Item-Level Passive RFID Technology Manufacturer's Information Guide

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Item-Level Passive RFID Technology

The Defense Logistics Agency (DLA) Customer Driven Uniform Manufacture (CDUM) Program has conducted research and development (R&D) efforts to identify, test, and evaluate how emerging passive radio frequency identification (pRFID) technology solutions at the item-level will affect fabric suppliers, combat uniform manufacturers, distribution warehouses, and the warfighter issuing points. The CDUM program confirmed that pRFID technology offers improved asset tracking and operational efficiencies throughout the military clothing and textile supply chain. Information gathered using pRFID technology also provides distinct advantages to the manufacturing community in terms of monitoring production and improving the precision of packing and shipping processes.

This guide provides manufacturers with important information and lessons learned by manufacturers involved in DLA's CDUM program item-level pRFID technology pilots and Industrial Base Innovation Fund (IBIF) item-level pRFID implementation projects. This guide describes, step-by-step, a typical process for implementing item-level pRFID technology in a uniform-manufacturing environment.

ITEM-LEVEL PRFID PROCESS

The processes and implementation steps described in this guide are somewhat flexible; manufacturers can tailor their item-level pRFID solution to a particular item, production process, or manufacturing environment. Figure 1 shows a typical item-level pRFID manufacturing process. Most successful pRFID item-level technology implementations will follow this basic approach, with only minor modifications to accommodate unique manufacturing processes and environments.

As shown in Figure 1, the item-level pRFID process affects three areas of current military uniform production:

- New and modified steps associated with pRFID item-level technology (in red)

- Existing and modified steps associated with the current case and pallet pRFID labeling (in blue)

- Existing and modified steps associated with the Virtual Item Manager–Apparel Research Network (ARN) Supply Chain Automated Processing (VIM-ASAP) shipping process (in purple).

Figure 1. Typical Item-Level pRFID Process at the Manufacturer

New/modified steps in manufacturer process

Step 2 Encode/print pRFID item tags

Step 3 Attach pRFID item tags

Step 4 Encode/print pRFID case labels

Step 5 Attach pRFID case labels

Step 6 Pack items in case

Step 7 Read pRFID item tags and pRFID case label

Step 8 Case validation/ item-to-case link

Local database

Step 12 Link pRFID case labels to pRFID pallet labels

Step 11 Attach pRFID pallet labels

Step 10 Build pallet

Step 9 Encode/print pRFID pallet labels

Existing/modified steps in manufacturer process

Step 1 Download contract data

Step 13 Manufacturer: Upload pack/ pRFID data to VIM-ASAP

Step 14 Generate partial DD250 & MSL

Step 15 Manufacturer: View and complete DD250

Step 16 Manufacturer: Review and complete MSL

Step 17 Upload to WAWF

WAWF

ARN

Existing/modified steps In VIM-ASAP shipping process

Note: MSL = military shipping label; WAWF = Wide Area Work Flow.

Note: Not shown in Figure 1 is an informal feedback loop consisting of email error messages sent to the manufacturer by VIM-ASAP after Step 13. VIM-ASAP generates these e-mail messages when it detects a problem, such as duplicate RFID tags and quantities in excess of order quantity (including variance excesses). The email error messages are not part of the manufacturer process but rather are a result of deviations to the process.

A description of each step involved with the item-level pRFID manufacturer's process follows below. Each step description provides an explanation of the process step, the pRFID equipment required to perform that step, and some pitfalls to avoid.

Step 1—Download Contract Data
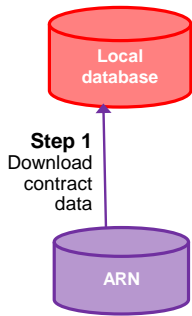
Equipment and software required for Step 1:

- Reliable high-speed internet connection
- PC workstation and display
- Microsoft Internet Explorer version 6.0 browser (or later)

The timely and accurate download of contract data associated with each item is critical for successfully applying item-level pRFID technology to each item. It is imperative that this source contract data is accurate, as it will be uploaded later in the process and made available to activities downstream as the items travel through the supply chain to the warfighter.

To accomplish the download process, manufacturers must set up a database (typically on a local server, but remote servers have also been used) and use VIM-ASAP to populate it with current contract information gathered from the ARN database and additional information associated with the items being produced.

VIM-ASAP is a collection of web applications used by apparel manufacturers to track production status, prepare invoices, ship items, and create all required documents and electronic transactions from a single source of data, the ARN database.

Each day manufacturers receive information from VIM-ASAP, including

- contract number and delivery order number;

- the prime contractor's commercial and government entity code (CAGE);[1]

- a Department of Defense Activity Address Code (DoDAAC) for the ship-to site;

- a contract line item number (CLIN);and

- all related CLIN data.

To access VIM-ASAP, manufacturers must acquire VIM-ASAP credentials, designate a local program administrator, and establish system connectivity. VIM-ASAP creates a home directory for each credentialed manufacturer; the manufacturer automatically downloads, from its designated VIM-ASAP home directory, a file containing the current contract information listed above. It is the manufacturer's responsibility to transfer this data to its internal information systems in a

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[1] A ship-from CAGE code (if different from prime contractor's CAGE code) is not provided in the downloaded data; it must be provided by the manufacturer.

format that is compatible with the software it uses to create pRFID item-level tags and case- and pallet-level labels.

Manufacturers can download their contract data onto either a local or remote server. There are advantages and disadvantages for both server types. Local servers tend to be faster, function better in high-volume manufacturing operations, and are not internet-dependent; but local servers also require a higher initial investment and may increase overall system maintenance costs. Remote servers will have lower initial and operating costs, if operating in a shared environment; but a remote server may include monthly operations and maintenance fees, may be internet-dependent, and may have scalability difficulties for high-volume manufacturing operations.

Appendix A contains a more detailed discussion of how to upload and download contract data using VIM-ASAP.

Lesson learned for Step 1:

◆ Manufacturers need to know their VIM-ASAP credentials (logon and password) for accessing the system. In some cases, VIM-ASAP credentials were established years ago to implement case and pallet level pRFID automated applications but have been forgotten or lost.

Step 2—Encode/Print pRFID Item Tags

Step 2
Encode/print
pRFID item
tags

Equipment and software required for Step 2:
- PC workstation and display
- pRFID enabled printer
- pRFID printer software

The encoding and printing of a tag consists of three sub-processes.

- *Printing the tag*. The necessary information is printed on the front of the item-level tag (see Figure 2). This information includes two elements:

  - The information that is currently on a manufacturer's non-RFID hang tag (in both human readable and bar code formats) and required by the contract

  - The unique RFID tag identification (ID) number—a unique hexadecimal serial number—in both human readable and bar code formats.

- *Encoding the tag ID*. The unique RFID tag ID number is encoded by the printer on the RFID inlay embedded in the tag.

- *Linking information*. The PC workstation and software links each unique tag ID to the contract information downloaded from VIM-ASAP in Step 1 and any other required item level information.

The manufacturer uses the contract data downloaded from VIM-ASAP and populated into its database to encode and print pRFID item-level tags. The manufacturer is responsible for creating this tag, much as they are responsible for creating the barcode hang tag specified in the contract.

Item-level tag size usually follows the current (non-RFID) hang tag dimensions. Typical sizing of the tag ranges from 3 in. × 1.75 in. to 4 in. × 2.125 in. An example of the front side and back side of the type of pRFID item-level tag currently in use is depicted in Figure 2; however, these tags may change in the future as technology improves, information on the tag is modified, and costs fluctuate.

Figure 2. Front and Back Side of an Item-Level pRFID Tag
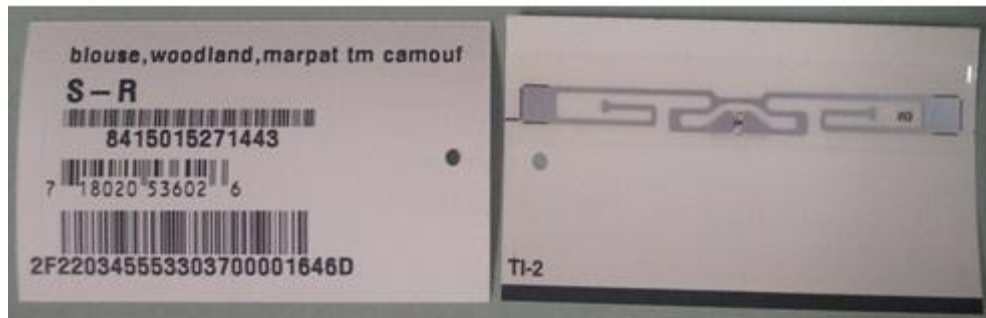
The pRFID inlay is embedded in the tag, and is visible in the top back half of the tag. The pRFID chip sits in the middle of the inlay, and the antenna spans nearly the full length of the tag. It is important to note that the only data element encoded in the RFID chip is the unique hexadecimal RFID tag ID number; none of the information printed on the front of the pRFID tag is encoded in the chip other than the pRFID tag ID number. The pRFID item tags and case and pallet labels use the same or similar pRFID inlays.

Figure 3 shows pRFID item-level tags being encoded and printed.

Figure 3. pRFID Item-Level Tags Encoded and Printed

Since 1 March 2007, DoD has exclusively accepted Ultra High Frequency (UHF) Generation 2 Electronic Product Code (EPC) standard tags. The frequency range

for these tags is 860 to 960 MHz, with a minimum read range of 3 meters. It is the responsibility of the manufacturer to ensure that every pRFID tag shipped to the government is encoded with a globally unique identifier (unique tag ID). The unique tag ID can only be used once in order to conform to the "one tag, one ID" rule.

DoD accepts two item-level tag constructs, the EPCglobal and the DoD-96. Only suppliers that are EPCglobal subscribers can use the EPCglobal tag construct.[2] To date, all manufacturers have used the DoD-96 construct for item-level technology. The combination of a header/filter code, CAGE code, and serial number, as provided by the construct, make the tag ID unique.

