Boeing Technology
Phantom Works

Aerospace Industry Response to the

Restrictions on Hazardous Substances (RoHS) Directive *on Military and Aerospace Systems*

DoD DMSMS Conference

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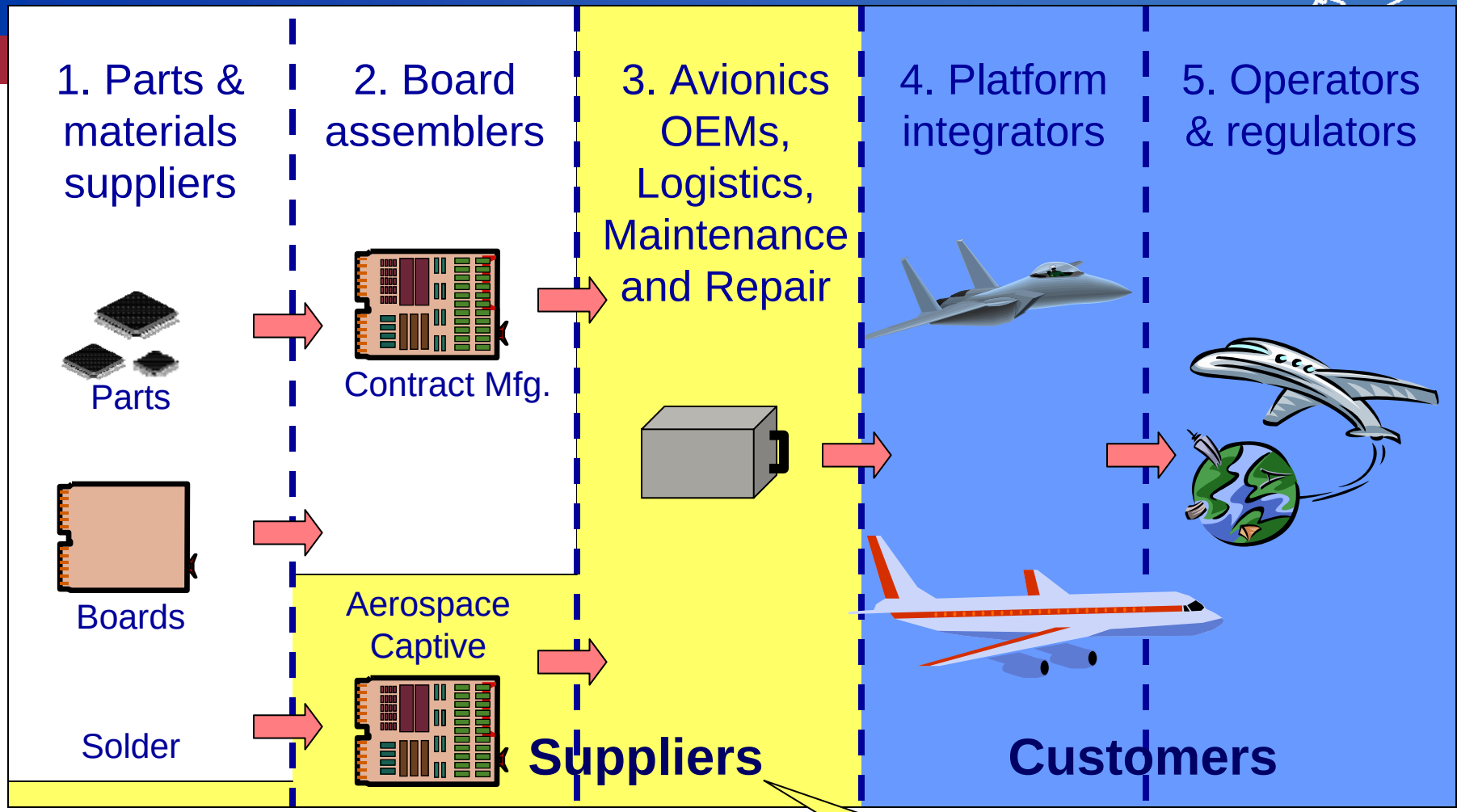
The Avionics Supply Chain



Non-aerospace Control

Aerospace Control

Majority of costs are incurred here

Suppliers

“Care-abouts”

- **Do I have to make the transition?**
- **How much will it cost?**
- **What do my customers want?**
- **How do I satisfy my customers?**
- **How much will it cost?**

