The NATO Codification System: Improving Data Quality through ISO Standards 22745 and 8000

Steven Arnett
Chief, U.S. National Codification Bureau
Tel: 269-961-5916
Email: steven.arnett@dla.mil

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Overview

• The Defense Logistics Information Service (DLIS)
• The NATO Codification System (NCS)
• Basics of ISO standards 22745 and 8000
• Implementation of ISO standards 22745 and 8000
• Summary
• Useful international Web sites
The Defense Logistics Information Service
• Mission: To provide interoperable, integrated, quality logistics data, and enterprise IT solutions for joint warfighters, the Military Services, the Defense Department, other Federal agencies and international partners in order to optimize the effectiveness and efficiency of the DOD Supply Chain.
Our Customers

Combatant Commanders…

The Military Services…

Other Government Agencies

NATO

International

Contractors
The NATO Codification System
Why the NCS Was Created

In The Days of WWII

Each military service uses their own logistics “language”

Potential for:
- Multiple NSNs, based on service and weapon system
- Multiple buying activities
- Multiple corporate contracts
- Loss of Interoperability/Asset Visibility

ONE ITEM OF SUPPLY
SINGLE MANAGER
SINGLE NSN
NCS History

- e-Commerce: 2009
- eOTD / ISO: 2002
- BASELOG: 1999
- PACS: 1994
- PFP: 1991
- CD-ROM: 1978
- NCB CODE: 1974
- DLSC: 1966
- STANAG 3151: 1956
- STANAG 3150: 1954
- CODIFICATION SYSTEM: 1952
- SUPPLY CLASSIFICATION: 1949
- PL152: 1949
- PL436: 1952
- US/UK/CA CLASSIFICATION: WWII
- NATO
- DESERT STORM
What Is The Purpose Of NATO Codification?

• To establish a common supply language throughout all logistic operations
• To enable interoperability
• To optimize resource management by minimizing duplication in inventories

Cataloging = Codification
What Is Codified?

• Generally, military items which are repetitively used, stocked, stored, issued, ordered and procured

• National rules vary in establishing the exact criteria and range of coverage of items

• Some nations limit national codification to defense equipment items, other include selected civil items
Language Independence

• NATO codification facilitates communication by overcoming the language barrier:
  – All participants use the same ‘language of supply’
  – All aspects of the item identification and description can be stored and exchanged in an encoded format

• NATO codification provides a common language for national and NATO Logistics
Help, I need NSN 4920-00-987-8835

Nie mam w zasobach tego NSN-a (I do not have this NSN in stock)

Saya ada NSN di dalam simpanan. (I have the NSN in my inventory)

Az ochakovam tazi nomenulatura skozo (I don’t have your NSN but can order it)

Peaks saabuma varsti (I expect this item soon)
How Many Languages Are Spoken Here?

Answer - 6

Malay
Saya ada NSN di dalam simpanan.
(I have the NSN in my inventory)

Bulgarian
Az ochakovam tazi nomenulatura skozo
(I don’t have your NSN but can order it)

English
Help, I need NSN 4920-00-987-8835

Polish
Nie mam w zasobach tego NSN-a
(I do not have this NSN in stock)

Estonian
Peaks saabuma varsti
(I expect this item soon)
An externally threaded fastener whose threaded portion is of one nominal diameter, No 0 (0.060 in./1.5 mm) or larger, designed to be held or driven with either a wrench or an inserted driver or both (excluding internal socket or internal multiple spline types), in sizes below No. 10 (0.190 in./5 mm). No. 10 and larger sizes must have a head designed for any type inserted driver (excluding internal socket or internal multiple spline types), but may also be designed for external wrenching. A locking feature may be incorporated in the design of the head or threads. Excludes BOLT, CLEVIS; BOLT, EXTERNALLY RELIEVED BODY; SCREW, EXTERNALLY RELIEVED BODY; and SCREW, ASSEMBLED WASHER. See also, SCREW, INSTRUMENT; BOLT, MACHINE; BOLT, INTERNAL WRENCHING; and SCREW, CAP SOCKET HEAD.

Information:

AASK: Head Style
THSD: Thread Series Designator
AHYM: Nominal Thread Diameter
AASA: Thread Length
AASB: Fastener Length
What Is A NATO Stock Number?

- NATO Stock Numbers represent item of supply concepts rather than an item of production.
- An item of supply concept represents a cluster of characteristics related to form, fit, and function.
- Many items of production may fit a single item of supply concept.