Pallet, case and item level tags and labels use the same DoD-96 construct. The difference is the first three digits of the unique ID number encoded in the inlay. Each tag, case, and pallet ID number begins with "2F." The next digit denotes whether the number refers to a pallet (0), a case (1) or a tag (2):

- 2F0… identifies a pallet

- 2F1… identifies a case

- 2F2… identifies an item.

Lesson learned for Step 2:

- Strict controls over archived and active item tag, case, and pallet label print files should be maintained to ensure a print file is used only once. Access to archived print files should be limited to only required personnel. This will prevent the duplication of printed tags and labels.
- The same process should be used to generate and encode the pRFID tag ID and print the tag ID in both barcode and human-readable formats. Using separate processes has led to tag mismatches.
- Care must be taken to place strict controls over naming and generating pRFID item tag encode/print files. Valid print files have been incorrectly overwritten, causing erroneous labels to be printed.
- Manufacturers need to understand the operation of the tag printers, especially the printing of tags during "power up," a restart after power loss, reloading the printer with blank tags, and changing the print ribbon. Some printers may start by purging tags in the printer when the power was turned off. These tags may need to be discarded.
- If using a remote print service to generate tag print files, ensure the printer software has the latest software changes. Printers with outdated software may encounter errors when print files are received. Automated printer software updates should be developed to guarantee successful printing operations.

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[2] For more information, please refer to the tag data standards document at http://www.epcglobalinc.org/standards.

Step 3—Attach pRFID Item Tags

Equipment and software required for Step 3:

- ◆ Plastic/nylon tag fasteners
- ◆ Tag gun

The manufacturer must attach the item-level pRFID tag printed and encoded in Step 2 to each item so all items can be counted when the case is packed and ultimately tracked through the supply chain. From past implementations, we know the item-level pRFID hang tags can often be placed at the same attachment point and in the same manner as the non-pRFID hang tag; however, in some instances, it was necessary to attach the pRFID hang tag using a different method or attachment point to achieve acceptable read rates when packed in a case.

Various factors can affect the ability to successfully read a pRFID tag. For example, tags should not be folded, bent, or in contact with each other, or they may not be readable. Also, the materials used in uniform items, such as metallic fibers, may inhibit the successful read of item-level pRFID tags. Trial and error for the tag attachment method and tag attachment point will help identify an acceptable tag attachment approach.

Tag attachment points and methods may vary by item and manufacturer. The following offer some examples:

- ◆ *ABUs*. pRFID item tags are attached to airman battle uniform (ABU) trousers using a nylon fastener that is normally looped through the hole in the tag and then looped through the flap of the side pocket on the thigh (see Figure 4). pRFID item tags are attached to ABU coats using a nylon fastener that is normally looped through the hole in the tag and then looped through the flap of the right breast pocket (see Figure 5). In both cases the nylon fastener is closed using the attachment gun (see Figure 6).

- ◆ *Boots*. pRFID item tags are attached to boots using a nylon fastener that is looped through the hole in the tag and then looped through the second speedloop from the top of the boot (see Figure 7).

- ◆ *Caps*. pRFID item tags are attached to caps using a nylon fastener that is looped through the hole in the tag and then looped through the band where the top of the cap is sewn to the bill (see Figure 8).

- ◆ *Duffel bags*. pRFID item tags are attached to duffel bags using a nylon fastener that is looped through the hole in the tag and then looped through the vertical seam in the duffel bag at a point near the top of the bag (see Figure 9).

Figure 4. Attachment of pRFID Item Tag to ABU Trousers

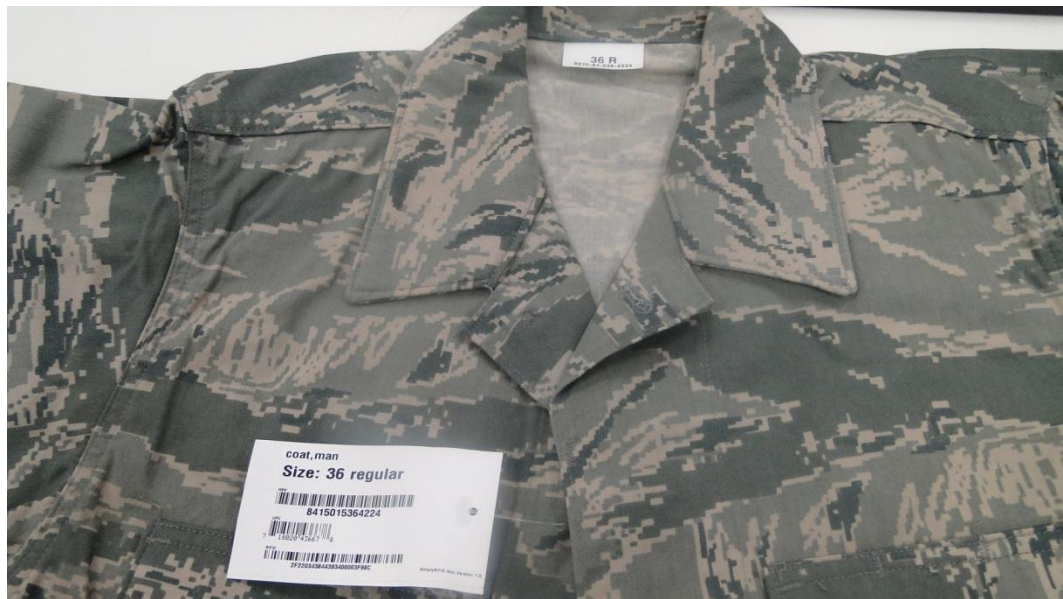
Figure 5. Attachment of pRFID Item Tag to ABU Coats

Figure 6. Tag Gun with Fastener
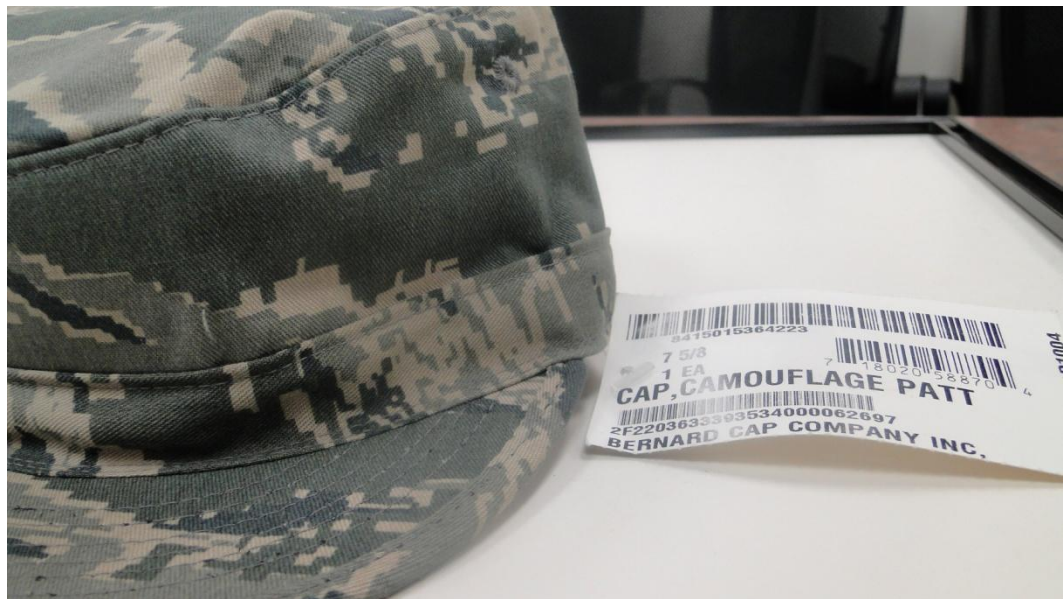
Figure 7. Attachment of pRFID Item Tag to Boots

Figure 8. Attachment of pRFID Item Tag to Caps

Figure 9. Attachment of pRFID Item Tag to Duffel Bags

Step 4—Encode/Print pRFID Case Labels

Equipment and software required for Step 4:

◆ pRFID printer

◆ pRFID printer software

Many vendors currently place case and pallet pRFID labels on their shipments. Information for pRFID case and pallet labels can be found in the *United States Department of Defense Suppliers' Passive RFID Information Guide* and MIL-STD-129P (Change 4), *Military Marking for Shipment and Storage*.

The printing and encoding of the case pRFID label can occur before or after the packing of the case. Like item-level pRFID tag constructs, the manufacturer has the option of using the DoD-96 bit tag construct for case labels or the EPCglobal (if the manufacturer is an EPCglobal subscriber) tag construct. The unique ID encoded in the pRFID chip used at the case level begins with 2F1.

To encode/print pRFID case labels, manufacturers use pRFID printer software to generate the case label with the required case information printed and the unique case pRFID label ID encoded.

Some manufacturers place additional labels on cases. These labels may support warehousing and shipment activities within their organization or they may fulfill additional contractual requirements. Manufacturers can take advantage of implementing the item-level pRFID process implementation to investigate the options for consolidating additional case labeling into one integrated case pRFID label, which could reduce material and labor costs.

Figure 10 shows a pRFID case label with the case information required by the contract printed on it. Figure 11 shows the case label's unique ID number in bar code and human readable form. Typically, case pRFID labels, like the label shown in Figure 10 and Figure 11, are 4 in. × 6 in Figure 21.

The inset for Figure 11 shows the pRFID chip inlay on the back of the case label. The case label (see Figure 10 and Figure 11) uses the same inlay as that on the pRFID item tag in Figure 2 and pRFID pallet label in.

