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

ABSTRACT

NATO Allied Committee 135, which manages the NATO Codification System, is putting a major emphasis on quality data through the development and implementation of ISO standards 22745 and 8000. ISO 22745 is a standard for the representation of master data. ISO 8000 is a standard for measuring and certifying data quality. This presentation will focus on implementation of these standards within industry, in particular projects that have occurred within the past year. Besides the NATO countries, the NCS is used by more than 30 non-NATO countries around the world, in Europe as well as Asia, North and South America, Australia, and Africa.

BIOGRAPHY

Steven E. Arnett
Chief, U.S. National Codification Bureau
Defense Logistics Agency

Steven Arnett is the chief of the United States Codification Bureau (NCB) at the Defense Logistics Information Service (DLIS) in Battle Creek, Michigan. Before being appointed to that position in April 2004, Mr. Arnett worked in the field of NATO codification policies and procedures for 14 years and has represented the United States at many meetings of NATO Allied Committee 135 (AC/135). He is the official liaison from AC/135 to ISO Technical Committee 184/Subcommittee 4, which is responsible for standards related to industrial data. Among other accomplishments, Mr. Arnett has had numerous articles published related to his work, including in the Defense Standardization Program Journal and the Defense Institute of Security Assistance Management Journal. Further, Mr. Arnett is the secretary of the Pacific Area Cataloging Seminar (PACS). Mr. Arnett received a bachelor's degree in humanities in 1973 from Michigan State University and also did graduate work at that institution. He was granted a master's degree in English literature from the University of Maine in 1978. Further, he is a 2007 graduate of the LOGTECH Advanced Program in Logistics & Technology from the Kenan-Flagler Business School at the University of North Carolina.

DEFENSE LOGISTICS AGENCY
AMERICA'S COMBAT LOGISTICS SUPPORT AGENCY

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Overview

- Overview of the NATO Codification System (NCS)
- Basics of ISO standards 22745 and 8000
- Implementation of ISO standards 22745 and 8000

DLIS

- *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.*

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Our Customers

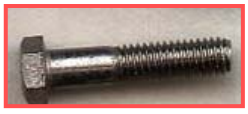
4

The NATO Codification System

Overview of the NATO Codification System

5

Why the NCS Was Created



DLA NSN 1

ONE ITEM OF SUPPLY
SINGLE MANAGER
SINGLE NSN

Each military service uses their own logistics "language"

In The Days of WWII

DLA NSN 1
Army NSN 2
Marine Corps NSN 3
Navy NSN 4
Air Force NSN 5
NSN 6
NSN 7
NSN 8

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

NATO NSN ?

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NCS History

1945 WWII
US/UK/CA CLASSIFICATION
1949 PL152 SUPPLY CLASSIFICATION
1952 PL436 CODIFICATION SYSTEM
1954 STANAG 3150
1956 STANAG 3151
1966 DLSC
1974 NCB CODE
1978
1991 PFP
1994 PACS
1999 BASELOG
2002 eOTD / ISO
2009 e-Commerce
DESERT STORM

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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

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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

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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**

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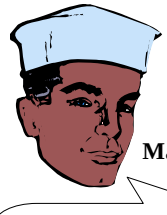
How Many Languages Are Spoken Here?



Malay

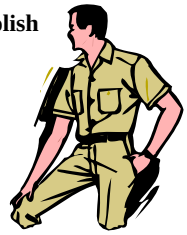
Saya ada NSN di dalam simpanan. (I have the NSN in my inventory)

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

English

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

Polish



Bulgarian

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

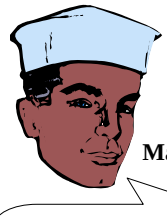
Estonian

Peaks saabuma varsti (I expect this item soon)

11

How Many Languages Are Spoken Here?

Answer - 6



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Estonian

Peaks saabuma varsti (I expect this item soon)

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NSN Item Description: SCREW, MACHINE

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:

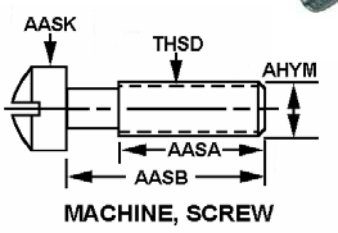
AASK: Head Style

THSD: Thread Series Designator

AHYM: Nominal Thread Diameter

AASA: Thread Length

AASB: Fastener Length



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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

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NATO Stock Number (NSN)

