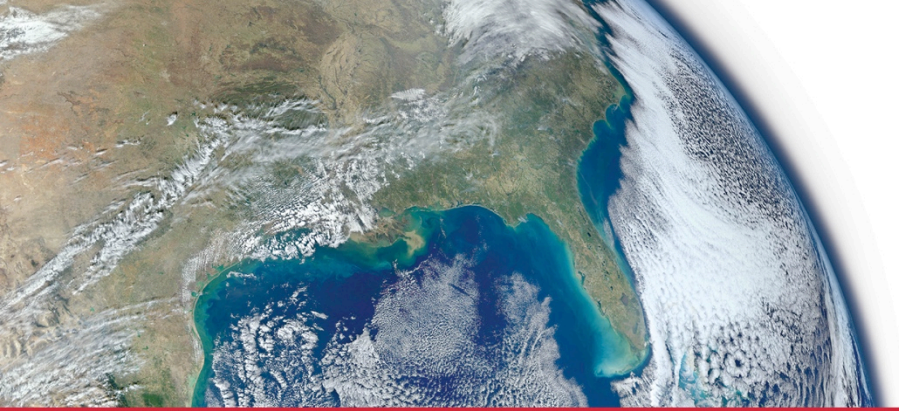

Chemical Substance Reporting for Defense Systems

Tim Sheehan
Raytheon Global Substances Program

Presentation to the NATO Science and Technology Research Workshop AVT-302
Paint Removal Technologies for Military Vehicles
October 13, 2017

Agenda

Raytheon

- Need for chemical reporting development for defense hardware systems
  - “Materials/substances declaration”
- Materials/Substances declaration development – aerospace and defence industry
- Defense product materials/substances declaration and chemical risk management.

Burning Platform

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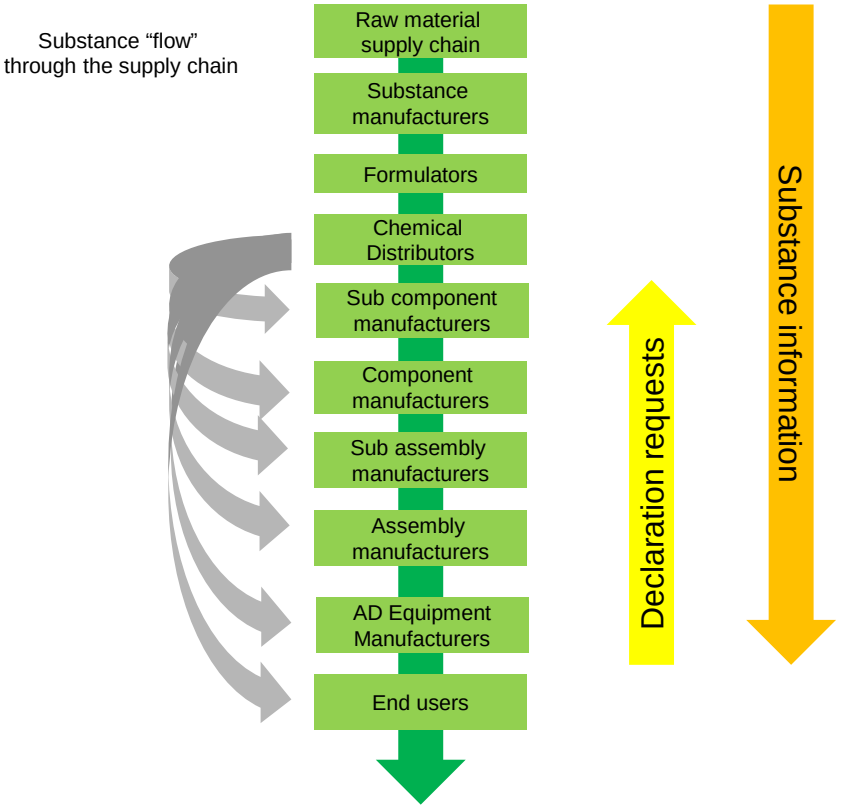
- The chemical composition of military system hardware products is mostly unknown
- Lack of insight has multiple impacts
  - Many lifecycle environmental, safety and occupational health (ESOH) risks are unknown to system owners
  - Product lifecycle management decisions are made difficult
  - Elevates ownership management costs
- Product-related composition information must come from within an extensive and international supply chain.

Materials/Substance Declaration

Raytheon

- Process to obtain product-related chemical information
- Suppliers provide information to their customers
  - Information is “rolled up” through the supply chain levels
- Standardized
  - Specific data elements, formats, etc.
- Several existing industry standards
  - IPC-1752 - electronics
  - IEC 62474 – electronics
  - IMDS - automotive

How Are Chemicals Introduced in the Product Supply Chain?



