Coordinated Activities for Risk Mitigation of Materials and Processes Obsolescence

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Scope

- Introduction to ESA
- M&P obsolescence through environmental regulations
- ESA management structure for REACH impact
- Joint European Materials and processes WG
  - Mapping of industrial exposure
  - Preliminary risk assessment
- Example of complexity on launcher program
- Conclusions

Introduction to ESA

European Space Agency (ESA)

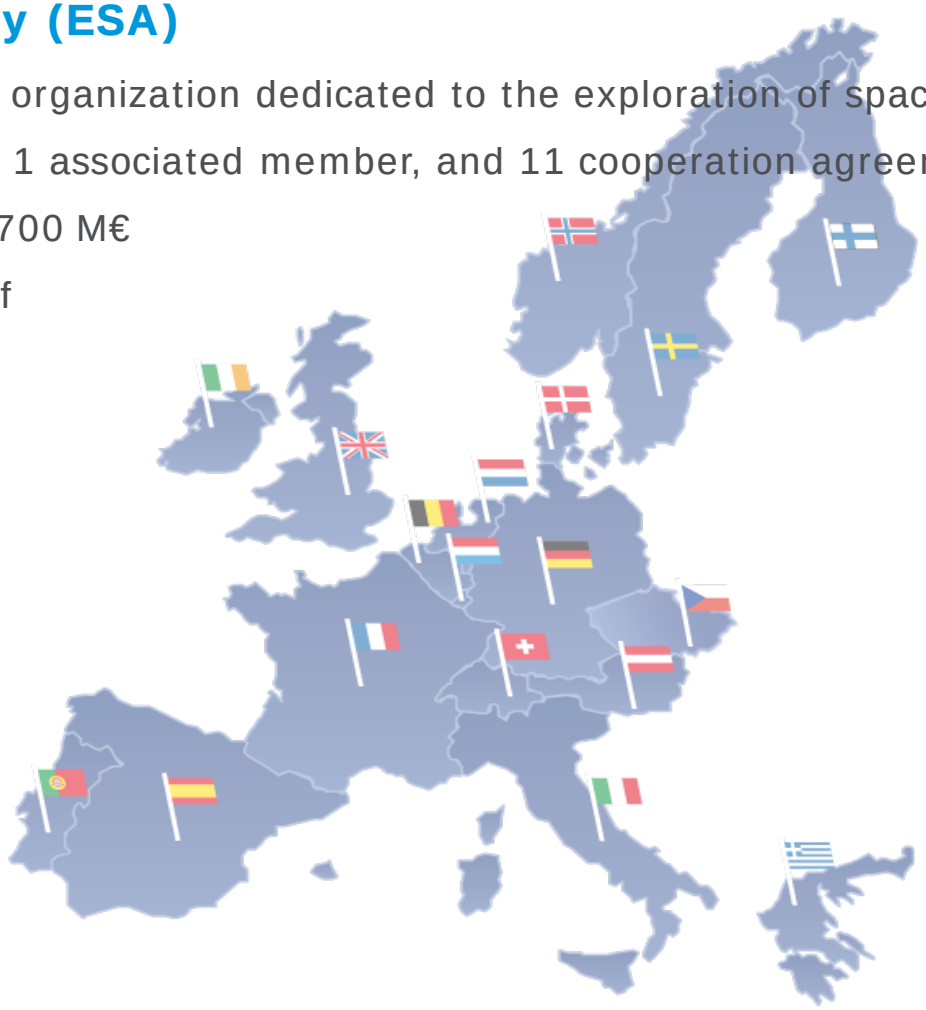
Intergovernmental European organization dedicated to the exploration of space

Currently 18 member states, 1 associated member, and 11 cooperation agreements

Annual budget 2010 about 3700 M€

Space activities in the area of

- Space science
- Human spaceflight
- Exploration
- Earth observation
- Launchers
- Navigation
- Telecommunications
- Technology
- Operations



Materials & Processes Obsolescence

Potential causes

Legislative and political reasons

- Environmentally driven regulations, e.g. REACH, RoHS
- Export restrictions, e.g. ITAR

Technical and market evolution

- Production shortfalls or stops
- Large volume consumer market moves ahead and space industrial niche market remains only user

Consequences

- Disappearance of products from European market
- Change in materials composition
- Change in manufacturing processes

Effects on European space programs

- Space validation of alternative materials and processes
- Costly new product and process developments
- Impact on project schedules, launch delays

Environmental Regulations (R)evolution

Progressive evolution and degree of complexity and consequently progressive reduction of availability of materials and processes.