**THE NATO STOCK NUMBER (NSN)**

5905-00-7345199

- **GROUP**
  - Electrical and electronic equipment components
- **CLASS**
  - Resistors
- **NCB Code**
  - 00 = United States
  - 12 = Germany
  - 14 = France
  - 99 = United Kingdom
- **Non significant number**
  - Unique identifier for the item.
NATO Stock Number (NSN)

**MANUFACTURERS IDENTIFICATION SYSTEM**

- DUNLOP
  - 11-00-20SPTGM
- GOODYEAR TIRE CO
  - 11-00-20SRLER
- GOODYEAR FRANCE
  - 11-00-20UNISRL
- CUP SNC
  - 1100R20GSRT4-16PR

**USERS CODIFICATION SYSTEM**

- NAVY
- ARMY
- AIR FORCE
- OTHER COUNTRIES

**2610-14-322-4604**

Single Stock Number
Data Associated with NSNs

The NSN – more than identification

Managing items over the life cycle

- Data Sharing
- Connectivity
- Standards

Sum of all its parts
The Costs of A Weapon System

**Weapon system**

**Acquisition Costs**

1/3

Political decision

= specific budget

**Operations Costs**

2/3

Operating budget of the armed forces

**Life Cycle Cost**
Multinational Systems Development

Source: Airbus Military
Benefits of the NCS

Operational Benefits

• Having a standard language of supply promotes inventory reduction and prevents item duplication

• Standardization of material leads to faster procurement and increased readiness

International Benefits

• Interoperability among the 60 nations that officially use the NCS

• The NCS can be used in many languages because it is based on numeric codes that link to 19 different languages
Benefits of the NCS

**Economic Benefits**

- Inventory rationalization means fewer items need to be procured
- On new systems, 25-50% of spare parts already have NSNs assigned
- Consolidation of orders leads to lower prices
- Multiple part numbers on NSNs promotes competition among suppliers

**Commercial Benefits**

- The NCS allows countries to make the products of its companies visible throughout the NCS user community
- AC/135 is working with industry to develop a common language of supply through ISO standards 22745 and 8000
NSN Statistics

• About 17 million NATO Stock Numbers have been assigned
  – 34 million reference numbers have been registered on these NSNs
  – 2 million manufacturers and other organizations are registered
  – 10 million NSNs with characteristics data display

• These NSNs contain more than 26 million user registrations
Basics of ISO Standards
22745 and 8000
Aims and Objectives

• DLIS and AC/135 undertook the partnership with ISO and other standards organizations for the following reasons:
  – To automate the codification process
  – To improve the quality and availability of data
  – To help align the NCS with international standards
  – To increase cooperation with industry
Industry’s Interest

• Develop a common language for naming and describing products and services for industry

Adopt Government’s Best Practices
International Standards

- **ISO 22745** is a standard for master data based on the NATO Codification System (NCS) but designed for industry and incorporating a modern data architecture.
- **ISO 8000** is a standard for measuring and certifying data quality.
- ISO 22745 and 8000 are managed by ISO Technical Committee 184/Subcommittee 4 (Industrial Data).
ISO 22745 Concept Identifier

Organization Identifier

Separator Character

International Code Designator (ICD) value

ISO/IEC 6523 defines requirements for identification of organization identification schemes

Registration Authority Identifier (RAI)

Object Identifier

Separator Character

Concept Code

Separator Character

Code Space Identifier (CSI)

ISO/IEC 11179-5 defines requirements for international registration data identifier (IRDI)

Version Identifier

ISO 22745-13 defines syntax and requirements for concept identifiers
Examples of ISO 22745 Concept Types

- **01 - Class**
  - machine bolt
  - self-aligning plain bearing
- **02 - Property**
  - thread series designator
  - thread diameter
- **03 - Feature**
  - flange
  - inner liner
  - outer ring
  - second hole
- **04 - Representation**
  - string
  - decimal measure
  - rational measure
- **05 - Unit of Measure**
  - degree
  - radian
  - kilogram
  - newton per square millimeter
  - bolt
- **06 - Qualifier of Measure**
  - nominal
  - minimum
  - maximum
- **07 - Controlled Property Value**
  - Monday
  - Tuesday
  - iron
- **08 - Currency**
  - US Dollar
  - Euro
ISO 22745 Architecture

