



NAVAL SUPPLY SYSTEMS COMMAND

*Ready. Resourceful. Responsive!*

**2003 Submission**

**United States Navy**

February 2003

**Supply Chain Council Award for  
Supply Chain Operational  
Excellence**



**U.S. Navy  
Serial Number Tracking  
Program**



NAVAL SUPPLY SYSTEMS COMMAND

## Executive Summary

February 12, 2003

*Ready. Resourceful. Responsive!*

This document contains the United States Navy's submission for the 2003 *Supply Chain Council Award for Supply Chain Operational Excellence*. Our nomination is for the Serial Number Tracking (SNT) program, the Navy's comprehensive initiative to improve material and financial accountability by the tracking of serialized assets through our complex supply, transportation and maintenance processes.

The SNT program was initiated in November 1998, in response to the Navy's Aviation Maintenance-Supply Readiness (AMSR) review, which determined that process improvements were needed to reduce inflated maintenance costs caused by loss of material accountability. While several attempts had been made over the years to reduce asset loss by tracking components by their serial numbers, these efforts proved to be either too labor intensive or too limited by their applicability to only selected programs which did not produce enterprise-wide results.

The growing availability of powerful resources, including information technology, Internet capabilities, and Automatic Identification Technology (AIT), has allowed the Navy to develop a seamless, enterprise-wide SNT solution. The program employs commercial practices and standards in using AIT capability, including contact memory buttons, 2-dimensional bar codes and portable read-write devices, to transfer serial number and other maintenance significant component information into legacy supply, transportation and maintenance applications. Once stored, in previously existing systems, the web-based Serial Number Tracking System (SNTS) allows users, through the worldwide web, to retrieve that information and use it in the logistics decision-making process. The end result is a web-enabled SNT application, linked to legacy Navy systems and available for use throughout the Navy, DoD and private industry, employing 21<sup>st</sup> century technology and commercial standards to the maximum extent possible.

**J. D. McCARTHY**  
Rear Admiral, SC, USN  
Commander  
Naval Supply Systems Command

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## Section 1. General Information and Project Complexity

Provide the name of the submitting organization:	United States Navy
Identify the name of the organization unit:	Naval Supply Systems Command (NAVSUP) Mechanicsburg, PA
Provide a brief mission statement of the organization:	NAVSUP's objective is to deliver combat capability through logistics to provide Navy, Marine Corps, Joint and Allied Forces quality supplies and services on a timely basis. NAVSUP will be the customers' choice for best value products and services, where a single request by the customer activates a global network of sources and solutions...in short, "One-Touch Supply." (Currently NAVSUP has over 9000 personnel involved in Logistics related functions)
Indicate the award category of submission:	Supply Chain Operational Excellence
Provide a brief description of the supply chain and the processes the submission spans: (Scope)	The Serial Number Tracking (SNT) System is a command level program designed to provide closed-loop, cradle-to-grave tracking of depot level repairable, serialized components. SNT provides asset visibility and material condition status enabled by Automatic Identification Technology (AIT) during the manufacture, shipment, storage, installation, repair and disposal of these components.

<p>Provide the names and number of people involved from each supply chain partner organizations involved in the project: (External)</p>	<p>Concurrent Technologies Corporation* (12 employees)  Macsema Corp (2 employees)  Kongsberg-Simrad (3 employees)  Raytheon, Inc (3 employees)  Intermec, Inc (3 employees)  Symbol Technologies (3 employees)  Manugistics, Inc. (2 employees)  Bruno Associates (1 employee)  Q.E.D. Systems Inc. (1 employee)  Unified Industries Inc. (3 employees)  Resource Consultants, INC (2 employees)  Marconi, Inc (3 employees)  Hamilton Sunstrand (2 employees)  Veridian Engineering (2 employees)  *<a href="#">Affiliated with the University of Pittsburgh research department</a></p>
<p>Provide the names of the functional organizations (Internal) involved in the project and indicate the number of people involved from each functional organization and category of functional category of each. (Internal)</p>	<p>Internal (DoD) Partner organizations participating in the SNT initiative:</p> <ul style="list-style-type: none"> <li>-Naval Air Forces, Atlantic Fleet</li> <li>-Naval Air Forces, Pacific Fleet</li> <li>-Naval Surface Forces, Pacific Fleet</li> <li>-Naval Air Systems Command</li> <li>-Naval Submarine Force, Atlantic Fleet</li> <li>-Naval Air Warfare Center-Aviation Division, Patuxent River, MD</li> <li>-Naval Air Warfare Center-Aviation Division, Lakehurst, NJ</li> <li>-Naval Aviation Depot, Cherry Point</li> <li>-Naval Aviation Depot, North Island, San Diego, CA</li> <li>-(11) H53 Helicopter Squadrons</li> <li>-(5) E2/C2 Aircraft Squadrons</li> <li>-(1) H60 Helicopter Squadron</li> <li>-(1) EA6B Aircraft Squadron</li> <li>-(1) V22 Aircraft Squadron</li> <li>-(1) F/A18 Aircraft Squadron</li> <li>-Regional Supply Office, Norfolk, VA</li> <li>-Commander, Mine Warfare Command</li> <li>-Fleet &amp; Industrial Supply Center, Ingleside Detachment</li> <li>-Naval Supply Systems Command</li> <li>-Naval Inventory Control Point (Philadelphia and</li> </ul>

	<p>Mechanicsburg, PA sites)          -Navy AIT Office, Mechanicsburg          -Naval Transportation Support Center          -Naval Supply Information Systems Activity          -Space and Naval Warfare Systems Center, Norfolk, VA          -Trident Refit Facility, Kings Bay, GA          -Fleet &amp; Industrial Supply Center, Advanced Traceability And Control, Norfolk and San Diego          -DoD Logistics AIT Office          -Defense Distribution Center          -Naval Surface Warfare Center, Crane Division, IN          - Naval Sea Logistics Center          - Naval Sea Systems Command, Washington, DC          - Tinker Air Force Base, Oklahoma City, OK          - Corpus Christi Army Depot, Corpus Christi, TX          -Defense Logistics Agency Asset Management Team</p> <p>All of the above organizations participate via a broad, cross functional teaming arrangement that includes policy makers, SNT users, and information system designers, guided by AIT implementation standards best practices experience. Over 200 personnel were involved from the various organizations.</p> <p>Training has been conducted for approximately 400 individuals. This number included shore based support staff personnel at Naval Inventory Control Point, Naval Air Systems Command, and Naval Supply Systems Command, as well as sailors and at pier-side support staff.</p>
<p>Provide a Point of Contact for each supply chain partner:</p>	<p><u>Primary Points of Contact:</u></p> <p>Commander, Naval Air Systems Command          POC: Mike Breckon (Air 3.2.5)          Bldg 416 Suite 100B          NAVAIRSYSCOM HQ, 47013 Hinkle Circle Unit 8          Patuxent River, MD 20670-1628          (301) 757-2670, DSN 757-2670          Email: breckonmj@navair.navy.mil</p>

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## Section 2. Implementation

### 1. Describe the reason that the supply chain project was undertaken and how it was selected:

The Serial Number Tracking (SNT) program was initiated in November 1998 to accomplish a goal that has existed since the beginning of repairables management – tracking individual serialized components through supply, maintenance and transportation processing. In addition to providing an enhanced asset visibility capability, convenient access to maintenance data and component history is also achieved. Automatic Identification Technology (AIT) is employed in several forms to ensure efficient and accurate SNT operations.