Figure 10. Example of Printed Information on pRFID Case Label
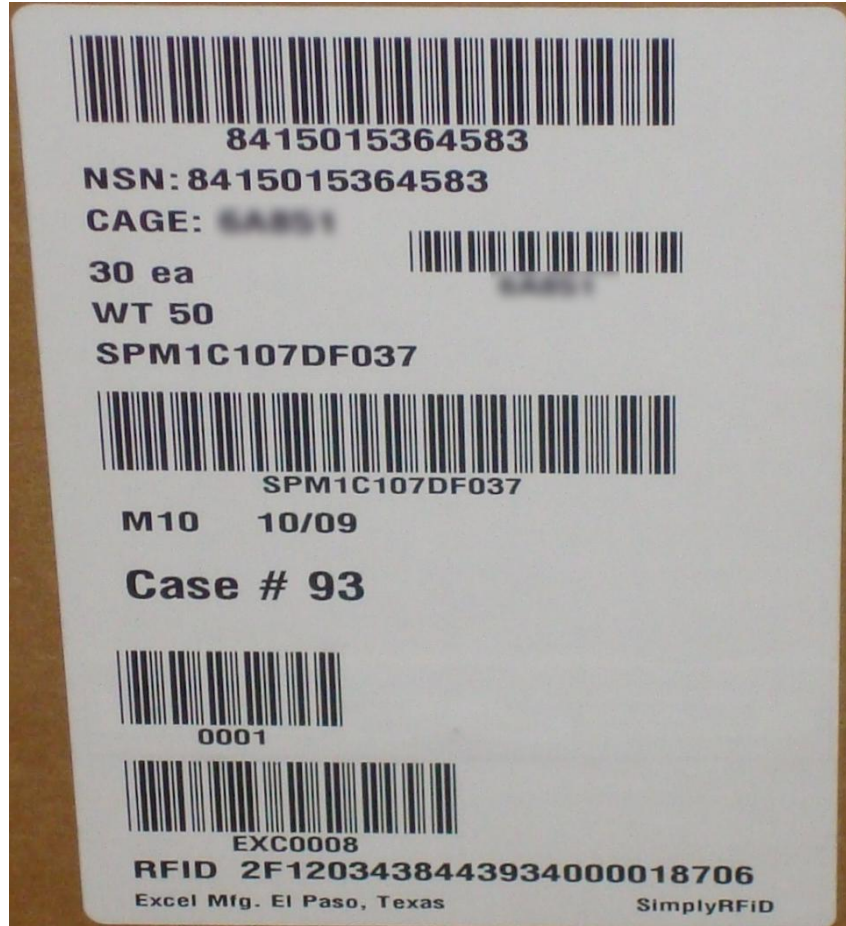
Figure 11. pRFID Case Label ID and Back of pRFID Case Label
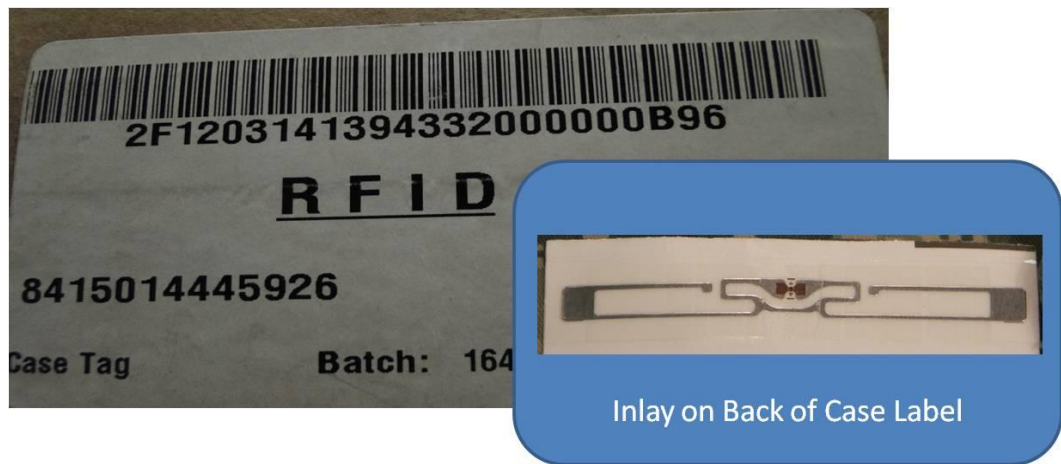
Step 5—Attach pRFID Case Labels

Step 5
Attach
pRFID case
labels

Equipment and software required for Step 5: None

The manufacturer must attach the pRFID case label so the particular case (and its contents) is accounted for when the pallet is built. The pRFID case labels are placed on each case

- ◆ to allow the markings to be easily read and

- ◆ to prevent the case labels from being destroyed when the pack or container is opened for inspection or until its contents have been used.

The markings should be placed so they are not obscured by any strapping or closure tape. More details can be found in MIL-STD-129P (Change 4), *Military Marking for Shipment and Storage*.

Step 6—Pack Items in Case

Step 6
Pack items
in case

Equipment and software required for Step 6: None

After the item-level pRFID hang tags have been attached to the finished item, cases must be packed with the correct type and quantity of items. The case can be packed prior to attaching the case labels (described in Step 5) or they can be packed in a case that already has the case pRFID label attached. The sequence of steps depends on the manufacturer's production process.

The ABUs shown in Figure 12 have been tagged and are awaiting packing.

Figure 12. ABUs Awaiting Packing

To pack items in a case, the manufacturer needs the case and the requisite number of items (per case pack quantity) with encoded pRFID item tags attached. Figure 13 shows items with pRFID item tags being packed in a case.

Figure 13. Items Being Packed in Case

In most cases, the method for packing cases will not change with the implementation of the item-level pRFID process; however, we did observe modification to the item packing process was necessary in some implementations to increase the readability of item tags in a case. The method used for case packing should prevent

- the bending or folding of item-level pRFID hang tags and

- item-level pRFID hang tags from touching each other.

One manufacturer of battle uniform trousers had to modify its hang tag attachment point and place the item-level pRFID tag in the trouser pocket to prevent the tags from folding and to eliminate tag-to-tag contact.

Lesson learned for Step 6:
- After packing, item tags may not be completely and accurately read during the first "read". Different items may require different tag attachment points (for example, placed in a pocket) or other tag adjustments to achieve an acceptable read rate.

Step 7—Read pRFID Item Tags and pRFID Case Label

Step 7
Read pRFID item
tags and pRFID
case label

**Local
database**
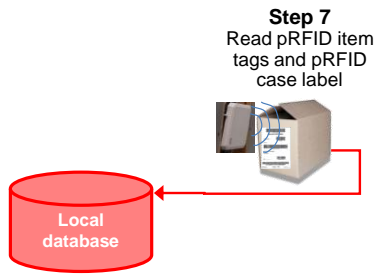
Equipment and software required for Step 7:

- ◆ PC workstation and display (or case label printer)
- ◆ pRFID antennas and reader
- ◆ pRFID reader software

During this step, each item-level pRFID hang tag and its case pRFID label are read. The output of the item and case level read is provided on a computer screen and reviewed by the station operator. The information collected in the read will be used to validate the case contents and to establish the item-to-case link in Step 8.

Past implementations used two[3] basic configurations:

- ◆ A pack station or table with fixed pRFID readers (see Figure 14)

- ◆ A conveyor with fixed pRFID readers (see Figure 15).

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[3] A third possible configuration is the use of handheld readers. Handheld readers are only practical in low-volume, low-pack-quantity manufacturing operations. They are more labor intensive and slower in comparison to the other configurations. There has been no implementation where it was feasible to employ the use of handheld readers for item tag to case label linking.

Figure 14. Item-to-Case Pack Station/Table

Figure 15. Conveyor with Fixed pRFID Readers

The equipment configuration is driven primarily by business considerations, such as the production process, location of facility (multiple-location; single-location; production and packing in one facility, with shipping and storage in another facility), equipment re-usability (print in one facility for use in another facility), ability to handle multiple customers' shipments using the same national stock numbers (NSN) and part numbers from separate suppliers (lot and part segregation and tracking by original part manufacturer), production volume (including surge), space availability, type of items, case pack quantity, and size of the case.

The following provide real-world examples:

- ◆ A packing vendor may pack a size 32L pant from two different manufacturers with different contract awards. The packing vendor must differentiate each manufacturer's items and ensure the contents of each case are all from the same vendor. This is critical for correct billing and shipment of the correct manufacturer's garments by contract.

- ◆ A vendor may have multiple manufacturing facilities that must share item, case, and pallet detail among all facilities to allow a product to move from location to location.

- ◆ A vendor may produce pRFID tags in one location, and then send them to another location for on-demand packing or palletizing. This allows the vendor to pre-encode pRFID tags using a single printer and have multiple remote locations packing and assigning products to the correct case or pallet as they are needed. This is known as "late binding." It allows a pRFID tag to be assigned to a particular case or pallet long after it has been produced.

Lesson learned for Step 7:
- ◆ The process to read tags and labels should be designed to isolate and eliminate reads of stray, undesirable tags and labels. Power settings should be adjusted or the immediate areas should be kept clear of other pRFID tags so only the pRFID tags of interest are captured.
- ◆ Some manufacturers may produce items that require item-level pRFID technology and other items that only require case and pallet pRFID labels. An item may follow a separate manufacturing process if item level technology is required. Strict controls must be put in place to insure that items requiring item level technology follow the manufacturer's item level pRFID process established.

Step 8—Case Validation/Item-to-Case Link

Step 8
Case validation/
item-to-case link

Equipment and software required for Step 8:

- PC workstation and display
- pRFID validation and linking software

Before the implementation of item-level pRFID, case validation was a manual process that could require several quality checks to determine whether the correct items (by size, CAGE code, and contract) and quantities were packed in the case. The item-level pRFID process automates this step. During item-to-case validation, data collected during the item tag and case label read process (Step 7) are used to confirm the contents of each case are correct. The pRFID hardware and software is capable of checking for the following case-pack conditions:

- ◆ The number of items in the case matches the correct case-pack quantity.

- ◆ The items in the case are all of the same type and size or NSN.

- ◆ The items in the case share the same CAGE code.

Other validation checks may be necessary; it depends on the manufacturer's circumstances and contract requirements.

The pRFID software uses the item-level tag reads and associated item information from the manufacturer's database to perform the validation. If the system detects an error, it immediately notifies the operator responsible for resolving the error by displaying an error message on the PC workstation display or print out. The operator can correct or override[4] the error. Figure 16 shows an example of a PC workstation display during a successful validation (when the items and quantity are all correct). Figure 17 shows an example of an unsuccessful validation, where the number of item tags read was greater than the desired case pack quantity.

