ESCCON 2011

European Space Components Conference
ESA ESTEC
(Newton 1 and 2 Conference Rooms)

Final Programme of Thursday 17 March 2011
Chairman: A. Coello - Vera / Thales Alenia Space

09:15 – 09:45	The European space market for EEE A. Colquhoun, Director Parts Agent, TESAT-Spacecom
09 :45 – 10:00	Product Roadmap D. Vignolo, Vishay Sfernice Thin Film Division
10 :00 – 10:15	Tantalum Capacitors for European Aerospace T. Zedníček, AVX Czech Republic
10:15 – 10:45	Users and suppliers' needs and interests consolidation A. Jain, Head of Standardisation and EEE Components Department, DLR
Coffee break	
11:15 – 11:45	Current and Future Parts management at NASA M. J. Sampson, Co-Manager, NASA Electronic Parts and Packaging Program
11:45 – 12:15	Retaining Semiconductor Manufacturing Experience in Europe C. Lee, Director General, SEMI Europe
12:15 – 12:45	Specialised and Advanced Parts Procurement Services D. Núñez, Business Development Director, ALTER TECHNOLOGY GROUP

ESCC

TESAT SPACECOM

PIONEERING WITH PASSION

The European Space Market for EEE Parts

ESCCON 2011

Alex Colquhoun, Director Parts Agent

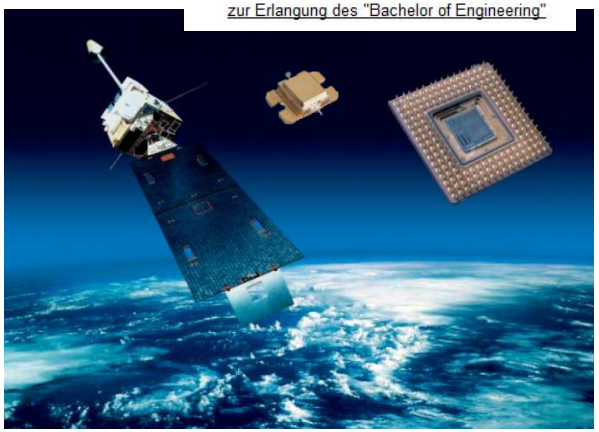
The European Space Market for EEE Parts

- This presentation gives an overview of the European EEE Parts market based on:
  - Statistics on parts procured by Tesat-Spacecom
  - Knowledge of parts procured as a European CPPA
- This Presentation builds on work carried out by Mr. Sven Zeidler between June and September 2009 for his Bachelor‘s degree
- Mr. Zeidler is currently employed by Tesat-Spacecom

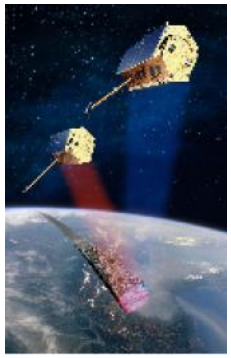
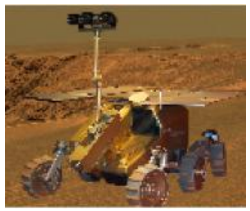
DHBW
Duale Hochschule
Baden-Württemberg
Stuttgart

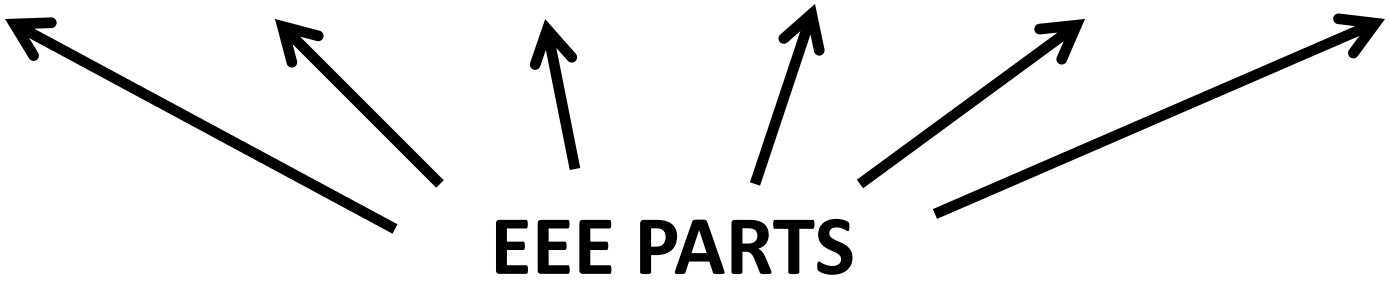
BACHELORARBEIT

zur Erlangung des "Bachelor of Engineering"



EEE Parts for Space

Communication	Earth Observation	Navigation	Scientific	Manned Space Flight	Launcher
					



EEE Parts Procured by Tesat

- Data Basis

- Parts for both Tesat and for external agent business customers
- Time Period 2004 - 2011
- Total Value: 264M€
- Total Number of Suppliers: ~260
- No. of Suppliers delivering 99% of value: 101
- No. of Lots ~36.600
- No. of Parts ~10,6 Million

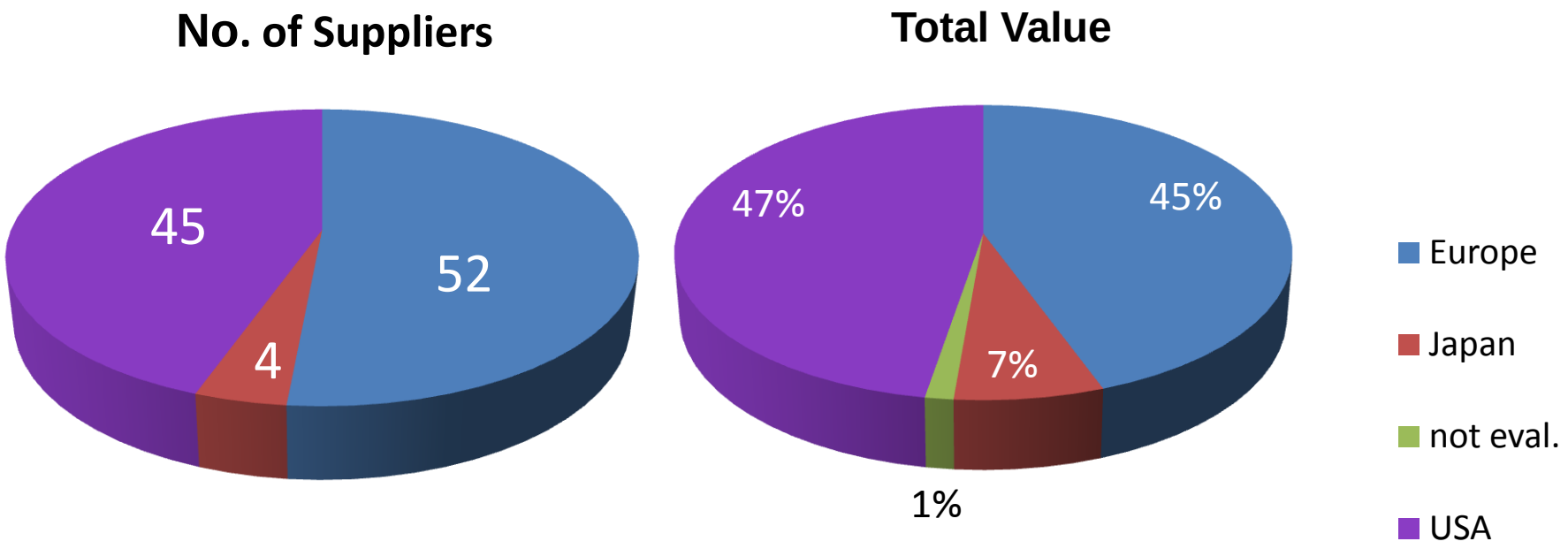
Tesat-Spacecom

Key Figures	
Location	Backnang, Germany
Core Business	Spacecom Satellite Payload Equipment & Subsystems
Employees 2010	approx. 1100
Turnover 2010	200 Mio Euro
Equipment Capacity	Up to 1500 Units per Year
Programs	Up to 75 per year
Homepage	www.tesat.de

Location
Backnang, Germany

EEE Parts Procured by Tesat 2004-2011

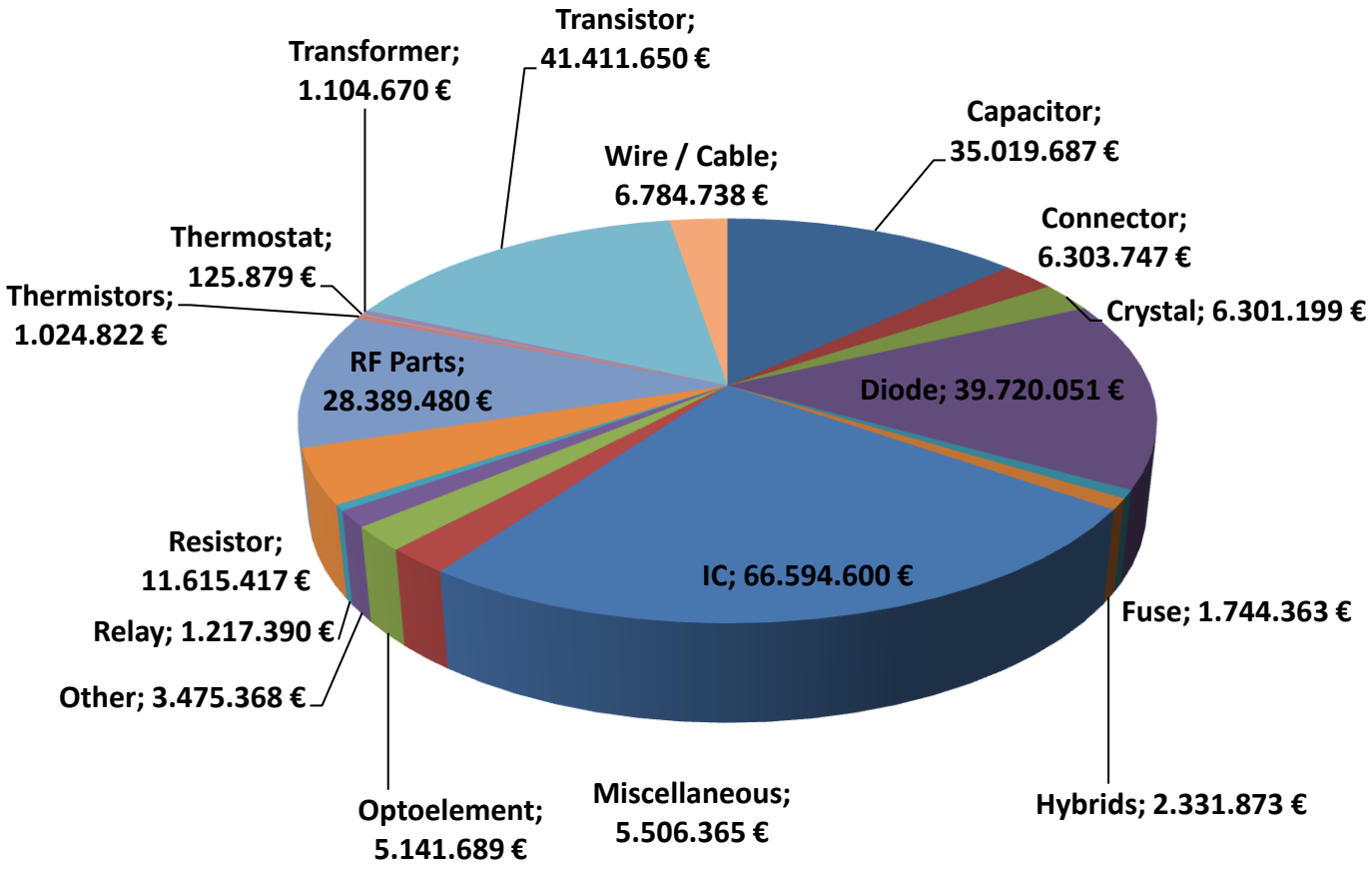
- Origin of the Parts



Note:
Only suppliers delivering 99% of value considered
Tesat manufactures RF-Equipment => High Value of µW Transistors from Japan

EEE Parts Procured by Tesat 2004-2011

- Family of the Parts

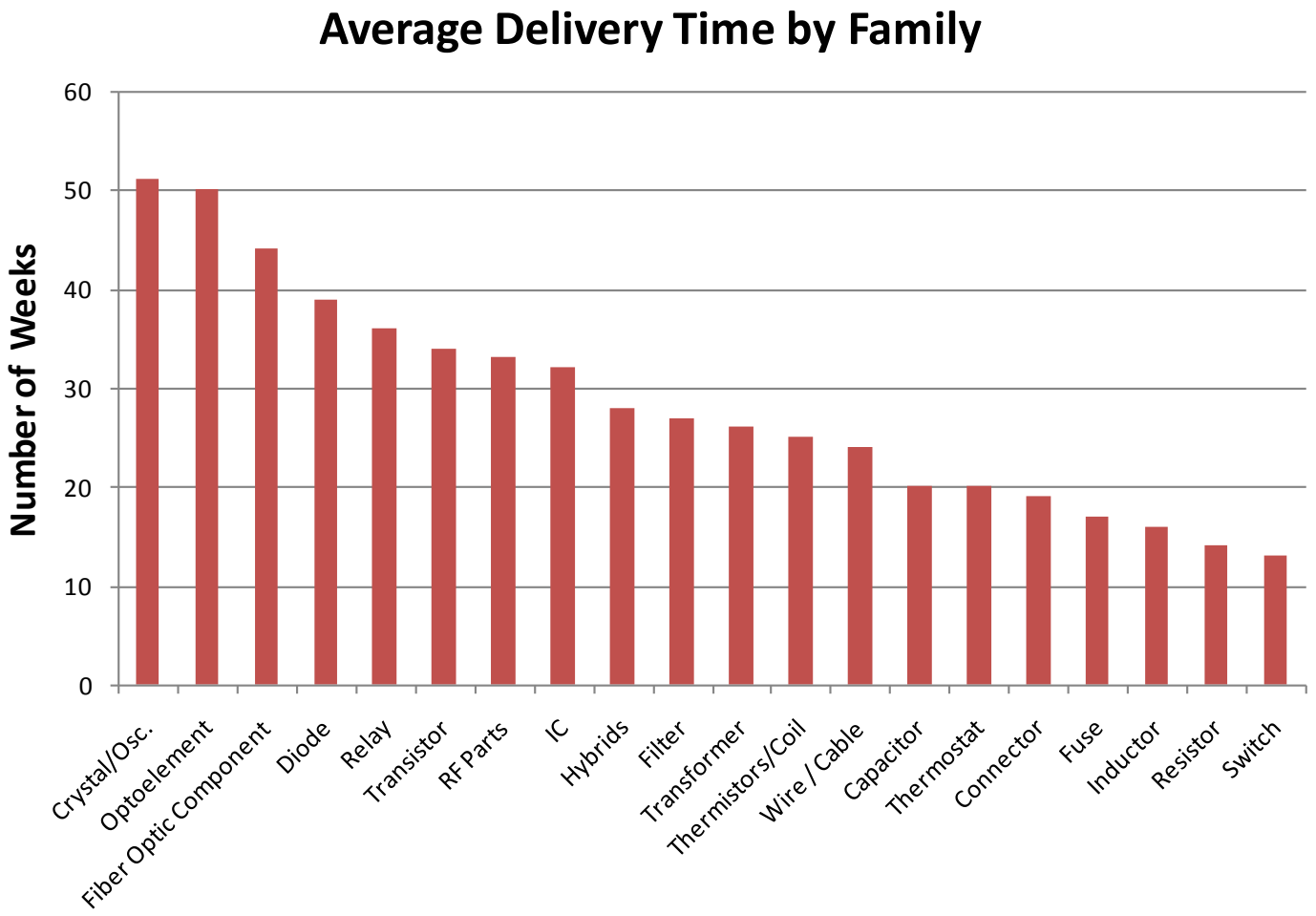


EEE Parts Procured by Tesat 2004-2011

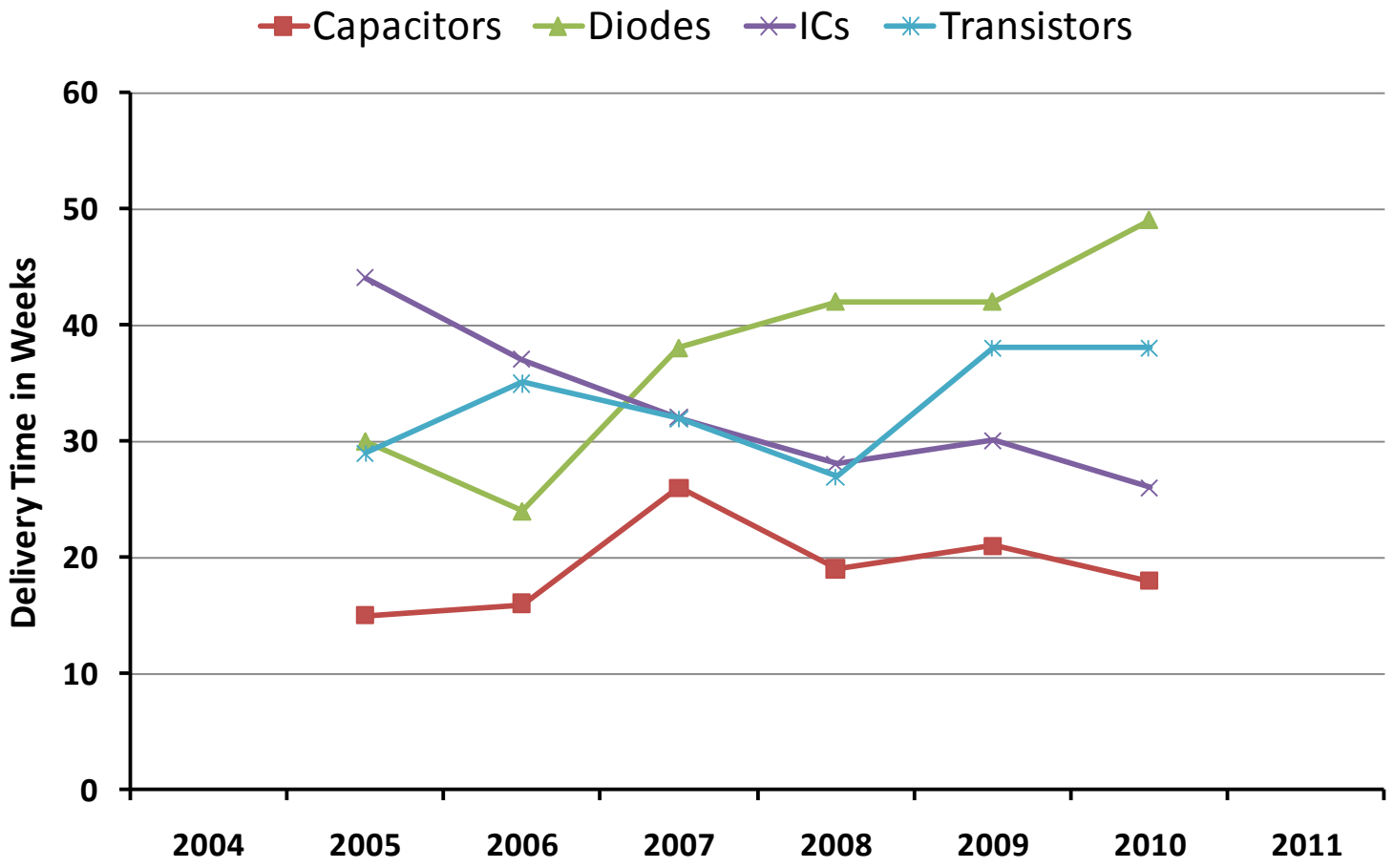
FC	Family	No. of Lots	No. Parts	No. of DPAs	Value	Av. Piece Price
1	Capacitor	6.668	2.439.850	2.382	35.019.687 €	14 €
2	Connector	3.243	426.720	125	6.303.747 €	15 €
3	Crystal	200	1.985	37	6.301.199 €	3.174 €
4	Diode	3.697	1.559.032	1.476	39.720.051 €	25 €
6	Fuse	99	35.328	39	1.744.363 €	49 €
8	IC	2.571	298.863	830	66.594.600 €	223 €
9	Relay	128	4.967	49	1.217.390 €	245 €
10	Resistor	11.240	4.585.998	240	11.615.417 €	3 €
11	Thermistors	171	15.070	73	1.024.822 €	68 €
12	Transistor	1.910	394.896	821	41.411.650 €	105 €
13	Wire / Cable	1.118	213.484	2	6.784.738 €	32 €
14	Transformer	92	6.363	34	1.104.670 €	174 €
18	Optoelement	197	72.531	76	5.141.689 €	71 €
20	Thermostat	12	311	0	125.879 €	405 €
30	RF Parts	1.296	181.166	155	28.389.480 €	157 €
40	Hybrids	11	270	4	2.331.873 €	8.637 €
89	Miscellaneous	3.465	331.810	260	8.981.733 €	27 €
	Total or Average	**36.118**	**10.568.644**	**6.603**	**263.812.988 €**	**25 €**