RoHS (Restriction of Hazardous Substances)

- Directive implemented in 2004
- Restricts the use of six hazardous materials in the manufacture of various types of electronic and electrical equipment.

Other directives

For example limitation of emissions of volatile organic compounds due to the use of organic solvents

REACH (**R**egistration, **E**valuation, **A**uthorization, and Restriction of **Ch**emicals)

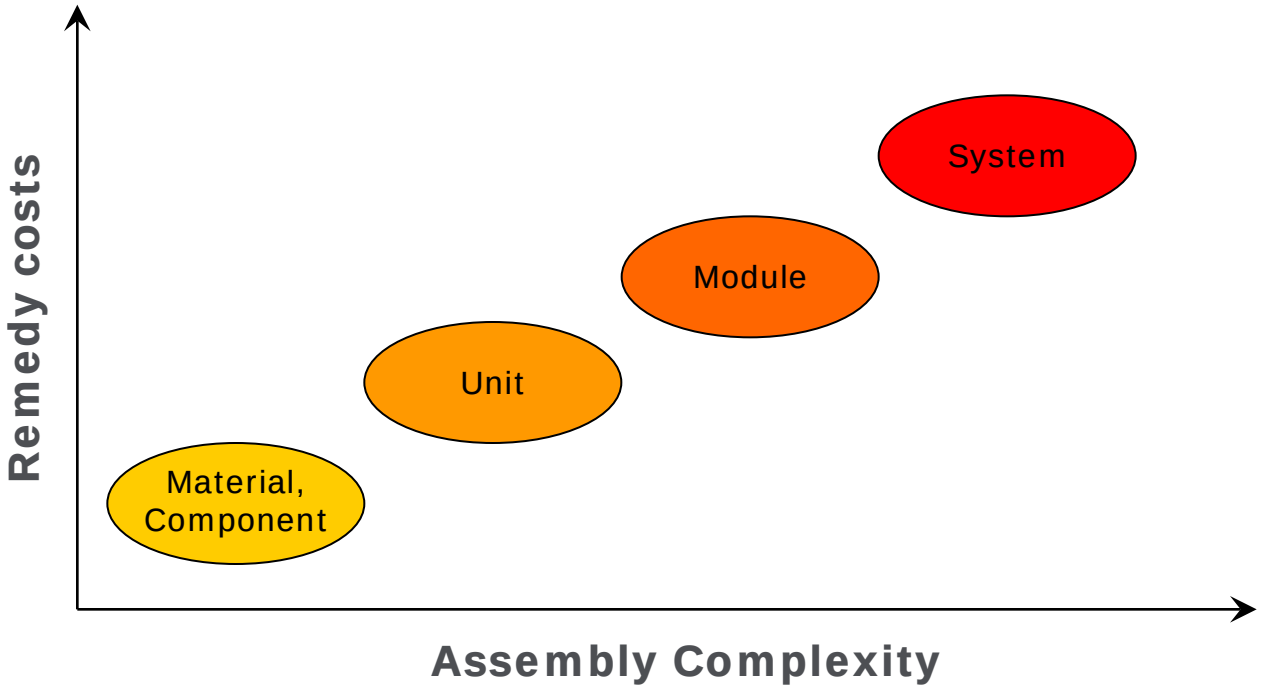
- Regulation N°1907/2006 of 18 December 2006, it affects the sale and manufacture of all chemicals unless specifically exempted
- Shifts responsibility for safe use of chemicals from authorities to industry
- Effects manufacturers, importers, distributors, and downstream users
- Need to understand respective roles and obligations, business implications, risks

Need for Active Risk Management

REACH is a strategic issue effecting future investments, process changes, and supply chain changes.

