a tight curve.
- If a single command takes responsibility for re-serializing hardware for different programs and uses their DODAAC as an enterprise identifier, there is a high risk of duplication of UID information. This problem was avoided by fabricating program codes to embed into the re-serialization string. Another solution would have been to obtain separate DODAACs for each part of the command responsible for issuing UIDs.
• Information Systems would benefit if documents they process (viz. DD250, and shipping docs) had the UID Data Matrix printed on them ready for scanning.
  o DD250s, for example, could have on them the UID symbol(s) for their specific hardware. This could automate some of the processing of the documents.

Marking, Reading & Verifying Processes
These processes constituted the core of the lessons learned.

• The marking process requires verification of the quality of the UID mark. From a vocabulary point of view “reading” a mark is different from “verifying” a mark. Reading a mark delivers the encoded information in the mark. Verifying a mark measures various quality metrics of the mark, such as, contrast and squareness. The quality of the mark is based on the measured values of these metrics.
  o MIL-STD-130M specifies 660 nanometer light (red light) be used in verification of the UID mark. Several of the currently available verifiers come with 630 nanometer light emitting diodes (also red light) used to illuminate the UID. This difference presents an unknown risk, but can be entirely avoided by checking this specification before buying.

• When/If the UID becomes essential to the processing of the hardware through an Intermediate Level Maintenance Facility (ILMF) or equivalent, damaged UIDs will require replacement. It will then be useful if the ILMF has marking equipment and the information necessary to regenerate the original UID mark. Currently the UID Registry does not require or retain enough information to reproduce the original mark. The information to uniquely distinguish the part is in the Unique Item Identification (UII). The UII does not, however, carry with it the semantics and metadata carried in the original mark. For this reason, STANDARD Missile will need a Memorandum of Understanding between The Naval Weapons Station Seal Beach and RMS specifying a method of transferring the original content of the UID mark from Raytheon to Seal Beach. If the UID Registry required, and maintained all of the information embedded in all UIDs, many programs would avoid this problem.

• A Memorandum Of Understanding needs to specify how to tell the difference between two types of new-build hardware. In one case the hardware would be delivered with a UID mark, the other without the UID mark (some hardware comes from older contracts without a UID requirement). The problem revolves around the Virtual UID (VUID). The VUID consists of constructing the UID information and submitting it to the UID Registry before the hardware is available for marking. Legacy STANDARD Missile hardware currently deployed aboard ships would fall into this category of hardware unavailable for marking. During normal maintenance processing, the legacy hardware would be marked at the ILMF. New hardware, delivered without a UID will need a VUID submitted to the UID Registry until the maintenance cycle brings it in for marking. New hardware delivered with UID marks will not need such a VUID submission. In fact, it would be bad to submit the VUID record for hardware already marked and registered because it would create two Registry records for the same hardware. Double counting hardware must be avoided.
  It would also be possible to avoid this problem by modifying the currently active contracts to require UIDs.
Database Lessons Learned
This section’s lessons learned are when using the UID in an extensive database.

- UID establishes the basis for advanced Serialized Item Management (SIM) and Continuous Process Improvement (CPI). Incorporating the UID into the IWGCP database created opportunities for optimization. These optimizations allowed savings to be identified, made, and incorporated. Greater database integrity naturally results from implementation of UID. UIDs, scanners, and a suitable database form the infrastructure to electronically enter data, so human typing errors can be eliminated. The infrastructure allows CPI points to be exploited, and allows optimization of hardware processing through thorough analysis.

- The format and construction of the UID marks applied on new build versus legacy hardware should be as similar as possible, but in practice will probably need to be radically different.
  
  RMS has an enterprise-wide view of UID. They have adopted as a basis for the uniqueness of the UID the following information: the CAGE code for Raytheon, the part number, and the serial number of the hardware to be marked. They have decided upon data qualifier “17V” utilizing format “06”. There are many issues to marking legacy hardware with UIDs in an identical fashion. Many revolve around using Raytheon’s CAGE code on hardware fabricated at non-Raytheon facilities. These issues and problems were never addressed because a bigger, intractable problem associated with utilizing an identical marking philosophy emerged.

  Within the currently active body of STANDARD Missile hardware, several instances of duplication of CAGE code, part number, and serial number exist. Given the uniqueness requirement for each UID, legacy hardware will have to deviate from the current marking philosophy of Raytheon. The most direct solution to the duplication problem is to use the identifying number found in STANDARD Missile’s maintenance database (the “key_id_no”). To implement the database’s identifying number as the basis for uniqueness, the data qualifier “25S” can be used along with the Department of Defense Address Activity Code (DODACC) for NSWC Corona as the issuing entity for the number. In this, the database identifying number represents “re-serialization” of the hardware.

  It may occur to the reader, that Raytheon could deviate from their philosophy for uniqueness in order to preserve congruency. The Sep 23, 2004 UID Policy stipulates, “Solicitations will not specify the UID construct or the type of data qualifiers to be used by a contractor.” Raytheon’s UID construct philosophy also spans several programs beyond STANDARD Missile. Requesting such a change will destroy efforts for common processes across Raytheon and should be avoided.
Legacy Hardware Lessons Learned

Legacy issues are important because they both comprise the vast majority of current hardware and because they have been marked and processed in a variety of ways unaffected by UID policy until now.

