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Original title on 712 A/B:
Automatic Identification Technology for Arms Room Management

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**Automatic Identification Technology for Arms Room Management**

**Author(s):**
US Military Academy Dept. of Systems Engineering, Mahan Hall West Point, NY 10996

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**SUPPLEMENTARY NOTES**

**ABSTRACT**

**SUBJECT TERMS**

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**LIMITATION OF ABSTRACT**
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Standard Form 298 (Rev. 8-98)  
Prepared by ANSI Z39-18
Automatic Identification Technology for Arms Room Management

LTC John B. Willis
US Military Academy
Department of Systems Engineering
Agenda

- Background
- Approach
- Analysis and Results
- Path Forward
Problem Background

- USMA Arms Room contains ~12,000 sensitive items and requires a system is to provide:
  - **Accountability** – employ AIT technology.
  - **Efficiency** – rapid draw and turn-in process.
  - **Accessibility** – allow open access for cadets.
The Systems Decision Process (SDP)

- **Problem Definition**
  - Stakeholder Analysis
  - Functional Analysis
  - Value Modeling

- **Solution Design**
  - Idea Generation
  - Alternative Generation
  - Solution Enhancement

- **Decision Making**
  - Decision Makers & Stakeholders
  - Solution Scoring
  - Sensitivity Analysis
  - Value-Focused Thinking

- **Solution Implementation**
  - Planning for Action
  - Execution
  - Assessment & Control
  - Solution Decision
  - Environmental
  - Emotional
  - Organizational

- **Desired End State – What should be?**
  - Current Status – What is?
  - Additional Needs

- **Environment**
  - Cultural
  - Historical
  - Legal
  - Moral / Ethical
  - Economic
  - Technological
  - Organizational
  - Emotional
  - Social
  - Political
  - Environmental
USMA Arms Room Layout

Inventory includes:
5,300 M16A2 Rifles
3,600 M14 Rifles
Machine Guns
Pistols
Night Vision Devices
Radios
Bayonets
Historical Weapons
Current Arms Room Process

Wait in Line

Claim Identity

Verify Identity

Retrieve Weapon

Retrieve Equipment

Validate Weapons and Equipment

Log Item, SN, Model

Sign Log

Paper-based:
DA3749 (Weapons Card)
Log sheet

Inventory operations are
time-consuming and labor intensive

Takes 3.5 hours
to process 125
Soldiers

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AIT-Based Arms Room

- Wait in Line
- One Step Authentication
  - Claim Identity/CAC
  - Verify Identity
- Retrieve Weapon
- Rapid Weapon and Equipment Retrieval and Immediate ID Confirmation
  - Log Item, SN, Model
- Real-time Logging and Transaction Recording
- Log Out
“AIT is a suite of technologies that enable the automatic capture of source data, thereby enhancing the ability to identify, track, document and control deploying and redeploying forces, equipment, personnel and sustainment cargo.”

*Logistics AIT CONOPS – Nov 1997*
The NAVAIR Team as an AIT Resource

**SPECIFIC AIT KNOWLEDGE**
- UID/ UII Requirements
- 1 and 2D Bar Code Scanners
- CCD and Laser Scanners
- Contact Memory Devices
- RFID (passive/active) Systems
- Interrogator’s - Fixed and Portable
- Wireless Networks

**EXPERIENCED TEAM**
- AIT Specialists
- Software Programmers
- System Analysts
- Operators/Installers
- Trainers

**AIT APPLICATION EXPERIENCE**
- Item Visibility Tracking
- Warehouse Asset Inventory
- Item Maintenance Records
- AIT System Integration
- Weapons Management
- Supply Management

**DoD Sponsors ....**
- Navy: NAVSUP, NAVSEA
- Army: LIA
- DoD Logistics AIT Office
- MARCORSYSCOM
- OSD AT&L

**Other Government Clients ...**
- Department of Homeland Security
- Transportation Security Administration
- Customs and Border Protection
- White House Communications Agency

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NAVAIR AIT Team Experience

Support for Department of Defense

- Navy’s Fleet Readiness Center Support Equipment Facility Business Process Analysis
- U.S. Army Armory Sensitive Item Marking (SIM) Asset Management System
- US Navy Shipboard RFID Compatibility Study
- OSD AT&L Analysis of Alternatives to DPAS
- US Army LIA Evaluation of Micro-Electrical-Mechanical Sensors (MEMS) for Military Medical Application

Support to other Federal Agencies

- Transportation Security Administration: Nationwide Asset Management System Support – Sunflower Asset Management System
- Customs and Border Protection: RFID Asset Tracking System for Weapons and Body Armor
- Federal Flight Deck Officers Program: RFID System for Weapons and Credential Management
- National Explosive Detection K-9 Program: Training Asset Tracking System
Project Overview

• Define Existing Operational Requirements
  – Requirements Analysis Completed.
  – Results Documented.

• Develop/Test Automated Armory Asset Management System (A³MS) Design
  – Develop approaches to integrate RFID and UID technologies.
  – Test and Evaluation Design Approach.
  – Establish Detailed Design Plan.