Options

- **Transition to lead-free**
- **Stay with SnPb**
  - **Assembly materials**
  - **Component terminations**
- **Operate parallel lines**
- **Do only what my customers require**

Customer “Care-abouts”

1. **Reliability**
2. **Configuration Control**
   (Obsolescence)
3. **Limitations on Use**
4. **Tin Whiskers**
5. **Repair and Maintenance**
   (Obsolescence)

We care about what we’ve always cared about

What We (Customers) Must *Not* Do

- **Fragment our efforts**
  - **Program-by-program approach leads to confusion**
  - **Potential for conflicting requirements**
- **Solve one problem by causing another**
  Don't impose technical solutions on suppliers
- **View the problem too narrowly**
  This is not just a logistics problem – it involves design, operation, repair, etc.

Industry Activities

- **Lead-free Electronics in Aerospace Project Working Group (LEAP WG)**
  - Formed in 2004 by AIA, AMC, and GEIA
  - Includes international industry and government leaders
  - Addresses primarily technical issues that are (1) unique to aerospace/military, and (2) within control of aerospace/military
  - Deliverables are military and aerospace industry consensus documents, published by GEIA (US) and IEC (international)

- **Executive Lead Free IPT**
  - Formed in 2005 by DoD
  - Includes US industry and government leaders
  - Addresses business, strategy, awareness issues
  - Deliverables are lead-free policy recommendations to government

LEAP WG *Actionable Deliverables*

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Document Number	Title	Task Leader	GEIA Publication	IEC/PAS Publication
GEIA-HB-0005-1	Program Management/ Systems Engineering Management Guidelines for Managing the Transition to Lead-free Electronics	Pat Amick	30 June 2006	31 December 2006
GEIA-HB-0005-2	Technical Guidelines for Aerospace Electronic Systems Containing Lead-free Solder	Stephan Meschter	31 December 2006	30 June 2007
GEIA-STD-0005-1	Performance Standard for Aerospace and Military Electronic Systems Containing Lead-free Solder	Lloyd Condra	30 June 2006	31 December 2006
GEIA-STD-0005-2	Standard for Mitigating the Deleterious Effects of Tin in High-Reliability Electronic Systems	Anduin Touw	30 June 2006	31 December 2006
GEIA-STD-0005-3	Reliability Testing for Aerospace and High Performance Electronics Containing Lead-free Solder	Tony Rafanelli	30 June 2007	31 December 2007

Objectives of GEIA-STD-0005-1

(Customer "care-abouts")

5.1 Reliability

The processes and materials related to the use of lead free solder are capable of producing reliable products.

5.2 Configuration control and product identification

The configuration of all systems, equipment, assemblies, sub-assemblies, and piece parts are identified and controlled.

5.3 Risks and limitations of use

Risks and limitations of use, due to the use of lead free solder, are identified, and information is provided to control them.

5.4 Deleterious effects of tin whiskers

The deleterious effects of tin whiskers are mitigated.

5.5 Repair, maintenance, and support

Repair, maintenance, and support activities are controlled in a manner that controls effects of lead-free solder materials and processes

Requirement is for suppliers to develop Lead-free Solder Control Plans (LFCP) that document their own processes to satisfy objectives

Program-by-program LFCPs *(most expensive)*

Avionics OEMs and maintenance

Integrators

Operators, regulators

Airlines

FAA

DoD

NASA

Program-specific lead free requirements and processes

Supplier-by-supplier LFCPs *(least expensive)*

Each supplier has a baseline LFCP

Airlines

FAA

DoD

NASA

Common lead-free requirements and processes

Supplier-by-Supplier vs. Program-by-Program Plans*

	Baseline	Program-specific
Life of the Plan	10 yrs.	10 yrs.
No of programs per Plan	25	1
Cost to customize a baseline Plan	0	0.25
A. Cost of Plan development	$5M	0.25 x $5M x 25 = $31.25M
B. Annual cost of Plan administration (0.10xA)	$0.5M	$3.125M
C. Annual cost of Plan execution (0.25xA)	$1.25	$7.8M
D. Annual cost of updating Baseline Plan	$0.5M	$0
E. NRE cost (A)	$5M	$31.25M
F. Annual cost (B+C+D)	$2.25M	$10.925M

**Adapted from a report by Peter Sandborn, U of MD*