- Re-serializing is the best way to manage H/W with serial number duplication.
- Using the Original Equipment Manufacturer (OEM) CAGE code on legacy hardware requires coordination with the manufacturer to ensure no duplication between legacy and future build hardware arises. The OEM is likely to resist this because it presents risk without benefit to them.
- UID placement on legacy equipment requires some flexibility. Previous gages utilized a variety of methods to mark the serial number. The placement of the UID and any human readable information is varied and requires time and flexibility to find an appropriate placement.
- Although not unexpected, deployed STANDARD Missiles are full of highly energetic explosives; this constrains how they are marked with UIDs and even how those marks are verified and read. Any processing done to the missile needs approval and, in some cases, certification. Electronic equipment may emit Radio Frequency (RF) energy which could damage electronics or initiate some of the energetics found inside the missile. Thus, electronic equipment (computers, printers, scanners, verifiers, lasers, etc.) require a Hazards of Electro-magnetic Radiation to Ordnance (HERO) certification prior to use in the processing of STANDARD Missiles. Any direct part marking solution for STANDARD Missile will require time, effort, and money to obtain appropriate certifications, so indirect part marking solutions are preferred for legacy hardware requiring HERO certification.
  - Printing labels outside of the production environment and bringing the labels to the missile eliminates the need for HERO certification for the UID generating device. In addition, label application procedures already exist for STANDARD Missile and can be leveraged for UID labels.
- There are three categories of STANDARD Missile hardware that require UID marking. There is a sizable collection of legacy hardware that is in the government’s possession and can be marked in a variety of ways at the government’s discretion. There will be hardware procured under contracts stipulating the DFARS clause 252.211-7003 requiring UID markings upon delivery. For these pieces of hardware, the UID construction and marking decisions rest largely with the prime contractor, Raytheon Missile Systems (RMS). The third category is for hardware yet to be delivered under old contracts without the DFARS clause requiring UID. For this hardware, the government can wait for delivery and then mark the hardware per established procedures or contracts can be modified to include the UID upon delivery. It is important to realize that all of this hardware will eventually co-mingle in ships, depots, and intermediate maintenance facilities. With this setting, consider the following lessons learned:
  - The types of hardware to be marked for each category should be the same.
  - If possible, the location of the mark on similar hardware should be the same, i.e. placement of the mark on newly built guidance sections should be the same as the placement of the mark on legacy guidance sections, etc. To match the
location exactly however, original identification marks on legacy hardware will be covered or obliterated. Destroying this information imparts a certain level of risk. It is unreasonable to believe 60,000 or so individual pieces of hardware will be marked without ever applying the right UID to the wrong hardware. Clearly, retaining the ability to verify, after the fact, that the UID applied to a piece of legacy equipment is indeed the appropriate UID seems important. For this reason the UID should be applied as near the original identifying marks as possible without obstructing them.

- For legacy equipment, a single location of UID marking is not always feasible. As example, in marking the IWGCP gages, multiple locations had to be used to avoid impacting the usability, and function of the gage.
- Technical drawing packages will need modification to accommodate the new markings.

Government Related Lessons Learned
The lessons learned in this section relate to government specific and in some cases US Navy specific issues.

- The Navy/Marine Corps Intranet (NMCI) is an extremely large network of computers run by non-governmental personnel spanning the Navy and Marine Corps. NMCI has many beneficial goals; one among them is to provide configuration management discipline. This discipline is wrought through a series of policies and procedures. The set of policies and procedures preclude installation of non-certified software on standard NMCI computers. There exists a process to certify software, given here in brief:
  1) Register the software in three databases
     i) Department of the Navy Application & Database Management System (DADMS)
     ii) ISF (Integrated Solutions Framework) Tools
     iii) NMCI Application Response System (NARS)
  2) Have the software “packaged” by the Ladra Lab
  3) Have the software tested by the Ladra Lab for conflicts with other software, malicious code, and hardware compatibility.
  4) Draft a System Security Authorization Agreement (SSAA); which is a process unto itself.

Software required for verification of UID marks, and drivers necessary for marking devices, etc. will need to go through the approval process for Navy and Marine Corps facilities responsible for marking legacy hardware.

- Software certified a few years ago took 2 years. Improvements to the process have reportedly reduced this time to 3 to 6 months.
- The cost to certify software is approximately $15K to $20K.

- Once specific software has been approved, it is approved for other sites that would want/need to use it. The registration of the software in various databases provides a method for other Navy sites to determine if desired software has already been approved. The system to determine if approved software exists that meets a functional need, does
not work well. One can find out if a specific piece of verification software is approved, but not if there is any, unnamed, software already approved to verify UIDs. The need for such functional cross-reference lookup is known and is currently being worked.

- Another important aspect to consider is software revision. If verification software is changed (possibly to comply with changes in MIL-STD-130) the new software version is no longer NMCI certified.
  - The revised software, in theory, should go through the entire certification process again to be useful.
  - Software that is written to run on a Web Server, so that distant users of the software do not have to install any Dynamic Link Libraries (.dll) or executable code, can avoid the NMCI certification process. Where possible, Server-side applications should be used.
    - Interfaces with legacy databases should use a Server-side application.
    - Interface with the UID registry should use a Server-side application.
    - Drivers for specific hardware (printers, verifiers, lasers, etc) are not suitable for Server-side applications.