The SNT system is a web-enabled Virtual Shared Data Warehouse that directly accesses multiple disparate maintenance and supply databases to provide responses to queries concerning asset visibility, maintenance history and warranty status (Figure 1). The addition of the serial number, as a new data element, into many of these databases was necessary to support the serial number tracking project, and current uploads of serial number data are enabled by AIT, wherever possible.

### Welcome To SNTS Web Page www.snt.navsup.navy.mil



Figure 1: (Welcome to SNT web page)

**Note – Acronym list is provided at end of award input - pages 29 & 30**

SNT will provide numerous benefits to stakeholders throughout the Navy. These include: improved asset visibility, enhanced warranty management, assessment of depot maintenance performance, simplification of fleet screening of material (fleet screens), identification of rogue items, reduction in carcass loss and many others.

Initial Operating Capability was achieved in January 2001 and initial training commenced shortly thereafter. Much remained to be accomplished. Initial Operating Capability provided limited retrograde tracking capabilities, access to installed aircraft parts and rudimentary accountability for repaired assets. Fully designed stakeholder benefits are to include the following (as partially depicted in Figures 2a and 2b):

1. Improved asset visibility. Existing systems track items of supply by a non-component specific National Stock Number (NSN). Tracking by serial number will provide accountability to each individual item within populations of the same stock numbered material.
2. Enhanced warranty management. Results of a study analyzing serial number material being processed for retrograde repair disclosed that 10% of the items were still under vendor warranty. Accountability was lost due to the inability to track specific items by unique serial number.
3. Assessment of depot performance. Measurement of maintenance depots performance could be maintained by the unique asset, vice the commodity level. Comparisons, by individual part and by repair site, can be made.
4. Simplification of fleet screens. Before development of the SNT system, multiple databases were searched to obtain the same information provided now by one web-enabled system.
5. Identification of rogue items. The SNT system will be able to identify problem items that are being repeatedly inducted for repair and analyze their potential for designation as being beyond-economical-repair. Similar item/class histories have the potential to disclose more serious material quality assurance shortfalls.
6. Reduction in carcass loss. Asset visibility by serial number identification will reduce carcass losses. The SNT web application will record latest component status, either in the repair cycle, or as an installed asset and will be available to provide key insight in research for misplaced items.

## SNT provides Common Links to Logistics Data



Figure 2a (Snapshot of SNT's Retrograde Query)



Figure 2b (Snapshot of SNT's Inventory Query)

Decision Support queries allow users to investigate components by their unique serial number or part number and make informed management decisions (Figures 3a and 3b) for:

1. Locating carcasses turned in to designated repair activities that have no record of receipt as reflected in associated databases.
2. Saving scarce dollars needed to support other operational commitments.
3. Tracking (via e-mail notification) carcasses in the retrograde cycle; and allowing managers to verify turn-in of carcasses.

4. Ensuring that items, which can be repaired at intermediate maintenance activities, are not forwarded to depots for restoration, saving operational funds.
5. Attaining, by serial number, highest cannibalization and failure reports of repairable components; allowing managers to determine maintenance history of these items for disposal or redesign considerations.
6. Receiving (via automated e-mail) notification of items under warranty being returned to commercial repair activities; following-up with the task of warranty management.
7. Receiving reports of No-Fault Found maintenance actions by Type Model Series, with drill-down capability to the asset serial number level.
8. Receiving reports of installed aviation assets by individual aircraft
9. Reducing the misidentification of material
10. Avoiding reintroduction of condemned parts
11. Improving configuration management
12. Improving technical directive compliance
13. Increasing the capability to track material reliability
14. Gaining the speed and accuracy of electronic database management of maintenance-significant documentation
15. Improving repair turn around time tracking and performance
16. Improving the carcass repair process, and repair material planning

**The SNT System can Generate, Collect and Analyze Maintenance Data**



Figure 3a (Example of Decision Support Report)



Figure 3b (Highest Failure Report from Decision Support Module)

### One-Touch System

SNT is a web-enabled data warehousing system that allows customers to submit queries (based on needed information) that simultaneously access multiple databases, and displays current information in a user-friendly format, allowing managers to make timely decisions. Figure 4 is a visual display of databases currently accessed by the SNT system.

### Serial Number Tracking Data Base Access

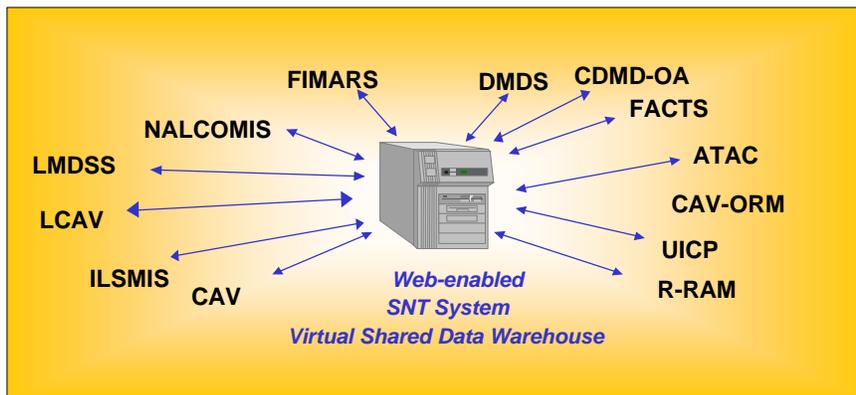


Figure 4: (Databases accessed by SNT)

Figure 5 is a visual display of the Contact Memory Button (CMB)/bar code reader/writer providing the capability to read/write data to the CMB and read bar codes. The SNT web application and all data accessed via the SNT System are also accessed via the Naval Supply System Command's One Touch System.



Figure 5 (Sample CMB/Bar Code reader/writer, CMB (approximate size = a dime) and 3/9 and 2D bar codes)

## 2. Indicate the duration of the project:

The SNT Program (with its supporting AIT installation program) is a joint venture between Naval Air Systems Command and Naval Supply Systems Command providing a six-year implementation plan. The plan lays out AIT installation by Type Model Series of aircraft. Initial prototyping proved the SNT concept and provided additional efficiencies that were not anticipated. With prototyping completed and initial operations underway, the first Type Model Series aircraft is completed with the next three currently being implemented. Concurrent with the aircraft implementations, initial applications are being developed for the Navy's ships and submarines.