- **Identification Scheme**: ISO 22745-13
- **H6+MRD Dictionary**: eOTD-xml, ISO 22745-10
- **FIIG Identification Guide**: eOTD-i-xml, ISO 22745-30
- **NSN Master Data**: eOTD-r-xml, ISO 22745-40

The NSN Master Data is coded using concepts in the Identification Scheme and conforms to the constraints in the FIIG Identification Guide, which constrains the use of the H6+MRD Dictionary.
Machine Bolt; Product Number: 3225020037; Nominal thread diameter: 1.0 inches; Width across flats: 1.450 inches; Width across corners: 1.653 inches; Head height: 0.591 inches; Count per pack: 10; Pack price: $0.80
Manufacturers and suppliers reference data
Descriptive data including the NSN as a property/value pair

- <ns5:reference reference-number="40-615-139-19" organization-ref="0161-1#OG-OK5294#1"/>
- <ns5:reference reference-number="5019120-008" organization-ref="0161-1#OG-OK5331#1"/>
- <ns5:reference reference-number="99-649-6748" organization-ref="0161-1#OG-0U91999#1"/>
- <ns5:reference reference-number="99-755-4252" organization-ref="0161-1#OG-0U91999#1"/>
- <ns5:reference reference-number="99-779-7019" organization-ref="0161-1#OG-0U91999#1"/>
- <ns5:reference reference-number="TDS5003.15A" organization-ref="0161-1#OG-OK0647#1"/>
- <ns5:reference reference-number="533-233" organization-ref="0161-1#OG-0K0F76#1"/>
- <ns5:reference reference-number="45-615-164-15" organization-ref="0161-1#OG-0K0801#1"/>

<ns5:property-value property-ref="0161-1#02-02750#1">
  <ns3:controlled-value representation-ref="0161-1#04-000001#1" value-ref="0161-1#07-032011#1"/>
</ns5:property-value>

- <ns5:property-value property-ref="0161-1#02-024544#1">
  <ns3:combination>
    - <ns3:measure-number-value representation-ref="0161-1#06-000000#1" uom-ref="0161-1#05-000845#1"/>
      <ns3:qualified-value qualifier-ref="0161-1#06-000000#1">
        <ns3:real-value representation-ref="0161-1#04-000000#1">19.50</ns3:real-value>
      </ns3:qualified-value>
  </ns3:combination>
</ns5:property-value>

<ns5:property-value property-ref="0161-1#02-0007072#1">
  <ns3:combination>
    - <ns3:measure-number-value representation-ref="0161-1#04-000000#1" uom-ref="0161-1#05-000845#1"/>
      <ns3:qualified-value qualifier-ref="0161-1#06-000000#1">
        <ns3:real-value representation-ref="0161-1#04-000000#1">20.50</ns3:real-value>
      </ns3:qualified-value>
  </ns3:combination>
</ns5:property-value>

<ns5:property-value property-ref="0161-1#02-007037#1">
  <ns3:combination>
    - <ns3:measure-number-value representation-ref="0161-1#04-000000#1" uom-ref="0161-1#05-000845#1"/>
      <ns3:qualified-value qualifier-ref="0161-1#06-000000#1">
        <ns3:real-value representation-ref="0161-1#04-000002#1">5.00</ns3:real-value>
      </ns3:qualified-value>
  </ns3:combination>
</ns5:property-value>

- <ns5:property-value property-ref="0161-1#02-0007072#1">
  <ns3:combination>
    - <ns3:measure-number-value representation-ref="0161-1#04-000000#1" uom-ref="0161-1#05-000845#1"/>
      <ns3:qualified-value qualifier-ref="0161-1#06-000000#1">
        <ns3:real-value representation-ref="0161-1#04-000003#1">5.00</ns3:real-value>
      </ns3:qualified-value>
  </ns3:combination>
</ns5:property-value>

<ns5:property-value property-ref="0161-1#02-0007072#1">
ACW Common Coding

One Common Anglo Number

Standardised Long Description:

Standardised Short Description:
Tire Pneumatic: Loader 25' 445mm 0.95 2*

52368965412 – Tyre Bridgestone 435/95 R25
56329845 – Tyre BS 435/R25 Standard Purpose E3 2 Star Radial
125435 – Bridge Stone 25inch 435/95
965123465 – Tyre Bridgestone Part Number 12345
“Boeing currently buys 200 different kinds of safety glasses and 80 different shades of white paper. The defense and commercial aircraft divisions each negotiate for their own aluminum and titanium. Why can't we buy two or three kinds of safety glasses? Why can't we have standard part numbers that go across the enterprise?”