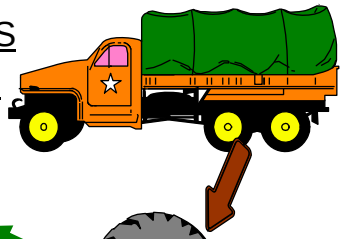
MANUFACTURERS IDENTIFICATION SYSTEM

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

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Data Associated with NSNs

The NSN – more than identification

Managing items over the life cycle

- *Data Sharing*
- *Connectivity*
- *Standards*

Sum of all its parts

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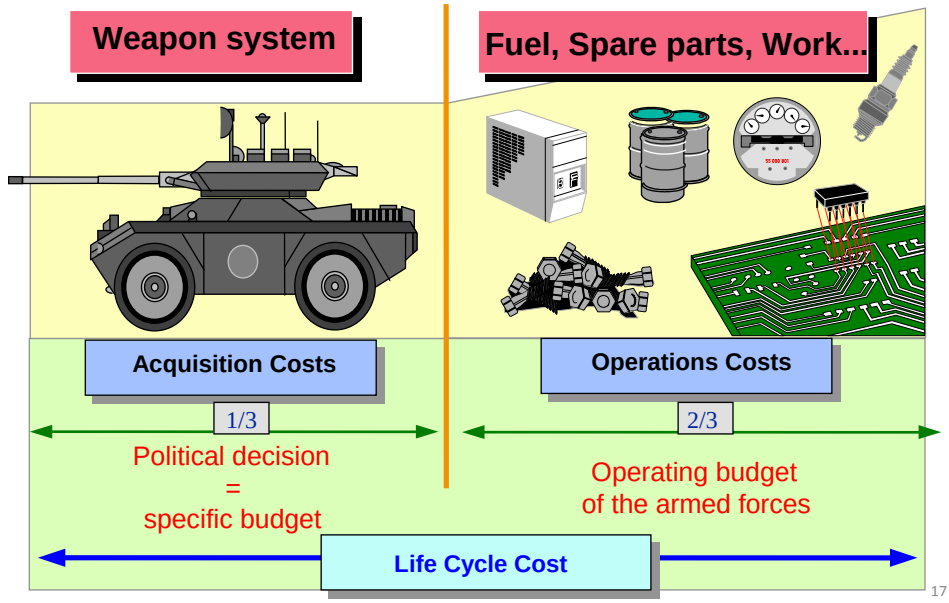
The Costs of A Weapon System



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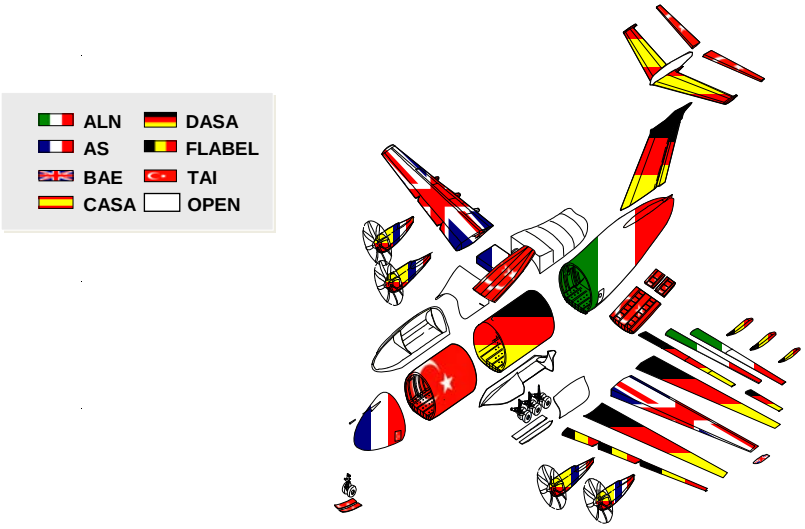
Multinational Systems Development



Source: Airbus Military

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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 58 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

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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

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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**

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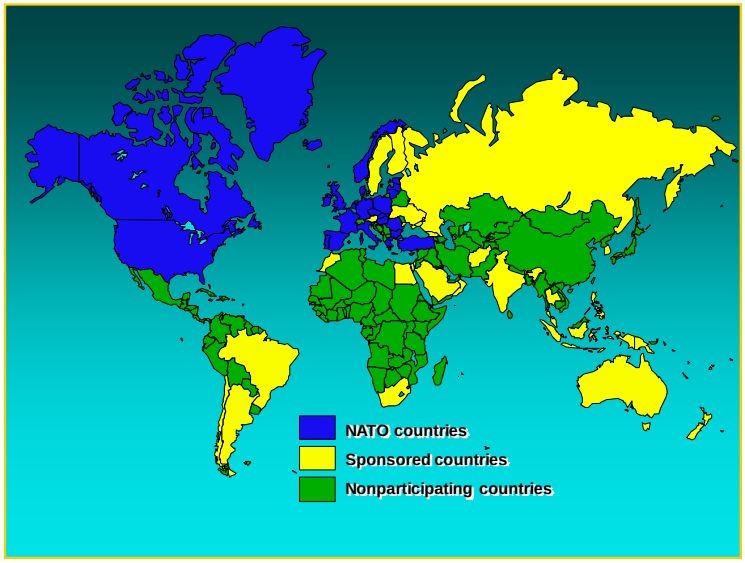
NATO Codification System Map



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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

International Organization for Standardization

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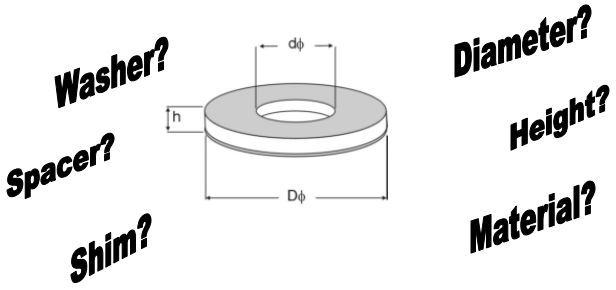
Industry's Interest

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



Adopt Government's Best Practices

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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 8000-110:2008 MASTER DATA QUALITY

