

Cadmium substitution on Connectors

ASETSDefense – December 6th, 2016



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Agenda

1. Company Overview
2. Status on cadmium substitution
3. Difficulties in qualifying a substitute
4. Conclusion



1. Company Overview



1. Company Overview



Pierre Gattaz (CEO)

- Founded in 1952
- Revenue 2015: 290 M€
- R&D 7 to 8% of revenue each year
- 11 Manufacturing plants in America, Asia & Europe
- 3,000 Employees

Globalization
Anticipation
Innovation
Excellence Financial Discipline
Ethics Flexibility



1. Company Overview



AEROSPACE



DEFENSE



SPACE



INDUSTRIAL



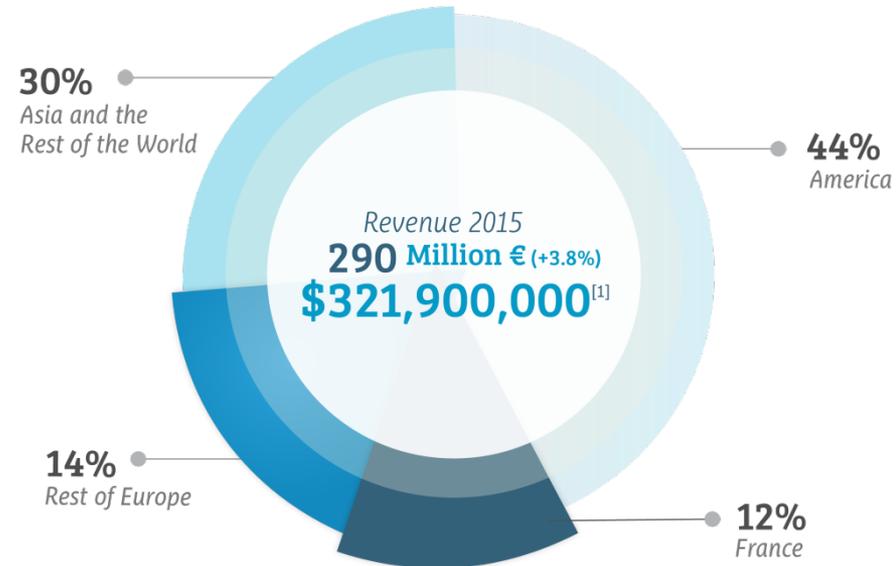
MEDICAL



TELECOM



TEST & MEASUREMENT



1. Company Overview

11 PLANTS
WITH OVER 3,000
EMPLOYEES
WORLDWIDE

Obregon, Mexico

New Haven, USA

Milan, Italy
(Van System)

Mendrisio, Switzerland
(Van System)

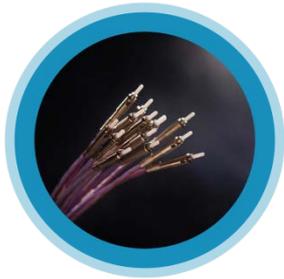
Château-Renault, France
Centr'Alp, France
Dole, France (IDMM)
L'Isle-d'Abeau, France
Voiron, France (Raydiall)