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[4] In some instances, cases may be packed in quantities under or over the stated case pack quantity when stipulated in the contract.

Figure 16. Case Acceptance during Validation Process
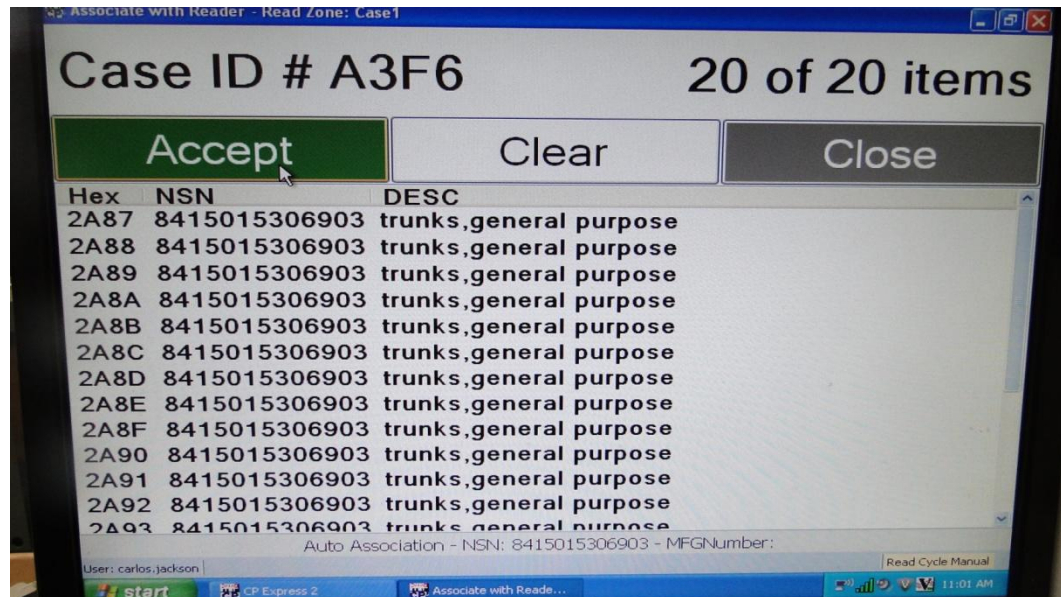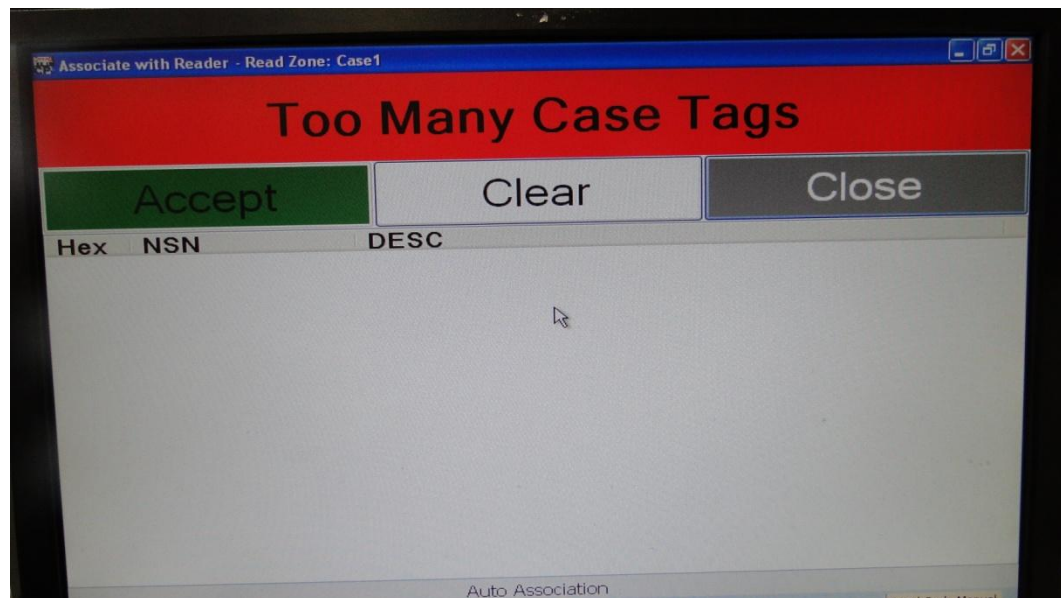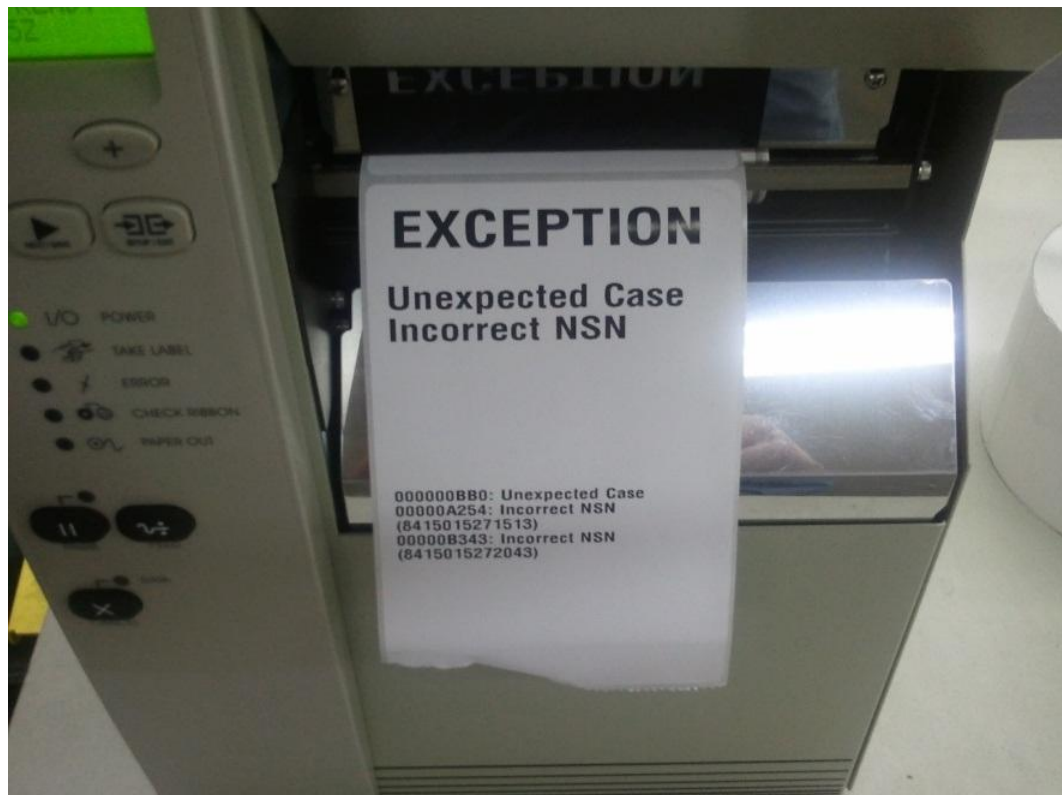

Figure 17. Quantity Overage Error Message during Validation Process

An exception label for the case can be printed as an alternative to using a screen display for case validation errors. The exception label in Figure 18 indicates an NSN error.

Figure 18. Exception Case Label with Incorrect NSN Error

Lesson learned for Step 8:

- ◆ Equipment must be protected against power fluctuations (power surges and "dirty" power). Components within printers and readers are vulnerable to unstable power supplies.
- ◆ Linking item tags to case labels and case labels to pallet labels requires local network connectivity, at a minimum, to exchange information. Redundant network capabilities should be available to prevent production delays.
- ◆ To prevent the introduction of duplicate tags, the processes and equipment used for item-level pRFID technology should be designed with tag verification checks performed at multiple points in the process. At a minimum, tag verification should be conducted at printing, validation, and shipping.
- ◆ If items are pulled out of cases for quality audit, rework or other reasons, the item must be disassociated with the case. If the item-level tag is removed or disassociated from the item for any reason, the manufacturer must have controlled processes in place to insure the item is properly tagged and associated with the correct item data.

Step 9—Encode/Print pRFID Pallet Labels

Step 9
Encode/print
pRFID pallet
labels

Equipment and software required for Step 9:

- ◆ PC workstation and display
- ◆ pRFID printer
- ◆ pRFID software

The manufacturer must perform this step to create the pallet's unique ID number, which can be linked to the cases and tracked through the supply chain. Pallet labels include, in both human readable and bar code formats, the unique pallet label ID number and other information required by the contract. Figure 19 illustrates the front of a pRFID pallet label. Figure 20 shows a pallet label attached to a pallet and the back of a pRFID pallet label, including the label's inlay. The inlay is the same or similar to the inlays used in the pRFID item tag (Figure 2) and pRFID case label (Figure 10 and Figure 11).

Figure 19. Front of pRFID Pallet Label

Note: Some small shipments are made without pallet-level RFID tags. Even when only a few cases are shipped separately, each case requires its own MSL.

Figure 20. Pallet Label Attached to Pallet and Back of Pallet Label Showing Inlay

Manufacturers that currently use a "slap-and-ship" process to link the case to the pallet and print the pallet label during their shipping process will likely need to modify their processes. To perform the case label read, validation, and linking processes, the case labels will need to be made available and placed on the cases earlier than required in a "slap-and-ship" operation.

Step 10—Build Pallet

Step 10
Build pallet

Equipment and software required for Step 10: None

After the case has been packed, validated, and sealed, and each item-level pRFID tag has been linked to its case pRFID label, the cases are put on pallets in preparation for storage, staging or shipment. As cases are placed on the pallet, it is preferable that outside cases be positioned so the case labels are visible and can be read; however, some manufacturers' contracts dictate case markings not be visible on the outside of the pallet cube and must have their case labeling face inward. Manufacturers with this requirement may need to use trial and error to identify the best placement of case labels and case orientation to achieve an acceptable case pRFID label read rate when palletized.