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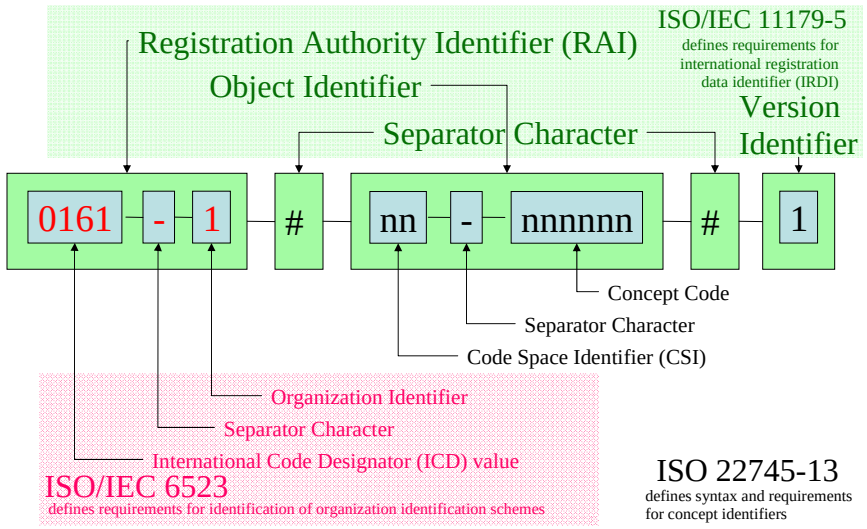
ISO 22745 Concept Identifier



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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

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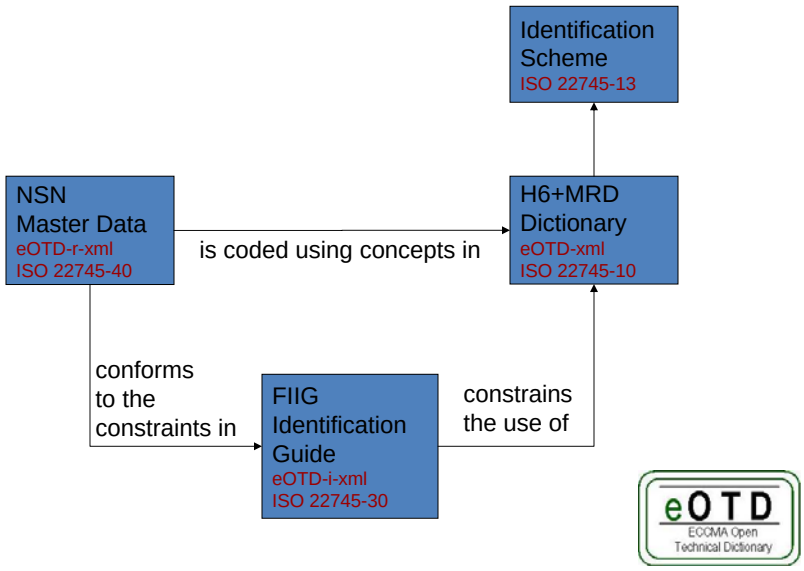
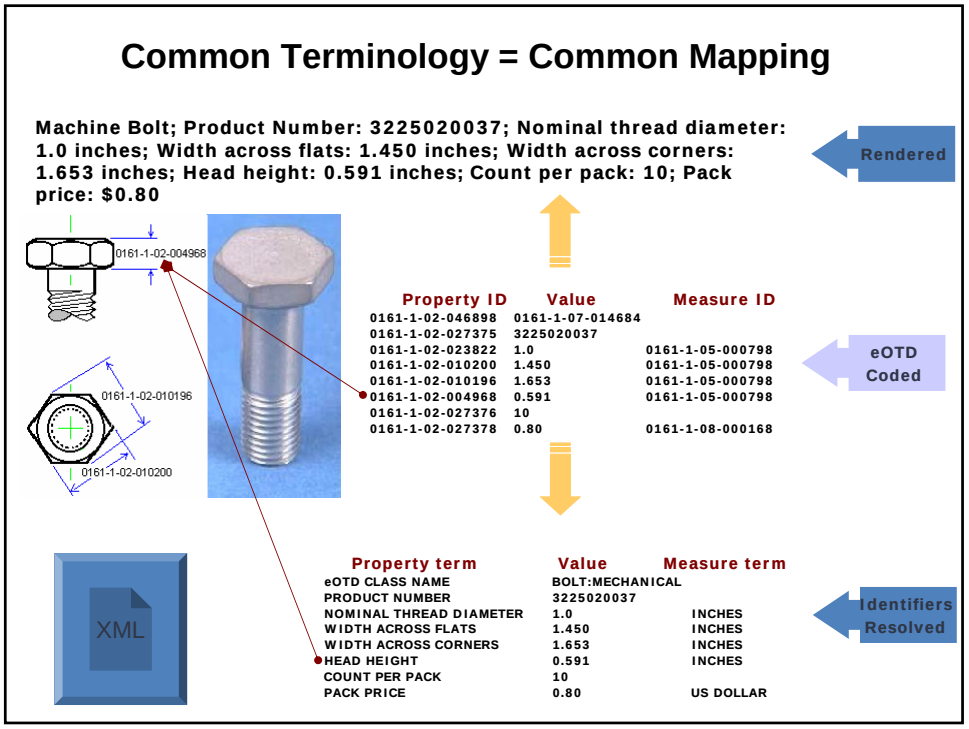
ISO 22745 Architecture