EEE Parts Procured by Tesat 2004-2011

- Delivery Times



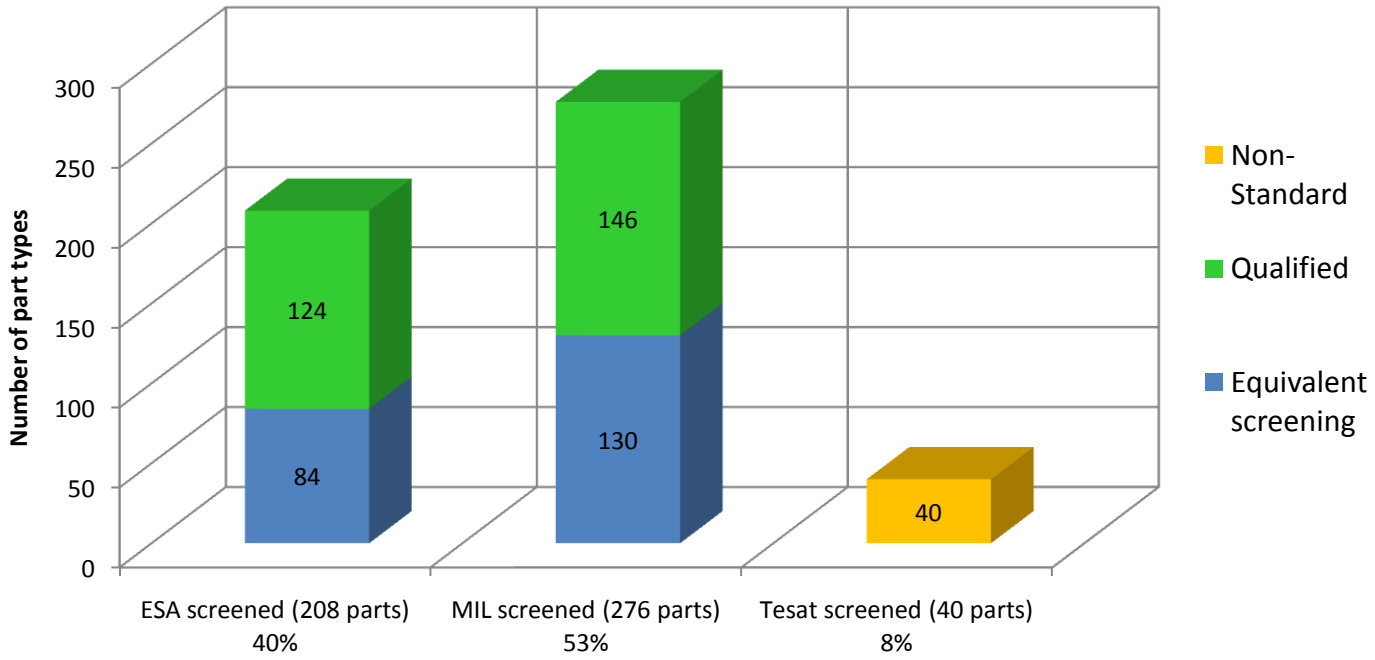
EEE Parts Procured by Tesat 2004-2011
- Trend – Delivery Times



Qualification Status of Parts Used by Tesat in 2010 (Standard Equipment)

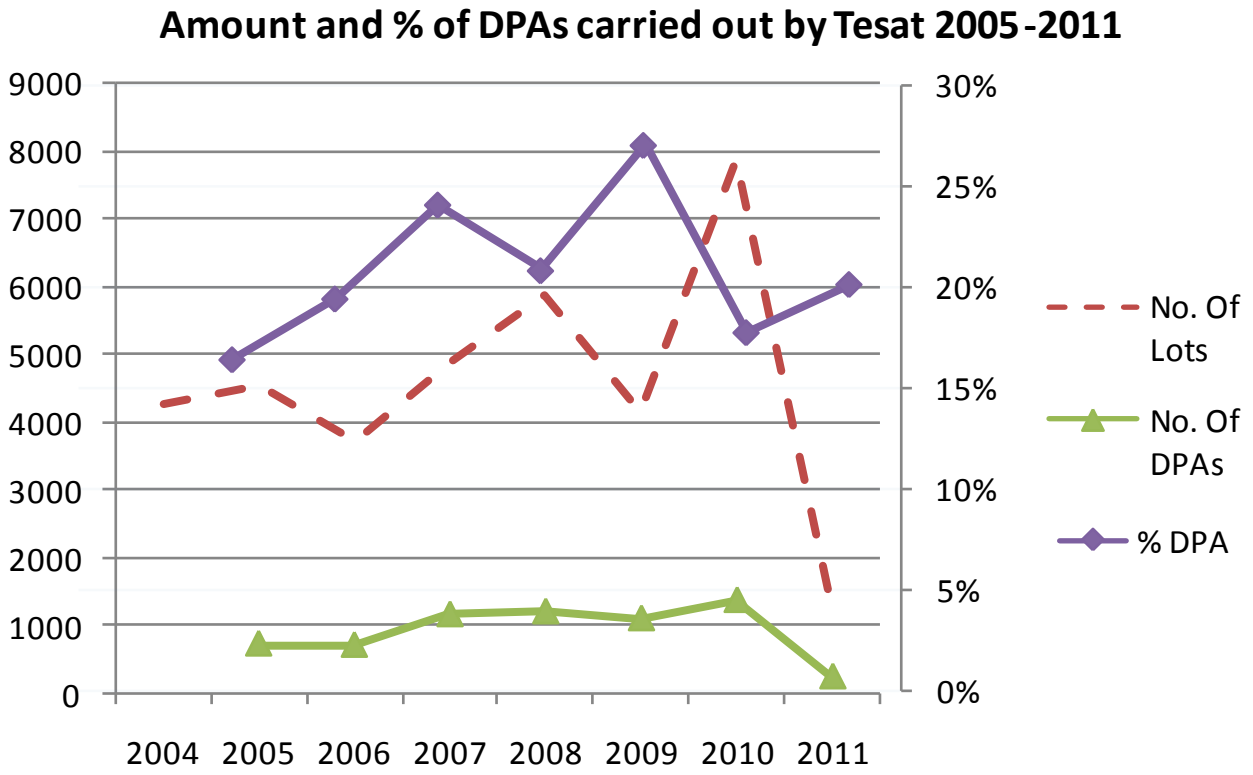
MIL/ESCC			
	MIL	ESCC	Other
	53%	40%	8%
Qualified/Non-Qualified			
	Qual	Not Qual.	
	52%	48%	

		No. Equip.	Parts per Unit	No. Parts
Qualification Status of Parts used in:	EPCs	33	849	28.017
	TWTAs	187	737	137.819
	MPMs	395	1190	470.050
TOTAL UNITS OF EQUIPMENT		615	TOTAL NO. Of PARTS	635.886



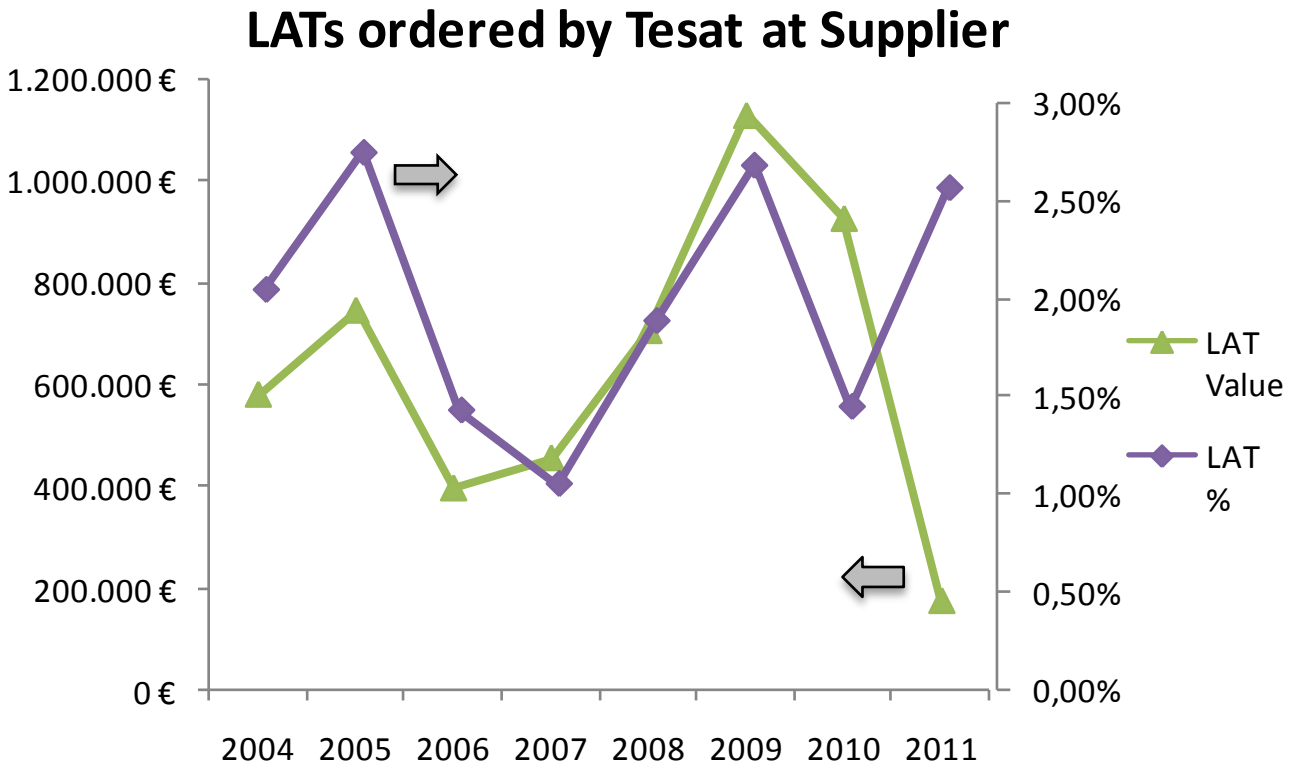
The European DPA Market

- Extrapolating from Tesat's figures => DPA on ~8000 Lots/a
- Assuming ~500€/Lot => 4M€/a
- Plus additional work for Failure & Constructional Analysis (+20%) => **5M€/a in Europe for DPA/FA/CA**



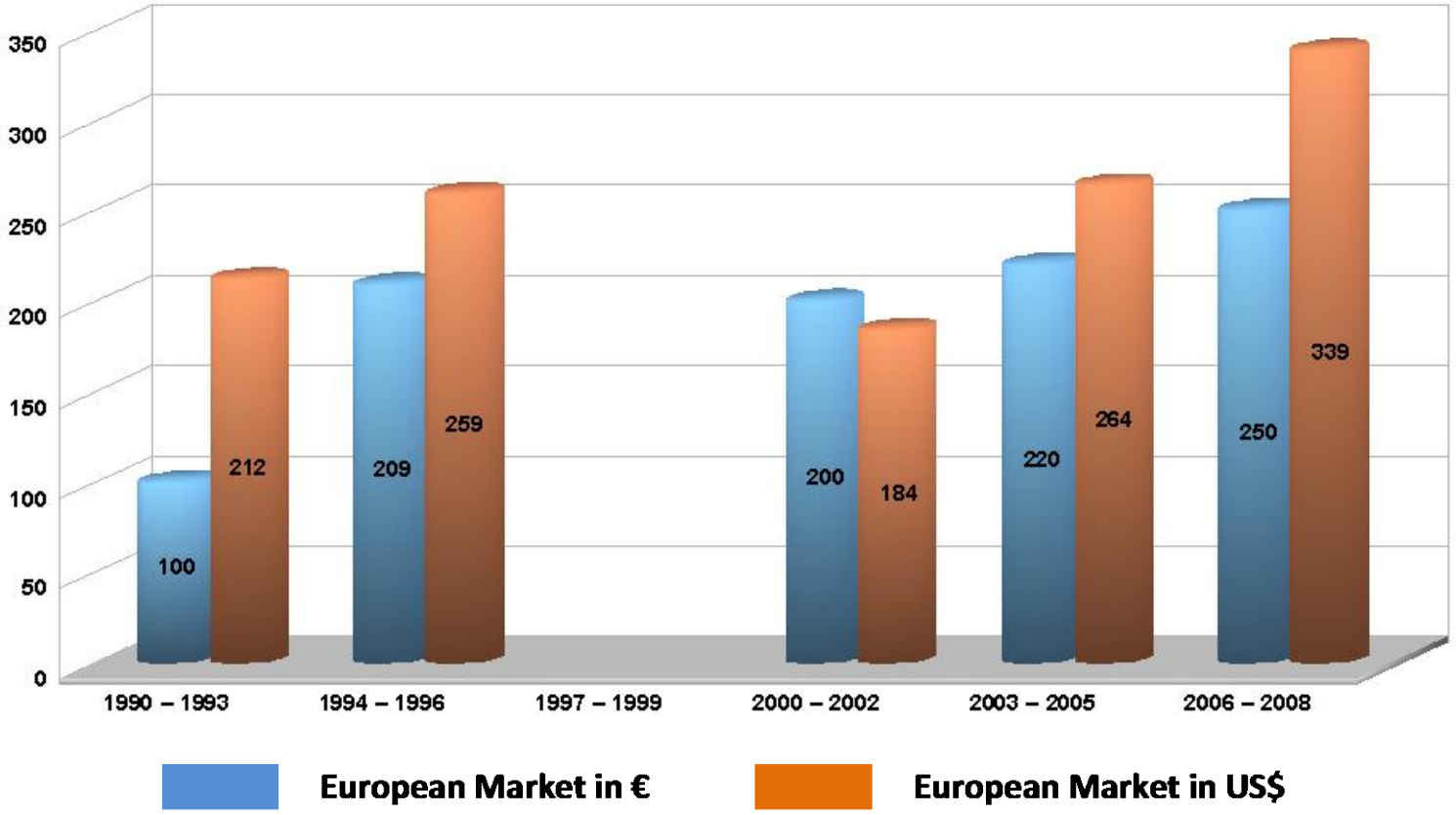
LAT/QCI Costs

- Tesat LAT/QCI costs ~2% of total EEE costs
- Due to frame contracts with the suppliers and the inclusion of QCI costs in the price of qualified MIL components this value is too low
- Real value estimated to be 4 – 6% of the vendor cost => **~15M€/a**



Growth of the European EEE Space Parts Market

- Growth since 2000: ~3-4% p.a. in €, ~10% p.a. in US$
- Market growth is affected by both price increases and the increase of the number of parts used



Conversion according to the exchange rate at that time

Estimation of the European Market for EEE Parts

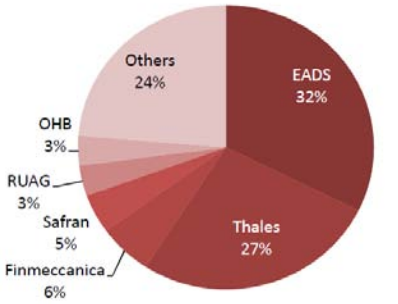
- Total Value ~300M€

	M€ Sales 2009 *	% EEE	Why? EEE Quality	Why? Mission Duration	M€ EEE
Telecom	1940	8%	Full Space	Long	155
Earth Observation	936	8%	Full Space	Med/Long	75
Navigation	204	5%	Full Space	Med	10
Launcher	1072	1%	Ind/Mil	Minimal	11
Manned Space Flight	379	4%	Mil	Mix	15
Scientific	442	5%	Mix	Mix	22
Total	**4973**				**288**