**Technical Assessment Lessons Learned**

This section deals with the lessons learned as part of the assessment of the technology involved in the UID pilot projects. This section highlights areas where a growth in the technology is needed.

- Readers and verifiers are not always economical and practical. While an extensive search to find both readers and verifiers that fit these requirements was completed, only one was able to accomplish the mission. It was over $6,000 and even then the company speculated that it would not meet the specified requirements.
  - On the practical side, we found that expensive fixtures or hand-made tooling is required to read and grade most of the Marine Corps’ gages.

- Stretching the technological bandwidth: Industry did not always have solutions for our needs. Not only did verifying software (or the verification standard for UIDs) require modification, but the reader also required custom light sources, setup, and other modifications to make reading/verifying the UID possible.

- Industry software solutions have not caught up with technology. Grading UID markings created by laser etching is tedious and time consuming. On flat, reflective surfaces, getting a passing grade is especially labor intensive. On surfaces that are rounded or having irregular shapes, it is virtually impossible to get passing grades on verifying equipment that is economical and easy to use.

- Laser etching is not optimal for all surfaces. Laser etching is a great method to use on flat surfaces; however, on rounded and irregularly shaped surfaces, the reading of the etched matrix presents variable conditions that are difficult to overcome. Custom fixtures and enhanced optics are helpful but still need improvement.
The laser beam etches on a flat plane, adapting this flat plane etch to round or irregular shapes requires compromises and trade-offs. Experience is invaluable in this respect. While the UID may be able to be read reliably, it is rarely able to achieve a passing grade when verified.

- Marking on surfaces that have tight tolerances: The laser creates heat that can change the characteristics of the surface. The heat can, in some cases, warp small diameter gages, making them unusable. Creating a UID on a gage, while keeping it within tolerances requires care and experience.

- Reading UID marks is based on obtaining an optical image of the mark. Readers are therefore very similar to digital cameras. The quality of any reader is based on a small number of factors:
  - The number of pixels (or pixel density) of the Charged Coupled Device (CCD) used in the reader. There are two varieties that we encountered, low density and high density. High density works better than low density.
  - The light source. A diffuse, single-color (red) light that provides even illumination of the mark from all directions is preferred for marks with inherent contrast (such as black on white labels). For marks without inherent contrast (such as direct part marking, dot-peen, laser etch, etc.) the light source is very important in generating contrast for the optics to capture.
  - The software. The software used to decode the UID determines more than anything else, the effectiveness of the reader. The 751g currently has (Intermec even admits it) very basic software used to read the mark. RVI (now Siemens) currently has the best software available to read the UID mark. Good software can handle three or more levels of brightness in the image of the UID by comparing brightness levels and anticipating information. The software is able to anticipate information because of the embedded error correcting code in the UID mark and the defined semantics used in assembling the content of the UID. Other software enhancements also exist.
  - The bottom line is the software is far more relevant to the quality of reader than either the CCD pixel density or light source because the CCD and light sources across various readers are frequently very similar in performance. Software improvements can be expected as time allows development of more sophisticated algorithms.
    - It may be wise to invest in upgradeable readers in anticipation of software upgrades.
    - Purchase of hardware should include software upgrades if possible.
    - Purchase of high quality marking technology should be tempered in light of expected improvements in readers.

- There is a trade-off between quality of mark and quality of reader that programs ought to address. In general, an expensive reader can read a poor mark and a cheap reader can only read a high quality mark. In some cases, like direct part marking on very small, round, steel gages, it is impossible to create high quality marks due to the reflectivity and shape of the asset. In this case, a high quality reader is necessary. High quality marks
are not necessarily expensive to produce, however. For STANDARD Missile, adhesive labels provide an inexpensive method for producing high quality marks, allowing the benefit of inexpensive readers.

- The Intermec 751g is a handheld computer capable of reading a UID mark. The following are interesting and useful facts to know about the 751g with respect to UID implementation:
  
  - The Intermec 751g has obtained HERO certification.
  - It is available to government agencies through an AIT III contract. The price is roughly half of the commercial (the 751 without the “g”) price. It costs $992 and comes with 256MB extra memory, an extra battery, a spare stylus, and a charging station (A scan handle is $10 more and recommended).
  - The 751g is a reasonably powerful computer, which runs Microsoft’s Windows CE operating system. Programming the 751g is possible in order to customize its interface with other systems.
  - The 751g can be networked wirelessly through a Radio Frequency (RF) link. This allows untethered data transfer to and from the 751g.
  - It has an adapter giving it Radio Frequency Identification (RFID) capabilities. We did not test this feature, however, and cannot comment on performance.
  - The 751g can also read standard bar codes, and in theory can be programmed to read any optical mark.
  - The UID mark has to be high quality, flat, and reasonably sized (0.5” x 0.5” to 1”x1”) for the 751g to read it reliably. Software upgrades for the 751g are promised to enhance its ability to read UIDs.

- The Symbol DS6608-HD2001 is a hand-held reader/scanner which comes with a Universal Serial Bus (USB) connection. Here are some lessons learned about the Symbol Reader:
  
  - The driver software comes standard in Windows OS. All other software is embedded in the Symbol reader. This is very useful, because it means that it will function on NMCI computers without any certifications. It is truly “plug and play.”
  - The Symbol reader reads many formats (data matrices, barcodes, the 2-D barcodes used on UPS packaging, and the 2-D barcode on the front of Common Access Cards (CAC)). The output of all this reading is a text string inputted into the computer as if the keyboard had typed the text.
    