28


Common Terminology = Common Mapping
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
Rendered
0161-1-02-004968
0161-1-02-010196
0161-1-02-010200
Property ID Value Measure ID
0161-1-02-046898 0161-1-07-014684
0161-1-02-027375 3225020037
0161-1-02-023822 1.0 0161-1-05-000798
0161-1-02-010200 1.450 0161-1-05-000798
0161-1-02-010196 1.653 0161-1-05-000798
0161-1-02-004968 0.591 0161-1-05-000798
0161-1-02-027376 10
0161-1-02-027378 0.80 0161-1-08-000168
eOTD Coded
XML
Property term Value Measure term
eOTD CLASS NAME BOLT:MECHANICAL
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 US DOLLAR
Identifiers Resolved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xmlns:ns4="urn:x-eotd:xml-schema:basic" xmlns:ns5="urn:x-eotd:xml-schema:catalogue" xmlns:ns6="urn:x-eotd:xml-schema:q
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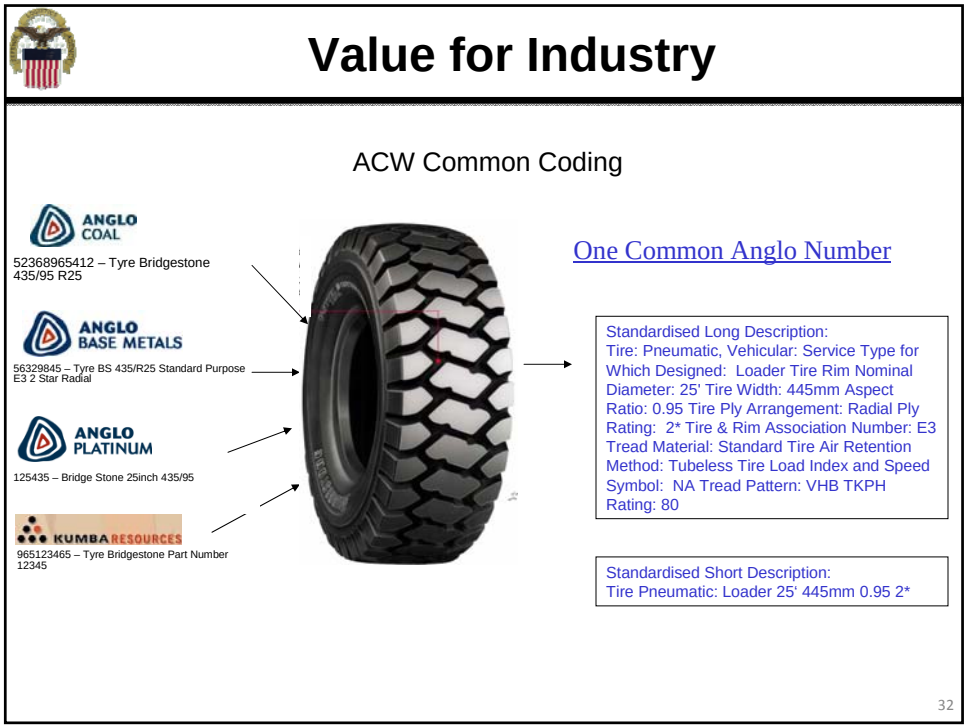
Value for Industry
ACW Common Coding
ANGLO COAL
52368965412 – Tyre Bridgestone 435/95 R25
ANGLO BASE METALS
56329845 – Tyre BS 435/R25 Standard Purpose E3 2 Star Radial
ANGLO PLATINUM
125435 – Bridge Stone 25inch 435/95
KUMBA RESOURCES
965123465 – Tyre Bridgestone Part Number 12345
One Common Anglo Number
Standardised Long Description:
Tire: Pneumatic, Vehicular: Service Type for Which Designed: Loader Tire Rim Nominal Diameter: 25' Tire Width: 445mm Aspect Ratio: 0.95 Tire Ply Arrangement: Radial Ply Rating: 2* Tire & Rim Association Number: E3 Tread Material: Standard Tire Air Retention Method: Tubeless Tire Load Index and Speed Symbol: NA Tread Pattern: VHB TKPH Rating: 80
Standardised Short Description:
Tire Pneumatic: Loader 25' 445mm 0.95 2*
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ANGLO AMERICAN

sasol reaching new frontiers

NEWMONT The Gold Company

"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

eOTD

BOEING

Boeing Technology
Phantom Works

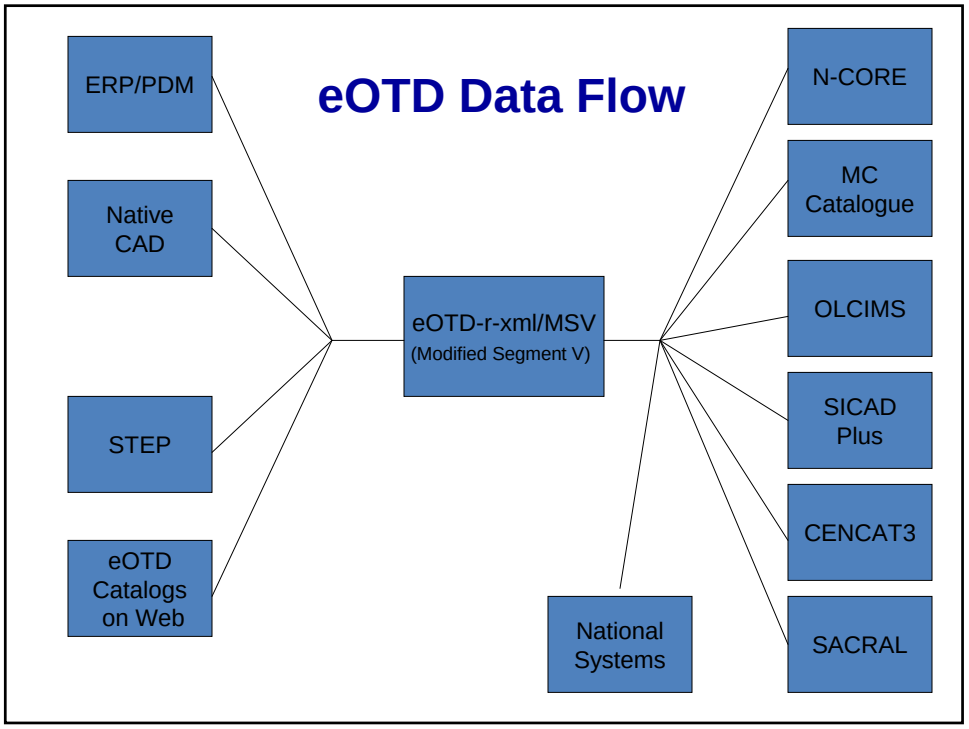
Phantom

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)