Bangalore, India

Shanghai, China



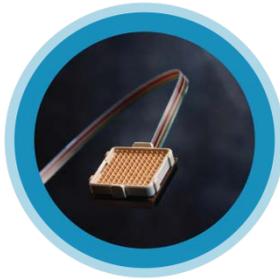
1. Company Overview



Optical Connectors



Optical Cable Assemblies



Active Optics



Outdoor Connectors



RF Coaxial Connectors



RF Cable Assemblies



Multipin Aerospace Connectors



Multipin Industrial Connectors



RF & Microwave Switches



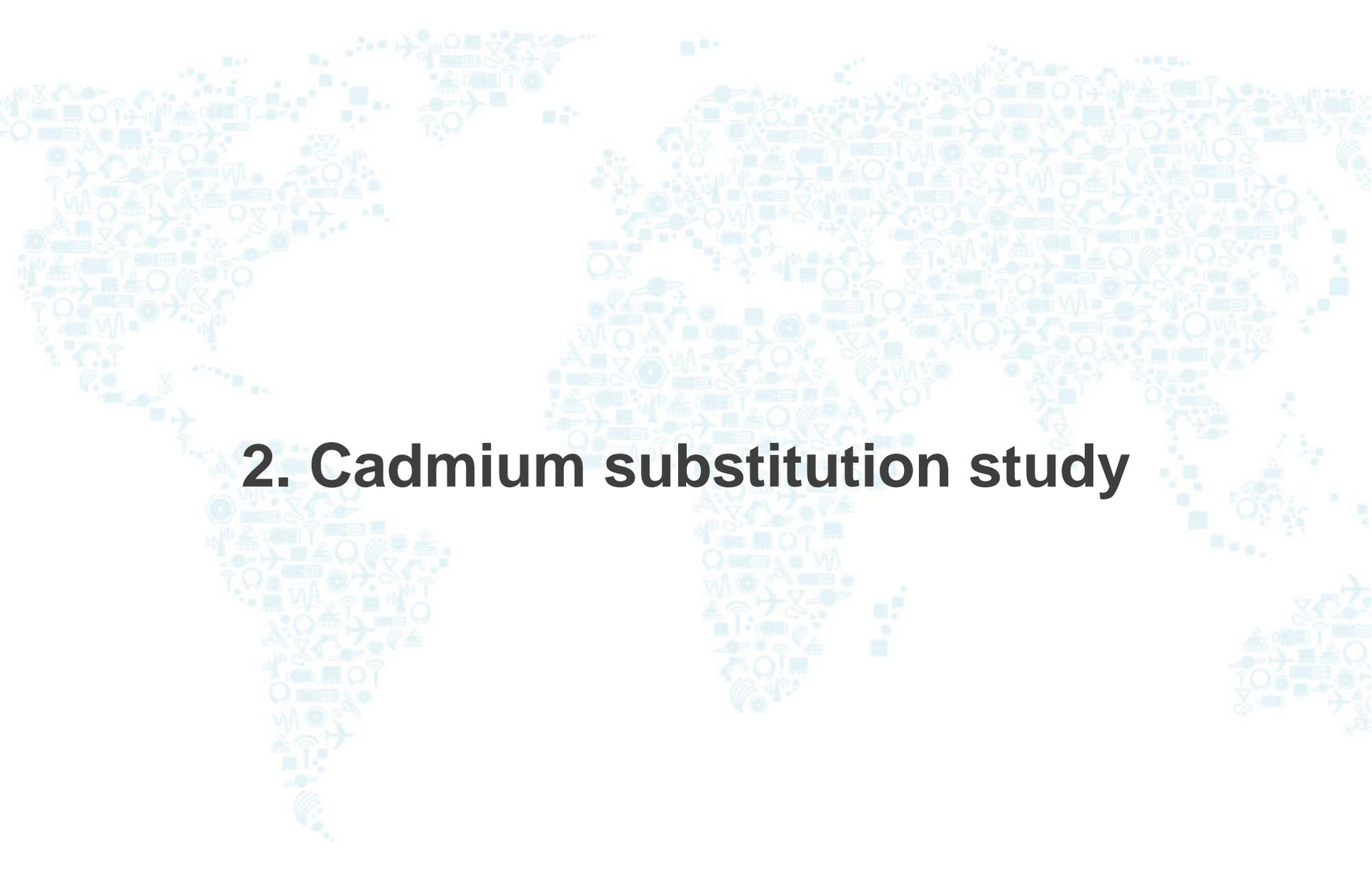
Microwave Components



Antennas



Space Qualified Components

A world map where the landmasses are filled with a dense pattern of small, light blue icons. These icons represent various aspects of technology, industry, and communication, such as airplanes, buildings, Wi-Fi symbols, and data points. The background is white, and the map is centered on the Atlantic Ocean.

2. Cadmium substitution study

Impact of REACH on Cadmium plating

Registered substances

14817 subs

All chemical substances imported or produced in the EU

Name	EC no.	CAS no.	Date of inclusion	Reason for inclusion	Decision	IUCLID dataset
Cadmium	231-152-8	7440-43-9	20/06/2013	<ul style="list-style-type: none"> Carcinogenic (Article 57a) Equivalent level of concern having probable serious effects to human health (Article 57 f) 	ED/69/2013	