Additional information on case and pallet-level pRFID labels can be found in the *United States Department of Defense Suppliers' Passive RFID Information Guide* and MIL-STD-129P (Change 4), *Military Marking for Shipment and Storage*.

Step 11—Attach pRFID Pallet Labels

Step 11
Attach
pRFID pallet
labels

Equipment and software required for Step 11: None

The pallet pRFID label may be integrated with the military or commercial shipping label (pRFID-enabled address label) or it may be placed in a separate location on the pallet. Pallet pRFID labels should be affixed at a suitable location where there is minimum risk of damage and the highest potential for successful pRFID label read.

Manufacturers have used different pRFID label configurations and attachment methods for their pallet pRFID labels. For example, when a palletized load was covered with stretch-wrap film, a pressure-sensitive pRFID label was placed on the outermost layer of wrap (see Figure 20).

The pallet pRFID label should not be placed over a seam nor should sealing tape or bands be placed over the label in a manner that interferes with the scanning of the label bar codes or the reading of pRFID labels. Also, it should not be placed in a manner that overlaps any other existing pRFID label.

Additional information on case- and pallet-level pRFID labels can be found in *United States Department of Defense Suppliers' Passive RFID Information Guide* and MIL-STD-129P (Change 4), *Military Marking for Shipment and Storage*.

Step 12—Link Case Labels to Pallet Labels

Step 12
Link pRFID case labels to pRFID pallet labels

Local database

Equipment and software required for Step 12:
- ◆ PC workstation and display
- ◆ pRFID reading equipment
- ◆ pRFID software

Before shipment, each case pRFID label on the pallet needs to be linked to its pallet pRFID label. The case-to-pallet linking process also must electronically link each pRFID pallet label to the contract, delivery order, and shipment numbers.

Several solutions are possible for the case-to-pallet linking process, including using fixed readers, using a pRFID reader placed next to a palletizer/shrink wrap stand,[5] or using a handheld pRFID reader/bar code scanner.

Figure 21 shows the handheld reader used to read and link cases to pallets; and Figure 22 shows a pRFID reader next to a palletizer/shrink wrap stand. As a precautionary note, power settings should be adjusted or the immediate areas should be kept clear of other pRFID tags so only the pRFID tags of interest are captured.

Figure 21. Linking Cases to Pallet—Handheld Reader

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[5] Palletizers/shrink wrap machines may be modified with RFID reader devices to accomplish the case-to-pallet link. It is important to note that palletizer equipment is not required for the item-level RFID process. Although the spinning action of the palletizer/shrink-wrap machine often improves the speed of the RFID reads, a manufacturer can use other fixed reader and handheld RFID reader/bar code scanners solutions to accomplish case-to-pallet association.

Figure 22. Linking Cases to Pallet—RFID-Enabled Palletizer

Once the pallet pRFID label and case pRFID labels are captured by the pRFID read equipment, the operator confirms the pallet has the correct number of cases. That confirmation also triggers the pRFID read software to send the case-to-pallet link information to the manufacturer's information system.

Step 13—Manufacturer: Upload Pack/pRFID Data to VIM-ASAP
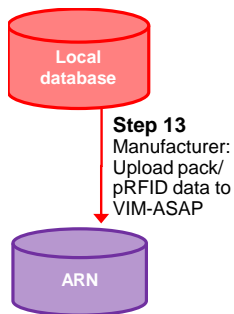
Equipment and software required for Step 13:

- Reliable high-speed Internet connection
- PC workstation and display
- Microsoft Internet Explorer version 6.0 browser, or later

The manufacturer must send its pRFID data (item, case, and pallet IDs and their associations) along with contract-related data and to VIM-ASAP. Information included in the uploads to VIM-ASAP includes data that will be used in Step 14 to generate the shipment's DD Form 250 (DD250) and military shipping labels (MSLs). The contract data the manufacturer will exchange with VIM-ASAP includes the following:

- ◆ Contract number and delivery order number
- ◆ Prime contractor CAGE code
- ◆ Ship-from CAGE code, if different from prime contractor CAGE code
- ◆ DoDAAC
- ◆ CLIN
- ◆ NSN
- ◆ Quantity shipped for the CLIN
- ◆ Pallet-level pRFID packing data
- ◆ Case-level pRFID packing data
- ◆ Item-level pRFID packing data.

As described in Step 1, VIM-ASAP sends manufacturer contract data (contract number, CAGE code, and CLIN, as described in Step 1) for open contracts. During this upload process, the manufacturer returns shipment data (quantity per CLIN; NSN; and pallet-, case-, and item-level pRFID data) for the items produced and shipped. VIM-ASAP stores this item-, case-, and pallet-level pRFID data and makes it available so manufacturers and receivers can trace shipments and particular items through the supply chain.

The file format for item-case-pallet pack and shipment pRFID data upload to VIM-ASAP can be found at https://wawf.eb.mil/. The frequency of contract data upload is tied to the manufacturer's production and delivery schedule. When manufacturers transmit their data to VIM-ASAP, the transmission must adhere to the file layout that VIM-ASAP expects. Additional information on VIM-ASAP upload and download procedures can be found in Appendices A and B. For further assistance, contact the VIM-ASAP Help Desk at 1-888-940-7348.

Lesson learned for Step 13:

- The transition to add item-level technology to manufacturing operations currently applying only case and pallet needs to be well planned to insure proper linkages are established and uploaded. If operations continue to only upload case and pallet level information to VIM-ASAP without item-level information, downstream supply chain processes will encounter significant problems with unassociated tags and lack of item level data.

Step 14—Generate Partial DD250 & MSL

Step 14
Generate partial
DD250 & MSL

ARN
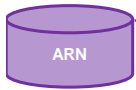
Equipment and software required for Step 14:

- ◆ Reliable high-speed Internet connection
- ◆ PC workstation and display
- ◆ Microsoft Internet Explorer version 6.0 browser, or later

VIM-ASAP uses the ARN Asset Visibility System (AAVS) to validate the shipment and pack data received from manufacturers. AAVS automatically generates a partial DD250 and MSL from that uploaded data. AAVS validates the information by comparing the uploaded information to existing contract data and pRFID files the manufacturer has already transmitted through VIM-ASAP. If VIM-ASAP detects an error in the transmission, it sends an email about the error to the manufacturer within 15 minutes.

The following are possible transmission errors:

- ◆ Unassociated item, case, and pallet pRFID tags

- ◆ Duplicate pRFID tag/label ID numbers

- ◆ Incorrectly coded tags

- ◆ Total shipped quantity exceeds the contract delivery order quantity plus the variance percentage.

An example of an emailed error message for a duplicate case tag reads:

> Duplicate Case RFID Tag: 2F120305A54463700000768D has already been imported from file 0ZTF7_0ZTF7_20110726.ftp.

Note that this message identifies the case pRFID tag that is a duplicate and identifies the uploaded file in which the original tag was sent.

If an error occurs with the uploaded file, VIM-ASAP does not generate a partial DD250. The manufacturer has to correct the error and retransmit. If the transmission is error free, VIM-ASAP will populate a DD250 document and the manufacturer can finalize the DD250 and prepare the shipping labels as described in the next step.

Step 15—Manufacturer: View and Complete DD250

Step 15
Manufacturer:
View and
complete DD250

ARN
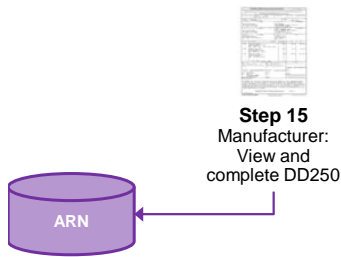
Equipment and software required for Step 15:
- ◆ Reliable high-speed Internet connection
- ◆ PC workstation and display
- ◆ Microsoft Internet Explorer version 6.0 browser, or later
- ◆ Ink-jet or laser printer

To access the partial DD250s created by VIM-ASAP in Step 14, the user logs in to VIM-ASAP and selects the "Manufacturing" folder located on the left side of the screen, above the Exit link, as shown in Figure 23.

Figure 23. First Page after Login Menu

Selecting the "Manufacturing" folder will display the submenu options shown in Figure 24.

Figure 24. Drop Down Menu of Manufacturing Folder Tab

The user selects "View/Edit Existing DD250s" to access the screen shown in Figure 25 and complete the DD250 processing.

Figure 25. View/Edit Existing DD250s Web Page

Unfinished DD250s can be edited, deleted, or simply recalled and finished. Once the desired DD250 is displayed, the manufacturer must enter the manufacturer's invoice and shipment numbers to complete it. The manufacturer's invoice number must be a unique number; VIM-ASAP will not allow invoice numbers that already exist in the system for that manufacturer.

Completed DD250s can be viewed by selecting the desired contract and delivery order and then clicking the appropriate button for the desired DD250. To modify a completed DD250, the user clicks the "unfinish" button associated with that document. This action restores the "edit" and "delete" options.[6]

"VOID" appears in red on the DD250 until it is finished. This signifies to users that the DD250 has not been finalized. Once the manufacturer clicks the "Finish" button, the "VOID" disappears; the DD250's shipped date field is updated with the current date, but it is not transmitted to the Wide Area Work Flow (WAWF) until the MSL is finished in Step 16. Once the DD250 has been sent to WAWF, the date transmitted is displayed and the DD250 is no longer available for editing or deletion. A copy of this form will be included in the shipment that corresponds to the completed DD250.

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[6] If the manufacturer needs to make a change to a completed DD250, it is much easier to do so if it has not been sent to the wide area work flow, or WAWF; however, there are times when DD250s can be recalled from WAWF and DFAS. The VIM-ASAP help desk can help users with these special types of recalls.