Approved for external release under various references



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

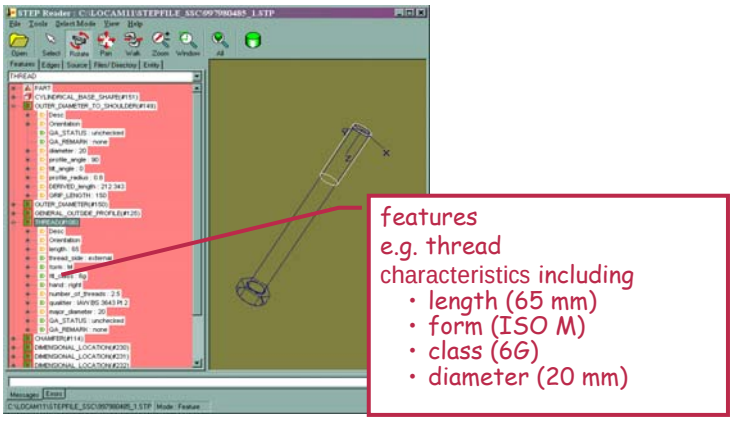
After

- 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



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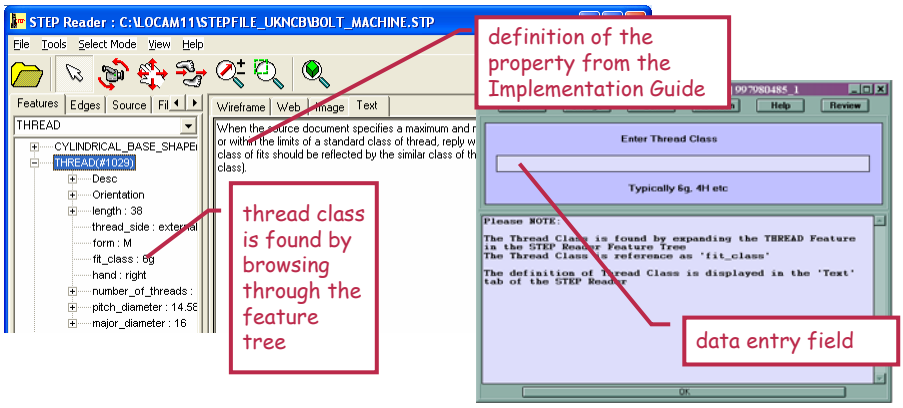
ISO 22745: Automation of Cataloging

- Create data one time and use throughout life cycle



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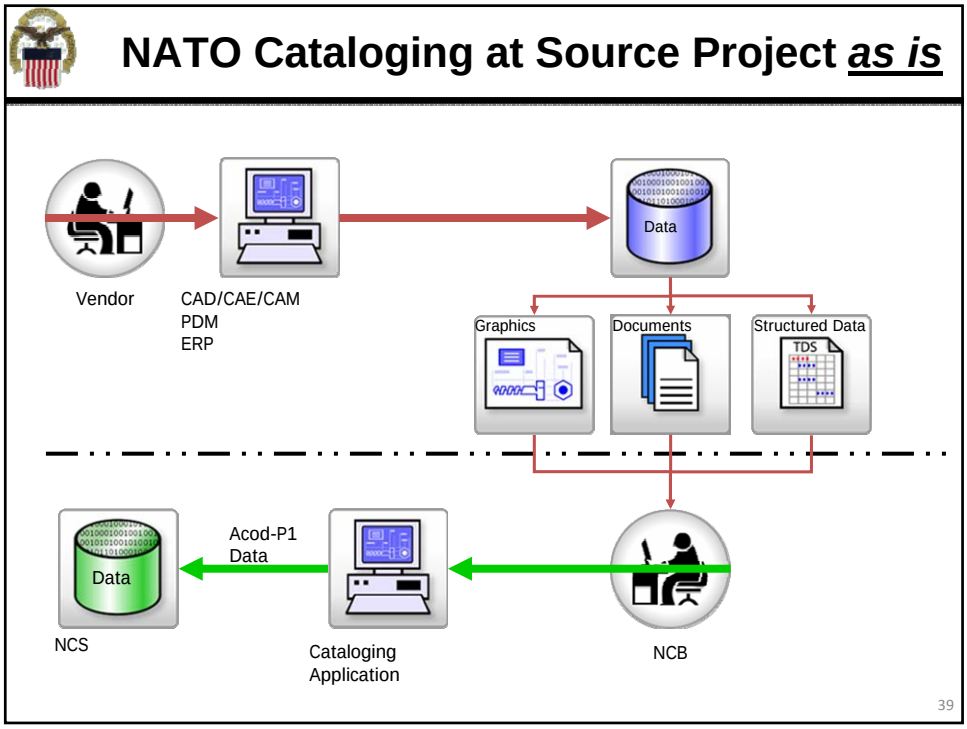
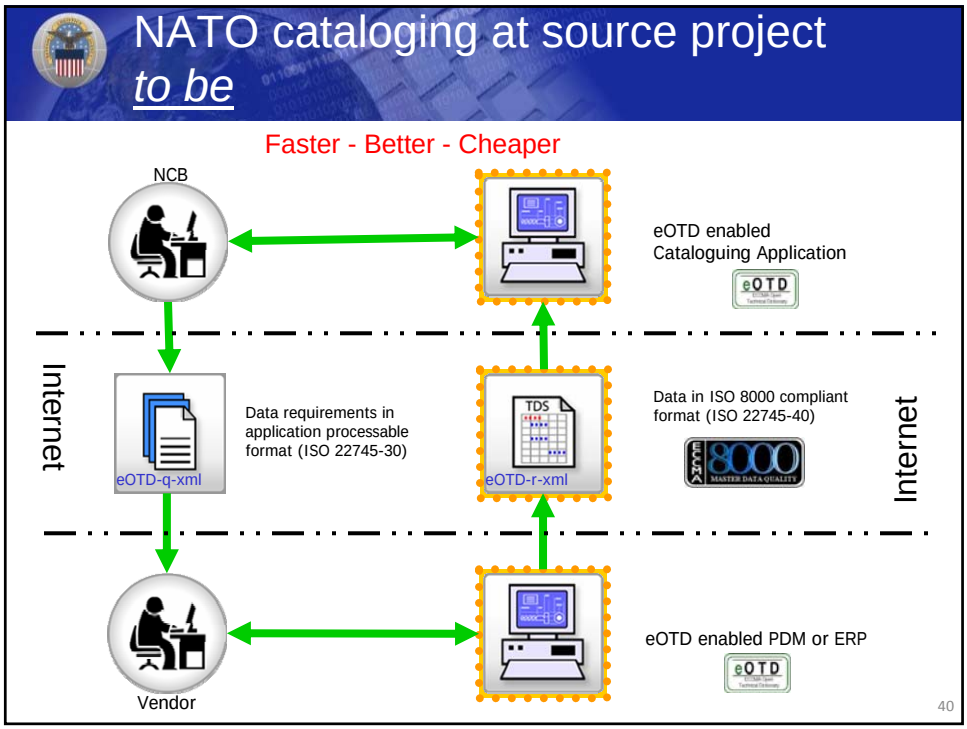