* Eurospace Report 2010

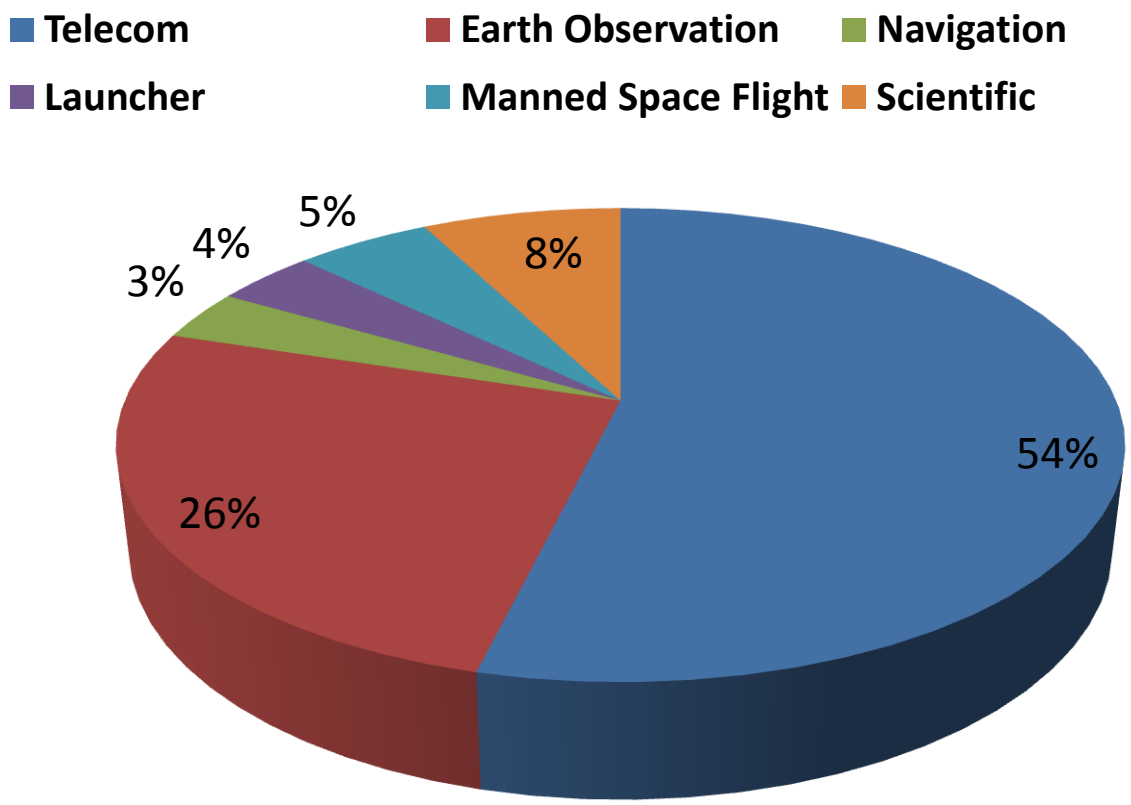
- Supporting calculation:
  - Astrium procures ~100M€/year EEE
    => 300M€ for European Space

Number of Employees *



Estimated European Market for EEE Parts

- Total Value 300M€



THE BIG PICTURE

Origin

- USA: >50%
- Europe: <50%
- Japan: ~3%

Qualified Parts

- Qualified: <50%
- All Parts
  - Acc. To MIL: ~50%
  - Acc to ESCC: ~40%

Family (by Value)

- Microcircuits: 25%
- Transistors: 16%
- Diodes: 15%
- Capacitor: 13%
- RF-Parts: 11%
- Resistor: 4%
- Wire & Cable: 3%
- Connector: 2%
- Other: 11%

The European Space Market for EEE parts **~ 300 M€/a**

Space Segment

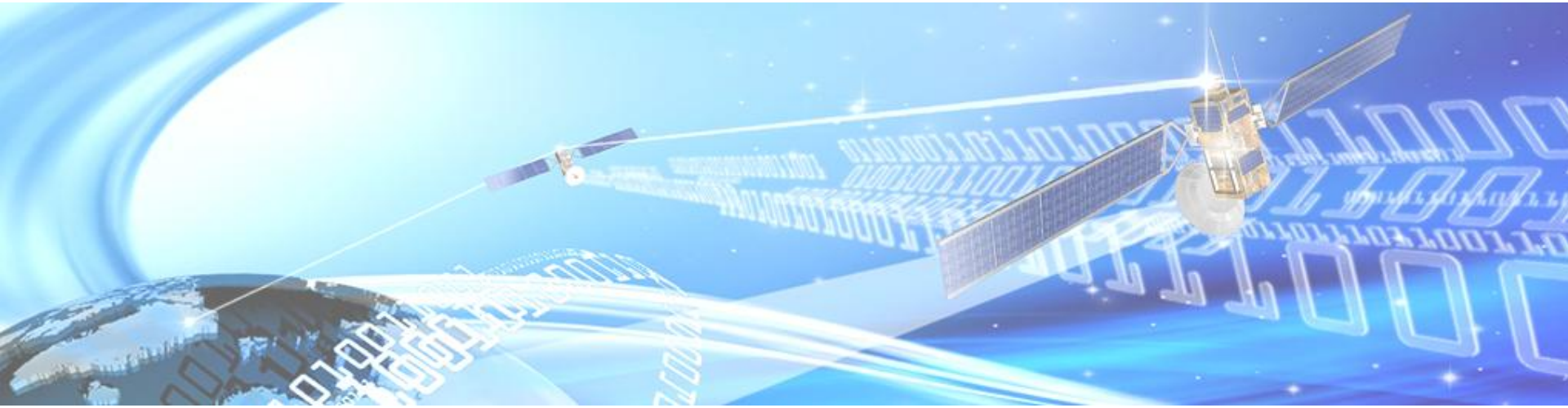
- Communications: 54%
- Earth Observation: 26%
- Scientific: 8%
- Navigation: 3%
- Manned Sp. Fl.: 5%
- Launcher: 4%

Test Costs

- DPA: ~2%
- LAT: ~5%
- Source Insp.: <1%
- Upscreening: no figure
- Radiation Test: ~1%

Quality Level

- Space Level: ~80%
- Military Level ~15%
- Commercial /Industrial ~5%



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VISHAY

One of the World's Largest Manufacturers of
Discrete Semiconductors and Passive Components

ESCCON 2011

Vishay Sfernice Thin Film Division

ROADMAP

Ms D. Vignolo

Build Vishay into your Design

Who are we?

Issues and Strategy

Roadmap

Other Specific Products

Let’s dream..

Conclusion

Vishay Sfernice has been involved in Space business since the early 80’s. With the evolution of electronics to miniaturization, today, only the Thin Film division of Vishay Sfernice is offering suitable products for Space applications.

Issues:

- Cost of Space qualified products
- Less and less European Manufacturers
- ITAR regulations

Vishay/Sfernice answer:

- Offer cost effective products
- Offer a complete product range of qualified resistors and resistive networks

ROADMAP 2006 - 2010

2 Main axis:

ESCC/QML qualification (Technology Flow qualification)

→ Goal: Increase number of qualified products more easily and quickly answer to the needs of our customers.

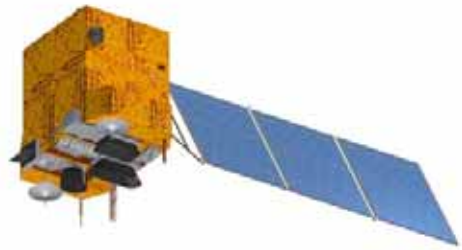
- Requirement for the Technology Flow qualification of film resistors Basic Specification No. 2544001
- Evolution of Generic ESCC 4001
- Qualified Products Listed in REP 006 list

ROADMAP 2006 - 2010

R Failure Rate

→ Goal: Offer a qualified cost effective part

- Failure Rate Level Sampling Plans and Procedures ESCC Basic Specification No. 26000
- Evolution of ESCC 4001/023
- Qualification of PFRR



In the meantime, extension of performances of other qualified products

ROADMAP 2011 - 2015

2011 Status

Qualified	PFRR	4001/023 Variant 09 to 12	Alternative to M55342E	100R - 3M01 depending on size (0603 to 2010) Also qualified with 0.05% - 10ppm/°C [-55°C; +155°C]	
	PHR	4001/023 Variant 01 to 08		10R - 3M depending on size (0603 to 2010) 0.01% to 0.1% - 5ppm/°C to 25ppm/°C[-55°C; +155°C]	
	PRAHR	4001/025 variant 01 to 21		100R - 1M depending on size 0.1% abs / 0.05% ratio - 10ppm/°C abs - 3ppm/°C ratio [-55°C; +155°C]	
	CNWHR	4001/025 variant 22 to 42		Same performances as PRAHR: different values in Networks	
EPPL Level 1	CHPHR	4001/026 Vaiant 01 to 10		1R - 10M / 1% - 2% - 5% / 100ppm/°C - 200ppm/°C [-55°C; +155°C] Evaluation completed - Qualification foreseen Q2/2011	
Evaluation On Going	LHR	4001/xxx		0R1 - 9R99 / 1% / 100ppm/°C to 300ppm/°C [-55°C; +155°C] - 0603 to 2512 - Completion of evaluation foreseen Q4/2011	
	PZHR	4001/yyy	Alternative to MI-PRF-32159	0R: Strap - 0402 to 1206	
	PHR0402	4001/023		Extension of qualification to size 0402	
	PFRR0402	4001/023	Alternative to M55342E	Extension of qualification to size 0402 (R Failure Rate on going)	
Not Qualified	RMK/RSK/ CS/TA	N/A		Wirebondable chips: Sizes: 22 / 33 / 55 / 515 - Tol: 0.01% to 0.1% - TCR: 5ppm/°C to 100ppm/°C [-55°C; +155°C] - Al pads	
	RMK/RSK/ CS/TA / CN	N/A		Wirebondable Networks: Sizes: 33 / 48 /408 /508 / 714 / 816 / 914- Tol: 0.1% abs - 0.01% ratio - TCR: 10ppm/°C abs - 2ppm/°C ratio [-55°C; +155°C] - Al pads - Custom available	
	SA, SB, SC	N/A		Wirebondable shunts - 50mR to 1R - 1% to 5% - 100ppm/°C [-55°C; +155°C] - 0.5W to 6W	

2010: Extension of PHR qualification down to 10Ω and TCR to 5ppm/°C [-55°C; +155°C]

Dies: Have been used for space applications for more than 10 years

ROADMAP 2011 - 2015

Complete qualification of:

- LHR
- PZHR
- CHPFR (alternative to M55342K)
- PFRR: extension of qualification down to 10Ω

Evaluation and qualification of:

- PRAHR073 and PRAHR074
- PHR: increase power rating (330mW for 1206)

Characterization in Cryogenics (-185°C)

- PHR
- PRAHR

Others Specific products

Not yet used for Space applications, but which can be of some interest

Hyper-frequency:

CH: Thin Film chip resistors (50GHz) 

HCHP: Thick film chip resistor (10GHz) 

High Temperature (230°C)

PHT: Wraparound chip resistor 

RMKHT: Wirebondable chip resistors and networks 

PRAHT: Wraparound chip arrays 

CHPHT: Wraparound thick film chip resistors 

We can imagine:

A precision resistor in TO220 package

Examples of products used by Space customers

TFS-W: temperature sensors (for temperature measurement)

EPIC: Electro-Pyrotechnic Chip Initiator (unfold antennas)

Tools to help Designers


VISHAY SFERNICE

Resistive Products | Application Note

Power Dissipation Considerations in High Precision Vishay Sfernice Thin Film Chips Resistors and Arrays (P, PRA etc.) (High Temperature Applications)

ABSTRACT

THERMAL MODEL

APPLICATION NOTE


VISHAY SFERNICE

Resistive Products | Application Note

Power Dissipation in High Precision Vishay Sfernice Chip Resistors and Arrays (P Thin Film, PRA Arrays, CHP Thick Film)

A. ABSTRACT

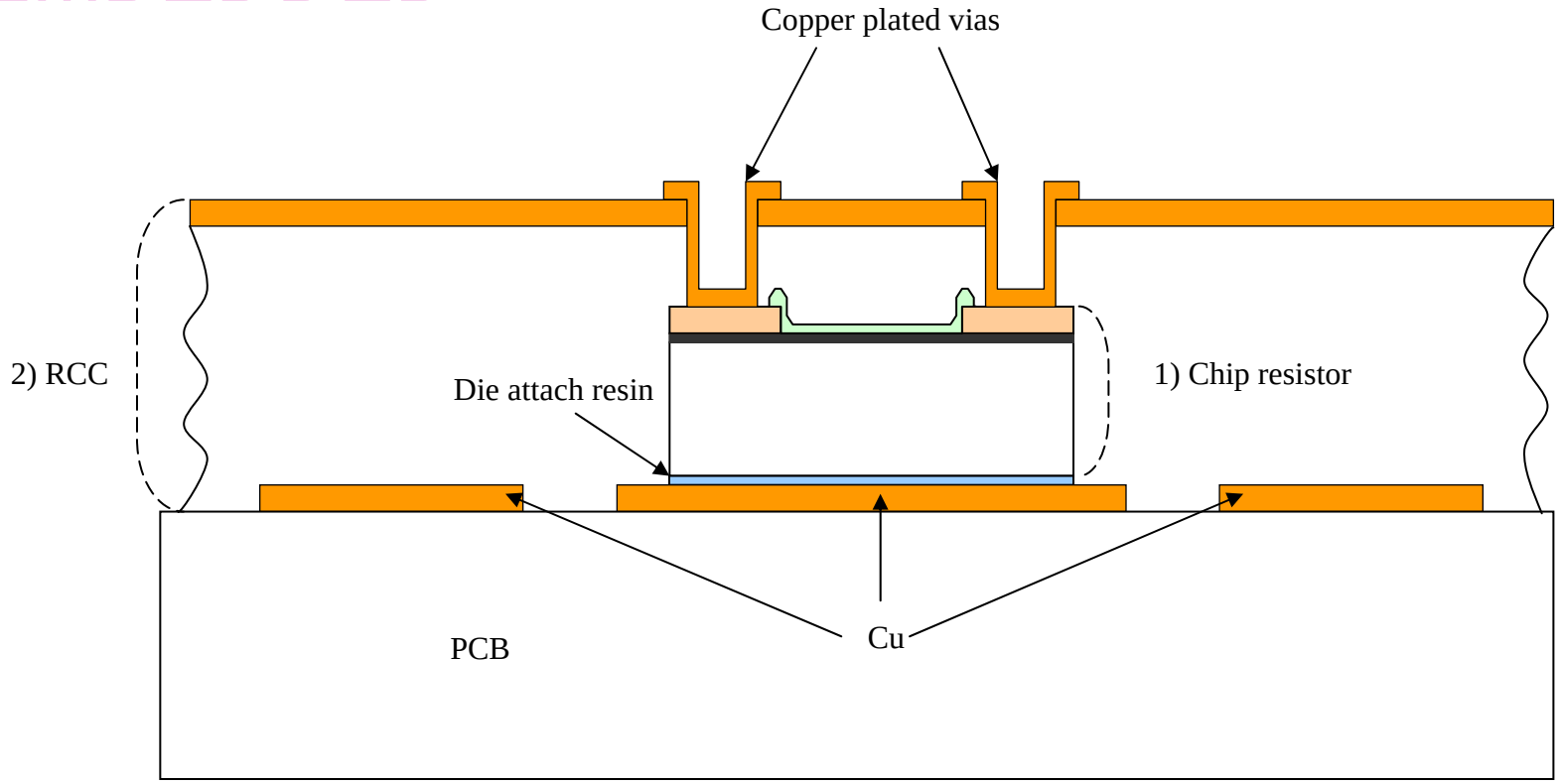
B. THERMAL MODEL

APPLICATION NOTE

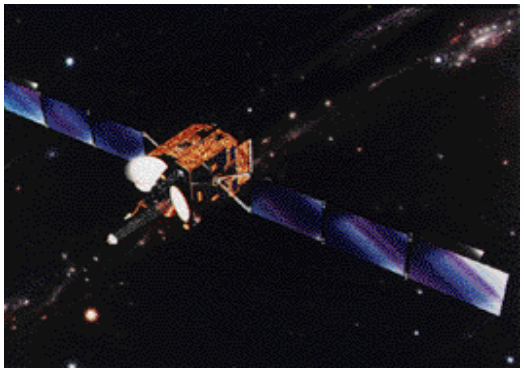
Application Notes
Space product Selector Guide
Capability brochure

Let's Dream !

EMBEDDED



2) RCC : Resin Coated Copper (or prepeg + copper)

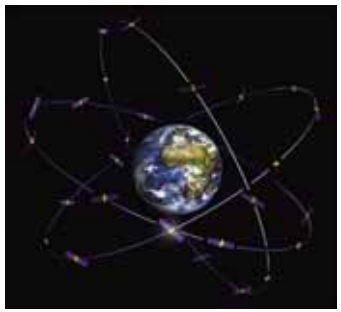


Vishay / Sfernice strategy is to be one stop shop for Space Customers
In this frame Vishay/Sfernice has run the qualification of

ESCC QML: ESCC Technology Flow Qualified Manufacturer

Vishay/Sfernice FIRST passive manufacturer qualified

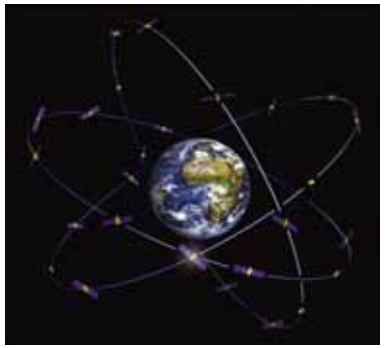
Vishay Sfernice on going qualification: to offer a whole range of resistive products from 0Ω to 10M:



Special Thanks to Jean-Paul Bussenot (CNES) for his un-valuable help during QML and products qualification processes

Thank you to ESCCON committee to have given me this opportunity to present Vishay/Sfernice Roadmap

Thank you for your attention



A KYOCERA GROUP COMPANY

TANTALUM CAPACITORS for EUROPEAN AEROSPACE

ESCCON

17th March 2011

Tomáš Zedníček
Technical Marketing Group
AVX Czech Republic
Tantalum Division

A KYOCERA GROUP COMPANY

OUTLINE

- COMMERCIAL PRODUCT STRUCTURE
- APPLICATION HIGHLIGHTS
- ESCC / MIL / COTS+ TANTALUM CAPACITORS
- EUROPEAN SPACE QUALIFICATION & DEVELOPMENT

A KYOCERA GROUP COMPANY

PRODUCT LINECARD

CERAMIC CAPACITORS

Surface Mount Multilayer Ceramic Capacitors

Automotive	HiCV
MIL/Cots+/Space	High Temperature
COR/High Reliability	Array
Flexiterm®	Tip and Ring
Flexisafe™	Low Distortion
Ultrathin	Gold Terminated
Tin/Lead	Tin/Lead w Flexiterm®

Switch Mode Power Supply Capacitors (SMPS)

MIL/Space	High Temp
Leaded	High Voltage
TurboCap™	

Leaded Multilayer Ceramic Capacitors

Axial	High Voltage
Radial	MIL/Space/High Reliability
2-Pin Dip	

High Voltage

Surface Mount	Flexiterm®
Leaded	MIL

Glass Capacitor

LOW INDUCTANCE / SIGNAL INTEGRITY

Reverse Geometry

Interdigitated

Ultra Low Inductance

CoreCap® Hybrid Niobium Oxide - MLCC

Low Inductance Array

TANTALUM CAPACITORS

Surface Mount Tantalum Capacitors

Low ESR	High Temp (THJ)
CWR	Established Reliability
Polymer	TACmicrochip®
Fused	Tin/Lead