James F. Albaugh, CEO Boeing Integrated Defense Systems,
Business Week March 13, 2006
The eOTD is a foundation for design collaboration and industry standards.

ISO 22745 and the eOTD are the foundational enablers for the breakthrough our industry needs in the next generation of direct, accurate, and effective collaboration across the supply chain at meaningful and granular levels of data exchange never before imagined.

Alton Sanders
Senior Manager,
IDS Engineering Standards Control Function
PW Knowledge and Reuse Management (KARMA)
eOTD Data Flow

- ERP/PDM
- Native CAD
- STEP
- eOTD Catalogs on Web
- eOTD-r-xml/MSV (Modified Segment V)
- National Systems
- N-CORE
- MC Catalogue
- OLCIMS
- SICAD Plus
- CENCAT3
- SACRAL
Transformation Through Automation

Before
- lack of clarity on data requirements
- disparate data format
- disparate data content
- disparate metadata
- potentially subjective human judgment
- operate as an additional process

After
- application processable data requirement statements
- consistently mapped metadata
- standard characteristic data exchange format

impact: faster, better, cheaper
ISO 22745: Automation of Cataloging

• Mapping Catalog Data from Source Data

features e.g. thread characteristics including
  • length (65 mm)
  • form (ISO M)
  • class (6G)
  • diameter (20 mm)
ISO 22745: Automation of Cataloging

• Create data one time and use throughout life cycle

- thread class is found by browsing through the feature tree
- definition of the property from the Implementation Guide
- data entry field
NATO Cataloging at Source Project as is
NATO cataloging at source project to be

Faster - Better - Cheaper

Data requirements in application processable format (ISO 22745-30)

Data in ISO 8000 compliant format (ISO 22745-40)

Vendor

NCB

eOTD enabled Cataloguing Application

eOTD enabled PDM or ERP

Internet

Internet
• Across the supply chains
• ERP masters: vendor/customer/material/service
• Manufacturing/production CAD/CAM/CAE/PDM
• Facilities/raw materials
• Human Resources
• Data life cycle management: from design through disposal

Common metadata mapping across applications
Benefits of ISO 22745 to Government

• Opportunities for improvement of NATO/DLIS system through increased industry participation

• Promotes NCS approach as an ISO standard

• Faster access to better industrial data

Goal: Electronic transfer of characteristic data from our suppliers and manufacturers to NCBs
• ISO 8000 incorporates all the key elements of data quality:
  - Syntax
  - Provenance
  - Completion
  - Accuracy
  - Certification
Data Quality

Problems Due to Poor Data Quality

• Extra time to reconcile data
• Loss of credibility in a system
• Extra costs
• Customer dissatisfaction
• Delay in deploying a new system
• Lost revenue
• Compliance problems

Sources of Data Quality Problems

• Data entry by employees
• Changes to root/source systems
• Data migration or conversion projects
• Mixed expectations by users
• External data
• System errors
• Data entry by customers
Parts of ISO 8000 Standard

Part 1: Overview, principles and general requirements
Part 2: Terminology
Part 100: Master data: Overview
Part 110: Master data: Exchange of characteristic data: Syntax, semantic encoding, and conformance to data specification
Part 120: Master data: Provenance
Part 130: Master data: Accuracy
Part 140: Master data: Completeness
The Steps to Quality ERP Descriptions

- Quality metadata
- Quality master data
- Quality (computer generated) ERP descriptions
Providing the data necessary for the **safe and efficient** operation of plant, and equipment is a legal requirement in most countries.

The contractor, sub-contractor or supplier shall, **as and when requested to do so**, supply technical data in electronic format on any of the items covered in this contract as follows:

- The data shall be ISO 8000-110:2008 compliant.
- The data shall comply with registered ISO 22745-30 compliant Identification Guides.
- The data shall be encoded using concept identifiers from an ISO 22745 compliant open technical dictionary that supports free resolution to concept definitions.
- The data shall be provided in an ISO 22745-40 compliant Extensible Markup Language (xml) format.
Data providers recognize that:

- data integration is one of the keys to a long term relationship
- the ability to provide their customers with quality data is a significant differentiating factor.
- *There is growing resistance to “data lock-in”*

Data providers are:

- looking to increase their visibility and understand that the best way to do this is to improve the quality of their data.
- looking for a Standard that they can use to identify the quality of their data.
Data Quality

The Process ...