SNT is a dynamic, ongoing initiative. Additional efficiencies are being realized as the program is expanded to allow customers a "one-stop" web site to track components and assist in other material management decisions.

## 3. Describe, in detail, the process used to complete the SNT initiative:

SNT **depends** on two critical and complimentary elements: (see Figure 6-Two Pillars)

**First** is live access to various databases via the **SNT Web-enabled system**. Currently SNT is accessing over 12 databases. This facilitates the assessment

of an asset's location and status with respect to its maintenance plan, the consolidation of this information for logistics analysis and if the component is installed in an aircraft.

**Second** is use of **Automatic Identification Technology (AIT)** to maintain data integrity. AIT symbology used in SNT is the Contact Memory Button (CMB) and the Bar Code. This automated means of marking and identifying equipment eliminates manual entry of the commonly used equipment identifiers, which inherently causes data errors.

Serial number tracking of assets is critical to inventory validity, spare part procurement decisions and the financial integrity of Navy inventory management. A consolidated and centralized view of **correct** information pertaining to the above is essential. In summary, the conceptual solution for Serial Number Tracking is to closely integrate a Serial Number Tracking system with automated technology for equipment identification.

### Two Pillars of SNT

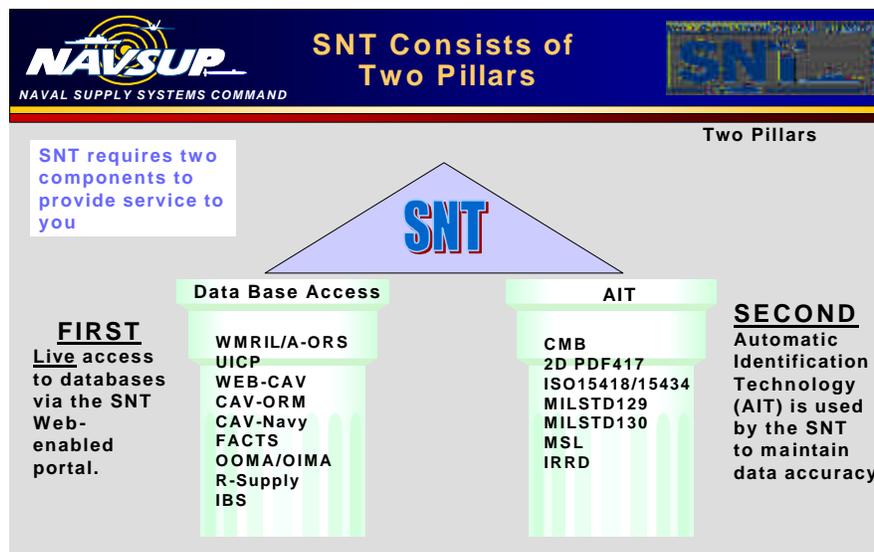


Figure 6: (Graphic of the Two Pillars of SNT)

Four basic steps comprise the process used in putting the SNT system together.

- a. In Depth Commercial Practice Review
- b. Changing Legacy Automated Information Systems
- c. Automatic Identification Technology Integration
- d. SNT Implementation and Deployment Strategy

## In Depth Commercial Practice

Based on information gathered from commercial industry, Navy maintenance activities, and Supply System activities, the following benefits will be realized with the SNT/AIT system:

- Reduction in misidentification/loss of material
- Avoidance of reintroduction of condemned parts
- Improvements in configuration management
- Improvements in technical directive compliance
- Increased capability in reliability tracking
- Access to electronic database of Electronic Logset information
- Improvements in repair turn around time tracking
- Improvements in repair and repair material planning
- Reduction of carcass tracking thresholds
- Improved efficiency in document reconciliation
- Increased revenue from sales at Defense Reutilization and Marketing Office

Also, additional analyses on SNT/AIT benefits have been completed by other Government activities. Notably, the Naval Air Systems Command study of May 1998, Aviation Maintenance Environment (AME) Cost Benefit Report that cited significant savings associated with reductions in A799s (No Fault Found Reports), and fleet maintenance man-hours.

During this formative stage in the evolution of the Program, the SNT/AIT teams met with maintenance, supply and support personnel from American Airlines, Boeing Corporation, United Airlines and the Air Transportation Association. Based on these meetings, it was evident that the commercial sector is gaining significant benefits from the implementation of SNT/AIT systems. Some of the benefits are:

- 13% data errors reduced to 2%
- 98% reduction in man hours to gather part location data
- Improved warranty claims
- Identification of error origination
- Improved analysis of Mean Time Between Failure
- Improved analysis of No Fault Found issues
- Improved analysis of modification benefits
- Improved tracking of assets
- Identification of reliability issues
- Improved trend and material analysis
- Improved component history

## Changes required to Automated Information Systems

SNT changed existing Automated Information Systems, making modifications where necessary to capture transactions to be reported up-line to the virtual shared data warehouse system. Figure 7 provides a graphic representation of the SNT information and asset data flow for aviation assets. A similar representation applies in the maritime world.

Optimized Organizational and Intermediate Level Navy Aviation Logistics Command/Management Information systems used by fleet activities to report transactions currently have the data fields to store Commercial and Government Entity (CAGE), Part Number, and Serial Number data. These systems will provide visibility for those items installed in aircraft and inducted into the Intermediate Maintenance Activity for repair.

Depot level repair invokes additional information systems support. Uniform Material Management, Advanced Traceability and Control, Depot and Transportation tracking systems have all been modified to add Serial Number fields to documents and associated databases. By capturing essential transactions from these systems and making the information available via a Web-enabled virtual shared data warehouse, users will have real time visibility of component location and status by vendor, part number, national stock number and serial number.