Leaded Tantalum Capacitors

Wet Tantalum

Radial Leaded

Niobium Oxide / OxiCap®

Low ESR

COTS Plus

Multianode

RF PRODUCTS

Inductors – Thin-Film

Filters

Band Pass	Custom
Low Pass	EMI

Passive Miniaturized Components

Couplers

3dB	3dB 90°
High Directivity	Splitter/Combiner

Capacitors

Microwave	Medium Power
Single Layer	Tight Tolerance/Thin-Film
High Power	RF Capacitors
Broadband	DC Block

ENERGY HARVESTING

Film Capacitors

Surface Mount Film Capacitors

Medium Power Film

High Power Film

Ceramic Capacitors

Molded Ceramic

Stacked Ceramic

Tantalum Capacitors

Multi-Anode (low ESR)

Stacked Capacitors

Pulse Power Supercap

BestCap®

CIRCUIT PROTECTION

MLV Transient Voltage Suppressors

Varistors

Multi-element Varistors

Varistor Feedthroughs

Application Specific Varistors

AntennaGuard	High Temperature
USB Series	Sub pF
CAN Series	Low Leakage
StackGuard	Maxicap
Automotive Series	Opguard

Medium Power Varistors

Thermistors

Negative Temperature Compensation

Leaded

Surface Mount

Fuses – Thin-Film

CONNECTORS

LED/Solid State Lighting

Wire to Board

Board to Board

End Cap

Board to Board

DIN 41 612 2-Piece

Compression Low Profile 1-Piece

Microlead/Fine Pitch 2-Piece

FFC/FPC

ZIF/LIF

Automotive

Custom connectors/modules

Pressfit

Insulation Displacement

Portable Devices

Battery

SIM

Memory Products

Speaker/Microphone

I/O

FILTERS

EMI Filters

Surface Mount	Bulkhead
High Current	MIL/Space

Noise Filters

Low Pass Filters

Ceramic Filters

SAW Filters

Filtered Arrays

Optical Low Pass

PIEZOELECTRIC DEVICES

Telephone Ringer/External Drive

External Drive/Self-Oscillating

Shock Sensor

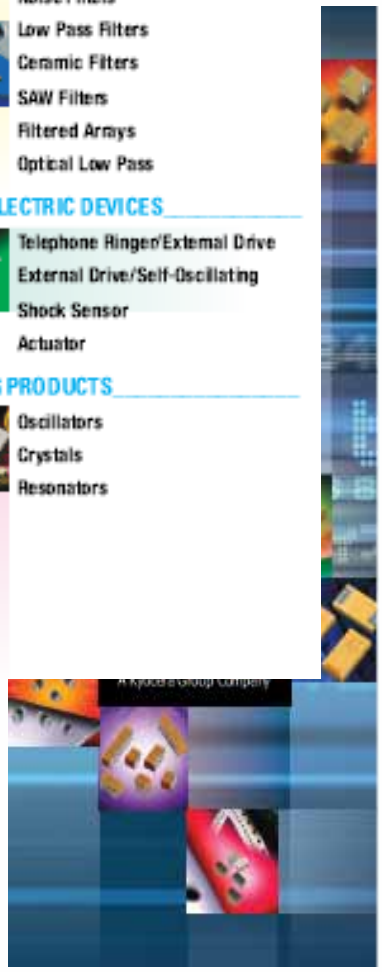
Actuator

TIMING PRODUCTS

Oscillators

Crystals

Resonators



LEADING PASSIVE COMPONENT SUPPLIER

A KYOCERA GROUP COMPANY

TANTALUM DIVISION

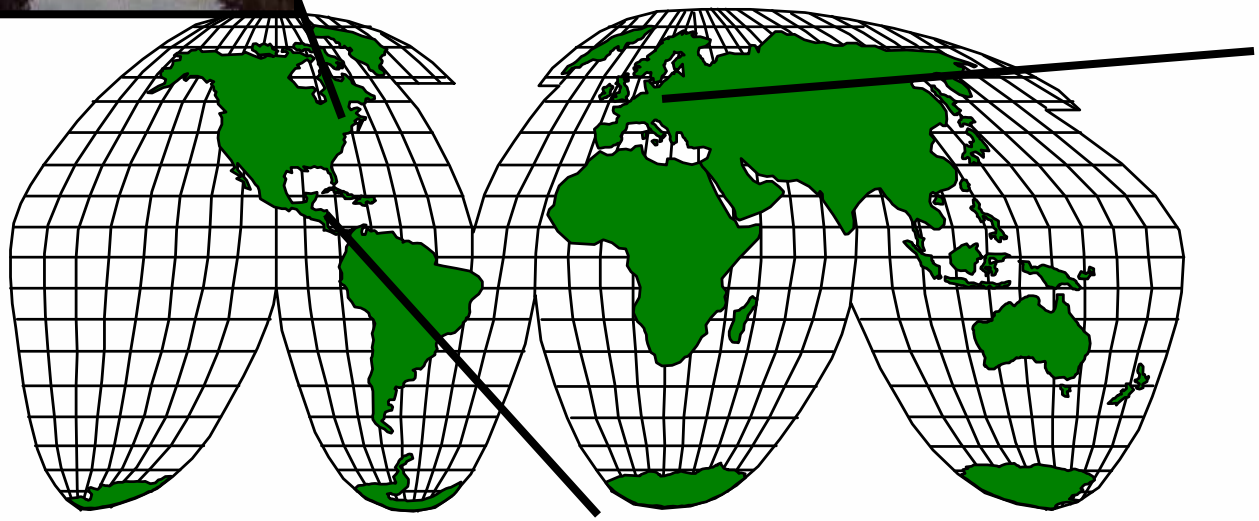
Tantalum and NbO Capacitors

MIL products

Biddeford
USA

No.1 Tantalum Supplier

Market Share > 27%



Lanskroun
Czech Rep.

High-End Consumer

ESA products

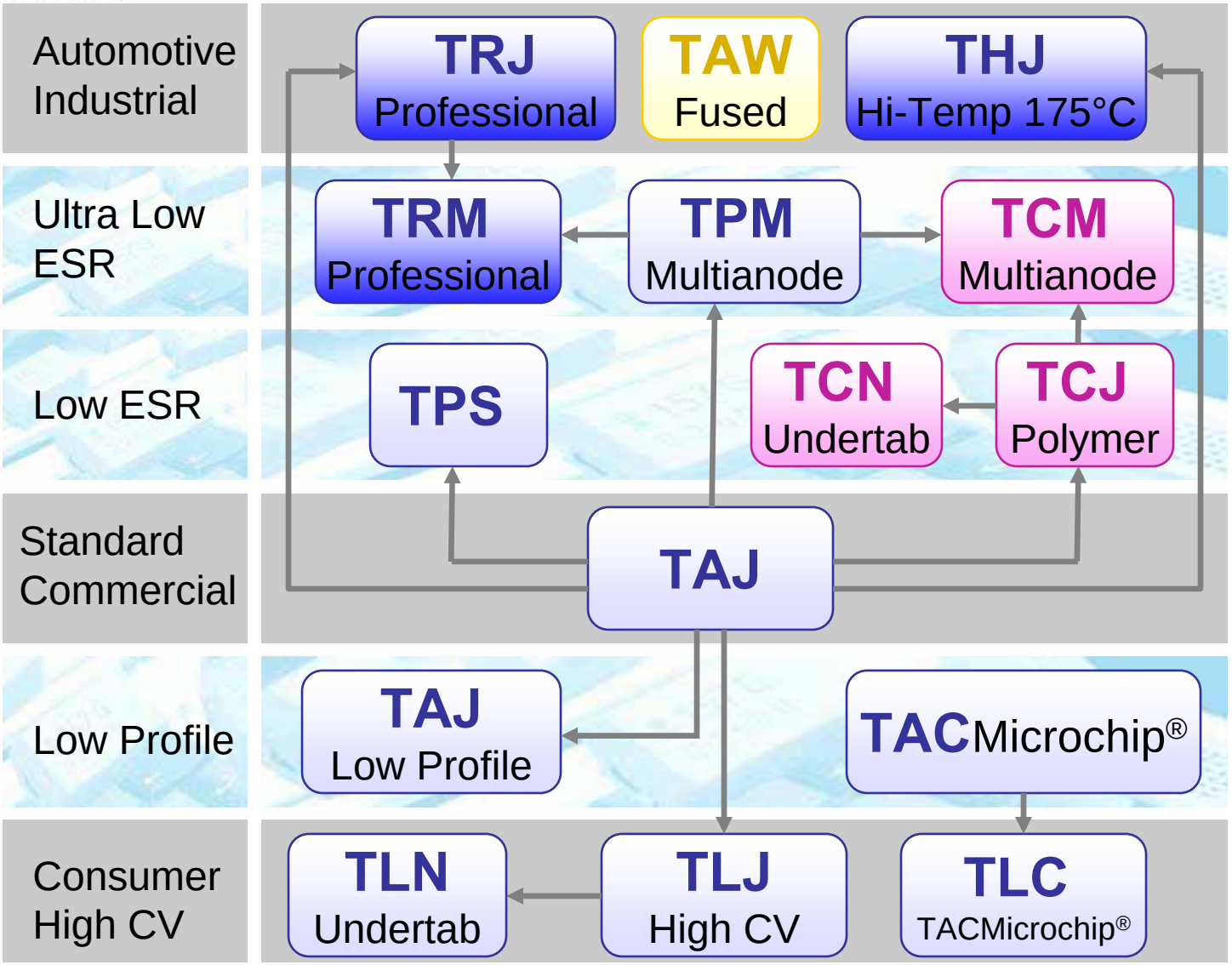
R&D

El Salvador
Salvador

consumer products

A KYOCERA GROUP COMPANY

Tantalum



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COMMERCIAL vs PROFESSIONAL

Tantalum Capacitors

- THJ, TRJ high reliability professional / automotive series
- Improved reliability to 0.5%/1kHrs

	Commercial	Automotive
Design	Commercial design rules that are less restrictive and do not attempt to account for the harsher environment of automotive.	**Restrictive design rules** that take the harsher environment of automotive into consideration. One example is an established minimum formation ratio of 3.0
Lot Acceptance	Uses commercial EIA standard	Exception limit controls in place. Rework control limits. **Maverick lot** prevention controls
Quality Control	Visual Check 0.25% AQL, Electrical 0.25% AQL	Visual Check **0.1% AQL**, Electrical 0.1% AQL, (Zero Sampling Plan – A0/R1), **Reflow test min 200pcs**/Lot
In line verification and test	2 x dynamic surges; minimum burn-in conditions 105C/RV	min 2 x **'hard' dynamic surges**; min burn-in conditions **125C/RV**; temperature cycling

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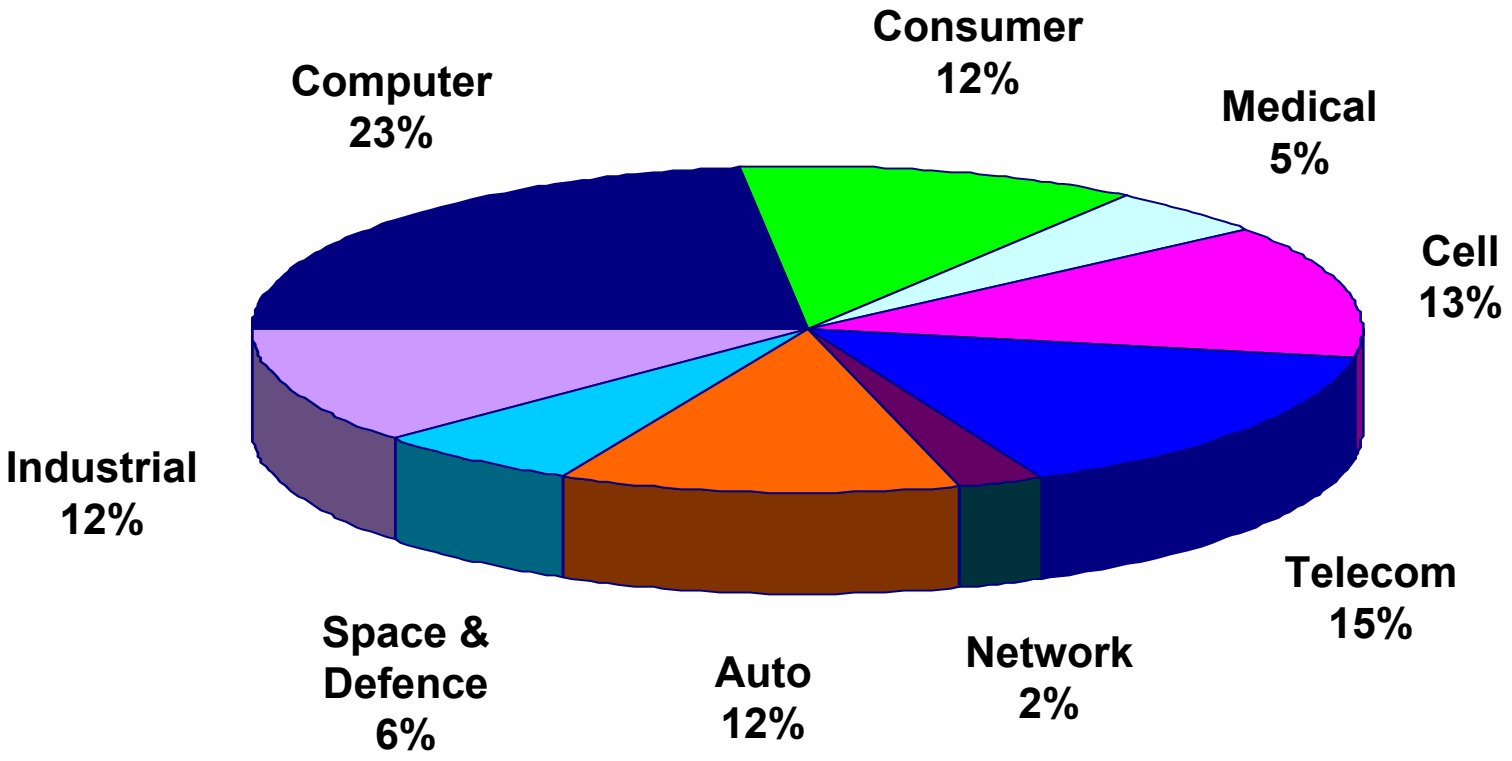
TANTALUM APPLICATION

End Market Shares



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TANTALUM APPLICATION
CONSUMER DEVICES

LCD/PDP TVs

Cellular phones and other hand held devices

Notebooks

Mobile electronics(Audio/Video)

Entertainment systems

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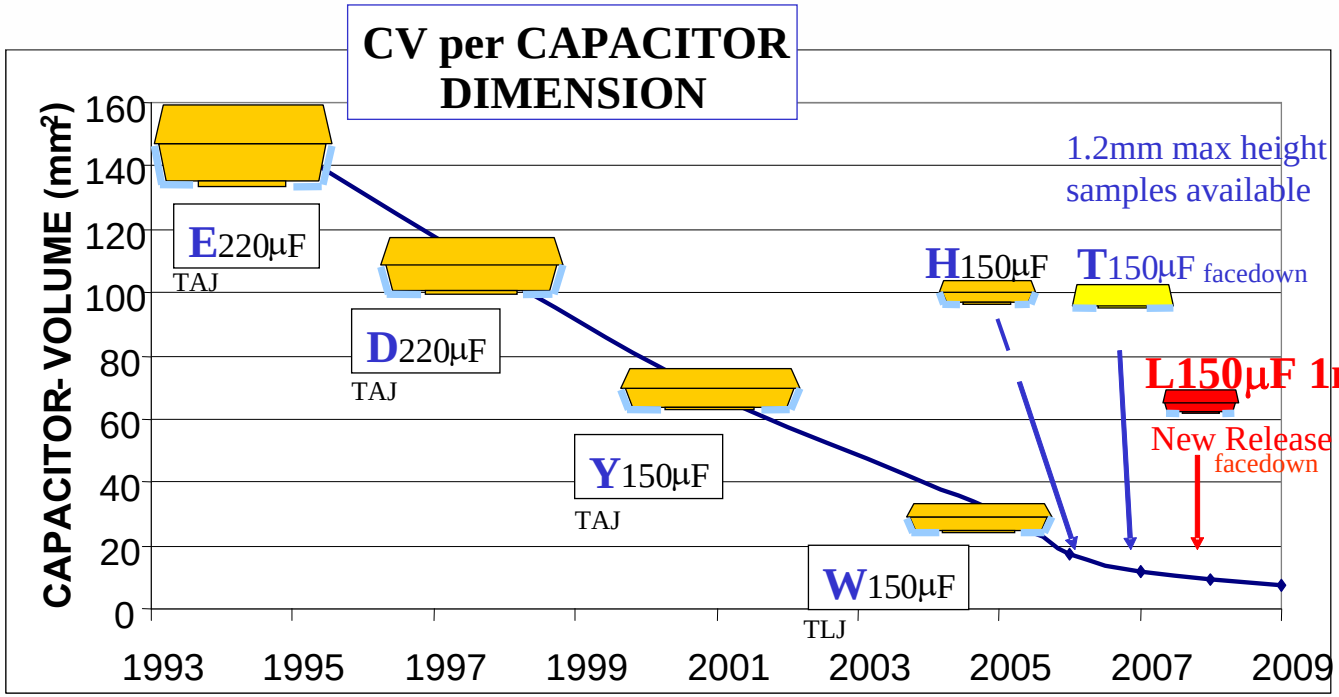
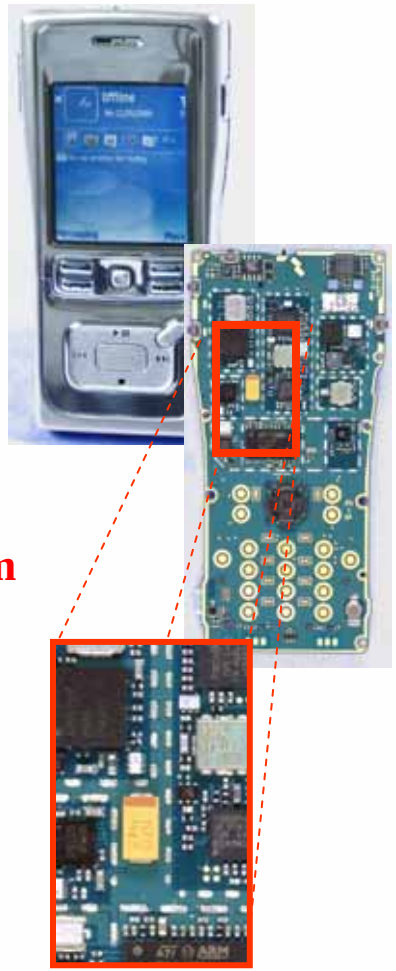
TANTALUM CAPACITORS
IN MOBILE PHONES

majority of mobile phones are using tantalum capacitor in power management systems