Substances under authorisation

Name	EC no.	CAS no.	Entry no.	Sunset Date	Latest application date	Exempted (categories of) uses	
Tris(2-chloroethyl) phosphate	204-118-5	115-96-8	13	21/08/2015	21/02/2014		
Trichloroethylene	201-167-4	79-01-6	15	21/04/2016	21/10/2014		
Strontium chromate	232-142-6	7789-06-2	29	22/01/2019	22/07/2017		
Sodium dichromate	234-190-3	10588-01-9, 7789-12-0	18	21/09/2017	21/03/2016		
Sodium chromate	231-889-5	7775-11-3	22	21/09/2017	21/03/2016		
Potassium hydroxyoctaoxodizincatedichromate	234-329-8	11103-86-9	30	22/01/2019	22/07/2017		
Potassium dichromate	231-906-6	7778-50-9	19	21/09/2017	21/03/2016		

2. Radial substitution study

→ Cadmium+HCP applied on different connector families. Induced different mating strengths, shapes, contact areas...



→ Evaluation of new developments realized on aluminium panels to avoid impact of these factors + faster procurement

→ First filter: Salt spray performance (ASTM B117)
Contact electrical resistance (MIL-DTL-81706)



2. Radial substitution study

Status on evaluations:

ZnNi + Cr III / Co



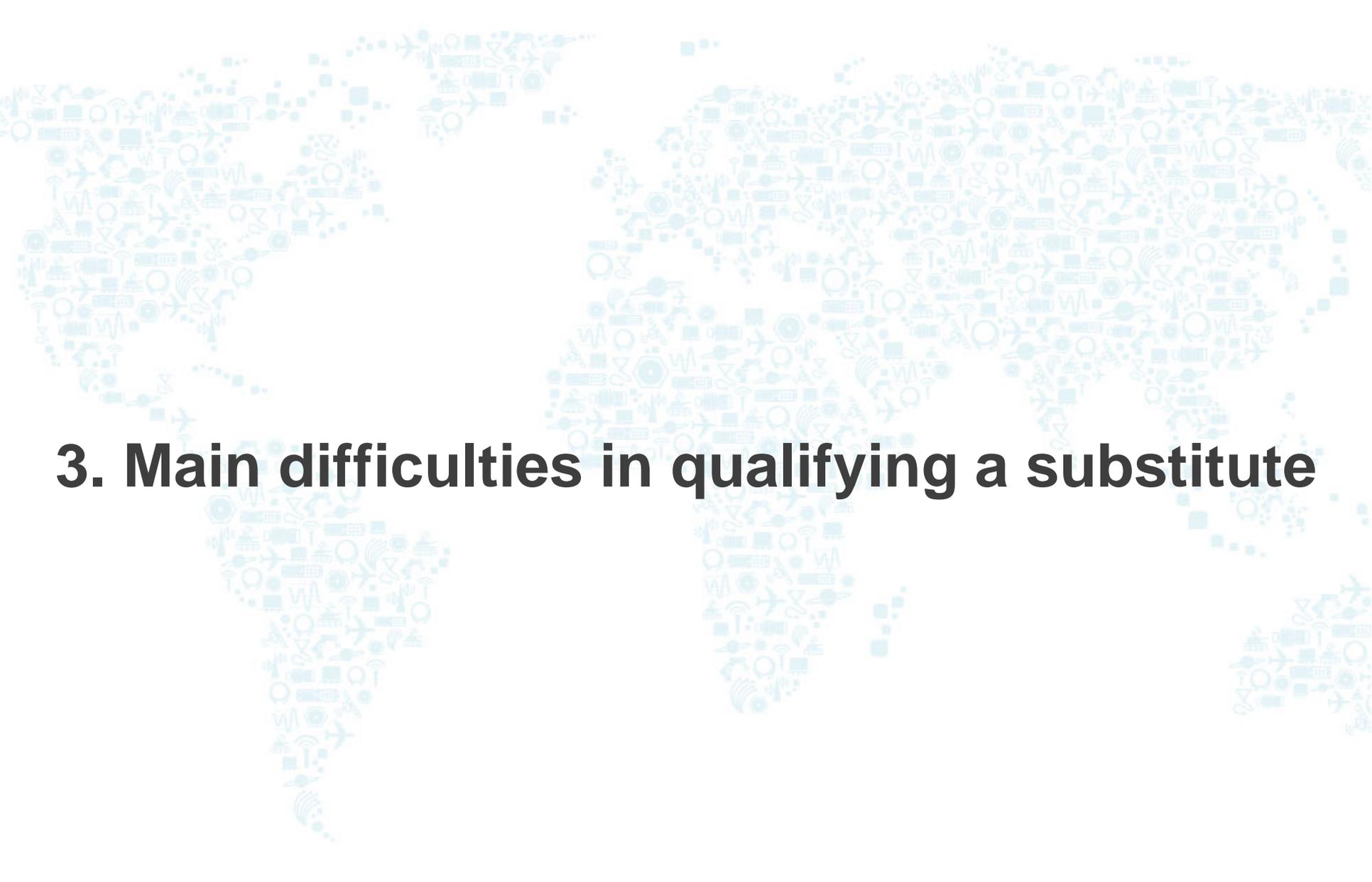
ZnNi + Cr III / Zr

ZnNi + Cr free
Cerium / Permolybdate/...

Other alloys
ZnFe / SnZn / ...

- Low TRL of technologies without Cobalt
- Difficulty to get dark passivates
 - High insulating effect of Zinc oxides

Readiness

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3. Main difficulties in qualifying a substitute

3. Difficulties in qualifying a substitute

Starting point:

Connector specifications not sufficient to determine qualification test files for plating substitution

- 1- Corrosion performances criteria
- 2- Galvanic compatibility required
- 3- Sacrificial corrosion criteria
- 4- Nonreflective criteria

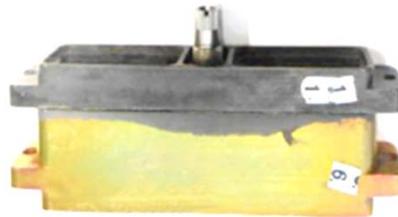


3. Difficulties in qualifying a substitute

3.1 Corrosion performances criteria