NATO Cataloging at Source Project as is
Vendor
CAD/CAE/CAM
PDM
ERP
Data
Graphics
Documents
Structured Data
TDS
Data
Acod-P1
Data
NCS
Cataloging
Application
NCB
39


NATO cataloging at source project
to be
Faster - Better - Cheaper
NCB
eOTD enabled
Cataloguing Application
eOTD
Internet
eOTD-q-xml
Data requirements in
application processable
format (ISO 22745-30)
TDS
eOTD-r-xml
Data in ISO 8000 compliant
format (ISO 22745-40)
8000
Internet
Vendor
eOTD enabled PDM or ERP
eOTD
40

Common Concept Encoding

- 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

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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

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ISO 8000: A Standard for Data Quality

- ISO 8000 incorporates all the key elements of data quality:
  - Syntax
  - Provenance
  - Completion
  - Accuracy
  - Certification

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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

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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

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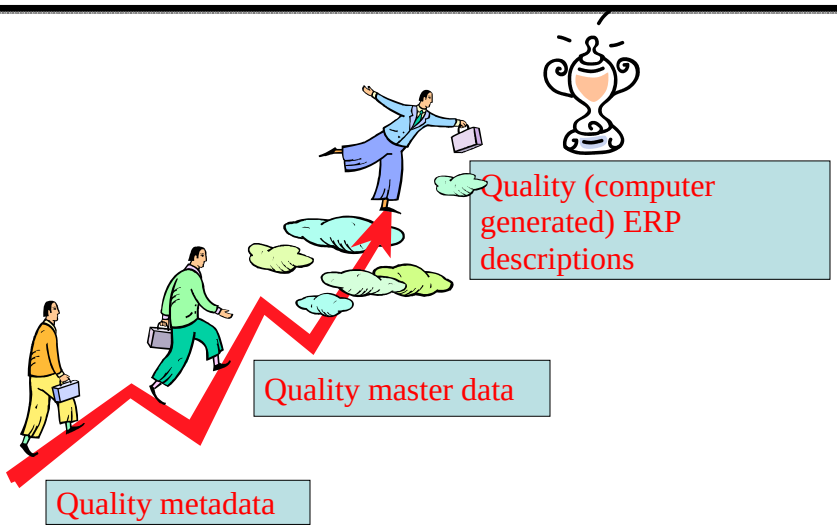
The Steps to Quality ERP Descriptions



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ISO 8000-110
Master Data Syntax and Encoding

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.

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ISO 8000: A Data Provider's Perspective

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.