Step 16—Manufacturer: Review and Complete MSL
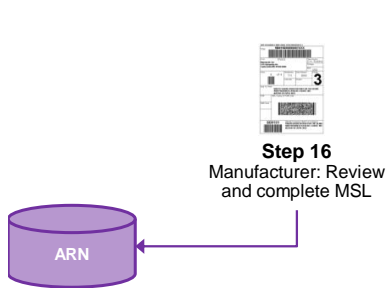
Equipment and software required for Step 16:

- ◆ Reliable high-speed Internet connection
- ◆ PC workstation and display
- ◆ Microsoft Internet Explorer version 6.0 browser, or later
- ◆ Ink-jet or laser printer

Step 16
Manufacturer: Review
and complete MSL

ARN

VIM-ASAP places every new DD250 into one of the lists of shipments that are organized by ship-from location and destination. The shipping labels (DD Form 1387, Military Shipment Label) are accessed for one or more shipments by selecting the desired ship-from location and destination.

To access and edit the shipment data, the user returns to the drop-down menu associated with the Manufacturing folder on the VIM screen (see Figure 25). When "Prepare Shipment Labels" is selected, the screen in Figure 26 will appear.

Figure 26. View/Edit Existing Shipment Labels

The shipping label will have "VOID" stamp in red, indicating it is incomplete. Once the shipment record associated with the DD250 (which the manufacturer completed) is selected, the user enters the following data to complete the MSL:

- ◆ *Weight*. Enter the weight of all containers for an individual shipment label.

- ◆ *Volume*. Enter the length, width, and height of all containers associated with an individual shipment label.

- *Tracking Number*. Enter the tracking number, as identified by the selected shipper.

- *Postage*. Enter the cost of the postage if the package is sent by the U.S. Postal Service.

- *Mode of Shipment*. Use the pull-down tab to enter the required DLA troop support code.

- *Shipper*. Use the pull-down list to select the appropriate shipper.

After entering all required information, the user clicks the "Generate Label" button to produce the shipping label. This action opens a new window that displays the shipping label for the manufacturer to view. Note it will have "VOID" printed in red across it. If the label is correct, the user clicks the "Finish" button. Doing so will remove the "VOID" and indicate the date printed. The label can no longer be edited once it has been finished. The manufacturer may now print the label to include with the shipment.

The printed MSL is displayed in Figure 27.

Figure 27. Complete and Printed MSL
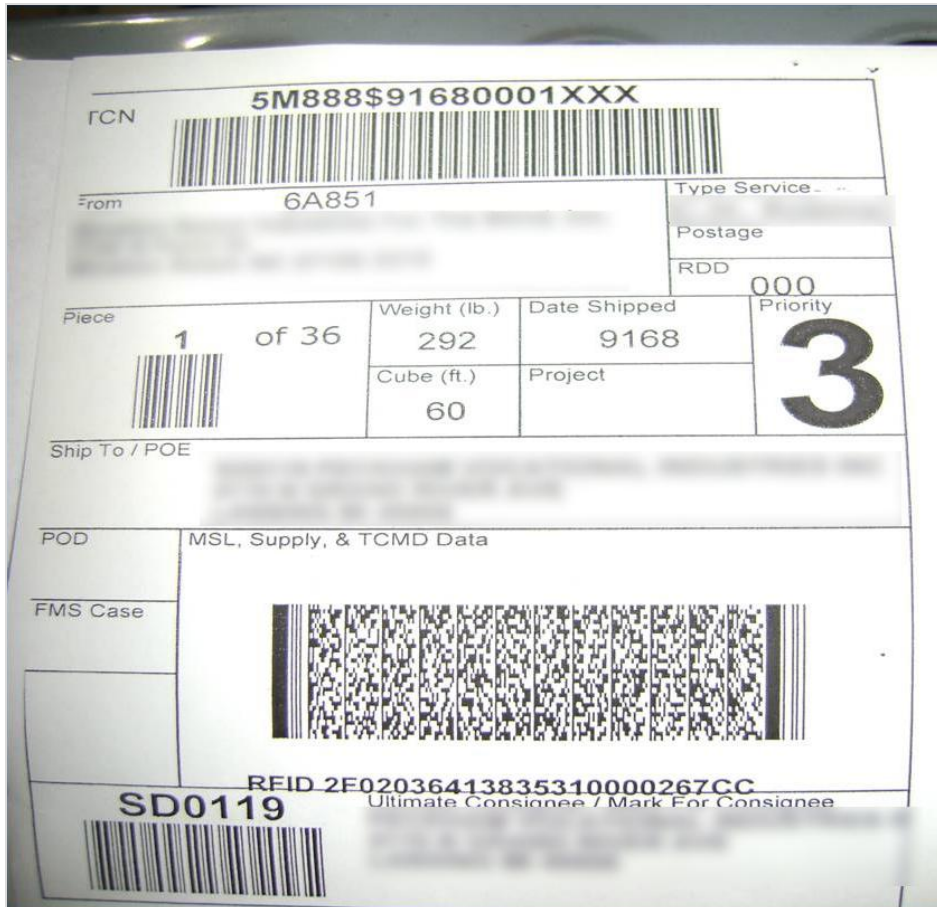
Step 17—Upload to WAWF

Equipment and software required for Step 17:

- Reliable high-speed Internet connection
- PC workstation and display
- Microsoft Internet Explorer version 6.0 browser, or later
- Ink-jet or laser printer

Once the manufacturer has entered the required data into the VIM-ASAP system, the DD250 and MSL are available for printing so they can be included in the shipment. VIM-ASAP transmits the DD250 data to WAWF at the top of each hour. Once in WAWF, the appropriate Defense Contract Management Agency QAR electronically signs the DD250 and processes the data to the Defense Finance and Accounting Service for payment authorization. In addition, VIM-ASAP transmits DD250 data to the appropriate DLA warehouses and the affected recruit training center.

PROJECT IMPLEMENTATION

In all CDUM R&D and IBIF implementations to date, each manufacturer procured a solution from an outside RFID provider. The implementation described in this section follows that common methodology; however, the manufacturer always has the option of fully implementing an acceptable item-level pRFID technology solution with internal resources.

The sample schedule of key implementation activities is based on lessons learned from past implementations.

The implementation schedule is based on a target "go-live" date, which is the manufacturer's desired date for when the new item-level pRFID system will be fully operational. The targeted go-live date includes such considerations as production schedule, contractual requirements, funding availability for capital expenditures, scope and complexity of the implementation, conflicts with and impacts on other internal information technology (IT) projects, personnel availability, and other operational factors.

The sample schedule provides the major project implementation tasks with an associated "no later than" (NLT) date to provide an estimate of when that task should be performed relative to the targeted go-live date:[7]

- ◆ Identify implementation project team (NLT go-live − 85 days)

- ◆ Manufacturer preparation (NLT go-live − 85 days)

- ◆ Create and distribute a request for proposal (RFP) to potential pRFID solution providers (NLT go-live − 50 days)

- ◆ Conduct RFID solution provider selection (NLT go-live − 42 days)

- ◆ Finalize and sign contract agreement (NLT go-live − 40 days)

- ◆ Finalize required equipment (NLT go-live − 38 days)

- ◆ Order equipment (NLT go-live − 37 days)[8]

- ◆ Receive equipment (NLT go-live − 7 days)

- ◆ Install and test equipment and software (NLT go-live − 5 days)

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[7] For example, *NLT go-live − x days* refers to the minimum number of days the task should be completed before the go-live date. *NLT go-live + x days* refers to the minimum number of days the task should be completed after the go-live date. A NLT time of *go-live − 30 days* means the task should be completed a minimum of 30 days before the scheduled go-live date; and a NLT time of *go-live + 30 days* means the task should be completed no later than 30 days after the scheduled go-live date.

[8] Note: Some equipment may have a longer lead time to acquire.

- Initial user training (NLT go-live − 3 days)

- Begin item tagging (go-live)

- Begin data gathering—collect tag performance, cost, and lead-time data from the new implementation to measure progress and identify areas for improvement (go-live)

- Begin resolution of issues as they arise and provide additional training, as necessary (go-live)

- Follow-up (NLT go-live + 20 days)

- Continue to resolve issues and provide additional training, as necessary (NLT go-live + 20 days).

The following describes selected key steps in further detail.

Identify Implementation Project Team

The manufacturer should establish a project team that includes personnel from IT, manufacturing, quality, and shipping operations. Many manufacturers do not have the pRFID expertise on their staff to handle the technical issues associated with an item-level pRFID technology implementation. After reading the information presented in this guide, the project team may consider hiring outside resources experienced in item-level pRFID technology to assist in planning and execution of the implementation; however, the use of such services in past implementations has been costly.

Manufacturer Preparation

In preparing for implementation, the manufacturer should collect, prepare, and review the following information:

- Contract requirements for non-pRFID item-level technology, and pRFID case and pallet marking and labeling. Data collected should include the information that must be printed in human readable and barcode formats.

- Non-pRFID item-level technology process.

  ➤ Tag and label size and placement and requirements. Placement of RFID tags and labels may need to be modified from current non-pRFID tag placement to achieve acceptable tag and label read rates.

  ➤ Tag attachment method. Attachment method of the current hang tag may need to be modified to ensure the item-level pRFID tag is attached in such a way as to ensure the tag stays on the item until issue.

- The current production volumes and surge requirements for the items produced and tagged.

- Documentation of the manufacturing process that would be affected by item-level pRFID technology, which should include both material flow and interfaces with supporting information systems.

- Any key metrics and measures of performance that are important to the manufacturer.

- Use of current pRFID technology at the manufacturer (i.e., case and pallet pRFID labeling) including the current

  - contractual requirements for case and pallet labeling and

  - volume and surge requirement of cases and pallets.

- Any exception handling procedures or requirements that may affect the item-level process. These exception handling procedures may be the result of quality audits, QAR inspections, etc., and they may require the manufacturer to remove an item from a case or a case from a pallet after the item-to-case or case-to-pallet association has occurred.

- The information technology systems that support production, inventory management, quality, shipping, etc., most notably

  - the function of each system and its interface with other systems and processes;

  - the software platform on which the system resides (SQL, Microsoft Excel, COTS software package, etc.);[9] and

  - data elements and formats used for file transfers between systems and report files.[10]

- Manufacturer information technology system capabilities and any planned future corporate updates or changes to information systems, facilities, or manufacturing process that may affect implementation.