Insufficient to observe the market, need to actively manage the risk

→ Cost trade-off



Approaching Zero Liability

ESA objective is to manage obsolescence risk mitigation on several levels

Proactive

Early identification of risks

Mapping of REACH impact, establishment of risk mitigation action plan

Reactive

Technology observatory

Response on problem notification and follow-up actions required, e.g. development, testing, qualification

Institutional

REACH management via procurement

Coverage by applicable standards and contract general clauses

Collaborative

Coordination with industrial partners (manufacturers, end-users), national, and international space agencies.

ESA Management Structure for REACH Impact

ESA Management

- Provide the resources to implement risk mitigation actions

ESA Corporate WG

- Members: ESA Directorate representatives
- Fact finding
- Risk analysis
- Recommendations
- Follow-up
- Coordination of REACH activities

Joint European Materials & Processes WG

- Members: End users, material manufacturers, space agencies, ESA
- Map Industrial exposure to REACH substances

ESA D/TEC internal WG on sustainability /obsolescence

- Members : TEC experts
- Address potential obsolescence due to REACH and other environmental legislations.
- Propose and coordinate technical (D/TEC internal) support actions

Joint European Materials & Processes WG

This WG is hosted by the Components Technology Board that has an established infrastructure for a European-wide platform. It is open to all relevant stakeholders covering end users, materials manufacturers, and space agencies. Tasks include:

- **Legislation:** Intelligence of legislative processes (*e.g.* REACH, RoHS) and coordination of preventive and corrective actions.

  Individual splinter groups covering aspects for **REACH, hexavalent chromium, lead-free solder**
- **Obsolescence:** Proposition of action plans to mitigate risk of obsolescence in the field of Materials & Processes.
- **Data exchange:** Coordination to share materials characterisation data and avoidance of test duplication.
- **R&D activities:** Strategy definition for M&P, harmonisation of R&D activities, monitoring of alerts, analysis of in-orbit anomalies, establishment of lessons learned, *etc.*
- **Communication & information exchange:** Support and coordination of information via symposia, WGs, training. Development of synergies with M&P activities with other industrial areas.

M&P Working Group – REACH Splinter

The Materials & Processes WG develops a common procedure to:

- Identify materials used for space applications projects
- Identify substances within these materials
- Cross check these substances with existing list of critical substances
- Define criticality level for all materials identified made with critical substances
- Propose a roadmap
- Identify additional materials which may be added to the candidate list

The database is currently populated with > 1000 materials from major European space manufacturers with about half of the materials split into components extracted from Materials and Safety Data Sheets (MSDS). The database is 'living' with periodic updates.

Most imminent risk is derived from the REACH regulation.

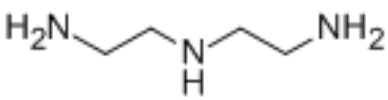
A first roadmap is expected 2010 with short/mid/long term risks identified.

Breakdown into Components

Identification of potentially hazardous components via MSDS sheets.

Trade Name	CAS# 01	CAS# 02	CAS# 03	CAS# 04	CAS# 05	CAS# 06
Hysol EA 9210 PRIMER 10%	78-93-3	109-86-4	13530-65-9			
Hysol EA 9309.3NA Part A	25068-38-6	4736-60-6				
Hysol EA 9309.3NA Part B	4246-51-9	140-31-8	111-40-0	1760-24-3	108-95-2	
Hysol EA 9321 Part A	7429-90-5	111-40-0	7631-86-9	112-24-3	7631-86-9	...
hysol EA 9321 Part B	68082-29-1	1344-28-1	111-40-0	7631-86-9	112-24-3	
Hysol EA 9323 Part A Quart	5026-74-4	9003-36-5	28064-14-4			
Hysol EA 9323 Part B Pint	68082-29-1	111-40-0	112-24-3	1760-24-3		
Hysol EA 934 Part A	28064-14-4	5026-74-4	7429-90-5	112945-52-5	7631-86-9	
Hysol EA 934 Part B	111-40-0	112-24-3	68082-29-1			
Hysol EA 9394 Part A	7429-90-5	67762-90-7				
Hysol EA 9394 Part B	7631-86-9	112945-52-5				
Hysol EA 9394/C-2 Part A	7429-90-5	112945-52-5				
Hysol EA 9394/C-2 Part B	6864-37-5	1761-71-3				
Hysol EA 9396 Part A	25068-38-6					
Hysol EA 9396 Part B	112-57-2					
Hysol FP4450	25550-51-0	85954-11-6	1675-54-3	25068-38-6	2386-87-0	...
Hysol FP4451	25550-51-0	85954-11-6	1675-54-3	25068-38-6	2386-87-0	...