Key points…

- What happens in the supply chain can have an effect on the final product composition
  - At each level, chemicals are added (or subtracted)
- Information is passed down the supply chain to determine product composition
- Formulators/ chemical distributors provide safety data sheets
  - May not be sufficient for estimating article content

Materials Declaration for Aerospace and Defense

Raytheon

- Process under development collaboratively by IAEG® and IPC®
  - IAEG® – International Aerospace Environmental Group (www.iaeg.com)
  - IPC® – Association Connecting the Electronics Industry (www.ipc.org)
- Two types of product chemical data reported
  - Product chemical content information
  - Chemicals used to make/required to support products
- Aerospace and defense (AD) companies use acquired data to:
  - Identify and comply with product compliance requirements – regulatory/ contractual
  - Identify dependence/materials obsolescence risks in the supply chain
  - Identify product-related ESOH risks
  - Meet customer data reporting requirements

Declaration Data Elements

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- Supplier/requestor identification
- Part/product information
  - Identifications
  - Weights
- Substance information
  - Substance identities
  - Substance product weight indicators
- Substance use information
- Declaration quality control information

Industry Declaration Process Overview

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Sub-tier Suppliers…

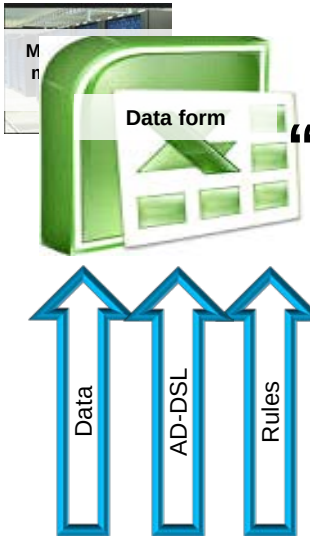
Supplier

Data Exchange

"Business to business"

Customer

Customer's customers…



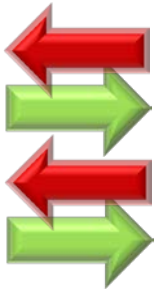
Data request

Data response

"C" - converter to electronic data format

"C"

or



IPC-1754

- Data reporting elements
- Entry/ transfer instructions
- Training

Materials/Substances Declaration “Components”

Raytheon

- Declarable Substances List (“DSL”)
- Data elements for materials declaration
- Data conversion to electronic format
- Guidance, instructions, technical support and training
- Data management system

Aerospace and Defence Declarable Substances List

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- "AD-DSL"
  - DSL for the international aerospace and defense industry
  - Product-related substances, subject to regulatory, or other requirements (e.g., reporting and/or restrictions)
  - Substances in use in the industry, or in its supply chain
  - Substances used in product development and product lifecycle management
  - Forward-looking – "what is, and what is likely to be subject to requirements…"

IAEG® INTERNATIONAL AEROSPACE ENVIRONMENTAL GROUP®

AD-DSL Excerpt

CAS Registry Number®	EC Number	Substance Name	First Added	Latest Revision
101-14-4	202-918-9	2,2'-dichloro-4,4'-methylenedianiline; 4,4'-methylene bis(2-chloroaniline)	3/17/2015	
101-77-9	202-974-4	4,4'-diaminodiphenylmethane; 4,4'-methylenedianiline	3/17/2015	
10588-01-9	234-190-3	Sodium dichromate	3/17/2015	
106-94-5	203-445-0	1-bromopropane; n-Propyl bromide	3/17/2015	
107-06-2	203-458-1	1,2-dichloroethane; Ethylene dichloride	3/17/2015	
11103-86-9	234-329-8	Potassium hydroxyoctaoxodizincatedichromate	3/17/2015	
111-96-6	203-924-4	Bis(2-methoxyethyl) ether	3/17/2015	
115-25-3		Octafluorocyclobutane	3/17/2015	
115-29-7	204-079-4	Endosulfan	3/17/2015	
115-96-8	204-118-5	Tris(2-chloroethyl)phosphate	3/17/2015	
1163-19-5	214-604-9	2,2,3,3,4,4,5,5,6,6-Decabromodiphenyl ether	3/17/2015	
117-81-7	204-211-0	Bis(2-ethylhexyl) phthalate; Di-(2-ethylhexyl) phthalate;	3/17/2015	
118-74-1	204-273-9	Hexachlorobenzene	3/17/2015	
121-14-2	204-450-0	2,4-Dinitrotoluene	3/17/2015	
123-91-1	204-661-8	1,4-Dioxane	3/17/2015	
124-73-2	204-711-9	Dibromotetrafluoroethane	3/17/2015	
12656-85-8	235-759-9	Lead chromate molybdate sulfate red; C.I. Pigment Red 104; C.I. 77605	3/17/2015	
12674-11-2		PCB Aroclor 1016	3/17/2015	
127564-83-4		Dichlorotetrafluoropropane	3/17/2015	