    - This “keyboard wedge” feature can be used to integrate this type of reader into a legacy system that requires manual keyboard entry without altering any programs.
  - The Symbol reader easily reads big or small, flat, high contrast UID marks, but fails to read UIDs on small, shiny, tightly curved surfaces. The Symbol reader will also read UID images straight from a computer monitor.
Green UID images on a computer screen are more reliably read than other colors. Using a reader on a UID image displayed on a computer screen allows instant validation of UID data in development scenarios.

- RVSI’s Hawkeye was the only reader examined, capable of performing verification of UID marks. The Hawkeye’s ability to read a UID matrix is tremendous. It is the only reader capable of reading UIDs on the small, round, shiny Marine gages. There are a few drawbacks with the Hawkeye. The cost is a fair bit more than the Intermec and a lot more than the Symbol. The Hawkeye’s software must be loaded on a host computer which means NMCI certification for Navy and Marine Corps facilities. Lastly, the Hawkeye connects to a computer through an Ethernet port. Although it is not terribly difficult to configure, it is not intuitive, and so requires training or support.

- NMCI has one approved thermal transfer printer to make labels, the Zebra S600. Unfortunately its 203 dots per inch (dpi) resolution is insufficient to create UID marks on labels of high enough quality to read reliably or pass verification. In theory a 24 x 24 data matrix used as a UID mark encoding up to 34 characters should take an area of 0.54” x 0.54.”

  - RVSI (now Siemens) has an Excel spreadsheet which is useful in calculating the size of UID marks necessary for verification given the resolution of the printer to be used, the number of characters to be embedded in the mark, and the number of bits in the rows and columns of the data matrix of the mark.

  - Raytheon has used a “Brady Thermal Transfer Printer” with 600 dpi resolution with reported success. 600 dpi is the highest resolution commonly available.

- Microsoft markets “SQL Server 2000” which is a database capable of automatically producing XML files. For government agencies with many (thousands of) records to upload to the UID Registry, using FTP to upload XML files is the only practical, allowable method. This very useful feature requires the database tables to follow a structure suitable to the intended schema. Currently the UID Registry is using Schema 3.0.

  - The connection required to upload the XML file to the UID Registry requires a static Internet Provider (IP) address.

    - [http://whatismyip.com](http://whatismyip.com) is a website useful to determine the current IP address on a computer.

- Verifying the XML file against the schema can be done using third party software such as “XML Spy.” Certification issues with NMCI caused us to develop server-side software to verify XML files generated through our web interface to the database.

Marking, Reading and Verifying Lessons Learned

The lessons learned in this section come mainly from the IWGCP pilot project. Varying types of hardware were marked to develop a knowledge base.
General Comments

- Costs associated with UID marking vary, while some surfaces require very little attention, some require intensive intervention, especially on legacy hardware.

- There is a trade-off a program must make between quality of mark and quality of reader. In general, an expensive reader can read a poor mark and a cheap reader can only read a high quality mark. In some cases, like direct part marking on very small, round, steel gages, it is impossible to create high quality marks due to the reflectivity and the shape of the asset to be marked. In this case, a high quality reader is necessary.

- Industry did not have solutions for all identified UID problems. Not only did verification software require modification; but also, the reader required a custom light source, setup, and other modifications to make reading/verifying the UID possible. There is not a COTS solution addressing the issue of marking equipment with highly reflective and irregular surfaces.

For the study, a Telesis Zenith-10F Laser Marking System was used. Below are the physical characteristics:

<table>
<thead>
<tr>
<th>Laser Type</th>
<th>Ytterbium (Yb) Fiber Laser</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser Source</td>
<td>Diode-Pumped, Fiber-to-Fiber, Pulsed</td>
</tr>
<tr>
<td>Power</td>
<td>10 Watt</td>
</tr>
<tr>
<td>Lens</td>
<td>160mm</td>
</tr>
<tr>
<td>Focused Spot Size</td>
<td>25 microns</td>
</tr>
</tbody>
</table>

The Zenith-10F laser has many controls which can be manipulated, but uses three main ones to control etching (viz. speed, intensity, and frequency). For the type of etching we needed, controlling the laser was even simpler because the Zenith-10F system controls the frequency.

Marking

- Laser etching is an art, not a well defined science at this point. Contrast, lighting, materials, surface geometries, speed, focus, insensitivity to etching, etc., affect the ability to etch the UID matrix. Each surface comes with its own characteristics; hardness; surface type – is it chrome, stainless steel, tool steel, etc.; and geometry are just few that we had to consider. Speed, intensity, density, and focus were the best four variables in obtaining a quality UID matrix. Generally, a density setting of 850, with a starting speed of eight, and intensity set at 75 to 80 would be a good starting point to etch a UID matrix. Also, multiple passes worked well in using lower power settings. A unique characteristic of the focus is created when you are out of focus by 1/8 inch, increase the intensity to 100%, and slow the speed down to one or less. This creates a black mark and it is not etched into the surface. However, the mark is slightly blurred and harder to read and verify. Telesis representatives describe this as the “annealing” characteristic of the laser. To analyze the UID matrix, the etch was magnified 50 times using a video measuring microscope system. Some of the etching variables are discussed later. A break down of each variable follows in Table 1:
### Table 1 Laser Etching Variable