- downsizing and miniaturization are key drivers
- upcoming new “facedown” designs reduce the height to **less than 1mm**
- the capacitor volume reduced by **more than one decade** during past 15 years

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TANTALUM APPLICATION

AUTOMOTIVE APPLICATIONS

Tantalum Capacitors meets specific requirements for **reliability**, **vibration resistance** and **high cost versus performance** value

Tantalum Capacitor

Tire Pressure Monitoring System

Core Electronics

Increased Power Train, Body & Safety Electronics

Tire Pressure Monitor

RF receive / Transmit

Ultrasonic Park Assist

Ultrasonic Sensor, DSP, Audible Alarm

Head Up Display

Infra-Red Camera, DSP, LCD display

Night Vision Display

Infra-Red Camera, DSP, LCD display

Adaptive Cruise Control

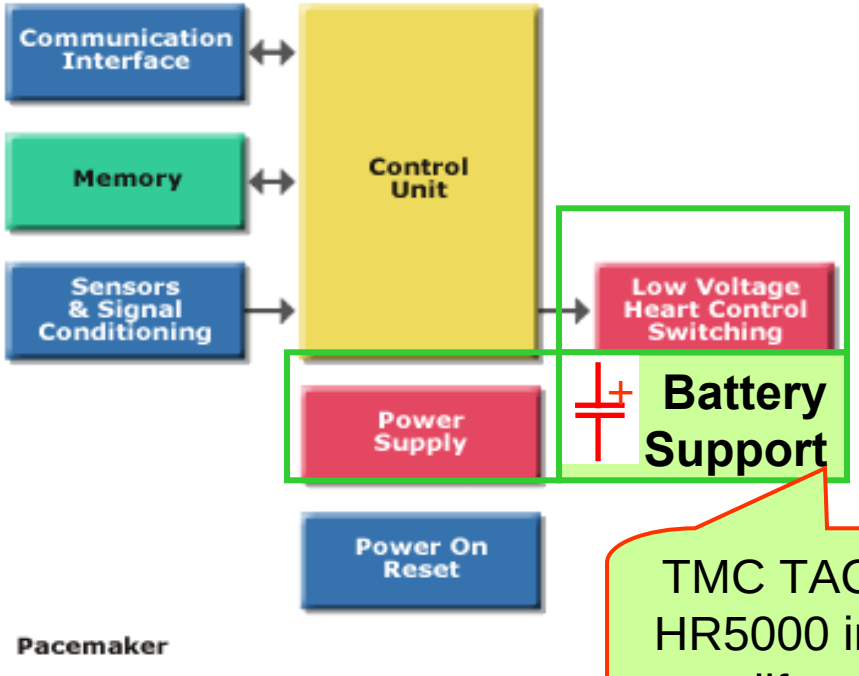
Millimeter Radar Send & Detect, DSP, Coupled ECU

Lane Detector

Digital Optical Camera, DSP, Audible Alarm

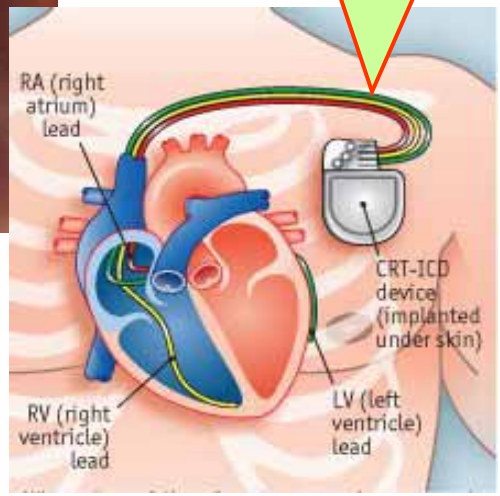
TANTALUM APPLICATION
MEDICAL APPLICATIONS

Implantable – Pacemakers, Defibrillators



TMC TACmicrochip HR5000 implantable life support

Miniaturization



References: Medtronic, Microsystems Engineering, Guidant

More than half a million pacemakers and defibrillators implanted each year!!!

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TANTALUM APPLICATION

OIL DRILLING

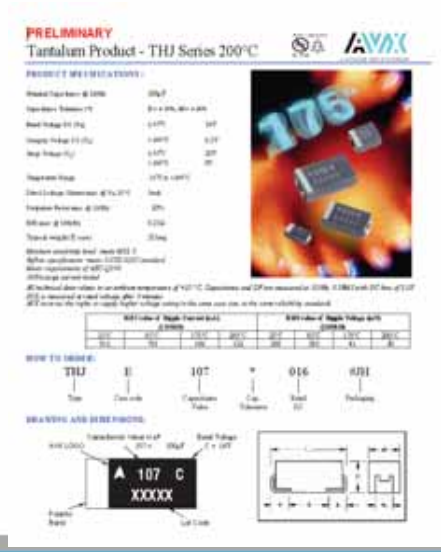
Oil Exploration Challenges

- Deeper Sea Exploration
- New Measures
- Deeper Drilling
- New Drill & Sensor Technology

200°C Temperature

New released
E 100/16, E 220/10

200°C Tantalum Capacitors



- Drill head / sensor application
- 3.3 and 5V rail application
- 200°C 1000 hrs life time
- 220µF and 100µF E case

… samples available

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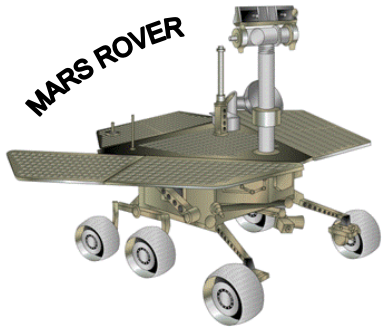
TANTALUM DIVISION

Tantalum Capacitors in Aerospace Applications

ESA/NASA co-operation

Tantalum Capacitors meet requirements of space applications for **top reliability in small & light capacitors**



SIGNIFICANT PAYLOAD REDUCTION

new generation of tantalum Hi-Rel capacitors provide higher capacitance & **lower ESR in smaller size** = lighter design

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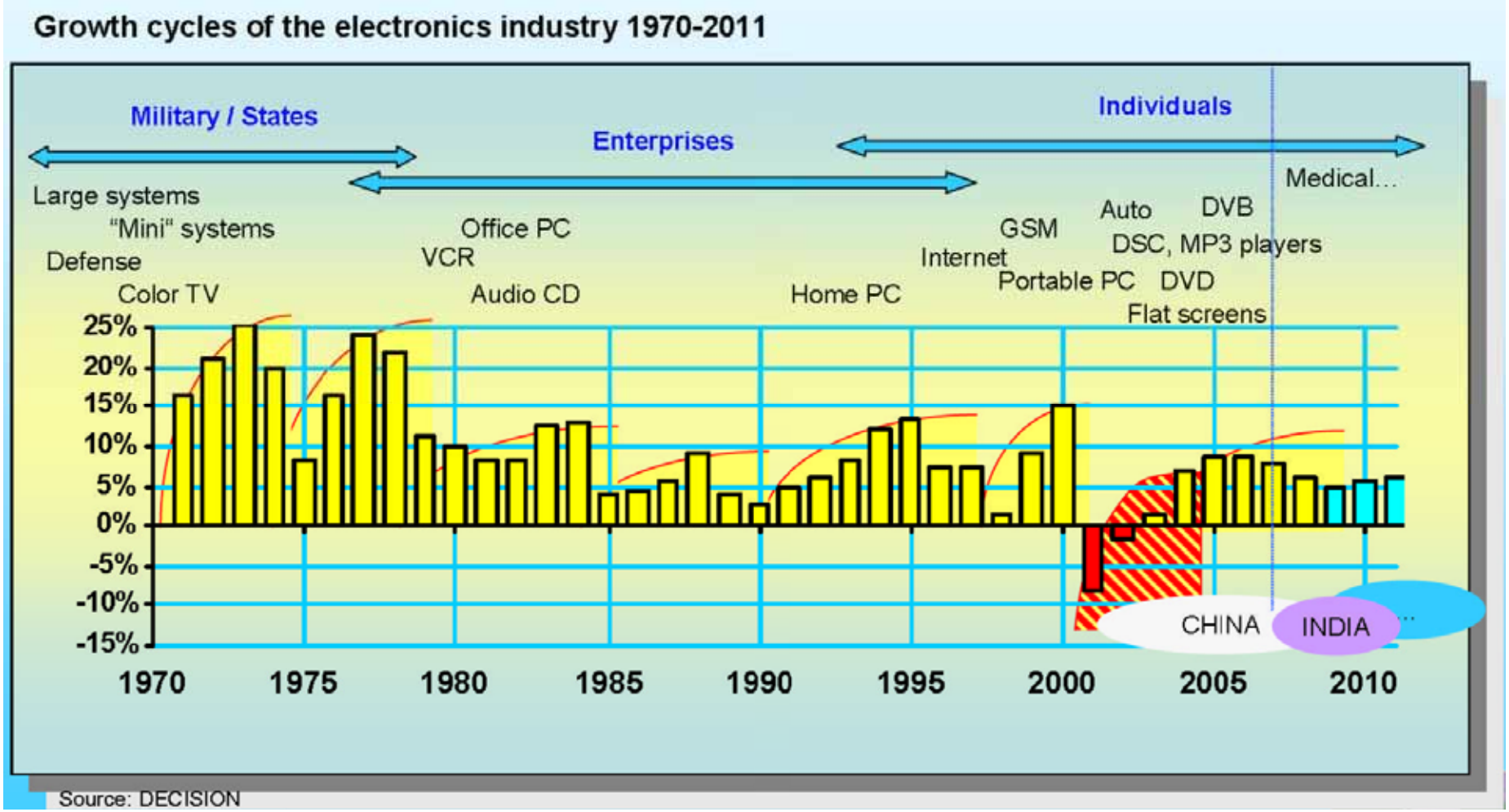
ELECTRONIC INDUSTRY GROWTH

1970 - 2011



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Eu vs US Standardization Grades

Tantalum Capacitors

European Standardization Based

ESCC 3012 – ESA QPL products

ESA EPPL (no tantalum at present)

CECC 30801 005
CECC 30801 011 (CTC4)
CECC 30201-032 (leaded Ta)

CECC Avionics & Industrial IQC

US Standardization Based

MIL group family

CWR09
CWR 11
CWR 15 (microchip)
CWR 19 (ext. range)
CWR 29 (low ESR)

DSCC 95158
DSCC 07016 (Hi-Rel, low ESR, ext. range)
DSCC 04053 (fused)
DSCC 93026 (wet)

COTS+
COTS+ Aerospace - SRC9000

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Hi Rel Test Level Comparison

Tantalum Capacitors

Group A testing comparison							
		MIL PRF 55365 QPL		AVX SRC9000	ESCC3012		
TEST	AVX COTSplus	"std" MIL	New "T" level	Space Level	LAT 1	LAT 2	LAT 3
AVX series	TBJ/TBM/TAZ	CWR09,11,15,19,29	CWR09,11,15,19,29	TBJ/TBM/TAZ	TAJ-ESA	TAJ-ESA	TAJ-ESA
Burn-in 168hrs					Y	Y	Y
100% Reflow	Y	Y	Y	Y	Y	Y	
Vibration		qualification only	qualification only		Y		
Adhesion (shear) & Shock					Y		
100% Thermal Shock	Y	Y	Y	Y	Y		
Climatique Sequence					Y		
Operating Life		group C & qual only	group C & qual only	**	Y	Y	
100% Weibull	Optional	Mandatory	Mandatory - level C	Mandatory-level C			
100% Surge Current	Optional	Optional	Mandatory - level C	Mandatory - level B or C	*	*	*
100% Electrical Testing	Custom test limits available	To specification limits only	+3 sigma limits	+3 sigma limits or custom	Y	Y	Y
100% Visual & Mechanical	Y	Y	Y	Y	Y	Y	Y
Simulated mounting, rework and accelerated life				Y	Y	Y	
Solderability Test	Optional - 75% Coverage	Mandatory - 90% Coverage	Mandatory - 90% Coverage	Mandatory - 90% Coverage	Y	Y	Y
100% X-Ray			Y	Y	level B	level B	level B
DPA - 1580 Destructive Physical Analysis			Y	Y			
Surge Voltage		qual only	qual only	Y	Y	Y	Y
Hot DC Leakage				Y			
Temperature Stability	Optional	Mandatory	Mandatory	Mandatory	Y	Y	Y

COTS Plus has all tests as options

MIL doesn't allow custom test, but new "T" Level has X-Ray & DPA

SRC9000 has all MIL "T" level AND additional Function Test, hot DCL, Surge Voltage as standard.

ESSC offer additional extensive tests

European Projects - Qualification

TES Low ESR QPL and European COTS+

Low ESR Single & Multianode technology

For High Power / Payload Weight Reduction

1] low ESR tantalum capacitor ESCC QPL

Evaluation & Qualification Started

at AVX (Cz) and EGGO (Cz) testhouse

Complete Date: Sep 2012

2] low ESR tantalum European COTS+

Based on Professional TRJ/TRM series

+ ESCC LAT Testing

Intended to propose for the next EPPL

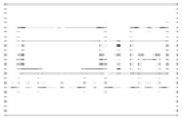
(Astrium, Ruag, SSTL expressed interest)

TES Low ESR European COTS+ Series

Low ESR Tantalum Chip Capacitor

- Manufactured in EU, ESA qualified plant
- Improved reliability design
- Robust against higher thermo-mechanical stresses during assembly process
- CV range: 0.10 - 470µF / 6.3 - 35V
- 5 case sizes available
- low ESR designed parts
- multianode D and E case included

CASE DIMENSIONS: millimeters (inches)



Code	EIA Code	EIA Metric	L±0.20 (0.008)	W+0.20 (0.008) -0.10 (0.004)	H+0.20 (0.008) -0.10 (0.004)	W_1±0.20 (0.008)	A+0.30 (0.012) -0.20 (0.008)	S Min.
A	1206	3216-18	3.20 (0.126)	1.60 (0.063)	1.60 (0.063)	1.20 (0.047)	0.80 (0.031)	1.10 (0.043)
B	1210	3528-21	3.50 (0.138)	2.80 (0.110)	1.90 (0.075)	2.20 (0.087)	0.80 (0.031)	1.40 (0.055)
C	2312	6032-28	6.00 (0.236)	3.20 (0.126)	2.60 (0.102)	2.20 (0.087)	1.30 (0.051)	2.90 (0.114)
D	2917	7343-31	7.30 (0.287)	4.30 (0.169)	2.90 (0.114)	2.40 (0.094)	1.30 (0.051)	4.40 (0.173)
E	2917	7343-43	7.30 (0.287)	4.30 (0.169)	4.10 (0.162)	2.40 (0.094)	1.30 (0.051)	4.40 (0.173)

W_1 dimension applies to the termination width for A dimensional area only.

HOW TO ORDER (tentative)

TES Detail Spec	D Case	226 Cap	K Tol	035 Volt	R Packaging	C ESR level	0 LAT	B Testing Level	H Termination Finish	0 Surge Option	0 DPA	0 FCSI	0 Qualification
TES = tantalum low ESR COTS+			K=10% M=20%		X =4" R=7" E=bulk	C=standard L=mirror multi U=multianode	0=N/A 1=LAT1 2=LAT2 3=LAT3	B=level B (Xray) C=level C	H=SnPb R=Sn matte tin A=Gold	0=N/A 1=current surge 85C	0=N/A 1=Yes	0=N/A 1=Yes	0=COTS+ 1=ESCC QPL

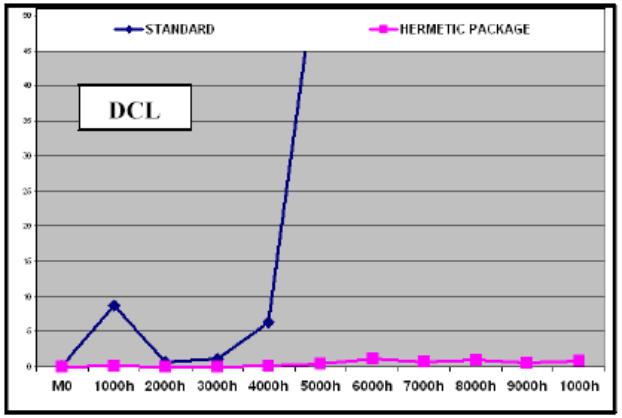
TECHNICAL SPECIFICATIONS

Technical Data:	All technical data relate to an ambient temperature of +25ºC						
Capacitance Range:	1µF to 470µF						
Capacitance Tolerance:	±10%; ±20%						
Leakage Current DCL:	0.0075CV						
Rated Voltage (V_R)	≤ +85ºC:	6.3	10	16	20	25	35
Category Voltage (V_C)	≤ +125ºC:	4	7	10	13	17	23
Surge Voltage (V_S)	≤ +85ºC:	8	13	20	26	32	46
Surge Voltage (V_S)	≤ +125ºC:	5	8	13	16	20	28
Temperature Range:	-55ºC to +125ºC						
Termination Finished:	SnPb Plating (standard), Gold and Sn Plating upon request						

European Projects - Development

Low ESR Hermetically Sealed Polymer Tantalum Capacitor

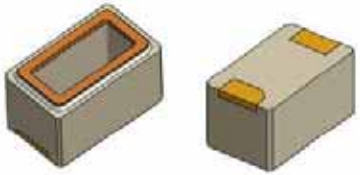
Tantalum Capacitor with Polymer 2nd electrode

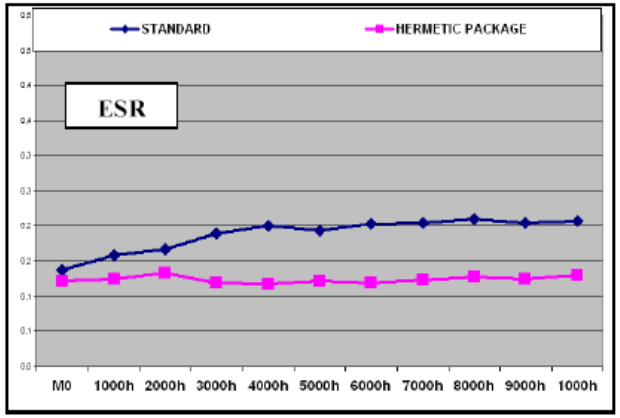


Pro: low ESR, reduced ignition

Con: reliability limited by humidity impact and oxygen atmosphere

HERMETIC PACKAGE SOLVES THE ISSUES





- Part of Czech Incentive Program

- Completion of Development Stage: 2012

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European Projects - AVX New Proposal