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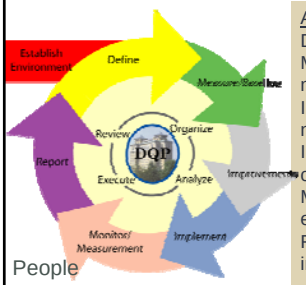
Data Quality

The Process …



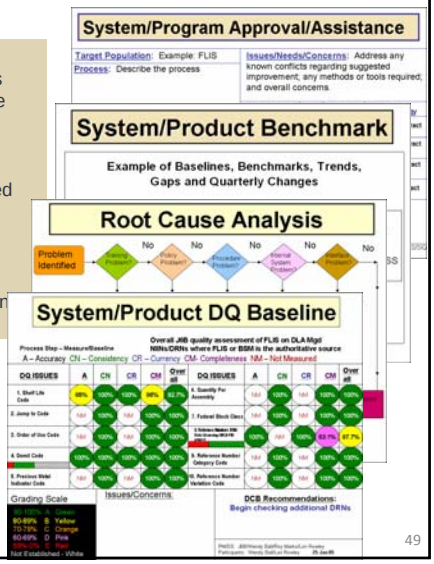
People
Process
Technology

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 savin

90-100%	Green
80-89%	Yellow
70-79%	Orange
60-69%	Pink
59%-0%	Red
NM Not Measured	White

Accuracy
Consistency
Currency
Completeness

The Results …



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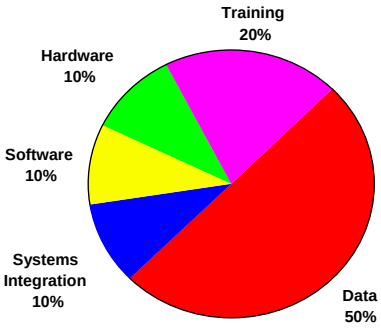
What Does an Information System Cost?

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.

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ISO 22745 = Accurate and Precise Data

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

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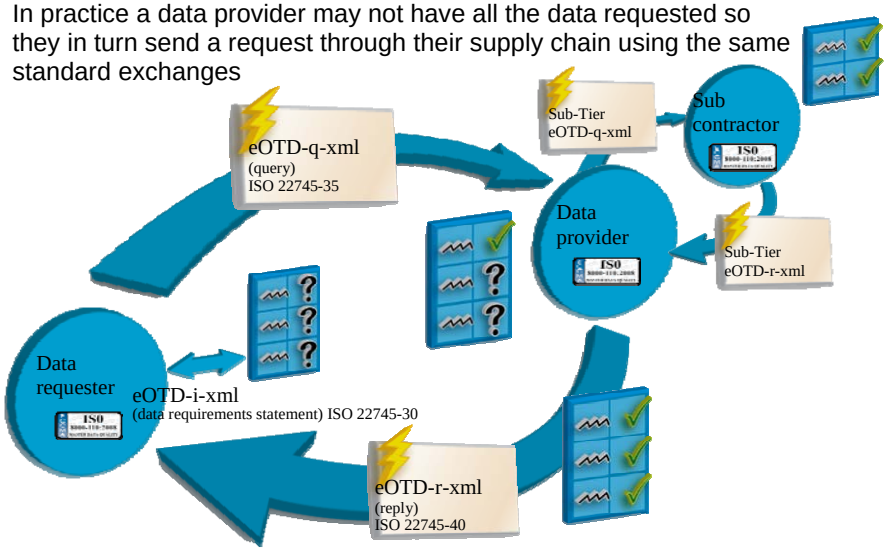
Automating the Data Supply Chain

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



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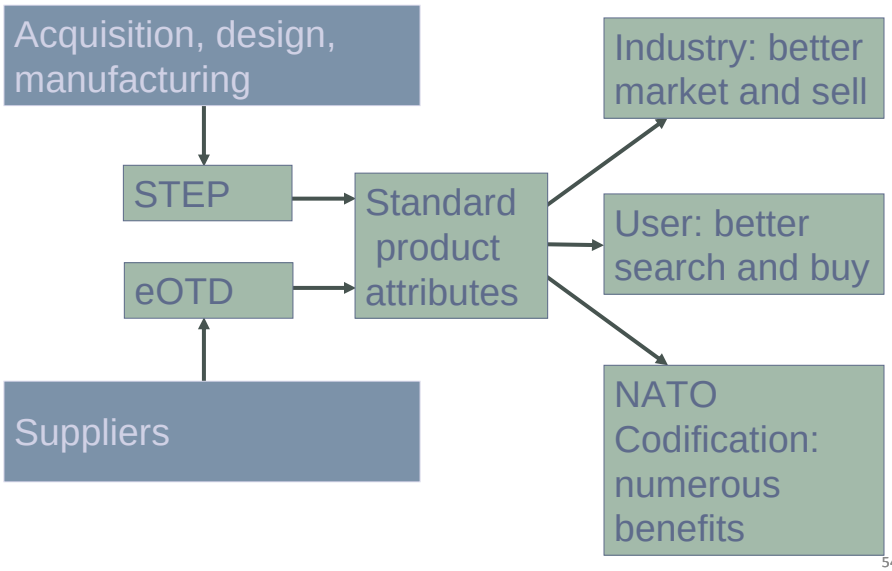
2020: A New World



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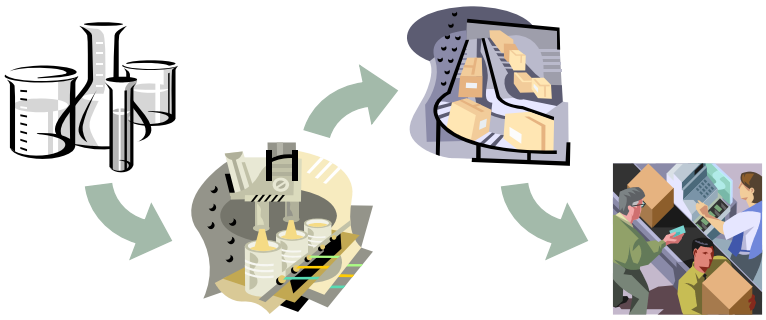
2020: A New World

- 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



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Smart Step Codification Phase 3

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.