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>CHARACTERISTICS</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPEED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SLOW</td>
<td>FAST</td>
<td></td>
</tr>
<tr>
<td>More Detailed</td>
<td>Less Detailed</td>
<td>At faster speeds, square corner became rounded affecting the UID matrix readability</td>
</tr>
<tr>
<td>Lighter Etch</td>
<td>Heavier or Bolder Etch</td>
<td></td>
</tr>
<tr>
<td><strong>INTENSITY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LESS</td>
<td>MORE</td>
<td></td>
</tr>
<tr>
<td>Lighter Etch</td>
<td>Deeper Etch</td>
<td></td>
</tr>
<tr>
<td>No Crater Effect</td>
<td>More Crater Effect</td>
<td>Crater is the raising of the sides of the etch (much like a crater)</td>
</tr>
<tr>
<td>No Bubble Effect</td>
<td>More Bubble Effect</td>
<td>Bubble effect is when the material bubbles up in the middle of the etch</td>
</tr>
<tr>
<td><strong>DENSITY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LESS</td>
<td>MORE</td>
<td></td>
</tr>
<tr>
<td>Less Clarity</td>
<td>More Clarity</td>
<td></td>
</tr>
<tr>
<td><strong>FOCUS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN</td>
<td>OUT</td>
<td>Out of focus by 1/8&quot;, “anneal” effect created</td>
</tr>
<tr>
<td>Clear Etch</td>
<td>Blurred Etch</td>
<td></td>
</tr>
</tbody>
</table>

- **Marking on surfaces that have tight tolerances:** The laser creates heat that could change or warp the characteristics of the gage. For example, an M-16 rifle uses a gage that checks the straightness of the barrel. This gage is a straight rod of hardened steel that cannot be bent more than .0002 of an inch over six inches. The laser creates enough heat to warp the gage and make it unusable. To create a UID and still keep it within tolerance is possible, however, care and knowledge are required. Etching the UID in the middle of the gage, bends it and renders it useless. This was true in all cases when the variables were set to get a readable UID matrix. However, by etching close to either end of the gage, using lower power and speed settings, the matrix could be etched without warping the gage. UID placement on most gages has to be precise. By incorporating a gage inspector (or engineer) and the user early in the planning stages of the UID process, areas that could be etched without damaging the gages were identified.

- **Etching rounded or irregular geometries:** The laser beam etches on a flat plane (see Figure 1), to use laser etching to create a UID on rounded or uneven surfaces; this must always be kept in mind. While the UID maybe able to be read reliably, it is almost always never able to achieve a passing grade when verified. On large diameter gages, this was not an issue. Adaptations were found to minimize the “roundness” effect by changing the UID matrix shape and etching down the plane of surface (see Figure 2). Most venders recommend etching no more than 1/6 of the diameter of the surface, while it was observed that this limit could be stretched to 1/5 the diameter and still get readable results on the small diameter gages.
• Small irregular surfaces require different methods of etching to create the data matrix. For example: An etched matrix (in contrast to an “annealed” matrix) is clearer but could create a raised or “bubbled” surface, or a crater effect if burned too hard (see Figure 3 below). However, using the “annealing” process, the matrix will not mar or score the surface. Conversely, the “annealed” UID is less clear, or blurred, and it may not withstand the longevity requirement of MIL-STD 130M. You must know not only how the item is used, but also the best way to etch the material. For the IWGCP small gages with rounded surfaces, a combination of the two processes (annealing and etching) was most effective. This tandem process created a way to etch the UID onto the gage and maintain the necessary tolerances.

• “Blasting” or high-powered laser etching is not a good technique (refer to Figure 3). Care had to be used when laser etching the UID matrix to avoid “blasting”. “Blasting” creates a bubbling effect on gages that raises the surface area. As a rule of thumb, low speed and low power was a good combination on most surfaces to start. However, because some material could not be etched using the low power/low speed combination, different combinations had to be experimented with, to obtain a useable UID matrix. A blend of knowing the laser’s characteristics and the materials to be marked is for success.
UID placement on legacy equipment requires flexibility. Previously serialized gages used a variety of means to mark the serial number. The placement of the UID matrix and any human readable information often must work around these vestigial marks and so, is varied and time consuming. Of the 26,468 IWGCP gages, only a few have the space to accommodate both the human readable information and the UID matrix. Also, legacy gages are manufactured over many years, with materials and configuration changes. Multiple speed and power settings must be used to accommodate these variations. Etchings cannot be placed on critical surfaces (measuring surfaces), which further limits placement options. Matrix size and shape plays a very important role. Changing the shape and size of the UID matrix is an invaluable tool to meet the marking requirements on such diverse hardware.

Surface color and texture is important. On machined surfaces that are black, grey or metal in color, different techniques are used get a readable matrix. Usually, a square, blank pre-etch (about the same size or larger then the UID) can overcome this obstacle. The pre-etch is then followed by the UID matrix. In some cases, by using a reverse image scheme, we would get the desired quality for the UID matrix. A chrome or stainless steel gage needs only one technique to etch the UID successfully. On surfaces that were painted or that were coated, the color determined the speed, intensity, and sometimes the frequency of the beam to have a successful etch. For example, blues were most difficult and required low speed and high intensity to etch, while yellow could never be etched. Greens and reds are comparatively easy to etch and will render acceptable marks with almost any speed/intensity settings.