Action Plan
- Define – identify data Issues
- Measure – apply appropriate metrics
- Improvements – address needed enhancements
- Implement – initiate approved changes and corrections
- Monitor – re-measure for effectiveness
- Report – document status improvements and cost savings

The Results ...

System/Program Approval/Assistance
- Target Population: Example: FLIS
- Process: Describe the process
- Issues/Needs/Concerns: Address any known conflicts regarding suggested improvement; any methods or tools required; and overall concerns.

System/Product Benchmark
- Example of Baselines, Benchmarks, Trends, Gaps and Quarterly Changes

Root Cause Analysis
- Problem Identified
- Training Problems
- Policy Problems
- Procedure Problems
- System Problems
- Interface Problems

System/Product DQ Baseline
- Overall JQB quality assessment of FLIS on DLA Mgd
- NINs/DRNs where FLIS or BRM is the authoritative source
- A – Accuracy CN – Consistency CR – Currency CM – Completeness NM – Not Measured

Accuracy
Consistency
Currency
Completeness

90-100% Green
80-89% Yellow
70-79% Orange
60-69% Pink
59%-0% Red
NM Not Measured White
What Does an Information System Cost?

Survey by Daratech, Inc

Hardware: The cost of additional infrastructure required for the project.
Software: The cost of licenses for the software used, or the cost of software developed.
Systems Integration: Cost of interfaces between applications in a system.
Data: The business cost of creating the data to configure and use a system.
Training: Cost of training and the 'cost' of getting accustomed to a new system.
YOUR POINTING AT IT WON'T HELP - THE COMPUTER RECORDS SHOWS NONE IN STOCK.
Achieving Data Quality

ISO 22745/8000 states that for data to be of quality, it must have a meta data property (which has an accurate definition) and a value which is measurable. These property value pairs form the cornerstone of high quality data:

10.50 😞

Overall length : 10.50mm 😊

ISO 22745-30 EOTD i-XML = A list of required properties

ISO 22745-35 EOTD q-XML = The transaction of those properties between two entities.

ISO 22745-40 EOTD r-XML = The returned transaction with values completed by the master data manager
In practice a data provider may not have all the data requested so they in turn send a request through their supply chain using the same standard exchanges.
2020: A New World

Acquisition, design, manufacturing

STEP

eOTD

Standard product attributes

Industry: better market and sell

User: better search and buy

NATO Codification: numerous benefits

Suppliers
The ultimate goal has been met: to provide a standard means of describing product data through the life cycle of a product – a shared resource for all
Implementation of ISO Standards 22745 and 8000
AC/135 have commissioned a Phase III of the SSC project

Phase I – Proved that STEP files could be used to generate codification records.

Phase II – Used SSC and ISO’s 22745 & 8000 to create 100 Item of Supply Concepts for ROSOMAK.

Phase III – Will look to continue this work and develop true IT based automated data exchanges between Defence and Industry. A detailed Cost Benefits Analysis will also be produced.
The Task

To take a medium sized platform with mature enough data to be codified which is stored in an electronic Product Data Management (PDM System).

Using ISO 8000 exchange methods, create a fully codified platform direct from the PDM.

Return a copy of that data to the supplier in ISO 22745 format including the NSN as a completed field.

The successful completion of the project will result in demonstrable improvements in quality and time in the completion of a codification task and provide information on potential whole life cost savings.
TERRIER is a new generation Combat Engineering Vehicle (CEV)

- Used for Early entry
- Used for Combat support
- Used for Post conflict roles
• TERRIER® Uses next generation Drive by Wire electronics
• Key points from TERRIER specification:
  – 2 man crew
  – 31.5 tonnes
  – 700hp engine
  – 70kph top speed
  – 5 tonne clamshell bucket
Key points from TERRIER specification:
- 2.5 tonne excavator arm
- Thermal Imaging and low light cameras
- Capable of being remotely controlled
- 10 tonne integrated winch system
- General Purpose Machine Gun
- Scatterable Mine Clearance Device
High capacity bucket – 2.8 m³
Excavator arm – 0.4 m³

Infantry and vehicle protective positions
Deployed Force Infrastructure
Host Nation Infrastructure
The tale of the tape

**BETTER** - Current NATO Average for the creation of Type 1 records is approximately 16%.

\[
\text{Smart Step Codification Type 1 Creation} = 60\%
\]

**FASTER** – UK NCB Average for the allocation of an NSN on receipt of the Source Data = approximately 50 minutes.

\[
\text{Smart Step Codification} = 10 \text{ Minutes}
\]
So what does that mean in financial terms to the supplier?