• Equipment Procurement, Installation and System Implementation
  – Future Effort.
• NAVAIR Team initially met with USMA October 06.
  • Discussed AIT technology solutions for arms room weapons and equipment tracking.
    – Documented high level requirements; reviewed arms room layout at USMA.
    – Earned concurrence from USMA for site survey/business process analysis.
    – Perform RF spectrum analysis used to identify any potential interference issues.
    – Resulting report used as checkpoint for proceeding.

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Thousands of Products use the RF Spectrum

- **Low Freq. EAS**: Data Modem
- **Mid. Freq. EAS**: Radio Toys, AM, CB
- **RFID: Access Control**: Animal ID
- **RFID: Smart Cards**: Data Terminal, TV, Garage Door
- **RFID: Toll Roads & Item Management**: Cell Phone
- **RFID: Item Management**: Microwave EAS

Frequencies:
- 10 kHz
- 100 kHz
- 1 MHz
- 10 MHz
- 100 MHz
- 1000 MHz
- 2.45 GHz
- 300 GHz

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Why Now?

- Technology Maturity
  - Costs dropping, reliability rising

- Realization of ROI for AIT and Total Asset Visibility (TAV)
  - Straight forward application with clear benefits

- DoD RFID Policy
  - The giant has been awakened…
### Characteristics of Active and Passive RFID Tags

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Passive Tags</th>
<th>Active Tags</th>
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<tbody>
<tr>
<td>Communication power supply</td>
<td>External – From reader</td>
<td>Internal battery</td>
</tr>
<tr>
<td>Read range</td>
<td>Up to 15 feet*</td>
<td>Up to 250 feet**</td>
</tr>
<tr>
<td>Write range</td>
<td>0.5x to 1.5x as read range</td>
<td>1X read range</td>
</tr>
<tr>
<td>Storage capacity</td>
<td>Relatively less</td>
<td>Relatively more</td>
</tr>
<tr>
<td>Susceptibility to interference</td>
<td>Higher</td>
<td>Lower</td>
</tr>
<tr>
<td>Tag cost</td>
<td>$0.35 to several dollars</td>
<td>Typically Over $20</td>
</tr>
<tr>
<td>Life of tag</td>
<td>Up to 20 years</td>
<td>Roughly 5 to 10 years</td>
</tr>
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</table>

* Metal impedes read range and can reduce it substantially.
** Some read ranges extend well beyond 250 feet in ideal conditions.
Passive RFID Technology

- RF energy emitted from antenna is used to power tag circuit.
- Tags use this energy to update data, emit (backscatter) signal at a fraction of the received power.
- These tags can carry single unique ID or multiple character length data fields.
- Range/performance is tied directly to frequency and power output.
Benefits of RFID

- Automatic identification of weapons and equipment.
- Rapid authentication of Soldiers and armorers.
- Information-rich environment, powered by RFID association.
- Captures, stores, and correlates detailed information about all system transactions
  - Draw and turn-in date/time and personnel.
  - Maintenance / cleaning.
  - Inventory requirements.
Benefits of an Integrated A³MS

• Benefits of Deploying RFID Technology
  – Automate the Inventory Process and Improve Inventory Accuracy
  – Update and Maintain a Real-Time Inventory
  – Time and Cost Savings for the Issue/Return Process

• Benefits of Deploying UID Technology
  – Unique Serialized Identification on each and every Asset
  – Permanent Mark for the Life of the Asset
  – Provides Asset Record for DoD Registry

• Benefits of an Integrated RFID/UID System
  – Meets DoD UID Requirements
  – Verify and Validate the Inventory to Ensure Clean Audit
RFID Tag Installation

- Attached to the receiver near S/N (accountable portion.)
- Input from arms room manager is critical.
- Few lost tags with proper mounting.
UID Marking

Laser Etched Permanent Mark

Removable Label Designed For Reading Weapon in Gun Rack
Example Portal Configuration

- Admin Database Station
- Cadet
- CAC Reader
- Interrogation Portal
- Verify Cadet To Assets
- Read Cadet Info
- Feedback to Cadet
- Feedback Monitor
Handheld Interrogator

- Low cost COTS product.
- Easy to navigate user interface using standard Microsoft Windows color schemes and controls.
- Intel XScale 600 MHz processor, 256 MB ram using Windows Pocket PC operating system for ease of use.
AIT Initial Concept Analysis & Results

• Business Processes addressed:
  – Initial issue/receipt of weapons to cadets using CAC card or other AIT media
  – Inventory Control process to increase accuracy and timeliness
  – Evaluate UID 2D data matrix barcode placement and size
  – Evaluate optimal marking processes/tag selection to fit weapon type

• Business Process Flows captured:
  – Cadet Issue and Return – via RFID portal, CAC identification of Cadet and RFID on asset supporting high traffic volume with accountability
  – Routine operations using handheld to perform low volume functions
  – Data captured automatically, hand receipt DA 2062 system-generated
  – System-generated reports (Issued/Returned, Asset Location, Inventory Discrepancy)

• Legacy inventory management systems interface if needed

• Observed “clean” RF spectrum during analysis sweep (902 - 928 MHz)
Path Forward

- Final design planning
- Procurement and installation
- Training
- Support
Questions

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