Unique methods of creating the UID matrix: Creating a UID by ablating (selectively removing) the top layer of paint from a different colored bottom layer of paint is one of the unique ways. This method can be used when the asset’s surface cannot be directly etched. Test patterns (normally available from the laser vendor) were used to determine the best combination of intensity, speed, frequency, density, etc. Using only one overall power setting and density; with multiple speeds on a grid was the most effective way of determining which settings to use (see Figure 4). Once the best combination was determined, the matrix then could be etched without harming the integrity of the material.
Read / Verify

• To read the UID Matrix, on highly reflective surfaces, innovation was required. Some shiny metal gages although marked with matrices that looked great, almost flawless, were unreadable. Under a five power magnifying glass; no flaws were detectable, but the matrix still could not be read. Experimentation showed that when the flat, highly reflective surfaces were tilted at a slight angle, successful reading of the mark was achieved. Even better success was achieved by taking common tissue paper, wetting it, and placing it over the UID matrix (tamping it down lightly, careful to get out all the wrinkles), then reading the mark. In nearly all cases, the UID matrix could be read, even on the small rounded surfaces. These methods are now being adapted to the production environment.

• Industry software solutions have not caught up to UID needs. Grading UID markings created by laser etching is tedious at best. On flat highly reflective surfaces, verifying with a passing grade is labor intensive. On surfaces that are rounded or that have irregular shapes, it is virtually impossible to get passing grades (at least on the verifying software and equipment that is economical and easy to use.) We found only one available verifier that could read the rounded surfaces, RVSI’s Hawkeye 1525HD with an external light source at a cost of $6K plus. Incidentally, RVSI’s corporate office was not sure that it would resolve the irregular shape issues. Work continues to come up with methodologies to obtain a verifiable, and readable UID matrix. Even when the UID matrix can be read reliably, verifying the mark with a passing grade is still a challenge. The long-term solution to the verification problem will require additional effort, changes to vendor software, and possibly changes to marking/reading/verifying requirements.

• In this study, it was found that is was possible to etch the most ancient of all missiles, the granite rock. Although missile technology has advanced significantly beyond the use of granite, the mineral is still commonly used in metrological benches and will eventually need to be marked. The mark was not initially readable. Further effort, however, found application of high-contrast paint followed by a good wiping (filling just the etchings) worked. This illustrates that you can etch a UID matrix on most anything, but reading and verifying it remains a challenge.
Conclusion
Both pilot projects provided numerous, complementary, lessons learned. Each project has some open items that will take additional effort to resolve. Some of these open items are the result of deficiencies in hardware and software; others just require long-term effort to resolve. UID related technology should be monitored on a continuous basis to find solutions to these open items and take advantage of new technology.
Recommendations:

- Create streamlined, robust methods for removing records from the UID Registry.
- Create streamlined, robust methods for editing records from the UID Registry.
- Create a designation within the UID Registry indicating the removal of hardware from the national inventory (the so-called “death record”).
- Create a robust method for data providers to query their data within the UID Registry to provide a quality assurance function.
- Embed the UID Symbol on hardware processing documents for custody transfers, shipping, etc.
- The UID Registry should require, and maintain all of the information embedded in the UID marks.
- Establish a Center of Excellence so that manufacturers and organic depots embarking on efforts to mark common assets may avoid duplication of analysis.
- Establish a highly publicized, easy to navigate, repository for lessons learned.
Acronyms

.dll Dynamic Link Libraries
AIT Automated Information Technology
AIT III the US Army’s Automatic Identification Technology III contract
ASCII American Standard Code for Information Interchange
CAGE Commercial and Government Entity
CCD Charged Coupled Device
COTS Commercial off the shelf
CPI Continuous Process Improvement
DADMS Department of the Navy Application and Database Management System
DFARS Defense Federal Acquisition Regulation Supplement
DoD Department of Defense
DODAAC Department of Defense Address Activity Code
dpi dots per inch
FTP File Transfer Protocol
GFE Government Furnished Equipment
GTS Gage Tracking System
H/W Hardware
HERO Hazards of Electro-magnetic Radiation to Ordnance
ILMF Intermediate Level Maintenance Facility
IP Internet Provider
ISF Integrated Solutions Framework
IWGCP Infantry Weapons Gage Calibration Program
NARS NMCI Application Response System
NAVAIR Naval Air Systems Command
NAVSEA Naval Sea Systems Command
NLT No Later Than
NMCI Navy Marine Corps Intranet
NSWC Naval Surface Warfare Center
OEM Original Equipment Manufacturer
OSD Office of the Secretary of Defense
RCM Reliability Centered Maintenance
RF Radio Frequency
RFID Radio Frequency Identification
RMS Raytheon Missile Systems
RVSI Robotic Vision Systems Incorporated
SIMSerialized Item Management
SMSMDS Surface Missile System Maintenance Data System
SSAA System Security Authorization Agreement
STANDARD STANDARD in STANDARD Missile is not an acronym.
UID Unique Identification
UII Unique Item Identification
USB Universal Serial Bus
USMC United States Marine Corps
VLS Vertical Launch System
VUID Virtual Unique Identification
Windows CE Windows Consumer Electronics (operating system for portable computers)
XML Extensible Markup Language
Marine Corps Maintenance Center Albany

Moving Forward On The Item Unique Identification (IUID) Program
To improve the identification, tracking, and management of Department of Defense (DoD) assets, the Office of the Secretary of Defense has funded multiple projects, including the Marine Corps Maintenance Center Item Unique Identification (IUID) Integration Project. The initial phase of this project was completed at the Marine Corps Maintenance Center in Albany, GA, on March 15, 2006 through the successful marking of items on the 7.5-ton crane, an air mobile crane support system capable of lifting 7.5 tons and swinging 360 degrees while on stabilizing outriggers.