Example CAS 111-40-0



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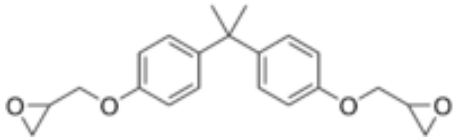

REACH ‘blacklists’

increasing risk

Registry of Intentions (Annex XV dossiers)

Public registry of intentions to create awareness to all interested parties of the substances, for which the authorities intend to submit Annex XV dossiers

Candidate list of SVHC for authorization

Candidates for authorization, currently 38 substances, continuously growing

ECHA makes recommendations to the European Commission on selected subset for inclusion in Annex XIV.

Annex XIV recommendations

Currently 7 substances (*e.g.* MDA, DEHP, BBP, DBP)

Authorization list (Annex XIV)

Currently empty, first release expected 2010/11, expect annual update

Restriction list (Annex XVII)

In force since June 1, 2009, continuous updates

Non-REACH sources for long-term risk assessment

SIN, national environmental regulations, *etc.*

Examples of Risks from Environmental Legislations

Constituent from Annex XIV/candidate list * – Short term risk (0-3 years)

Constituent	Identified Material
Dibutyl phthalate	Hardchrome Lacquer
Bis(2-ethylhexyl)phthalate	Medium tack dicing tape
Boric acid	Montage BC36
Trichloroethylene	PR-420

Constituent from Annex XV – Mid term risk (3-5 years)

Constituent	Material
Chloroform	Cleaning processes
Chromium trioxide **	Alodine 1200, black chromating processes

Constituent from other lists – Mid/long term risk (3-10 years)

Constituent from other lists of concern ***	Material
Toluene, ethyl benzene, MDI (isocyanate)	Paint solvents, polyurethane paints

* Currently only a candidate list exists for substances of very high concern, a decision by the European Parliament on the first batch of substances to be taken into Annex XIV is expected for Q1 2011

** Main driver is RoHS - space industry is currently exempted

*** RoHS, SIN, national environmental lists, etc.

Unanticipated Risks to Supply Chains

A US supplier has informed its European customers that there was a delay in submission of their lead dossier to the European Chemical Agency (ECHA) for a chemical constituent. Thus, import problems are expected after December 1 until acceptance of the dossier, currently estimated for February 2011.

It is recommended to create a buffer stock to avoid disruption of ongoing activities.

We need to anticipate

- Human errors, companies may pass deadlines
- Business cases leading to the conscious decision not to register

A high production study in 2002 indicated en expectation of about 9000 registrations by 2010. Current number of registrations ~ 5000.

Large risk that registrations will be late or that substances will disappear starting 2011

Example of Complexity on Launcher Program

The launcher program implicates a higher degree of complexity:

- Legal status of ESA (e.g. launch-site infrastructure)
- Non-European sources (e.g. Soyuz)
- Impact of REACH on use of propellants
- Impact of REACH on design for future launcher programs

  Which technology readiness level requires consideration of such regulations?

Depending on program ESA could be classified in the REACH sense as producer or importer.

REACH becomes a multilateral/transversal task throughout all ESA programs.

Conclusions

- Progressive evolution and degree of complexity of European environmental regulations
- Progressive reduction of availability of materials and processes is expected
- Active obsolescence risk management required
- ESA management structure for REACH impact in place
- The relevant WGs provide a network between all relevant stakeholder of the European space community.
- A preliminary risk assessment in materials level is available for space platforms.
- REACH becomes a multilateral/transversal task