Mil-Dtl-38999

(3.17.1) *“When tested as specified in 4.5.13, unmated connectors shall show **no lifting of plating or exposure of basis material** [...]”*



Evaluation of compatibility between ENPTFE and Cadmium

→ Acceptable ?

3. Difficulties in qualifying a substitute

3.2 Galvanic compatibility of Cadmium substitute

Mil-Dtl-38999

(3.3.1.2) *“Dissimilar metals and compatible couples are specified in MIL-STD-889.”*

BUT:

- SnZn, ENPTFE, ZnNi , etc., not included in MIL-STD 889C
- Material in contact not always known by connector manufacturers

→ How to qualify a plating not mentioned ?
→ Only evaluation of compatibility with cadmium ?



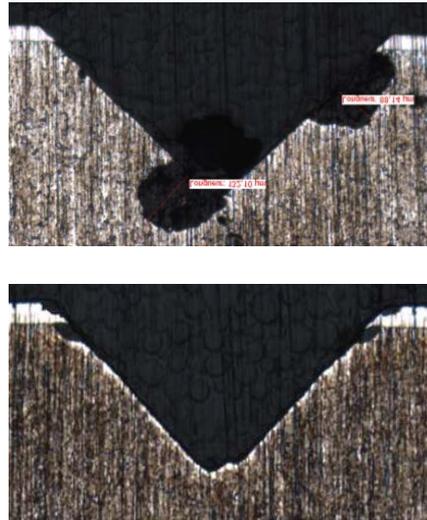
3. Difficulties in qualifying a substitute

3.3 Sacrificial corrosion criteria

Risk of galvanic corrosion in case of coating damage on use condition

Key parameters to fix

- Load
- Scratch dimension
- Shape
- Tool
- NSS exposure



Criteria?

- Corrosion Deepness
- Number of corrosion sites

Dimensions: Width : 0.5 mm ; Depth : 0.2 mm
Tool: automated milling cutter
Salt Spray: 500 hours exposure



3. Difficulties in qualifying a substitute

3.3 Nonreflective coating

Mil-Dtl-38999

(6.1.1) *“Class T, series III and IV and finish T, series I and II, is required to be nonreflective...”*

- Aspect is one of the **great challenge** of cadmium substitution. Acceptance criteria should be clarified.
- Measurement of reflectance ? Use of gloss-meter?



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4. Conclusion

4. Conclusion

- Greater maturity of Zinc-Nickel coatings but lot of work necessary to get a global solution
- Current specifications and test sequences are not sufficient to qualify cadmium and chromate finish substitute
- Working groups for product specifications updates?



Thank you

Questions / comments ?

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