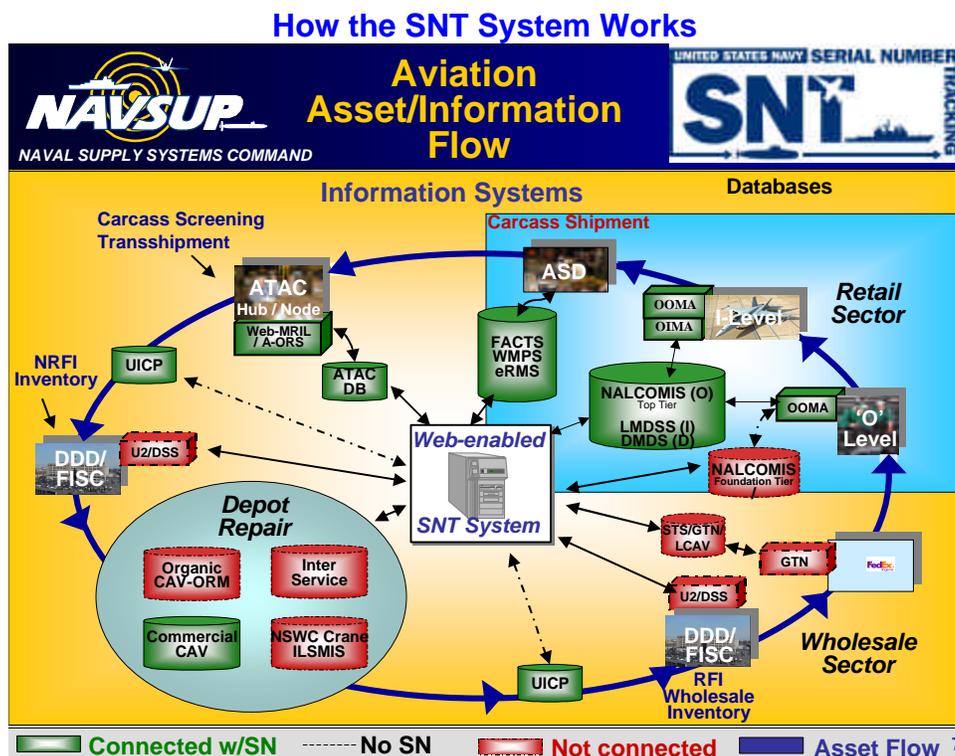


Figure 7: (How the SNT System Works – accessing live data bases, displaying information via Virtual Web-enabled system, based on customer query)

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## Automatic Identification Technology

### A. Reduction of Errors

Based on information provided to the SNT team during an Air Transportation Association brief, a touch typist has an error rate of one character for every 30 typed. The personnel entering data into maintenance and supply information systems are not all touch typists. For the purpose of this analysis, the rate of one character in 15 will be used. The Air Transportation Association also uses this rate. The error rate for AIT in the form of bar codes is one character in three million. Implementing AIT for repairable components will reduce data errors significantly.

### B. Man Hour Reductions

Current maintenance systems require manual entry of vendor, part number, and serial number data. Maintenance activities induct and repair thousands of items monthly. For example, Naval Air Station Oceana's Intermediate Maintenance Activity inducts between 16,000 and 18,000 components per month. Assuming 2-3 minutes per item to manually locate, read, and enter data into the system, and a few seconds to locate and read bar coded data, significant man-hour reductions will be achieved with the implementation of AIT.

### C. Application

AIT, specifically contact memory buttons in this case, can be applied to items in two scenarios: forward-fit and retrofit. Forward-fit pertains to items in the procurement cycle. The AIT is applied prior to delivery to the government. This is accomplished through contract modification or new contracts. Retrofit is more difficult, and is applied to installed legacy weapons systems. Many options exist for which activity to be assigned the task of labelling material for AIT processing (organization level, depot, warehouse, etc.) and how quality assurance is to be assured. To date over 24,000 CMBs have been applied to H53, C2/E2, H60, EA6B, V22 and F/A 18 aircraft components. Figure 8 below shows photos of a CMB applied to a helicopter tail rotor blade and a circuit card.

Another issue is the choice of AIT devices (bar code or CMB) to be applied. Bar codes can be applied to several different media substances, each with different levels of survivability. Paper labels are cheap but easily damaged. The most survivable, metal nameplates with photoengraved marking are relatively expensive and require special facilities to produce. In order to process all of the information necessary to achieve the greatest benefits (e.g. warranty data, maintenance history, and logbook, all in addition to equipment nameplate data) the use of a CMB is necessary. The cost per CMB ranges from \$10 - \$15.

### Installed CMB's



Figure 8: (CMB attached to Helicopter Tail Rotor Blade and Circuit Card)

A separate but related aspect of SNT is the application of the component serial number to shipping documents and inventory labels. When a component is packaged, supply and transportation personnel do not have direct access to the component and are unable to scan the component AIT device. This necessitates adding the serial number to existing data on applicable documentation (DD 1348-1A (Issue Release Receipt Document - IRRD) for example) and bar coding it. The SNT Team has generated changes to the Fleet Automated Control Tracking System, Advanced Traceability and Control and Commercial Asset Visibility in order to support SNT initiatives. Additionally, new contracts are specifying that Original Equipment Manufacturers provide the serial number along with other parts identification data in bar coded format on the outside of the unit pack shipping container, which makes the data available to material management information systems. See Figure 9 for an example.

### 2D Bar Codes used for Unit Pack and IRRD

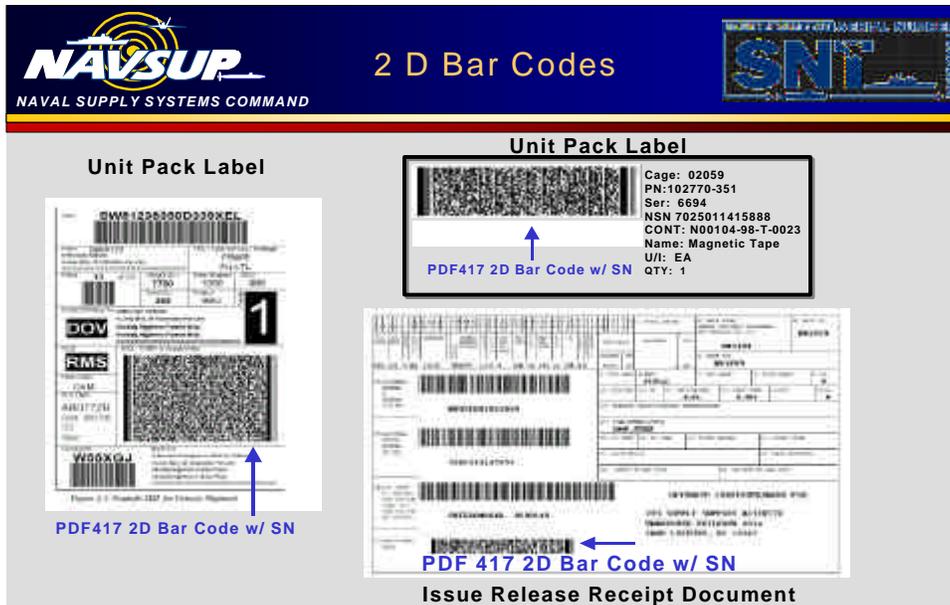


Figure 9: (Sample Unit Pack Labels and IRRD document with PDF 417 2D Bar Codes)

## D. Standardization

Implementing prescribed AIT standards in the form of American National Standards Institute (ANSI) MH10 allows for all supporting information systems to take advantage of a single standard in executing AIT. ANSI MH 10 is DoD mandated and is being used in implementing SNT throughout its affected systems.

### **SNT Implementation and Deployment Strategy**

SNT deployment mirrors the two-pronged SNT concept in that the system is first developed and then the implementation of the AIT integration follows. Each is its own separate event.