Rf ThinFilm Products Range

Accu-P® Thin Film Capacitors	0201/ 0402 / 0603 / 0805 / 1210
Accu-L® Thin Film Inductors	0402LGA/ 0603 / 0805
TF Directional Couplers/3dB 90°Couplers	CP0402LGA/CP0603LGA/0603/0805/
ITF Harmonic Low Pass/Band Pass Filters	0402LGA /0603 LGA / 0805
ACCU-GUARD® SMD Thin Film Fuses	0402LGA ,0603,0805,1206,0612

Production moved recently to Czech Republic (ESA member)

– front end still in Israel, middle and end processes in Czech

- potential for European Space evaluation, EPPL in case of interest

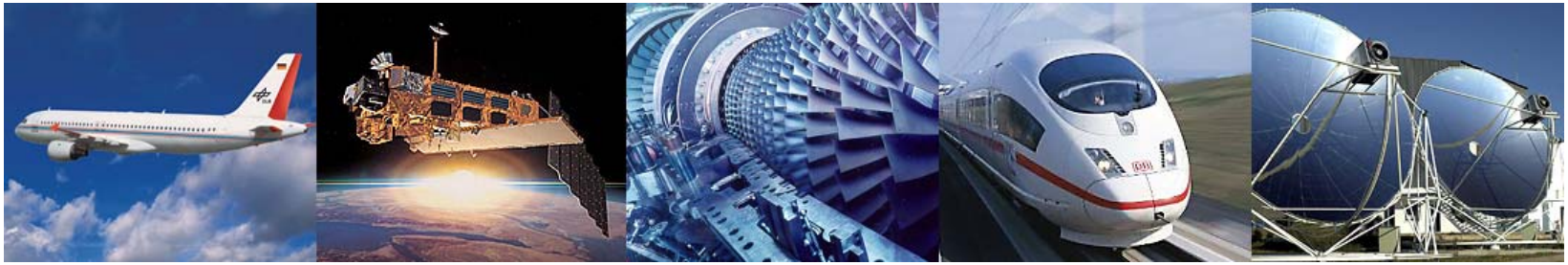
THANK YOU FOR YOUR ATTENTION

User and Supplier Needs and Interests Consolidation in Germany

Dr.-Ing. Andreas K. Jain (andreas.jain@dlr.de),
Jürgen Tetzlaff (juergen.tetzlaff@dlr.de),
ESCCON, Noordwijk, 15. - 17. March 2011

Deutsches Zentrum
für Luft- und Raumfahrt e.V.
in der Helmholtz-Gemeinschaft

German Aerospace Center (DLR)



Aeronautics Space Transportation Energy

- Research Institution
- Space Administration
- Project Management Agency
- 6500 employees across 29 research institutes and facilities at 13 sites
- Total budget (2011) : 2980 Mio €

Tasks and Responsibilities within the DLR EEE-Parts Section on behalf of the Space Administration

- Determination and prioritization of the national EEE-parts demand → National technology development and qualification program → increasing EEE-part availability
- Launching EEE-part qualifications
- Performing qualification and re-qualification audits with manufacturers
- Establishing strategies to increase the availability of EEE-parts in the frame of the European programs (ECI, ESCC, FP7)
- Representation of the German Space Administration, German manufacturers and users within the European Space Components Coordination (ESCC)
- EEE-part conferences for user and supplier needs and interests consolidation

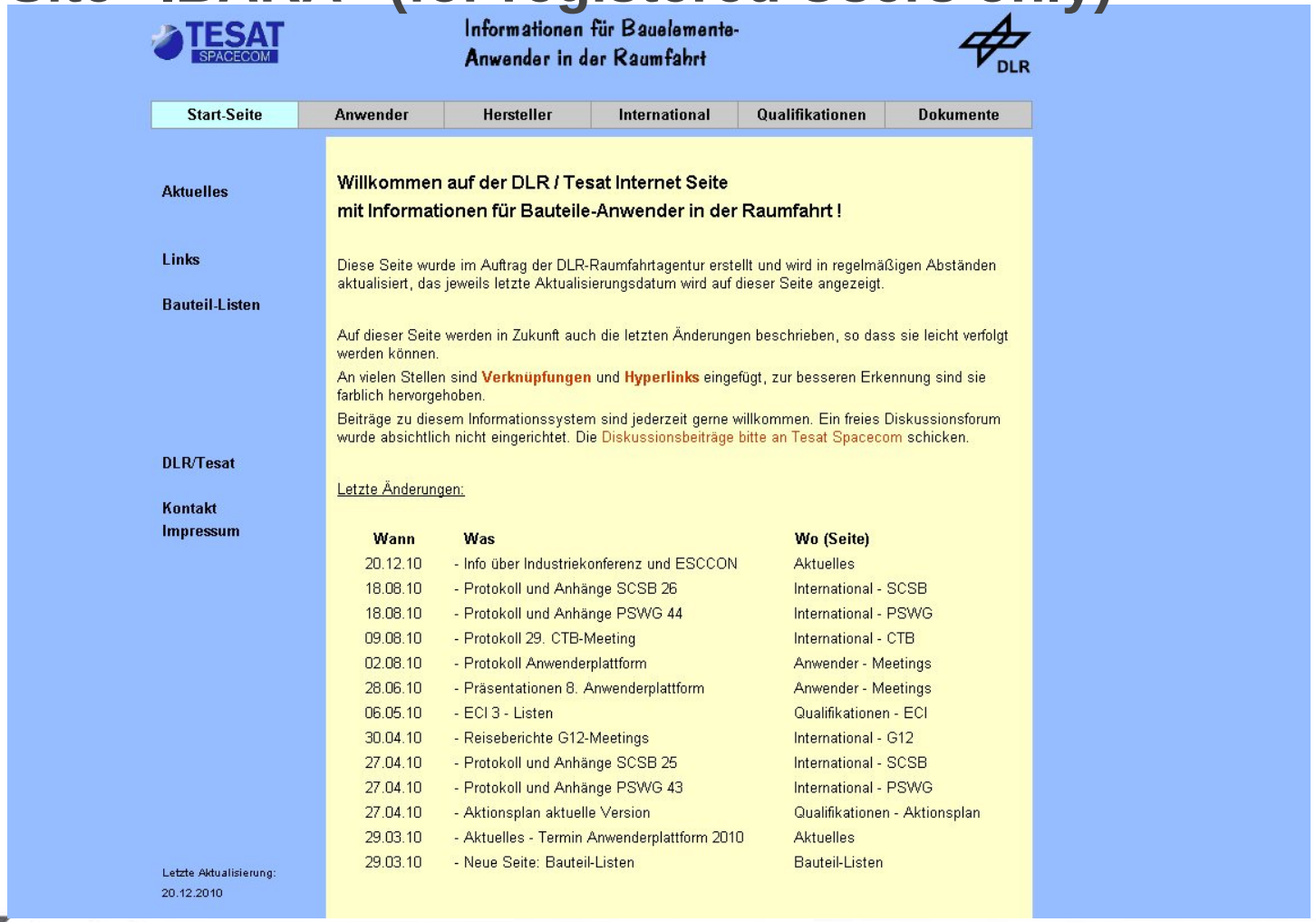
Topics of the EEE-part Conferences :

- Annual for users
- Bi-annual for users and suppliers (part manufacturers)
- EEE-part availability (and application of the EPPL)
- Qualification procedures
- Parts problems (alerts, export restrictions …)
- Technology developments
- Harmonization of the national technology development and qualification program

Harmonization of the National Technology Development and Qualification Program in Detail :

- To propose actions and tasks to improve the EEE parts availability
- To agree on actions and tasks
- To prioritize and approve the proposed action list
- To report on actions and tasks performed, their results, and their application
  - ➔ To increase the acceptance at customer level
  - ➔ To reduce the impact of export restrictions
- Supported by information web site (password protected only for German users, www.ibara.de see slide 6)

Additional Harmonization / Discussion via DLR Web Site “IBARA“ (for registered Users only)



TESAT SPACECOM

Informationen für Bauelemente-Anwender in der Raumfahrt

DLR

Start-Seite | Anwender | Hersteller | International | Qualifikationen | Dokumente

Aktuelles

Links

Bauteil-Listen

DLR/Tesat

Kontakt

Impressum

Letzte Aktualisierung: 20.12.2010

Willkommen auf der DLR / Tesat Internet Seite
mit Informationen für Bauteile-Anwender in der Raumfahrt !

Diese Seite wurde im Auftrag der DLR-Raumfahrtagentur erstellt und wird in regelmäßigen Abständen aktualisiert, das jeweils letzte Aktualisierungsdatum wird auf dieser Seite angezeigt.

Auf dieser Seite werden in Zukunft auch die letzten Änderungen beschrieben, so dass sie leicht verfolgt werden können.

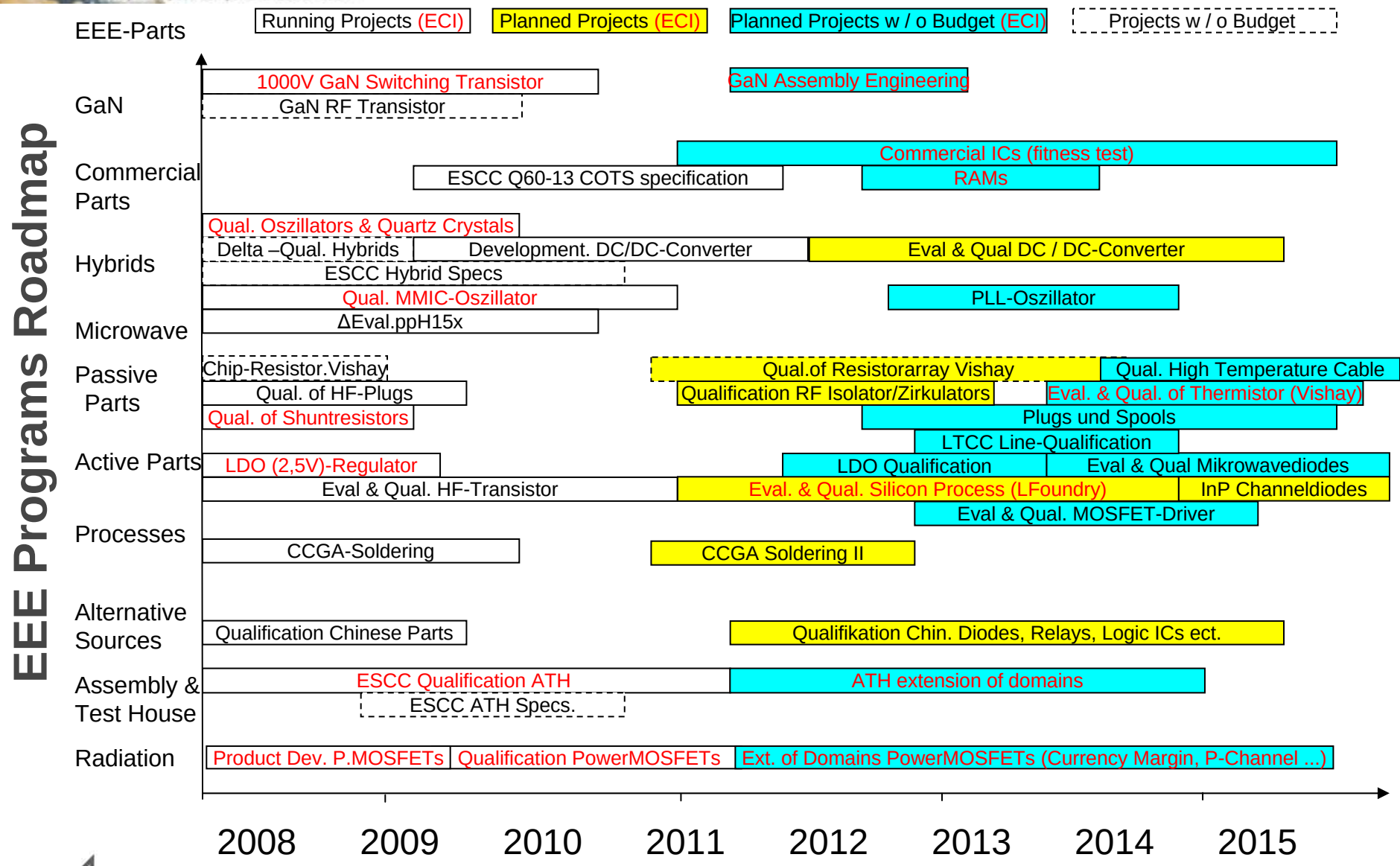
An vielen Stellen sind **Verknüpfungen** und **Hyperlinks** eingefügt, zur besseren Erkennung sind sie farblich hervorgehoben.

Beiträge zu diesem Informationssystem sind jederzeit gerne willkommen. Ein freies Diskussionsforum wurde absichtlich nicht eingerichtet. Die Diskussionsbeiträge bitte an Tesat Spacecom schicken.

Letzte Änderungen:

Wann	Was	Wo (Seite)
20.12.10	- Info über Industriekonferenz und ESCCON	Aktuelles
18.08.10	- Protokoll und Anhänge SCSB 26	International - SCSB
18.08.10	- Protokoll und Anhänge PSWG 44	International - PSWG
09.08.10	- Protokoll 29. CTB-Meeting	International - CTB
02.08.10	- Protokoll Anwenderplattform	Anwender - Meetings
28.06.10	- Präsentationen 8. Anwenderplattform	Anwender - Meetings
06.05.10	- ECI 3 - Listen	Qualifikationen - ECI
30.04.10	- Reiseberichte G12-Meetings	International - G12
27.04.10	- Protokoll und Anhänge SCSB 25	International - SCSB
27.04.10	- Protokoll und Anhänge PSWG 43	International - PSWG
27.04.10	- Aktionsplan aktuelle Version	Qualifikationen - Aktionsplan
29.03.10	- Aktuelles - Termin Anwenderplattform 2010	Aktuelles
29.03.10	- Neue Seite: Bauteil-Listen	Bauteil-Listen