IUID and Marine Corps Maintenance Center

The IUID Integration Project enables better management of tangible items used in warfighter support through improved identification and tracking. By assigning each mission critical item a unique identifier, the Department has the capability to track identical items throughout their individual lifecycles and across the global supply chain. As part of this change management initiative, the Department funded qualifying Depot activities to jump start the marking process, realize lessons learned, and share experience as the program is instituted throughout the supply chain.

Beyond improving its own operations, the Marine Corps Maintenance Center Item IUID Integration Project also focuses on improvements that can be applied throughout the DoD. In order to share best practices and lessons learned throughout the DoD, the project team is documenting all implementation procedures, while demonstrating the successful application of Unique Item Identifier (UII) marking technology on Depot commodities, gaining experience, and evaluating implementation costs and schedules. Knowledge will be shared with other DoD organizations and suppliers via an After Action Report, the IUID Toolkit, and at IUID Program Forums.

Implementation Process

This IUID Pilot followed the roadmap and process outlined in the IUID Toolkit.

Development of an Item/Parts List

To implement IUID on the crane, Depot employees first developed an item list of parts for marking. The project team applied the criteria of item selection contained in IUID policy to identify which parts of the crane required marking. The policy requires that an item be marked if it meets one of the following criteria:

- Acquisition cost of $5,000 or greater
- Serially managed, mission essential, or controlled inventory equipment or repairable item, or a consumable item or material for which permanent identification is required
- A component of a delivered item deemed by the program manager to require unique identification
- A DoD-recognized IUID equivalent is available for that item

IUID Marking Technology

Following compilation of the item list, the project team evaluated the use of Commercial-Off-The-Shelf (COTS) products for marking technologies (dot peening, laser etching, chemical etching, and inkjet marking). The Depot will contribute its lessons learned to the IUID Toolkit, providing key information relevant to cost of technology, ease of use, and applicability in the DoD environment.

Marking Parts

Each item identified for labeling is being marked with a laser-etched anodized aluminum data plate. Each plate includes human-readable and machine-readable information. Templates for etching metal data plates were developed, and sample data were used to proof the plates.

Legacy parts are also marked as part of the Marine Corps IUID Project to determine what issues emerge when constructing the IUID and marking the parts (e.g., dirty, worn, original manufacturer unknown, etc.).

Reading IUID Marks

The project includes reading multiple parts — different sizes, materials, colors, finishes, shapes, etc. The four legacy parts being marked in this current phase are the crane main vehicle, the transmission, the engine, and the main boom cylinder. This phase also includes testing the ability to read parts under a wide variety of conditions — poor lighting, bright lighting, outdoors, in tight spaces, etc. This has helped the Depot to determine the time and cost of IUID reading, as well as gauge the reliability and ruggedness of the readers.

As part of the marking process, a Quality Assurance (QA)/Quality Control (QC) step has been included after parts are marked to measure the quality of the marks made in the Depot environment. The ability to read the data plate information is confirmed using a verifier and then firmly attached to the part using epoxy resin.
Data Entry
All data-entry tasks are tested using databases that mimic the IUID Automated Information System (AIS) that is being developed as part of the IUID Program.

Development of an AIS
The Marine Corps Maintenance Center is evaluating AIS software for loading data into the marking equipment that generates the data labels. The AIS (turnkey) is being developed so that it will accept the data elements as delineated in the Department of Defense Unique Identification (UID) Implementation Plan for DoD Maintenance Depots. The system in development will accept input data from keyboard and scanner devices. The system design includes generation of two-dimensional barcodes (2D) and the ability to transmit the barcodes to a variety of output devices that engrave, print, etch, and peen the 2D barcode onto the item. The system will send the IUID data elements to the UID Registry. The operation of the system will be transparent to the operator and approved by Navy Marine Corps Intranet (NMCI) for installation on NMCI computers and use on the NMCI network. This system will interface with existing DoD systems and future DoD Enterprise Resource Planning (ERP) systems when developed.

The IUID Integration Project is ongoing and consists of marking items used during the Service Life Extension Process (SLEP) being performed on the 7.5-Ton Crane. Additionally the integration of IUID procedures into existing Depot processes is being realized.

Depot Personnel Enablers
During the IUID Integration Project, special attention was paid to the shop floor personnel in order to determine the effect of this new process on day-to-day tasks. New tasks for these shop floor personnel included removing, marking, reading, and recording IUID data on the 7.5-Ton Crane. Overall, these new tasks were successfully incorporated into Depot procedures.

Training of Personnel
Four graphic artists and one engineering employee have been trained on the operation of the laser etching equipment, the printers, and the IUID AIS software.

Procedures Established
The Marine Corps is in the process of creating IUID procedures that specify for Depot personnel what items to mark and how to mark the items. A set of procedures to document workflow for marking of items was defined at the Maintenance Center and will be added to the IUID Toolkit.