Current – Version 2, August 2017

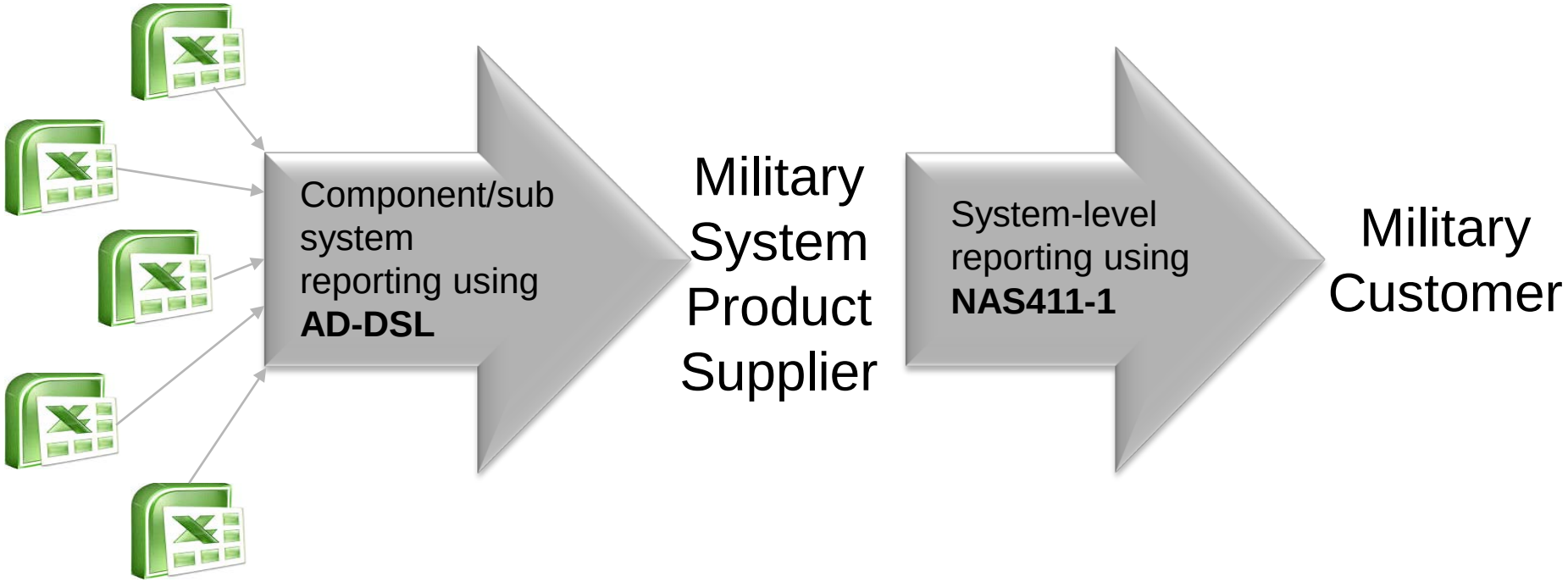
National Aerospace Standard 411-1

Raytheon

- NAS411-1, *Hazardous Material Target List*
  - Aerospace Industries Association (AIA; www.aia-aerospace.org) standard
  - DSL for US military acquisition systems
  - Reportable hazardous substances under US military Hazardous Materials Management Programs (HMMPs)
  - Product-related substances - regulated and/or posing operational risks
  - Defense system product content or used in maintenance & repair
  - Current - Revision 1: Oct 2016

DSL Relationship: AD-DSL and HMTL

AD Industry Supply Chain Declarations



MIL-STD 882E

Raytheon

- US Department of Defense approach for identifying hazards and assessing and mitigating associated risks encountered in the development, test, production, use, and disposal of defense system products (military hardware)
  - Consists of environmental safety and occupational health (ESOH) risk management
  - Typically started during system development
- Contains numerous ESOH-related tasks
  - Task 108 – *Hazardous Material Management Plan*

MS882E - Task 108, continued

Raytheon

- Requires identifying, reporting of hazardous materials (substances) used in developed defense systems
  - NAS411-1 = reportable substances
  - Other substances can be added
  - Includes substances in hardware and those needed for system operations or support (e.g., in maintenance or repair)
- Imposes use permission requirements for some high-risk substances (e.g., hex chrome)

Materials/Substances Declaration Supports ESOH Risk Assessment and Reporting

Current Status

Raytheon

- NAS411-1 becoming integrated as the standard DSL for US defense acquisition materials/substances declaration
- AD industry declaration process (using the AD-DSL) is under development and is expected in 2018

Next Steps

Raytheon

- Develop aerospace and defense industry materials declaration process
  - Deploy in the industry supply chain
- Use declaration process to obtain defense system materials/substance information from supply chain
- Use declaration information to better identify defense system-related ESOH risks
- Support the re-use of system information within the customer community.

Thank you!