- The manufacturer's VIM-ASAP credentials (logon ID and password).[11]

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[9] If software modifications to any systems can be performed with internal resources, or the software is a purchased product or service, those changes must be coordinated with the software provider.

[10] These data elements and formats need to be understood only for those systems that are interfacing with functions that may be affected by item-level pRFID technology (i.e., those software systems that provide information for current VIM-ASAP upload).

[11] The manufacturer must obtain VIM-ASAP credentials if they are new to the VIM-ASAP system.

- ◆ The footprint (square footage) currently in use, and available, to perform operations associated with printing hang tags and case and pallet labels, applying current item tags, packing, applying case and pallet labels, palletizing, storage, and shipment.[12]

- ◆ The location and availability of electrical outlets and internet access points, including wireless access points. (This will identify any facility modifications required and ensure that power and internet capabilities are available as needed for implementation.)[13]

Create and Distribute an RFP to potential pRFID Solution Providers

To acquire item-level RFID process design and implementation services from a pRFID solution provider, the manufacturer should follow an industry Request for Proposal (RFP) process to solicit and receive proposed solutions offered from interested pRFID solution providers. The RFP should include both specific solution design requirements identified during the manufacturer's preparation phase and instructions to respond with complete descriptions of how the item-level pRFID process is addressed by their solution design. The structure of the RFP should prompt pRFID solution providers to include detailed descriptions in their proposed responses.

The example provided in Appendix C is a sample outline for an industry RFP to acquire item-level pRFID technology. It may serve as a useful guide to highlight pertinent information that should be included in the RFP, and it will give candidate pRFID solution providers valuable information for their responses. Using the outline will provide all prospective RFID solution providers with the same information.

Resources are available to identify potential RFID solution providers that may be interested in providing item-level RFID technology to military uniform manufacturers. VIM-ASAP support maintains a list of service providers that have experience with the VIM-ASAP data requirements and have successfully demonstrated the capability to upload and download information.

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[12] Also document the footprint of other operations that may be affected by the implementation of item-level technology.

[13] For those locations where power/internet availability are less than robust, the manufacturer will need to evaluate any proposed solution for backup/work around plans for impacts on performance due to the loss of power or internet capabilities.

The following is a current list of those companies and their points of contact:

COMPANY	POINT OF CONTACT	EMAIL
ComponentSoft, Inc.	Robert Zanghi	BobZanghi@ComponentSoft.com
Mid-South Marking Syste	David Summers	davidsummers@midsouthmarking.com
Miles Technologies, Inc.	Brett Prior	bprior@milestechinc.com
MilPac Technology	Greg Tsiknas	info@milpac.com
Odyssey RFID, LLC	J Cotty England	cotty.england@odysseyrfid.com
Quest Service Labs	Dalene Becka	dbecka@dowlinggroup.com
SimplyRFID	Eric Richmond	eric.richmond@simplyrfid.com
Military Logmars Plus	Michael Mulray	mmulray@laserlabels.com

Firms that would like broader advertisement of their RFP to solicit more responses can use the services provided by the *RFID Journal* at www.rfidjournal.com and the Association for automatic identification and mobility (AIM) at www.aimglobal.org.

Once the RFP is released, the manufacturer may want to conduct a workshop with interested RFID solution providers to clarify requirements. This workshop enables the RFID solution providers to observe the manufacturer's operations first hand and gives them the opportunity to gain additional information that may not be in the RFP.

Alternatively, the manufacturer may decide to conduct the item-level RFID design and implementation with in-house resources. This can certainly be the case where production volumes are low, item-level RFID integration is simple, and/or the manufacturer has RFID expertise available to design and acquire an item-level RFID capability. This approach may also be taken in higher production, more complex scenarios with larger manufacturers where robust manufacturing, IT, and RFID technical capabilities are readily available. Valuable information can be found in this guide to support either approach.

Conduct Solution Provider Selection Meeting

The manufacturer should review/evaluate the proposals received in response to the RFP and conduct a provider selection meeting. It is suggested that the project team convene to evaluate all proposals received by the due date. The scorecard in Appendix D may serve as a useful tool to evaluate RFPs. The goal of the meeting is to identify the RFID solution providers that have best satisfied the requirements in the RFP while demonstrating the capability to successfully implement the proposed solution within cost and schedule.

The scorecard categories and criteria in Appendix D are provided for reference. Manufacturers are encouraged to tailor the scorecard's categories, criteria, and scoring methodology to suit their needs. For example, a scoring methodology can be as simple as giving a 3 to the strongest responses, 2 to acceptable responses,

and 1 to the weak responses. The scoring can also be more elaborate with a 1 to 10 scale and include weighting the different categories and criteria as a relative measure of importance.

Another key consideration in selection are implementation and operations costs. Implementation and operational costs will differ for each manufacturer depending upon a number of variables, including the size of the implementation, complexity of the implementation, available infrastructure, solution provider business model, personnel costs, production volume, number of pack station, etc.

To help evaluate each response regarding costs, past implementations have divided the item-level RFID manufacturer process into fixed (start-up) costs and variable (recurring) costs.

- Start up costs

  - Hardware cost

  - Software cost

  - Installation cost

  - Labor, travel, other direct costs

- Recurring costs

  - Cost of RFID item tags and labels per month (Projected number of tags per month × Cost of each item-tag)

  - Hardware support

  - Software support

  - Subscription/license fees

  - Other support costs, such as printer ribbons.

While each implementation will vary in both design and costs, Appendix E provides historical equipment cost information.

Installation and Operations

Once the manufacturer's selection has been made, the manufacturer should enter into a contractual agreement with the selected RFID solution provider for both installation and operations support. The installation consists of the RFID solution provider ordering and receiving the equipment, installing hardware and software, and testing and training. It also involves making any changes to internal information systems and establishing any system interfaces with the chosen solution.

The project team will work directly with the RFID solution provider once selected to successfully implement the technology solution. It is likely that the design solution may need to be adjusted during implementation due to unforeseen issues/challenges that may arise.

Once operational, data should be collected on system performance such as tag print errors and tag loss, read rate success, impact on processing times, and number of validation errors to monitor performance. A review should be held a few weeks after Go Live to review the data and make any changes necessary to improve the performance of the system.

Once implemented, the manufacturer along with any solution provider, should monitor advancement in pRFID technology and modifications that may improve the operation of the system.

APPENDIX A. VIM-ASAP

VIM-ASAP is a collection of web applications used by apparel manufacturers to track production status, prepare invoices, ship items, and create all required documents and electronic transactions from a single source of data, the ARN Asset Visibility System (AAVS) DataMart. AAVS DataMart integrates the data from multiple legacy systems and Virtual Item Manager–Apparel Research Network (ARN) Supply-chain Automated Processing (VIM-ASAP) provides the web applications that fill voids in the supply chain data.

Generally, manufacturers interact with VIM-ASAP through the web portal at https://vim.dla.mil. If you do not have access to the ".mil" domain, you need to contact the VIM-ASAP Help Desk at 1-888-940-7348. The help desk is open from 7:00 a.m. to 4:00 p.m. (Pacific Time), Mondays through Fridays, except holidays.

There are three crucial computer/hardware requirements that must be satisfied in order to exchange data with VIM-ASAP:

◆ Establish an Internet connection through an Internet service provider.

◆ Ensure that your computer has Microsoft's Internet Explorer version 6.0 browser, or later, installed. VIM-ASAP may not operate successfully with other browsers, such as Mozilla Firefox.

◆ Acquire an ink-jet or laser printer for printing the forms and bar codes produced by VIM-ASAP.

Users need to identify an administrator as the primary point of contact (POC) with VIM-ASAP. The manufacturer's administrator will receive a user ID and password credentials. No one can update or access a manufacturer's VIM-ASAP web pages without being authorized by the manufacturer's administrator. If you misplace your password or have any other problems, call the VIM-ASAP Help Desk at 1-888-940-7348.

The VIM-ASAP Secure Shell (SSH)/Secure File Transfer Protocol (SFTP) site transitioned from the .com domain to the .mil domain. This move changed the way RFID files are uploaded to and contract data are downloaded from VIM-ASAP. Current VIM-ASAP site information is summarized in Table A-1.

Table A-1. Summary of VIM-ASAP Interface Information

VIM-ASAP interface	Information
1. URL	vim-ftp.dla.mil
2. Authentication method	User ID and Public Key
3. Temporary extension	Upload to temporary extension, rename when upload is complete
4. File name standardization	PrimeCAGE_SiteCAGE_yyyymmddx.ftp Or PrimeCAGE_SiteCAGE_yyyymmddx_wawf.ftp
5. Contract data upload/download	From SSH/SFTP in XML format

1. *URL*. the VIM-ASAP website address.

2. *Authentication method*. The server requires public and private keys for account authentication. Each user must have a public/private key pair. To accomplish account authentication, the private key is installed on the manufacturer machine, and the public key is communicated to the SSH server administrator. It is a good idea to have a backup plan, in case the client machine goes down; if the private key is not backed up, a new key pair will need to be generated, and the new public key will have to be associated to the SSH account. Since all actions on the SSH accounts require action by the SSH administrator, expect any change to take time to implement.

3. *Temporary extension*. With the new server, users need to upload files with a temporary extension (e.g., ".tmp", or ".part"), then rename them on the destination, so the process that picks up the files does not try to pick up files that are still being uploaded.

4. *File name standardization*. Users need to include the CAGE code of the prime contractor (C&T contractor), an underscore character, the CAGE code of the ship-from site, an underscore character, the four-digit year, two-digit month, and two-digit day, followed by a one-character sequence indicator, then, if the file is based on the WAWF COMBO_UDF format, the string "_wawf," and in all cases, end with ".ftp."

5. *Contract data upload/download*. Files are uploaded to and down-loaded from the SSH/SFTP site vim-ftp.dla.mil. Any software that supports that protocol may be used. Several free SSH/SFTP clients will interface with the SSH/SFTP site:

http://www.bitvise.com/downloads/Tunnelier-Inst.exe

http://winscp.net/eng/download.php

http://www.openssh.org

http://the.earth.li/~sgtatham/putty/latest/x86/pscp.exe

http://the.earth.li/~sgtatham/putty/latest/x86/psftp.exe.