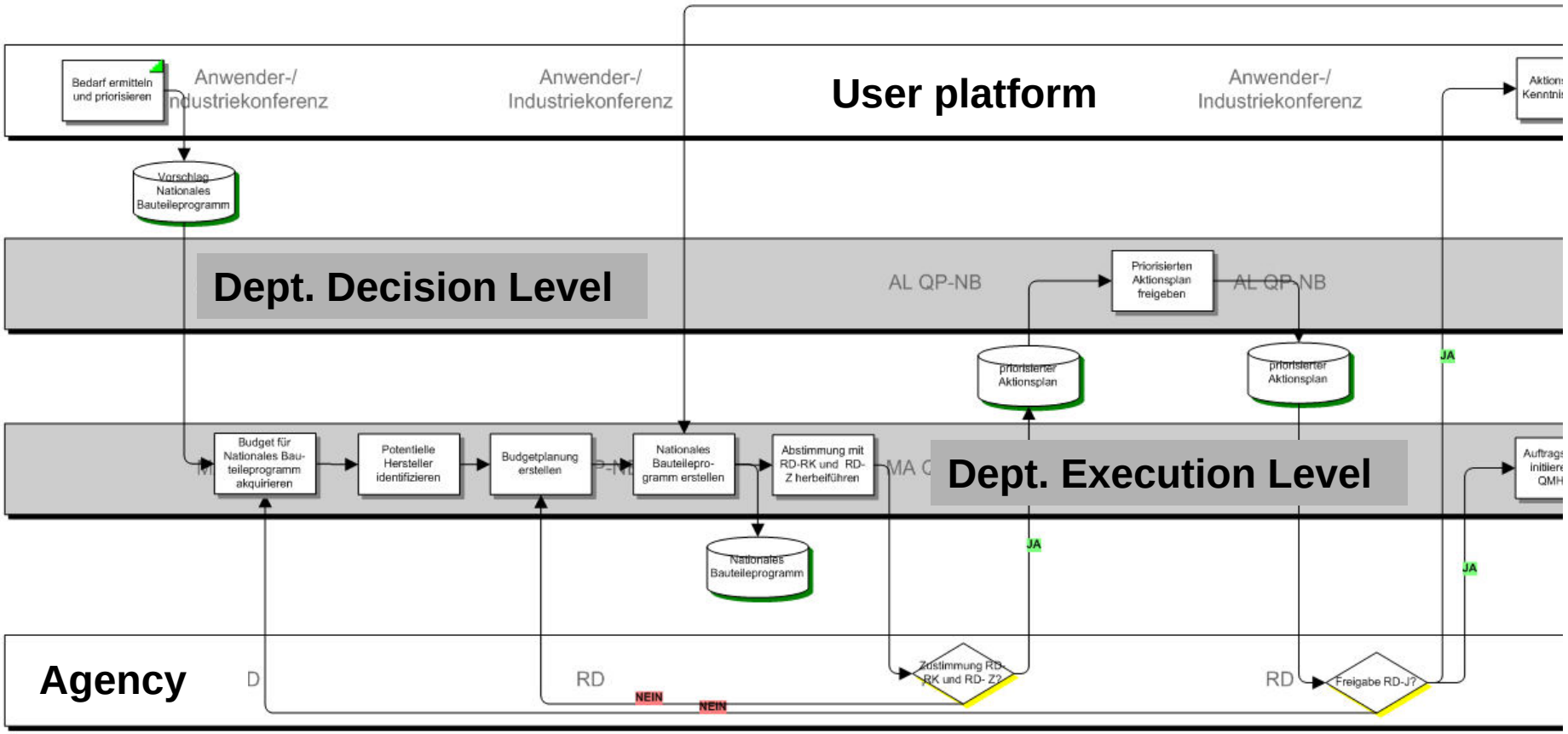
EEE Programs Roadmap



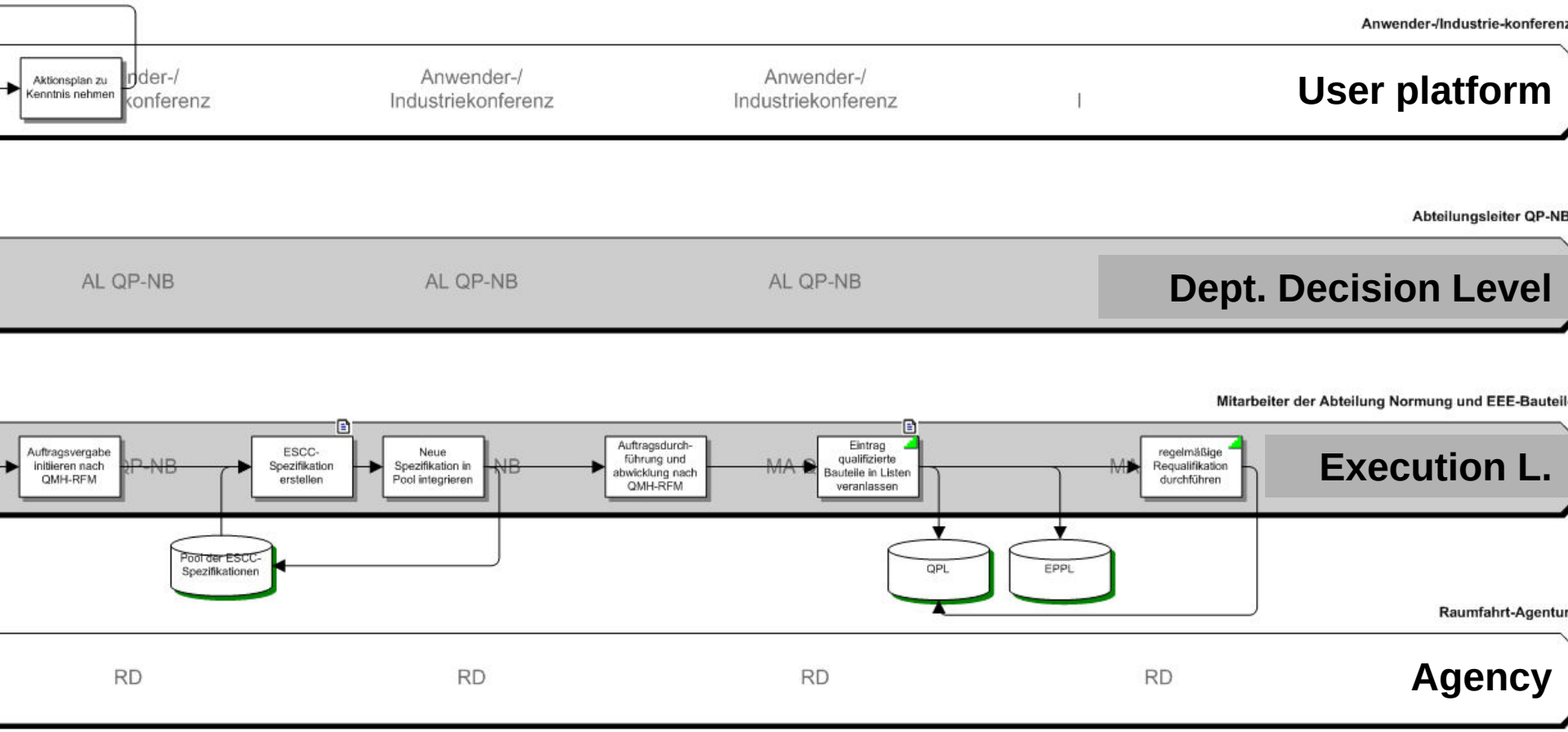
DLR Way for Action Plan Consolidation

- Draft action plan as input for German User Platform (example on slide 11)
- Discussion, harmonization and prioritization of user needs at this platform
- Identification of suitable manufactures
- Internal negations (budget, priorities, human resources, approvals …)
- Establishing specifications if not available from ESCC
- ESCC harmonization (CTB input for AQP)
- Consolidated budget table = German action plan (see example on slide 12)
- Contract placing and execution regarding to DLR process requirements (see process flow on slide 9)
- Input to ESCC QPL and EPPL
- To report results and application of running or performed programs

Graphical Process Description (1)



Graphical Process Description (2)



Draft Action Plan as Input for User Platform

Product	Manufacturer	Action	Planned Start	Actual Start	Status
Commercial ICs	Tesat/Astrium	Radiation Characterization	2009		Postponed to ?? - Need ?
µW-Dioden	IAF	Development, Evaluation and Qualification	2009	2009	Tesat -internal Qualification performed
High Temerature Cabel	Leoni Special Cables	Development, Evaluation and Qualification	2009	?	Planed from ESA within ECI-3 intended manufacturer: Axon
Assembly- and Test House	NN	Extension of certified domain	2009		Possible only after certification
PoL-Converter	IHP	Development	2010	2010	Standardized product
RF-circulator and isolator	Tesat	Evaluation and Qualification	2010	2010	Product available, existing need
German Foundry	Tesat	Suitability Examination of a Commercial ASIC Technology for Space Applications	2010	2010	Urgent need for European independency
German Foundry	L-Foundry	Evaluation and Qualification (Capability Approval)	2011	2010	Existing need, especially for obsolete technologies
LTCC-Technik	Tesat	Evaluation and Qualification	2011		High reliable and fully automated production line
PoL-Converter	IHP	Evaluation and Qualification	2012		Capability Approval
PoL-Converter	Astrium	Radiation tests on a regulator component for short term realization of a discret PoL-Converter	2011 ?		Existing need
Chinese parts	Tesat	Follow-up activity Evaluation and Qualification	2011		Cooperation with CAST

Example of Consolidated Budget Table (partly blurred)

FKZ	Thema	AN/ ZE	Laufzeit	Mittel-Abfluss	2011	2012	2013	2014	2015	Förder-Summe	Bearbeiter
Festlegungen: laufende Vorhaben				**Stand: 7.1.**							
50PS0606	Qualifikation: Assembly und Testhaus	Lewicki	09/06 - 12/11	0							Tetzl. Neuhs.
50PS0702	Unterstützung Bauteilequalifikationsaufgaben	TESAT	05/07 - 04/12	0							Tetzl. Neuhs.
50PS0704	GaN 1000V-Schalttransistor	TESAT	07/07 - 09/11	0							Tetzl. Neuhs.
50PS0705	Qualifikation eines MMIC-LO	KT	09/07 - 03/11	0							Tetzl. Neuhs.
50PS0802	Evaluation und Qual. von Dioden u. Hf-Transistoren	Infineon	07/08 - 08/11	0							Tetzl. Neuhs.
50PS0804	Evaluation des ppH15x-Prozess	UMS	07/08 - 07/11	0							Tetzl. Neuhs.
50PS0901	Detektor f. mikrobiol. Kontamin. ("Elektron. Nase", MLA))	EADS	10/09 - 03/12	0							Lenic Neuhs.
50PS0903	Power-MOSFETs: Produktentwickl. (u. Qual.) Ph.2	Infineon	07/09 - 10/11	0							Tetzl. Neuhs.
50RE0404	Beratertätigkeiten Standardisierung	DLR	12/04 - 02/11	0							Jain Neuhs.
	Zw.summe:		**65%**	**0**							
geplante Vorhaben a) Realisierung noch in 2011 (VE-relevant)											
50PS0705 (A)	Qualifikation eines MMIC-LO	KT	- 03/12								Tetzl. Neuhs.
50RE1102	Beratertätigkeiten Standardisierung	DLR	03/11 - 12/13								Jain Neuhs.
50PS1001	Tauglichkeit kommerz. ASICs (L-Foundry)	TESAT	03/11 - 09/13								Tetzl. Neuhs.
50PS1102	HF-Zirkulatoren & -Isolatoren: Evaluation und Qual.	TESAT	05/11 (26 mon)								Tetzl. Neuhs.
50PS1103	Qual. eines CCGA-Lötprozesses für die Rf	tbd	05/11 (15 mon)								N.N. Neuhs.
50PS11-B	SiC-Dioden	tbd	06/11 (26 mon)								N.N. Neuhs.
50PS11-D	Chinesische Bauteile	TESAT	10/11 (3 y)								N.N. Neuhs.
50PS11-E	Update PS-Katalog 2011/2012	TESAT	07/11 (8 mon)								N.N. Neuhs.
	Zw.summe:										
geplante Vorhaben: b) Realisierung ab 2012 (nicht mehr VE-relevant)											
50PS12-A	DC/DC- bzw. PoL-Konverter: Evaluation und Qual.	TESAT	07/12 (2 y)								N.N. Neuhs.
50PS12-B	GaN - Aufbautechnik	TESAT	01/12 (13 mon)								N.N. Neuhs.
50PS12-D	Bauteil-Qual.-Aufgaben	TESAT	05/12 (5 y)								N.N. Neuhs.
50PS15-A	Update PS-Katalog 2015	TESAT	03/15 (4 mon)								N.N. Neuhs.
PL-PS-00	Programmkorridor "Produktsicherung"	--	-- (--)								
	Zw.summe:										

DLR EEE Parts Projects

Activity	Term	Status
PPH15-Process Evaluation	2003 - 2006	finished
Evaluation and Qualification of Thin Film Chip Resistors	2004 - 2008	finished
Evaluation and Qualification of Cables	2005 - 2009	finished
Qualification of Quartzes and Oscillators	2005 - 2010	in progress
Qualification of Microwave Connectors	2005 - 2011	in progress
Certification of an Assembly and Test House	2006 - 2011	in progress
Qualification of MMIC Local Oscillator	2007 - 2011	in progress
Development and Qualification of PowerMOSFETs	2008 - 2011	in progress
Qualification of Diodes and RF-Transistors	2008 - 2011	in progress
Evaluation of the UMS PPH15x Process	2008 - 2011	in progress
Development of a GaN 1000V Switching Transistor	2007 - 2011	in progress
Capability Approval of L-Foundry	2010 - 2013	In grogress
Qualification of RF-Circulators / Isolators	2011 - 2013	planned
Capability Approval of IHP‘s SG13 Technology	2011 - 2013	planned
Qualification of a fully automatic LTCC Line	2011 - 2013	planned
Feasibility Study of the SiC Diodes Technology	2011 - 2013	planned

All projects under : www.dlr.de/qp/en/desktopdefault.aspx/tabid-3091/4699_read-6881/

Thank you for your attention!

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European Space Components Conference (ESCCON) 2011

National Aeronautics and Space Administration

Current and Future Parts Management at NASA

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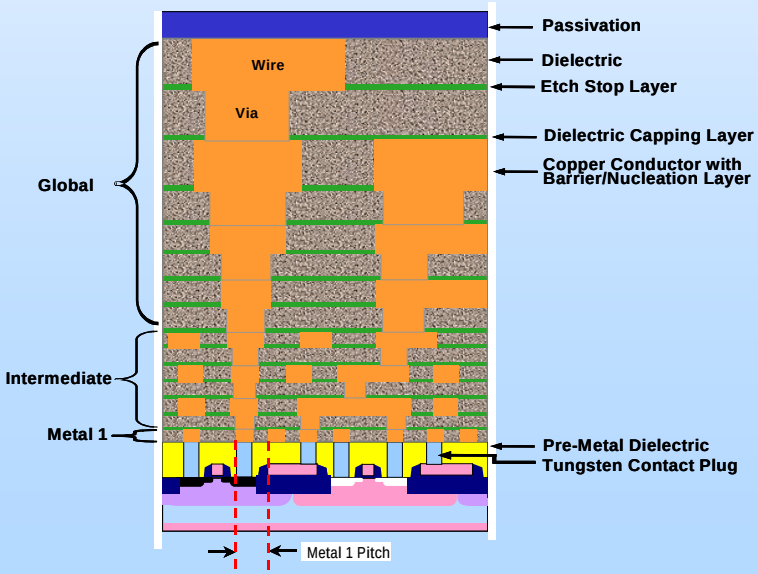
Overview

- **NASA Today – The Backdrop**
- **Current Parts Management at NASA**
- **NASA Parts Policy, NPD 8730.2**
- **Center Implementation of 8730.2**
- **The "Universal" Parts Management Process**
- **NASA Center Missions**
- **Examples of Parts Management Implementation**
- **Immediate Challenges:**
  - Advanced packaging – Class Y
  - Obsolescence and Counterfeit
  - Global Supply Chain
  - Parts Management for COTS "boxes"
  - Commercial Crew
- **Future Challenges**

This Presentation Does Not Discuss Radiation Hardness Assurance


Spiral galaxy M81, located approximately 12 million light-years from Earth, as seen by the Spitzer Space telescope.



NASA Today – The Backdrop

- NASA is at a major crossroads
- The Shuttles will soon be retired
- NASA launch systems (crewed) to be replaced with commercial ones for transport to the International Space Station – “Commercial Crew”
- There will be a gap in NASA-launched, human space flight
- Increasing budget pressure in these tough economic times (affordability)
- NASA will manage a new Space Launch System (SLS) for heavy lift and exploration
- Exploration focus is Mars, asteroid, moon? TBD
- New Vision Statement: "*To reach for new heights and reveal the unknown so that what we do and learn will benefit all humankind.*“

This Presentation Does Not
Radiation Hardness Assurance

Current Parts Management at NASA

- NASA Parts Policy NPD 8730.2 applies to all NASA flight projects and critical ground support equipment but it is high level and allows considerable flexibility of implementation
- Each NASA Center has similar goals and processes are similar but the tools are different between Centers
- The differences reflect the different missions, histories and cultures of the 8 flight Centers
- Parts management/control functions may be in different managerial chains, engineering, mission assurance or both
- NASA has no standard or preferred parts list, preferred or qualified vendor list or parts database
- The NASA Parts Selection List (NPSL) is an optional on-line tool that mainly captures lessons learned
  - It does not cover radiation effects

NPD 8730.2

- **NASA Policy Directive NPD 8730.2, NASA Parts Policy, applies to materials and mechanical parts such as fasteners as well as electronic packaging and parts**
- **Overall Requirements:**
  - Parts and Materials Management Plans
  - Reporting of non-conformances via NASA Alert Policy NPR 8735.1
  - Parts management and assurance actions such as audits
- **Electronic Parts Requirements**
  - Selection to meet mission requirements
  - Maintenance of the NASA Parts Selection List (NPSL)
  - Participation in the US Military Standardization Program
  - Parts qualification and screening
  - Derating
  - Lead-free Control Plans (LFCP), GEIA 0005 standards or equivalent
  - Counterfeit Parts Control Plans (CPCP) SAE AS5553 or equivalent

NPD 8730.2
NASA Parts Policy

NASA EEE-INST-002, Instructions for EEE Parts Selection, Screening, Qualification, and Derating

Maintained by GSFC

NASA Parts Selection List (NPSL)

http://nepp.nasa.gov/npsl/

Maintained by NASA Electronic Parts and Packaging (NEPP) Program

ARC

APR 8730.2, Ames EEE Parts Control Requirements, NPSL

JSC

SSP 30312, EEE Parts Management and Implementation Plan for the Space Station Program

GRC

Space Assurance Requirements NPSL, EEE-INST-002

KSC

ISS and Shuttle Servicing Requirements

GSFC

Mission Assurance Requirements (MAR), EEE-INST-002, NPSL

LaRC

NPSL, EEE-INST-002

JPL

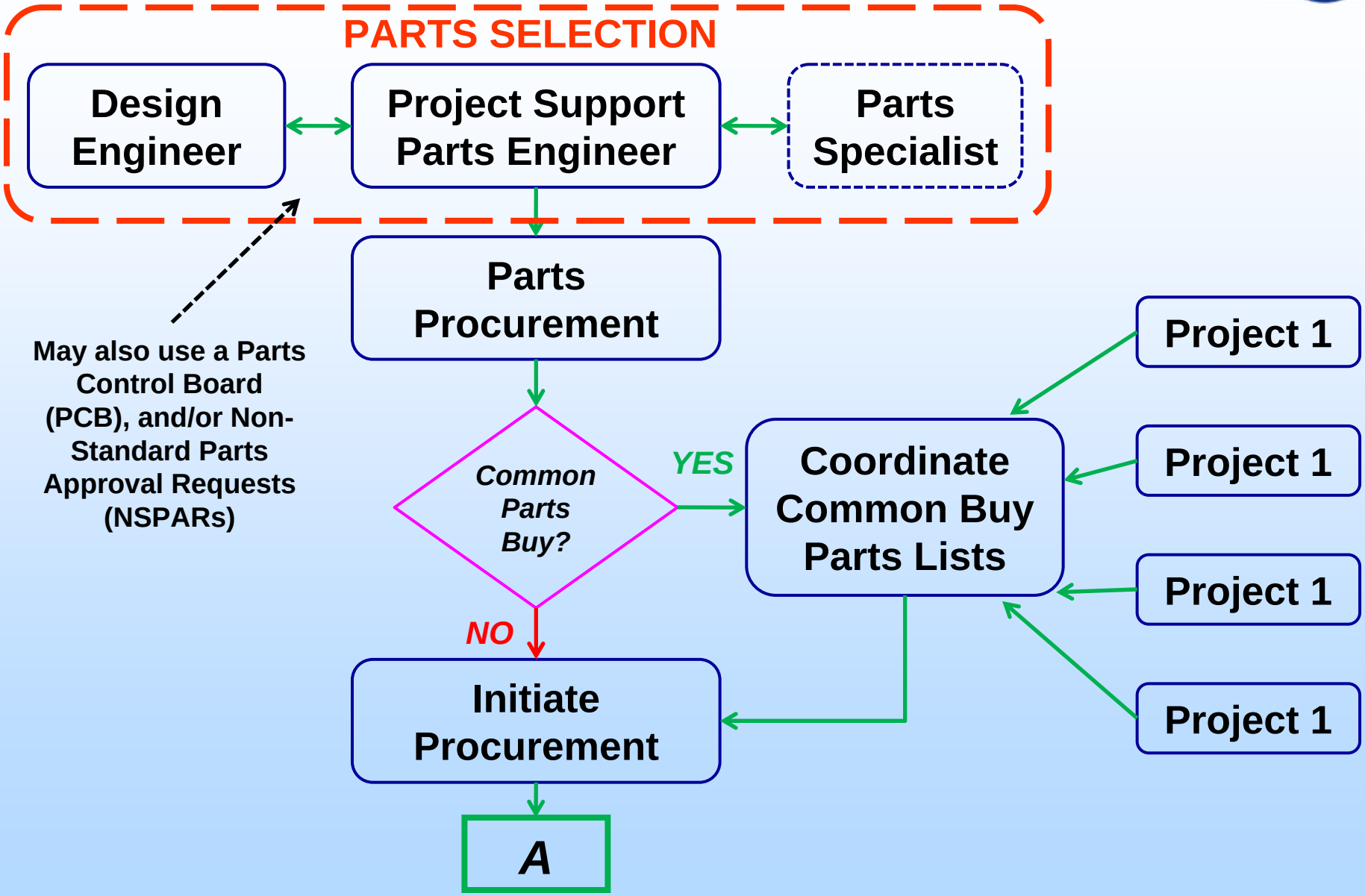
JPL Rules Doc 57732, Institutional Parts Program Requirements (IPPR)