The SNT System deployed immediately after initial operating capability was established in January 2001. Deployment consisted of establishing the application in a production environment, and granting access to users via the world-wide-web. User training and desk guides were made available on the web page as well.

AIT deployment is more complicated and a series of steps is required before components can be marked. Engineering approval must be granted via a technical directive, and drawings are then changed to indicate AIT placement on the component. Since multiple echelons of maintenance activities could be engaged in applying the AIT, consistent media location is essential. It must be noted that SNT can occur without AIT – serial number capture during supply and maintenance transactions could be processed manually, however, this does not ensure the accuracy desired with AIT.

Continued access to various information systems is sought in support of ship and submarine efforts. Overall, new Navy initiatives such as Enterprise Resource Planning (ERP) and Systems Application Programming (SAP) are monitored to ensure SNT capabilities will be perpetuated in new information systems on the horizon.

#### **4. Identify significant challenges encountered, the process for resolution, and the solutions. Identify best practices.**

Existing supply and maintenance management information systems are separate and distinct from one another and are designed to collect and manage different types of data. Supply systems are primarily concerned with inventory and financial information that enables managers to budget for and predict material requirements, using a DoD-assigned national stock number.

Maintenance systems, on the other hand, collect information and associate it with a specific manufacturer's part number. The part number allows the ability to determine how well items are performing in their operational environment. Maintenance data identifies when failures are discovered, how items fail, what actions are taken to accomplish repair, who performs the repair, repair parts required, operating times between failures and other related maintenance management data.

In today's environment, there is a requirement to gather information on each specific configuration item regardless of the stock number or part number assigned. The uniquely assigned component serial number provides the bridge between the configuration item and its associated information. Serial number tracking, aided by appropriate decision support tools, can help identify logistics deficiencies in reliability, maintainability and supportability and allow logistics managers to develop most affordable cost solutions and increase material readiness. In this way, SNT is a valuable source of information for both supply and maintenance managers.

### **The Supply and Maintenance Communities**

Supply and maintenance professionals alike recognized the need to uniquely identify hardware components. Each recognized changes would be required to their systems to have an across-the-board solution. The individual serial number was, in many instances, embedded in the maintenance philosophy. This, however, required the supply system, which does not record serial numbers, to entertain changes to various information systems. While the need for serial number tracking was prevalent, acceptance of change to accommodate the need was not. Paradigm shifts have been necessary. New business practices would have to be made to various information management systems, crossing many internal and external organizations. A dedicated staff of three was instituted to educate, communicate, preach, cajole, task and refine various requirements to bring SNT to fruition. This team was used to conduct site surveys, identify information technology architectures and see to many administrative tasks.

### **The Decision to Move Ahead**

As with any new system, the choice to implement a whole new solution or make changes to legacy systems had to be addressed. The initial thought was to go with an off-the-shelf solution. This was found to be cost prohibitive and in competition with other, more comprehensive Navy information system initiatives. SNT was embedded in the designs of these new information systems. However, the new designs would only provide SNT-related information system changes at the inventory management level. It would not address information system changes to those systems in the field that require a serial number tracking AIT

interface. After exhaustive discussion and research, the SNT team decided to exercise changes to those fielded systems and proceeded with AIT marking. Unlike system development, AIT implementation complements the Navy's other new initiatives and provides an improved data collection methodology that will readily fit into new endeavors such as ERP solutions.

## **AIT Technology**

Barcode Technology, consisting primarily of linear and Two-Dimensional (2D) barcodes, provides several options in identifying assets. The 2D barcode provides the most data storage capability within this technology.

The use of a highly survivable CMB/Barcode system is one of the keys to ensuring the integrity of manual interactions with various systems. Most importantly, the user never has to transcribe complex serial numbers, part numbers, etc., as labeled on inventory items. Rather, a "one-touch" scan of the CMB/Barcode is used, in conjunction with the automated interface between the CMB/Barcode and legacy maintenance and supply systems, to achieve transcription-free interaction between serialized item identification and associated maintenance records. In addition, the CMB/Barcode technology provides significant barriers to duplication in order to preclude the introduction of unapproved parts into the system.

## **System and CMB/Barcode Interface**

In the context of the overall SNT System, the relative strengths and weaknesses of each component of SNT/AIT are as shown in Table 1.

SNT system and CMB/Barcode technology must have a flexible interface in order to expand as additional user requirements are defined. From the outset, the interface between the two systems was defined according to the following premise:

- The CMB/Barcode contains component nameplate data; specifically, stock number part number, serial number, and vendor identification. Other mandatory and conditional data is in the process of being proposed by the Navy AIT Working Group. All other data will reside on the central database. In this manner, human intervention can be minimized in the effort to identify serialized equipment items.
- The CMB/Barcode ensures that accurate information is input into individual components of the SNT System.

### **Strengths and Weaknesses of Tracking Repairable Components**

<b>SNT Component</b>	<b>Relative Strengths</b>	<b>Relative Weaknesses</b>
SNT System	<ul style="list-style-type: none"> <li>• Consolidated view of serial number data</li> <li>• Database technology greatly facilitates complex and ad-hoc searches</li> </ul>	<ul style="list-style-type: none"> <li>• Identification of serialized items requires some level of human transcription of identifier data (e.g. serial number, part number, etc.)</li> </ul>
CMB	<ul style="list-style-type: none"> <li>• On-item repository of a completely customizable set of relevant data</li> <li>• Eliminates human errors</li> </ul>	<ul style="list-style-type: none"> <li>• Data content is not readily searchable or updateable; i.e. must “walk-up” to and touch item in order to acquire or update its data</li> </ul>
BARCODE	<ul style="list-style-type: none"> <li>• On-item repository of a completely set of relevant data</li> <li>• Eliminates human errors</li> </ul>	<ul style="list-style-type: none"> <li>• Data content is not readily searchable; i.e. must “walk-up” to item in order to acquire its data</li> <li>• If data is changed, the barcode must be replaced (chance of human error)</li> </ul>

Table 1: (Strengths and Weaknesses of Tracking Repairable Components)

### **DOD Partnering**

The information recorded on the AIT devices needs to be in a standard that is recognized by all the military Services and the private sector. This proved to be more achievable within DoD than out in the commercial world. For example, the aviation commercial world embraces a standard known as ATA Spec 2000. While there are similarities with that standard, it is not the one chosen by DoD. Standardization is and will continue to be an issue to study with DoD and other components. The SNT system and Project will continue to ensure standards are used and readable across all DoD components.

Through the SNT team’s initiative, an agreement was made with the Defense Logistics Agency (DLA) to provide the Document Number (DOC #), National Stock Number (NSN) and Serial Number (SN) of Ready For Issue (RFI) “A” condition assets to a Navy Repository known as Department of Defense – Commercial Asset Visibility (DOD-CAV). Resulting from this initiative is a recent SNT system enhancement. The improvement provides access to and display of the DOC #, NSN, SN and Transportation Control Number (TCN) to a customer.