The user is responsible for any conversion required to import the data into the manufacturer's in-house system.

The system downloads a file containing the current contract data (from ActiveContracts_UPC report) into the user's home directory every evening. It is important to use extensible markup language (XML) parsing methods to process this file as the content (order and number of fields) of the file may change without notice.

APPENDIX B. FIELDS REQUIRED BY VIM-ASAP FOR FILE UPLOAD

The items in Table B-1 are required for lines that start with number 1 through 17, 28, and 29. Lines 11 and 28B are used as needed.

Table B-1. Fields Required for VIM-ASAP File Upload

Sample line	Description
1*SPM1C107D0009^0194^	Contract and delivery order
9*0B419^	Prime contractor CAGE
11*1TKK5^	Ship from CAGE; optional if same as prime
13*SD0131^	Ship to DoDAAC
15*0005^	CLIN
16*8415015364227^	NSN
17*540^	Qty shipped on CLIN from line 15 above
28*RFID^2F02031544B4B3500007A47D^	Packing data; pallet-level RFID
28A*RFID^2F12031544B4B35000076591^	Packing data; case-level RFID
28B*RFID^2F22031544B4B35000076232^	Packing data; item-level RFID
29*0005^1^	CLIN and quantity
28B*RFID^2F22031544B4B35000076233^	Packing data; item-level RFID
29*0005^1^	CLIN and quantity
	More lines 28, 28A, 28B, and 29 as required
=END=	

In the example above, material is packed in cases that are placed on pallets. Further, material is marked to the item level; therefore, all lines numbered 29 specify a quantity value of 1. If, as an example, material is packed as described above, but marked to the case level only, there would be no lines numbered 28B, and the lines numbered 29 would specify the quantity of items packed in the case.

APPENDIX C. RFP OUTLINE FOR AN ITEM-LEVEL TECHNOLOGY IMPLEMENTATION

The outline in Table C-1 serves as a useful guide to ensure the necessary and pertinent information and requirements is provided in the RFP/RFQ. Using the outline will ensure all prospective solution providers receive the same information.

Table C-1. RFP Outline

Description	Requirements and capabilities sought
Download data from VIM-ASAP	Download current open DLA Troop Support contracts, including item information
	Daily downloads via file transfer protocol
	Ability to pull contract data for sub CAGE codes, if necessary
	Highly desirable for solution provider to have previously demonstrated this capability
	System has automated synchronization with VIM/ASAP
RFID item tag printing	The new item-level RFID technology process will be able to support production volume of average and surge of items per month
	Prefer to convert current hang tag required by contract to RFID item tag; converted tag to have same information as current hang tag plus RFID inlay with unique RFID tag ID number—unique hexadecimal serial number (human readable and bar code)
	If unable to consolidate the current non-RFID hang tag with the new item-level RFID tag, the RFID item tag must be attached in addition to current hang tag
	Item-level RFID Tag ID will follow the EPC or DOD-96 bit tag ID construct
	RFID item tag recommended to be L" × W" and will contain the unique RFID tag ID number in human readable and bar code formats
	The system should have a robust capability to prevent duplicate tags from being produced
	The system should have controls on archived tags so they cannot be created/used again
	Automatic updates to solution software are required to ensure continuation of successful operations
	The system should provide controls on the file naming convention to maintain integrity of files
	Verify actual tag IDs at various stages to ensure duplicate tags do not enter the supply chain
	Ensure that encoded/bar code/human readable information are generated from the same data source

Table C-1. RFP Outline

Description	Requirements and capabilities sought
RFID Case and Pallet Label Printing	Average and surge numbers of case and pallet labels required per month RFID case label required to be L" X W" RFID pallet label required to be L" X W" Case and Pallet Label RFID tag ID will follow the EPC or DOD-96 bit tag construct The pallet tag will include the words "pallet tag" in human readable form and must be accompanied by a VIM-ASAP produced MSL Require the ability to print the case and pallet RFID labels in batches or on demand and to print these labels on the production floor, if desired Case level RFID label formats are defined in MIL-STD-129P, change 4 @ http://www.acq.osd.mil/log/rfid/MIL-STD-129PCH4.pdf Pallet labels and MSLs will be attached in accordance with MIL-STD-129P,change 4 found on the website above A universal product code, or UPC, bar code will be printed on each case label
Item Packaging	State requirement for solution to integrate with current packing process State item hang tag placement requirements and attachment method Require solution to fit in current physical limitations ◆ Production area ◆ Item tag area ◆ Pack area ◆ Shipping/receiving area Provide production and staffing limitations for item level technology and case and pallet labeling
Validate RFID Item Tags and Link to RFID Case Label	RFID item tags to be associated with case labels either during the packing process or after case has been sealed RFID case label placed on case before packing or after packing Specify standard case quantities for each NSN as part of data downloaded in Item 1 Specify Validation logic, such as: If quantity in case equals case quantity based on manufacturer's/third party logistics provider's RFID case label—accept If quantity in case does not equal case quantity based on manufacturer's/third party logistics provider's RFID case label—reject for correction If there are multiple NSNs inside the case, regardless of the quantity—reject for correction Specify time requirements to read item tags within a case (Usually between 4 and 6 seconds) The solution design should identify an isolation zone ("no tag zone") required to eliminate undesirable reads System should identify if any unknown tags are read
Exception Handling	◆ Specify procedures for physically replacing items within a case after the RFID item tag has been linked to the RFID case label ◆ Specify procedures for regenerating a tag that has been damaged, destroyed, or lost
RFID Case Label to Pallet Label Linkages	◆ Electronically link RFID case labels to RFID pallet labels ◆ Electronically link RFID pallet labels to contract/delivery order and shipment number ◆ Specify option to configure the system to make the link on the shipping floor

Table C-1. RFP Outline

Description	Requirements and capabilities sought

Upload Data to VIM/ASAP	◆ Data uploaded to VIM-ASAP includes:
	  ○ DD Form 250 shipment data
	  ○ RFID pallet label data for each shipment
	  ○ RFID case label data linked to correct pallet label
	  ○ RFID item-level data linked to correct case label
	◆ System will Identify and replace any duplicate tags and prior to the upload to VIM/ASAP

Deployment	◆ Order, install, and test equipment ◆ Install and test software ◆ Provide end-user training and documentation ◆ Provide post implementation support ◆ Perform data gathering to determine RFID item tag performance

APPENDIX D. RFP EVALUATION SCORECARD

This scorecard (Table D-1) may serve as a useful tool to evaluate RFPs.

Table D-1. Scorecard for RFP Evaluation

Criteria	Category	Solution provider #1	Solution provider #2	Solution provider #3
Description of functionality	How clearly are the details explained?			
RFP evaluation	A. Item-level visibility			
	B. Item-level accountability			
	C. Customizable/scalable solution			
	D. Quality			
RFP capabilities	A. Download open contract data from VIM-ASAP			
	B. Commission and print item-level tags in accordance with user requirement			
	C. Commission and print case and pallet tags			
	D. Integration into manual packing process within space specified			
	E. Item to case link			
	F. Exception handling			
	G. Case to pallet link			
	H. Upload to VIM-ASAP			
Timeline	Does the proposal meet the RFP implementation timeline?			
Cost	Fixed			
	Variable			
	Price quote?			
	Payment options			
Solution architecture	Remote vs. local			
	Totals			

APPENDIX E. EXAMPLE COSTS SUMMARY

Table E-1 provides the primary hardware costs associated with the test kits provided in past implementations. Manufacturers should be aware that the cost trend of hardware and software was downward over the timeframe of CDUM R&D and IBIF implementations.

Table E-1. Test Kit Equipment Costs

Component	Typical cost
pRFID printers and encoders	$3,899.00
Fixed pRFID antenna	$130.00
pRFID reader	$1,587.00
pRFID handheld reader	$3,000.00
PC workstation with display	$800.00

The spreadsheet below provides an example of calculating the per unit cost increase for pRFID technology. The example below includes additional unit costs for case and pallet level pRFID labeling, in addition to item-level pRFID technology costs. Most manufacturers already pRFID label at the case and pallet level, so these costs may not apply.

Equipment Amortization							
	Equipment Cost			$29,217.41			
	units per week			15,000			
	weeks per year			50			
	years to recovery			3			
	Total Units to recovery			2,250,000			
				Total $ per units			0.0130
Tag Cost							
	Item Level Tag Cost						0.1320
	unusable tag %		1.000				0.0013
	Case Label		0.135				
	units per case		30.000				
	cost per unit case label						0.0045
	Pallet Label		0.137				
	units per pallet		450.000				
	cost per unit pallet label						0.0003
				Total Cost			0.1511
				labor, overhead margin 10%			0.0151
				Total Cost per unit			**0.1662**

APPENDIX F. ABBREVIATIONS

AAVS	ARN Asset Visibility System
ABU	airman battle uniform
AIM	automatic identification and mobility
ARN	Apparel Research Network
CAGE	commercial and government entity
CDUM	Customer Driven Uniform Manufacture
CLIN	contract line item number
COTS	commercial off-the-shelf
DLA	Defense Logistics Agency
DoD	Department of Defense
DoDAAC	Department of Defense Activity Address Code
EPC	electronic product code
IBIF	Industrial Base Innovation Fund
ID	identification
IT	information technology
MHz	mega hertz
MIL-STD	Military Standard
MSL	military shipping label
NLT	no later than
NSN	national stock number
PC	personal computer
POC	point of contact
pRFID	passive radio frequency identification
QAR	quality assurance representative
R&D	research and development
RFID	radio frequency identification
RFP	request for proposal
RFQ	request for quotation
SFTP	secure file transfer protocol
SSH	secure shell

UHF	ultra high frequency
VIM-ASAP	Virtual Item Manager–Apparel Research Network Supply Chain Automated Processing
WAWF	Wide Area Workflow
XML	extensible markup language