Lessons Learned
This pilot includes testing and documenting procedures using various IUID part marking equipment within the Depot process in order to define procedures for future part marking and data-entry requirements. Some early lessons learned from testing the part marking methods on multiple materials include conclusions that ball peening is not viable for a painted surface, while laser etching can successfully be applied to anodized aluminum. Additionally, the use of epoxy adhesive for attaching plates has been successfully demonstrated.

Both phases of this pilot contain real-time, in-process procedures at the Depot for instituting IUID requirements, including marking equipment within the Depot process, validating the mark, using an AIS to transport the data to the IUID registry, and managing the IUID markings. These procedures will be shared with other Depot organizations through an After Action Report, the IUID Toolkit, and at UID Program Forums.

Hurdles that Have Been Overcome
The greatest hurdle to overcome was convincing people to advance from manual stamped data plates to machine-generated data plates. Software permissions have been established to extract data from multiple programs used in maintenance functions.

Benefits
The IUID program enables the DoD to reach established goals and objectives for enhanced total asset visibility, improved lifecycle item management and accountability, and improved financial audit requirements. The IUID program will eliminate the photo process for making labels, which requires multiple graphic art steps along with photo storage, and handling and disposal of hazardous materials.

Legacy data plates of the 7.5-ton crane are being replaced with new data plates that contain human readable and 2D Data Matrix instituted by the IUID program to identify items.

The IUID pilot project has transformed a World War II era Depot into a 21st Century Depot. The adoption of advanced technology at the Depot, including lasers, is a necessary evolution to support the modern warfighter. The pilot project is also demonstrating capabilities of how lasers may be used for marking serial numbers on other warfighter technology.
IUID

Item Unique Identification

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White Paper

Are Companies Ready for RFID?

A Survey of DoD Suppliers and DoD Personnel Provides Insight

December 2006
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A Survey of 300 DoD Suppliers and DoD Personnel

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I. OVERVIEW

Radio Frequency Identification (RFID) is expected to be one of the most influential technologies in the next twenty years in the defense industry and across retail, distribution and supply chains in all industries. It is estimated that more than ten trillion RFID tags will be in use by the year 2015.

With the high expectations placed on this valuable technology, corporations and governments need to be efficient in their adoption of RFID and have little room and budget to make the wrong choices. This publication was developed as a result of a comprehensive survey conducted in October 2006 by the RFID Solutions Center in Dayton, Ohio. The survey sought information to determine where suppliers and DoD personnel currently operate in the RFID Implementation life-cycle (described below) and to determine the greatest challenges that will arise in each phase of the life-cycle.

For more information regarding the survey or this publication, please contact Research@RFIDSolutionsCenter.com

II. IMPORTANCE OF RFID IN THE DOD

The U.S. military has been at the forefront for using active RFID tagging of containers of goods, vehicles, and equipment. However, DoD has issued the most sweeping mandate of any organization, calling for its suppliers to transition to using passive RFID in their military shipments of items of all types by 2007. This ambitious step is being taken as part of an overall strategy to enhance visibility and control over the complex and far-flung supply operations necessary to support the U.S. military's global missions.

The DoD’s RFID mandate, alongside Wal-Mart's, is considered the catalyzing event in RFID, with the projected demand for RFID products and services coming from the 43,000 DoD suppliers affected by the mandate.

In order to implement appropriate and successful RFID solutions, firms will need to find qualified individuals to plan, design and implement the solution. According to a 2005 executive survey by COMPTIA and reported at the RFID World 2005 Conference, two-thirds of respondents felt that training and educating employees in RFID technology will be one of the most critical challenges they will face in succeeding with RFID.
III. THE RFID IMPLEMENTATION LIFE-CYCLE

To properly plan and execute an RFID implementation, a roadmap is needed to guide each step of the life-cycle. Experts in RFID have developed the following RFID implementation roadmap breaking the life-cycle into six distinct phases.

Each phase has a distinct purpose and relationship to all other phases. Planning done up front will help reduce risks and identify the best design and implementation path for the duration of the project. As with all technology-oriented programs, project management disciplines are critical to monitor budget, schedule and scope adherence.

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IV. WHERE COMPANIES RESIDE IN THE LIFE-CYCLE

As a result of the survey completed by more than 300 organizations, the following chart shows the position in the RFID implementation roadmap for the survey respondents across the six phases of the life-cycle.
V. SUMMARY

RFID is expected to be one of the most influential technological advances in retail, distribution and logistics over the next two decades. With the level of interest and the need for compliance across DoD suppliers, it will be imperative that suppliers address RFID with the right resources and the right plan. Topics such as developing a strong business case, proving Return on Investment, developing a talented workforce, managing cultural change are among the many issues companies will face.

About the RFID Solutions Center (RSC)

The RFID Solutions Center Dayton, a division of Alien Technology, is dedicated to driving RFID technology innovation and adoption of RFID solutions worldwide through collaboration with RFID end-users, key participants in the RFID industry, and academic institutions focused on RFID research and application. Infrastructure and equipment at the center enable technical services and applications engineering teams to simulate key stages in "real world" supply chains, and work closely with RFID customers to evaluate, design, specify, and deploy RFID systems. The center's simulated environment, which includes shipping dock doors, material handling equipment and conveyors, shipping stations, a store backroom and a retail store floor, offers a comprehensive engineering laboratory and educational RFID environment. More information regarding the RFID Solutions Center is available at www.rfidsolutionscenter.com.