This allows a user to obtain in-transit status of a RFI, serial numbered component, which they have requisitioned. This is accomplished by: (see Figure 10 below for graphic of process.)

- Requisition for RFI asset is forwarded to the Item Manager (IM).
- IM provides material release order to Defense Depot (DDD).
- DDD provides acknowledgment to IM and shipping status to requisitioner.
- DDD provides Document Number, NSN and SN to DOD-CAV when the component is shipped.
- Based on a query by requisitioner, the SNT system retrieves Document Number, NSN and SN from Navy Repository.
- Then the SNT system obtains the TCN (by matching the Document Number to the Transportation Code Number (TCN)) from One Touch/Global Transportation Network (GTN).
- The SNT system displays the information to the user.

### SNT Accessing Shipment Information

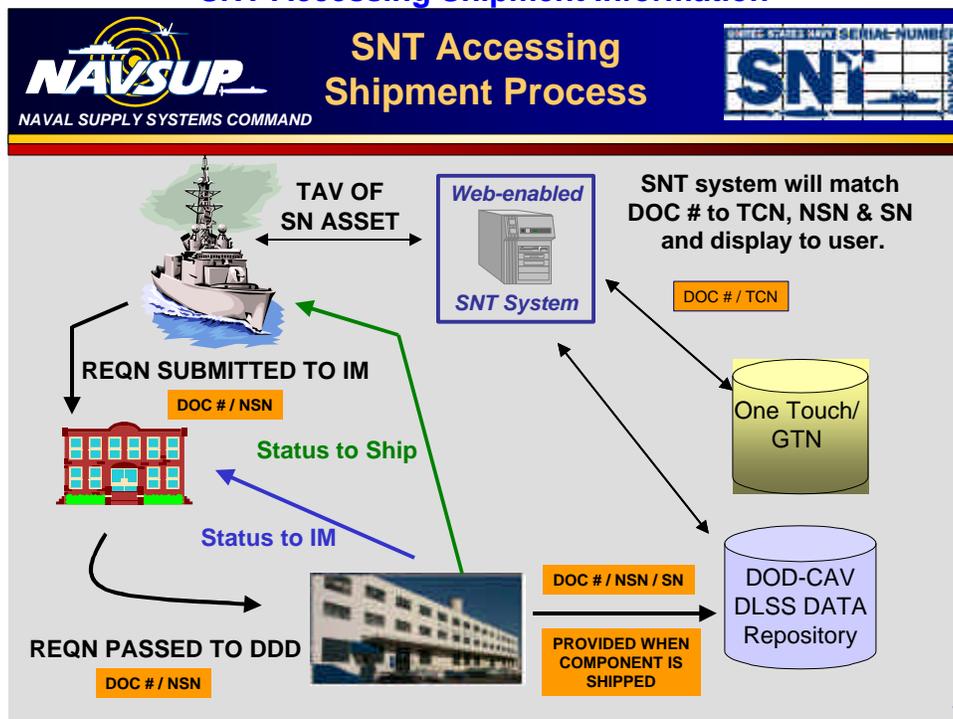


Figure 10: (Graphic of how SNT helps user find shipped components in Transportation System)

## Government Policies and Directives

In many instances, government policies and directives provide broad guidelines from which to meet a common goal. In regards to SNT, existing and

newly published policies such as DOD's Material Management Regulation, Defense Reform Initiative Directive 54, Defense Acquisition Regulation 5000.1, and others provide guidance that supports SNT. DoD's new Serialized Item Management (SIM) initiative proposes principles and concepts that are already supported by the SNT Project. Those are:

- Identifying Populations of Select Items (via access to data sources)
- Generate, Collect and Analyze Maintenance Data (including Decision Support)
- Collection of Data in Automated Manner (using AIT devices)
- Common Links to Other Logistics and Acquisition Data (including inventory and retrograde data)

#### **5. Indicate the metrics used to measure (a) progress and (b) success:**

The metrics for tracking progress and success are partially developed for this maturing initiative. Prototype testing has proven the concept of cradle to grave tracking of serialized components, however, additional components must be marked with AIT to fully incorporate the system and provide meaningful statistics to measure progress. Current and future methodologies focus on reflecting support of the Naval Supply System Command's five strategic goals.

#### **Progress Metrics**

Goal 1 – Deliver products and services that provide effective Combat Capability while ensuring best value to the war fighter.

SNT allows managers to have improved total asset visibility and decision support information regarding critical serialized components. One area of development within SNT is to have Scheduled Removal Component (SRC) card information loaded onto the CMB. Currently a SRC card is required to accompany many aviation components when they are returned for repair. If this card is missing, a full overhaul of the repairable item is required vice the partial repair documented on the SRC. Having SRC information on the CMB allows maintenance personnel to make quicker, less expensive repairs. Metrics are being developed to track these savings. A recent Business Case Analysis projected these savings, coupled with the cost avoidance of fewer items of lost material, to be more than \$86M over a five-year period.

Goal 2 – Develop our People into a skilled and flexible logistics team that is involved, motivated and focused on enterprise goals.

Initiatives that allow our people to access accurate and timely information (via a dedicated SNT Web site) for decision making purposes allows them to be more effective. SNT provides this service so that managers can focus on

problem areas and make informed decisions. As the SNT system is expanded to incorporate additional query capabilities, metrics will be developed to measure user acceptance of the database.

Goal 3 – Demand and achieve the highest standards of Quality of Service.

SNT provides assistance to every organization. It is designed to allow fleet personnel access to determine material and supply status as well as inventory managers to make informed support decisions. As SNT use increases, metrics will be designed to measure the system's effectiveness for providing users with the information they need to do their jobs. Metrics will, for example, monitor material loss savings and reductions in the number of lost maintenance documents. The US Navy (Naval Supply Systems Command) SNT System currently leads the way for all services in the area of serialized asset tracking.

Goal 4 – Become a leader in Joint Logistics.

SNT is at the cutting edge of providing an ERP solution for material asset visibility. Plans are in progress to join with Defense Logistics Agency, Army, Marine Corps and the Air Force for SNT to provide information shared by these agencies. Examples include: (1) warranty information to be provided to all Services, and (2) Primary Inventory Control Activity / Secondary Inventory Control Activity cross-service repair contracts. Item managers are included in formulating metrics to support this initiative.

Goal 5 – Be the pre-eminent military logistics enterprise by leveraging Technology, best Business Practices and world-class Communications.

The Navy is the forerunner with the use of AIT to support SNT. Standard business practices that are being used by industry (e.g., U.S. airlines and aircraft industries, NASA, Texas Instruments and Raytheon to name a few) are being incorporated into SNT, including the latest in AIT and more efficient uses of the world-wide web.