389 Items for codification so far

129 Items screened out which is 33%

BAES will put forward approximately 2000 items for Terrier by project end. That is a cost of approximately £44,000 in hard charging for codification.

33% of £44,000 is £14,520 which would be the estimated savings on codification costs.

BAES Don’t have a classification system
So what does that mean in financial terms to the supplier?

IF a supplier was to place codification at the design stage and be able to accept the automated import of an R-XML File:

TERRIER had 129 Items Screened out as already existing in ISIS which UK NCB produced R-XML files which BAES GCS imported into the ISO 22745 Module they had access to.

It costs BAES GCS £3000 to introduce an item in to their catalogue

In accordance with the Shell UK commissioned survey 50% of those costs are for data.

129 x £1500 = £193,500.00
So what does that mean in financial terms to the supplier?

The potential to BAES GCS is far greater than that as UK NCB can provide data in r-XML format for 19,000 items that can be automatically loaded into any classification system they choose with XML capabilities. This data will be in ISO 22745 format and in accordance with ISO 8000 Pt 110.

If, we can get codification introduced at the design of a platform, before the engineers start to create properties and values:

The potential is there to save hundreds of thousands of pounds.
BAES GCS Has no classification system!

This means that at present they have no supporting data electronically that can be used for codification.

For this project it means a work around by giving BAES GCS access to the suppliers modules available from both ESG and AURA.

For BAES it shows why they would be so interested in taking part in this project.
James Beer is the project manager at BAES GCS responsible for the introduction of a classification system, why?

He provided the following figures:

Cost to introduce an item into their Product Data Management Tool: **£3000**.

Average number of duplicates per item found in their PDM Tool: **10**

Each item has an un-necessary support cost of on average: **£27,000**

BAES GCS Newcastle has approximately **19,000** items registered against its NCAGE currently.
Benefits & Barriers

Benefits already apparent

The Data the supplier has access to is far greater than what is traditionally sent to NCBs.

The Supplier is in a better position to make judgement calls on the item.

Barriers still in place

It was worrying that the supplier did not have a readily identifiable and accessible repository for their data.

The willingness of commercial companies like BAES to allow ‘plug in software’ into their systems is very limited.
• Many companies are now in the business of building ISO 22745/8000 compliant catalogs. Some examples:
  
  – PiLog – South Africa
  
  – Quadrem
  
  – ESG
  
  – AURA
Many organizations are have implemented ISO 22745/8000 compliant catalogs, are testing them, or having committed to adopting them:

- ArcelorMittal
- PHP Billiton
- Severstal
- Aramco
- Anglo-American Inc.
Many nations within the AC/135 community are running or planning to run pilot projects to test electronic data exchange between suppliers and government offices using 22745/8000, including Belgium, Czech Republic, Finland, New Zealand, Norway, Poland, Russia, Slovakia, United Kingdom, and the United States.
Data is the DNA of materiel management
- Acquisition
- Financial management
- Hazardous material
- Freight and packaging
- Maintenance
- Sustainability
- Disposal
- Demilitarization
Summary

- The **NATO Codification System** is an international standard for exchange of catalog data in government.
- **ISO 22745** is an e-catalog standard based on the NCS and **ISO 8000** ensures the quality of the data.
- ISO 22745 and 8000 are working in practice and poised for wide implementation around the world.

**Investment in ISO 22745 and 8000 = Strong Return on Investment**
Useful International Web Site Addresses

• NATO CODIFICATION SYSTEM (NATO ALLIED COMMITTEE 135)
  – http://www.nato.int/structur/AC/135/welcome.htm

• NATO MAINTENANCE AND SUPPLY AGENCY (NAMSA)
  – http://www.namsa.nato.int/home/www.namsa_e.htm

• NATO MCRL
  – http://www.nato.int/structur/AC/135/nmcrl/nmcrl_e/index.htm

• NATO AMMUNITION DATA BASE (NADB)
  – http://www.namsa.nato.int/ammo/nadb_e.htm

• NATO HEADQUARTERS
  – http://www.nato.int

• PACIFIC AREA CATALOGING SYSTEM (PACS)