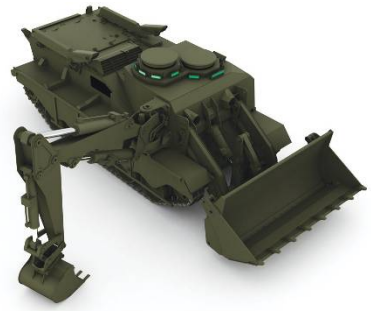
The successful completion of the project will result in demonstrable improvements in quality and time in the completion of a codification task and provide information on potential whole life cost savings

TERRIER is a new generation Combat Engineering Vehicle (CEV)

- Used for Early entry
- Used for Combat support
- Used for Post conflict roles

TERRIER® Capability

- **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**



TERRIER® Capability

- **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**

Counter Mobility / Survivability

High capacity bucket – 2.8 m^3

Excavator arm – 0.4 m^3

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%.

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.

Smart Step Codification = 10 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

The Biggest Challenge

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.

The Cost of not codifying!

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-neccesary support cost of on average: £27,000

BAES GCS Newcastle has approximately 19,000 items registerd 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.

Implementation of ISO 22745/8000

- Many companies are now in the business of building ISO 22745/8000 compliant catalogs. Some examples:
  - PiLog – South Africa
  - Quadrem
  - ESG
  - AURA

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Implementation of ISO 22745/8000

- 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.

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Implementation of ISO 22745/8000

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

ISO International Organization for Standardization

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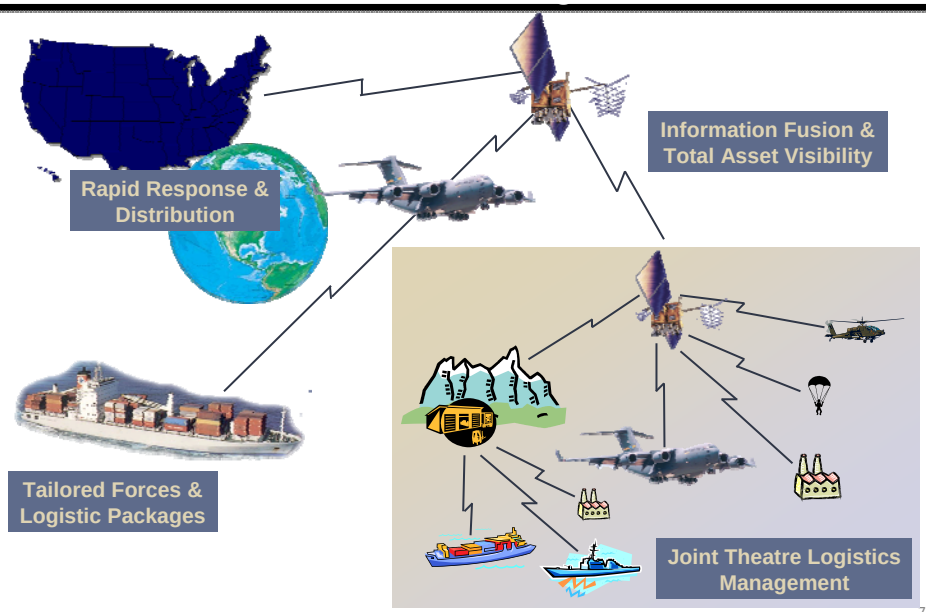
Netcentric Logistics



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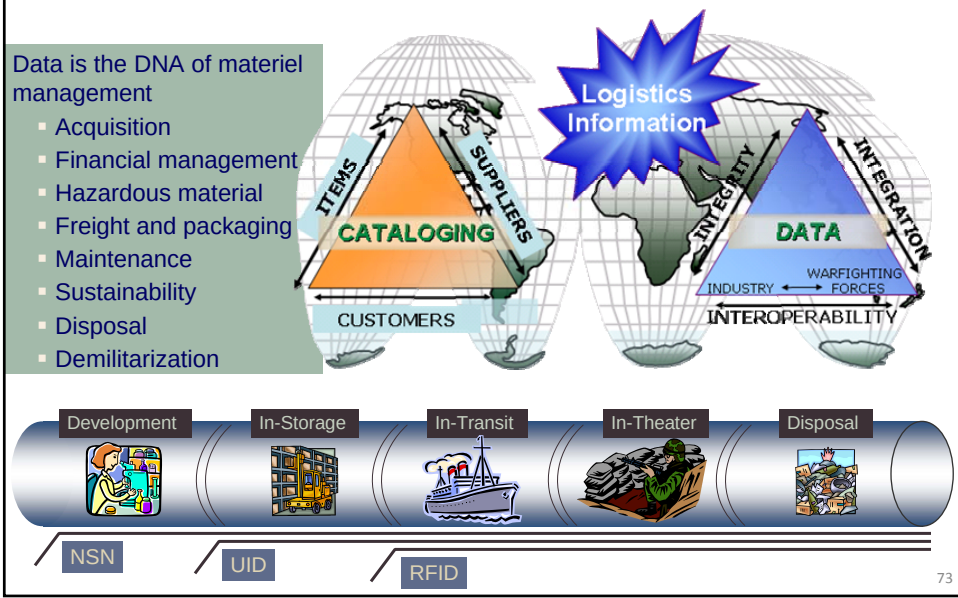
Data is the DNA

Data is the DNA of materiel management

- Acquisition
- Financial management
- Hazardous material
- Freight and packaging
- Maintenance
- Sustainability
- Disposal
- Demilitarization



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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

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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)
  - http://www.defence.gov.au/dmo/_jlc/pacs

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