### **Success Metrics**

A comprehensive metrics system that reflects the capabilities and accomplishments of SNT is partially developed. As additional components are marked with AIT and other queries are developed to provide managers with decision tools, additional progress metrics that meet Naval Supply Systems Command's strategic goals will be completed.

Current SNT metrics include:

- Ratio of queries with a result that is usable by a manager
- Average response times by query, user and command
- Total queries submitted in a given period by query, user and command

Future SNT metrics being reviewed:

- Decision Support tools being used by managers for:
  - o Beyond Capability of Maintenance repairs by serialized component
  - o Highest Failure Reports by serialized component
  - o Highest Cost Drivers by serialized component or aircraft for a selected time period
  - o Highest Cannibalized Report by serialized component

SNT continues to review the SCOR model to match pertinent metrics to the SNT initiative to prove the benefits of cradle-to-grave component tracking by serial number. Metrics determination is being evaluated for reduction in component losses, warranty management, decreased repair costs, timely repair turn around times and improved fleet readiness resulting from the SNT program.

Regardless of the final number of selected metrics, SNT is focused on supporting the Naval Supply System Command's mission of providing "One-Touch Supply" to every level of the organization and meeting its Strategic Goals.

**6. Document and quantify cost and performance benefits, including the project's return on investment and changes in the value of one or more of the SCOR Level 1 metrics:**

Since SNT is a maturing initiative, cost benefits have not been fully evaluated, however performance benefits are reflected in the current metrics. This effort has a multiyear implementation plan for aviation assets. Metrics are in continual development to document the associated benefits. A September 2000 Business Case Analysis (BCA) for SNT projected the following return on investment through FY06:

- \$86M savings in repair of components (includes subtracting the cost of SNT project)
- \$109M in acquisition savings
- \$38M in aircraft inventory man-hour reductions
- \$3.5M in man-hour savings for error corrections
- \$3.5M in man-hour savings for data entry

As discussed in Section 2, Item 3 above, additional benefits expected from the SNT system are:

- Reduction in misidentification/loss of material
- Avoidance of reintroduction of condemned parts
- Improvements in configuration management
- Improvements in technical directive compliance
- Increased capability in reliability tracking
- Improvements in repair turn around time tracking
- Improvements in repair and repair material planning
- Reduction of carcass tracking thresholds
- Improved efficiency in document reconciliation
- Increased revenue from sales at Defense Reutilization and Marketing Office

These benefits are not included in the September 2000 BCA. Additional benefits are being discovered as training, discussions and planning continues across the various internal and external activities involved in this project.

While strictly private industrial related SCOR Level 1 metrics may not apply to SNT, improvements in the Supply Chain Process can easily be found. Examples are:

- Asset Visibility – Permits fleet, supply, maintenance personnel and managers to know the availability, by serialized number, of components that are installed in equipment, in repair, in storage or in transit. This improves delivery, order fulfillment, supply-chain response, inventory days of supply and asset turn performance by allowing access to installed, in transit, retrograde, retail and wholesale storage and repair databases.
- Warranty notification – Permits component item managers to have automatic email notification of warranted parts returned for repair. This improves cost of goods, cash-to-cash cycle time, warranty processing costs and supply management cost performance.
- Decision support – Permits managers at fleet, maintenance and supply organizations to review reports of the following:
  - Highest number of items beyond capability of repair by organizational and intermediate maintenance activities
  - Highest number of cannibalized components by aircraft type
  - Highest failure rates, by serialized component
  - Highest cost drivers, by serialized component for a selected time period, unit, repair activity, etc.

- Top readiness degraders, by serialized component for a selected time period, unit, repair activity, etc.
- Highest No-Fault Found rates, by serialized component for a selected time period, unit, repair activity, etc.
- Comprehensive repair analytical tool
- Unmatched Retrograde reports (see **Note below**)
- Carcass watch with automatic email notification

This allows for improved fill rate, order fulfillment, production flexibility, supply-chain management cost and value-added performance.

**Note:** An example of the retrograde tracking query's usefulness: A Type Commander's Carcass Loss Manager, utilizing the SNT web site, recently reversed a \$300,000 carcass charge to one of his deployed carriers. The ship turned in a Not Ready for Issue (NRFI) component for repair. The normal tracking system did not have visibility that the asset had arrived at the Advanced Traceability and Control (ATAC) hub for receipt processing, which stops the normal carcass tracking process. Receipt by an ATAC Hub prevents a carcass charge to the activity. The manager found that the part had been received at a commercial vendor for repair by matching the NSN and SN, via the SNT system, from two separate databases. This receipt provided proof that the component was returned by the ship reversing the \$300,000 charge.

### **7. Outline how the success of the effort supports the organizational objectives described in section 1, item 3:**

The success of the Serial Number Tracking initiative supports the Naval Supply System Command's current and future goals. By establishing an accurate web-based application that retrieves timely data from various existing sources, there is no duplication of data and no need to create a new database. The SNT initiative has been successful at establishing a serial number field in databases not previously providing this information, paving the way for a thorough, accurate tool with which the Navy can better track its assets. SNT supports the overarching goal of delivering a product that improves combat capability, ensuring the best value for the warfighter.

Towards the goal of achieving high standards of quality service, the SNT initiative provides an easy-to-use asset tracking tool never before available to the fleet sailor, easing the work burden of those in the business of tracking parts and maintenance data. Use of AIT makes the sailor's job easier, while saving time and valuable human resources. The SNT project has used AIT, in the form of CMB's and bar codes, to reduce both maintenance time and administration time requirements for the sailor. Aircraft inventories, for example, have been reduced from four days to only three hours.

The SNT Team is actively involved in Joint Logistics, another goal contained within the Naval Supply System Command's Strategic Plan as well as several DoD Offices. The SNT Project has been briefed to Air Force and Army logistics leaders and has been praised for its efficiency and effectiveness, leading the way for future projects within the other services. In fact, other projects providing similar capabilities are currently in work in the other services. As a member of the DOD Unique Item Tracking Committee, the SNT Team provides valuable input to all issues regarding serial number data, fields and reporting requirements.

Finally, supporting the Naval Supply Systems Command goal of being a military logistics enterprise by leveraging technology and best business practices, the SNT Team has exploited the use of the very latest in AIT technology. This technology is used to automatically feed already existing databases, ensuring accurate data and thereby improving business practices and arming the fleet with a powerful asset tracking tool capable of saving valuable time, manpower and dollars.

### **Section 3. Knowledge Transfer**

#### **1. Describe the efforts to share lessons from this effort with other internal organizations:**

In order to share information and lessons learned with other internal organizations, the SNT Project Team has adopted an aggressive information dissemination and training program. As the project has already been briefed to dozens of groups within the Naval Supply System Command, interest has grown on a daily basis and training sessions within the Naval Inventory Control Point sites in Philadelphia and Mechanicsburg, Echelon II commands and the fleet are now routine. Thus far, well over 200 sailors and civilian employees have been trained on the content and use of the SNT web application. Likewise, nearly 200 Naval Supply Systems Command personnel have been exposed to the benefits of the SNT application. This continual sharing of information about SNT has improved the quality of the tool and ensured its optimal use within Naval Supply Systems Command and its component organizations.

The SNT Team also meets periodically with members of the Carcass Tracking, retrograde cycle and material-in-transit teams. An open exchange of ideas on a regular basis eliminates any possibility of duplicative efforts or redundancy. Consistently attuned to the needs and objectives of the Naval Supply Systems Command's Enterprise Resource Planning (ERP) initiative, the SNT project serves to not only complement its current and future efforts, but to provide guidance and assistance in any unique item tracking issues. For instance, the developers of the SNT AIT software have recently met with members of Electronic Data Systems to ensure SNT compatibility with SAP and

other ERP-related systems. Since ERP will fundamentally change the way that Naval Supply Systems Command and its subordinate organizations conduct their daily business, the need to integrate SNT efforts into the ERP initiative is vital to the success of the program.

**2. Explain how this initiative can be transferred to other organizations and specify the likely candidates for transference:**

Since the beginning of the SNT Project, significant functionality has been developed to provide applications that can be used beyond the immediate requirements of the Navy Supply and Maintenance Systems. First, the SNT/AIT software was developed to create the ability to load information onto and draw information from an AIT device, such as a CMB or a bar code. This information has been coded to automatically feed various databases, ensuring the maintenance of highly accurate data. This software, which ensures the integrity of the entire SNT system, can and has been transferred to numerous other organizations, like the contractors Kongsberg-Simrad and Sikorsky, and applications, such as the Commercial Asset Visibility database, Commercial Asset Visibility-Organic Repair Module (CAV-ORM) and electronic Retrograde Management System (eRMS).

Due to the unique nature of the SNT Project and web application, countless other aspects of the project can be utilized by outside organizations. Because of the groundwork laid by this project and its success in building serial number fields in various existing databases, the SNT initiative has developed a useful tool with information never before available. The users of this information are numerous, as any user having asset information in any of the databases used by the SNT system will have an interest in the application. From item managers at DoD Inventory Control Points, to members of private industry, to Supply Officers and sailors working at sea, all will find a valuable tool in the SNT System. Providing timely and accurate information with no duplication of data, the SNT web page provides reports, queries, and an automatic email capability that is extremely easy to use. Further, the only requirement to transfer this capability to an endless number of other organizations and individuals is an Internet hook-up and a password.

Finally, in keeping with the Navy's joint initiatives, the SNT application can easily be moved to other DOD organizations. Armed with only a password and user ID, a user from any DOD organization can view information on any assets tracked by databases in the SNT system.

Leading the way in the 21<sup>st</sup> century as a tool for accurate asset management and tracking, the Naval Supply System Command's Serial Number Tracking Program will provide the Navy logistics community with tools that will result in reduced maintenance costs and improved fleet readiness. Ensuring



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accuracy by use of AIT and tapping into the latest technological advances with an efficient and all-encompassing web application, the SNT project can serve as a guide for other services to use in developing the best possible way to track assets down to the individual component level, and to do so in all areas of the Supply Chain.

## Acronyms

<u>2D</u>	Two Dimensional
<u>ATAC</u>	Advanced Traceability And Control
<u>AIT</u>	Automatic Identification Technology
<u>ANSI</u>	American National Standards Institute
<u>A-ORS</u>	ATAC Operating Reporting System
<u>AT</u>	Allowance Type
<u>CAGE</u>	Commercial and Government Entity
<u>CAV</u>	Commercial Asset Visibility
<u>CAV-Navy</u>	Commercial Asset Visibility – Navy (repository of data)
<u>CAV-ORM</u>	Commercial Asset visibility – Organic Repair Module
<u>CDMD-OA</u>	Configuration Data Managers Database – Open Architecture
<u>CMB</u>	Contact Memory Button
<u>DDD</u>	Defense Distribution Depot
<u>DLA</u>	Defense Logistics Agency
<u>DLSS</u>	Defense Logistics Standards System
<u>DMDS</u>	Depot Maintenance Data System
<u>DOC #</u>	Document Number (Also known as REQN – Requisition Number)
<u>DoD</u>	Department of Defense
<u>DOD-CAV</u>	DOD Commercial Asset Visibility – repository of data
<u>DSS</u>	Distribution Standards System
<u>eRMS</u>	Electronic Retrograde Management System
<u>ERP</u>	Enterprise Resource Planning
<u>FACTS</u>	Fleet Automated Control Tracking System
<u>FIMARS</u>	Force Inventory Management Analysis Reporting System
<u>FISC</u>	Fleet and Industrial Supply Center
<u>GTN</u>	Global Transportation Network
<u>IBS</u>	Integrated Bar Code System
<u>ILSMIS</u>	Industrial Logistics Support Maintenance Information System
<u>IM</u>	Item Manager
<u>IRRD</u>	Issue Release Receipt Document
<u>ISO</u>	International Standards Organization
<u>LCAV</u>	Logistics Support Center Customer Asset Visibility
<u>LMDSS</u>	Logistics Management Decision Support System
<u>MILSTD</u>	Military Standards (129-Package marking standards, 130-Property marking standards)
<u>MSL</u>	Military Shipping Label
<u>NALCOMIS</u>	Naval Aviation Logistics Command/Management Information System
<u>NRFI</u>	Not Ready For Issue
<u>NSN</u>	National Stock Number
<u>OH</u>	On Hand
<u>OIMA</u>	Optimized-Intermediate Maintenance Activity
<u>OOMA</u>	Optimized-Organizational Maintenance Activity

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## Acronyms Continued

<u>PDF</u>	Portable Data File
<u>RFI</u>	Ready For Issue
<u>RRAM</u>	Realtime Reutilization Asset Management
<u>R-Supply</u>	Relational Supply
<u>SAP</u>	Systems Application Programming
<u>SCOR</u>	Supply Chain Operations Reference-model
<u>SIM</u>	Serialized Item Management
<u>SN</u>	Serial Number
<u>SNT</u>	Serial Number Tracking
<u>SNTS</u>	Serial Number Tracking System
<u>STS</u>	SMART Transportation Solution
<u>TAV</u>	Total Asset Visibility
<u>TCN</u>	Transportation Control Number
<u>UIC</u>	Unit Identification Code
<u>UICP</u>	Uniform Automated Data Processing System – Inventory Control Point
<u>WEB-CAV</u>	Web – Commercial Asset Visibility
<u>WEB-MRIL</u>	Web - Master Repairable Items List
<u>WMPS</u>	Web-MRIL Partnering Site