MSFC

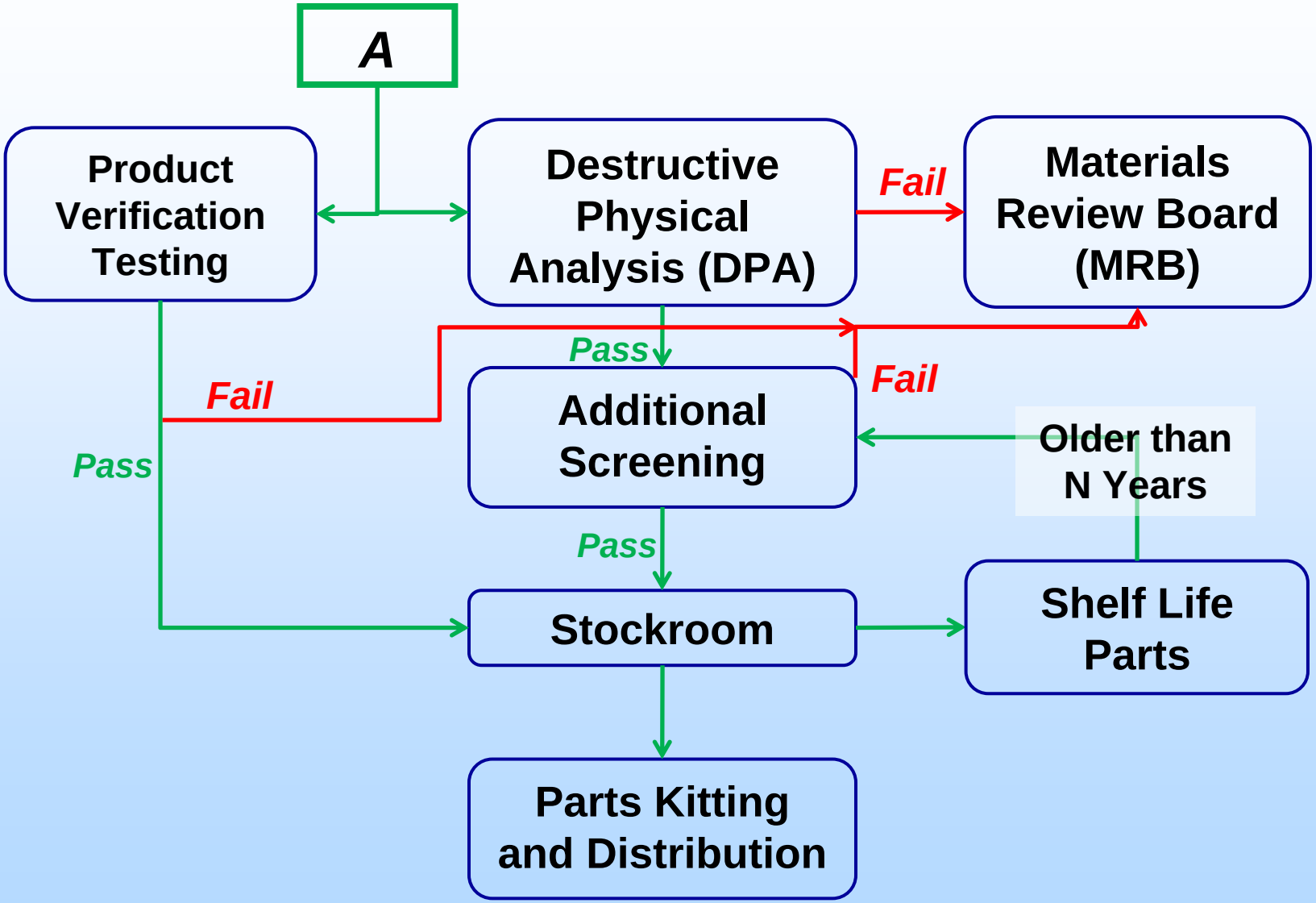
MSFC-STD-3012

EEE Parts Management and Control for MSFC Space Flight Hardware

Typical EEE Parts Management Flow



Parts Management Flow Continued



NASA Centers - Mission Focus

Center	Primary	Other
Ames Research Center (ARC)	Mini and Microsats, Lunar Science	C & D Missions, Aeronautics, Astrobiology
Glenn Research Center (GRC)	Rocket Propulsion, Aeronautics	Power Systems, Communications
Goddard Space Flight Center (GSFC)	Earth and Interplanetary, Science, Satellites and Instruments	Sounding Rockets and Balloons
Jet Propulsion Laboratory (JPL)	Interplanetary Exploration Satellites and Instruments	Earth Science Satellites and Instruments
Johnson Space Center (JSC)	Human Spaceflight, ISS, Shuttle Program	Crew Vehicle Development
Kennedy Space Center (KSC)	Launch Services and Commercial Crew	Ground Systems Development
Langley Research Center (LaRC)	Earth and Space, Science, Satellites and Instruments	Aeronautics and Advanced Technologies
Marshall Space Flight Center (MSFC)	Space Transportation and Rocket Propulsion	Low Earth Orbit Science Satellites and Instruments

Inter-Center partnerships and roles are dynamic. This is a snapshot

Examples of NASA Center Variation

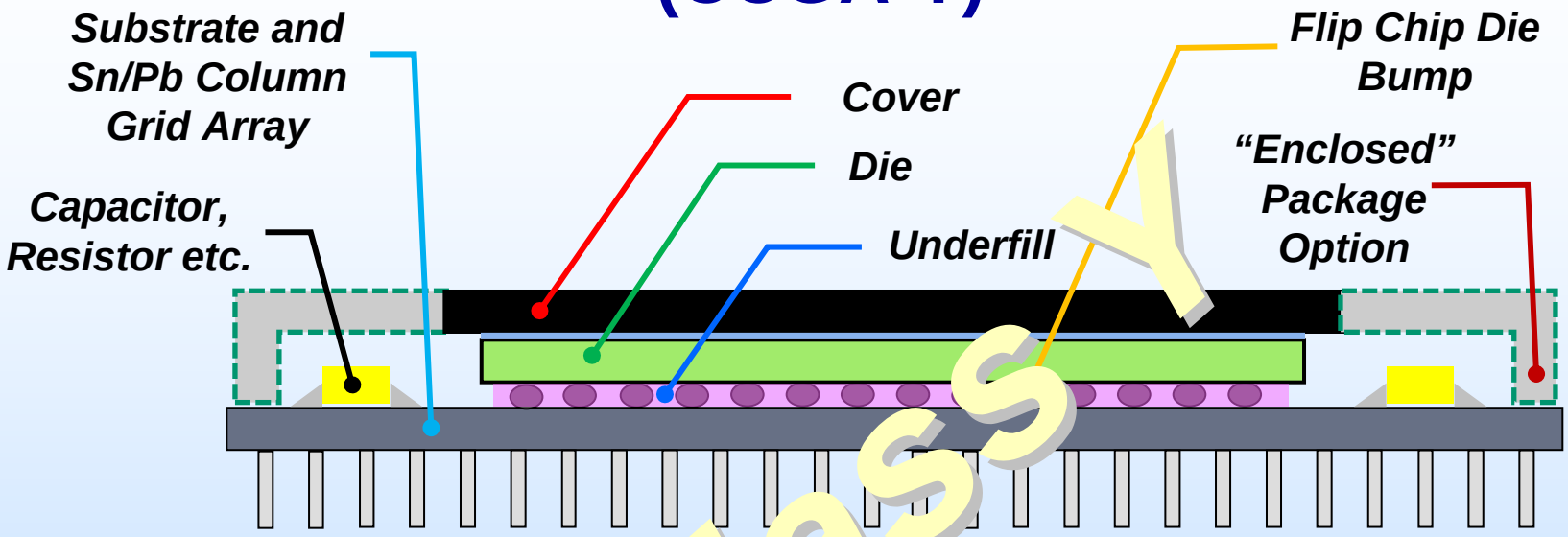
	ARC	GRC	GSFC	JPL	JSC	KSC	LaRC	MSFC
Center Level Controlling Std	APR 8730.2	SAR	None	None	None	KNPR 8720.2	None	None
Electronic Parts Standard	APR 8730.2	SAR, EEE-INST-002	EEE-INST-002	IPPR, Parts Eng. Tech Std (PETS)	SSP 30312, OPPR	KNPR 8720.2	None	MSFC-STD-3012
Project Requirements	APR 8730.2	SAR	MAR	PPPR	JPD 5320.6	KNPR 8720.2	Flexible	Project Parts Plan
Project-specific Parts Mgt. Plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Selection	Flexible	Flexible	MAR, EEE-INST-002	PPPR, IPPR	Program Specific	Flexible	Flexible	MSFC-STD-3012
Derating	No	Flexible	EEE-INST-002	IPPR	Program Specific	Flexible	Flexible	MSFC-STD-3012
Screening	Flexible	Flexible	EEE-INST-002	IPPR	Program Specific	Flexible	Flexible	MSFC-STD-3012
Qualification	Flexible	Flexible	EEE-INST-002	IPPR	Program Specific	Flexible	Flexible	MSFC-STD-3012
Classification Levels (Grades)	Flexible	1, 2, 3, COTS	1, 2 or 3	1,2,3 or 4	Program Specific	Flexible	Flexible	1, 2, 3, or 4
EEE Parts Database	NO	No	Yes	Yes	Program Specific	No	Flexible	Yes
NSPAR or PCB?	PCB + NSPAR	Flexible	PCB	Parts Specialists	PCB and NSPAR	Flexible	Flexible	PCB and NSPAR
Parts Responsibility	Engring	Engring	Engring + S&MA	Engring + S&MA	Engring + S&MA	Engring	Engring	Engring

Immediate Challenges

- **Complex non-hermetic packages for space**
  - The “Class Y” concept
- **Counterfeits and Obsolescence**
  - A challenge for obsolescence management
  - An increasing challenge, even for one-off science birds
- **Global supply chain, global challenges:**
  - Security restrictions, secrecy
  - Limited sources
  - International politics and unrest
- **Parts management for COTS “boxes”**
  - Am I crazy?
  - Faith, or is assurance possible with no parts list?
- **Commercial Crew**
  - Balancing risk with heritage and precedence

Lunar Reconnaissance Orbiter (LRO), Built at GSFC, Launched with LCROSS, June 18,2009

Non-hermetic Package, With ”Space” Features (CCGA*?)



Space Challenge	Some Defenses
Vacuum	Low out/off-gassing materials. Ceramics vs polymers.
Shock and vibration	Compliant / robust interconnects - wire bonds, solder balls, columns, conductive polymer
Thermal cycling	Compliant/robust interconnects, matched thermal expansion coefficients
Thermal management	Heat spreader in the lid and/or substrate, thermally conductive materials
Thousands of interconnects	Process control, planarity, solderability, substrate design
Low volume assembly	Remains a challenge
Long life	Good design, materials, parts and process control
Novel hardware	Test, test, test
Rigorous test and inspection	Testability and inspectability will always be challenges

* Ceramic Column Grid Array

MIL-PRF-38535, Class Y

- **“Y Not” Non-hermetic for Space? We have no choice**
- **Proposed new class for MIL-PRF-38535, monolithic microcircuits**
- **Class Y will be for Space level non-hermetic**
- **Class V will be defined as hermetic only**
- **Addition to Appendix B, “Space Application”**
- **Package-specific “integrity” test requirements proposed by manufacturer, approved by DLA* and government space**
- **The Package Integrity Test Plan must address:**
  - Potential materials degradation
  - Interconnect reliability
  - Thermal management
  - Resistance to processing stresses
  - Thermo-mechanical stresses
- **G12 Task Group established 01/13/10**

* MIL spec qualifying activity Defense Logistics Agency, Land and Maritime

Obsolescence and Counterfeit

- **For space systems, greatest risk for encountering counterfeit electronic parts is obsolescence**
  - Cost and schedule are also risks if oversight is poor
  - Ignorance is always a factor
- **Increasing pace of technology turnover combined with increased use of COTS for space and the decreasing supplier base means the obsolescence issue will continue to grow**
  - Even for “one off” science missions
- **Counterfeits evolve as our detection gets better**
- **Obsolescence control plans, counterfeit avoidance plans and training are *essential***

Global Supply Chain, Global Challenges

- **Recent events have highlighted the risks to electronic parts supply from the global market**
- **Source reduction is continuous and rapid: mergers, acquisitions and facility consolidations**
  - Many single source situations for combinations of quality levels, package styles and specific performance
- **Political and social unrest in the source country can introduce "new" challenges:**
  - Monitoring/auditing may be considered too dangerous
  - Supply may be impaired by collapse of infrastructure
- **Time changes, language barriers, laws and customs issues are always with us**
- **Success requires resources dedicated to maintenance of the global supply chain**

Parts Management for COTS “Boxes”

- **Growth in “commercial space” is making more Commercial-Off-The-Shelf (COTS) systems (boxes) available**
  - Star trackers, single-board computers, gyros, wheels
- **Available from world-wide sources**
- **Flight history claims require study**
- **Parts lists are guarded secrets**
- **Apparent “affordability” of these systems will increase their selection for government space**
- **How do we assure these systems will meet our needs?**
- **Perhaps they should be treated as “parts”, super hybrids maybe?**

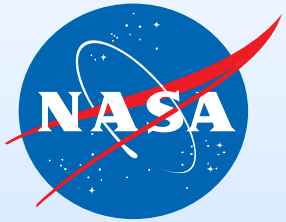
Commercial Crew

- **Commercial launch vehicles and crew capsules to put NASA and NASA-sponsored crews in orbit**
- **A "sea change" for NASA – breaking with 50 years of culture, painful lessons learned and corrective actions**
- **What constitutes "human rated"?**
- **Expectation is that commercial systems will be more affordable than NASA ones**
- **Dilemma:**
  - Will commercial still be more affordable if it has to meet current NASA requirements for human rating?
  - But if we relax them for commercial crew aren't we saying the requirements can be relaxed for NASA too?
  - Can we do that given our risk aversion based on our experiences from a long history of success and failure?
  - This precedent **will** encompass electronic parts selection and qualification AND if it's good enough for humans, then why not unmanned AND if NASA can do it, why not ESA?

Future Challenges

- **Who knows? BUT it will be:**
  - Smaller and lighter
  - More efficient
  - Faster
  - Changing continuously
  - Desirable BUT perhaps not space-worthy
  - And someone always expects it to be more affordable
- **And we need to be:**
  - Flexible and innovative
  - Open-minded
  - Willing to expand the definition of “part” as integration puts more system levels on a chip or in a package

Business as Usual – JUST EVEN MORE COMPLEX



http://nepp.nasa.gov

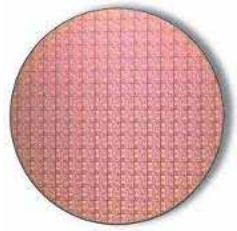
Retaining semiconductor manufacturing expertise and value chain

Carlos Lee
Director General
SEMI Europe, Brussels Office
clee@semi.org www.semi.org

About SEMI

Semiconductor Equipment and Materials International

- **Global** industry association
- **1800 Members**
- **Established in 1970** to serve the semiconductor supply chain
- Today serves members in the following industries
  - Semiconductor
  - Flat Panel Display
  - Photovoltaic/Energy
  - Nanotechnology
  - MEMS



Characteristics of the SEMI industry

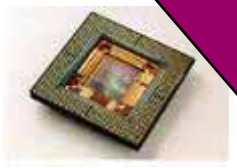
- Enabling technology
- Pervasive technology
- 2nd most R&D intensive
- Global industry
- SEMI (semiconductor equipment and materials international)
  - Industry association since 1970, 11 offices
  - 1800 members worldwide
  - 85% are SMEs (Small and Medium sized Enterprises)
  - SMEs drivers of innovation
- Strongly interlinked eco-system

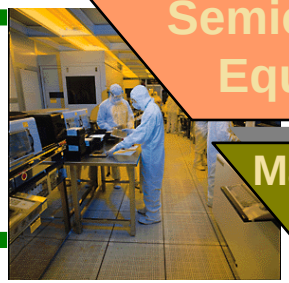
- **Strongly interconnected supply chain**
- **The fab is the lab & the lab is the fab**
- **SEMI members benefit of working closely with their customer and suppliers**

“… *in the long run R&D activities are likely to follow production to third countries*”

Source: Communication from the European Commission COM(2009) 512 "Preparing for our future: Developing a common strategy for key enabling technologies in the EU“

Semiconductors are the innovation enablers, also for aerospace, security and defence

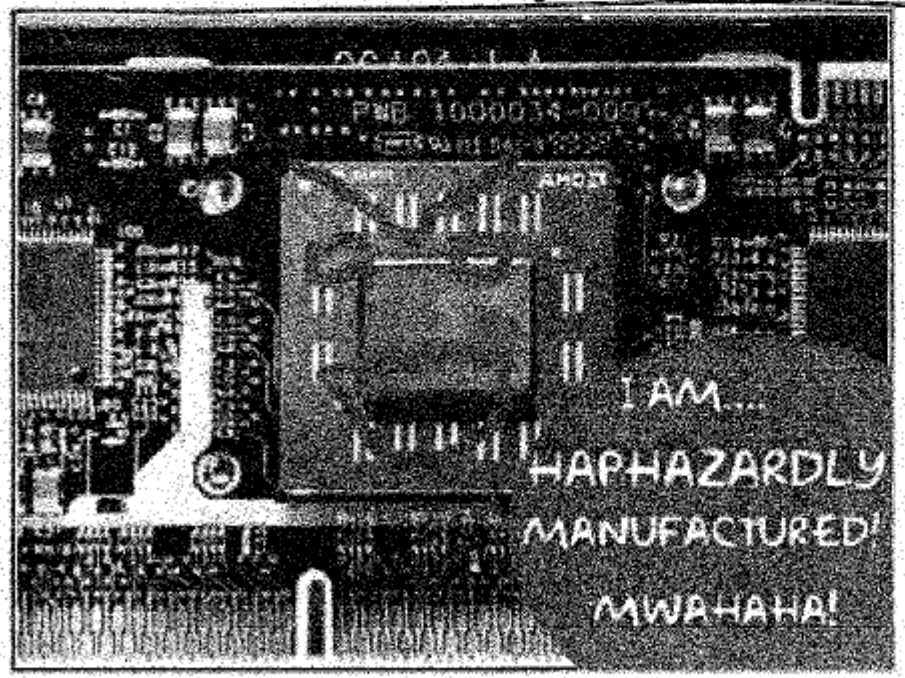




	Estimate 2007	Forecast 2009
Electronic End Equipment	$1,570B	$1,846B
Semiconductors	$256B	$296B
Semiconductor Equipment	$43B	$45B
Materials	$42B	$50B

SEMI® membership

Fake Electronic Components Cause Military Malfunctions, Possibly International Espionage



BusinessWeek reports that counterfeit hardware has been found to be the cause of several malfunctions in high-level military machinery. The phony infiltration has a distinct possibility of leading to espionage or sabotage. In other words, move over, [illegible]: you're not the biggest faker in town anymore.

Several crashes of military aircraft can be attributed to knockoff chips, but more insidiously, internal military data might be at risk. Melissa E. Hathaway, a head of cybersecurity at the FBI,

IN DEPTH October 2, 2008, 5:00PM EST

Dangerous Fakes

How counterfeit, defective computer components from China are getting into U.S. warplanes and ships

By Brian Grow, Chi-Chu Tschang, Cliff Edwards and Brian Burnsed

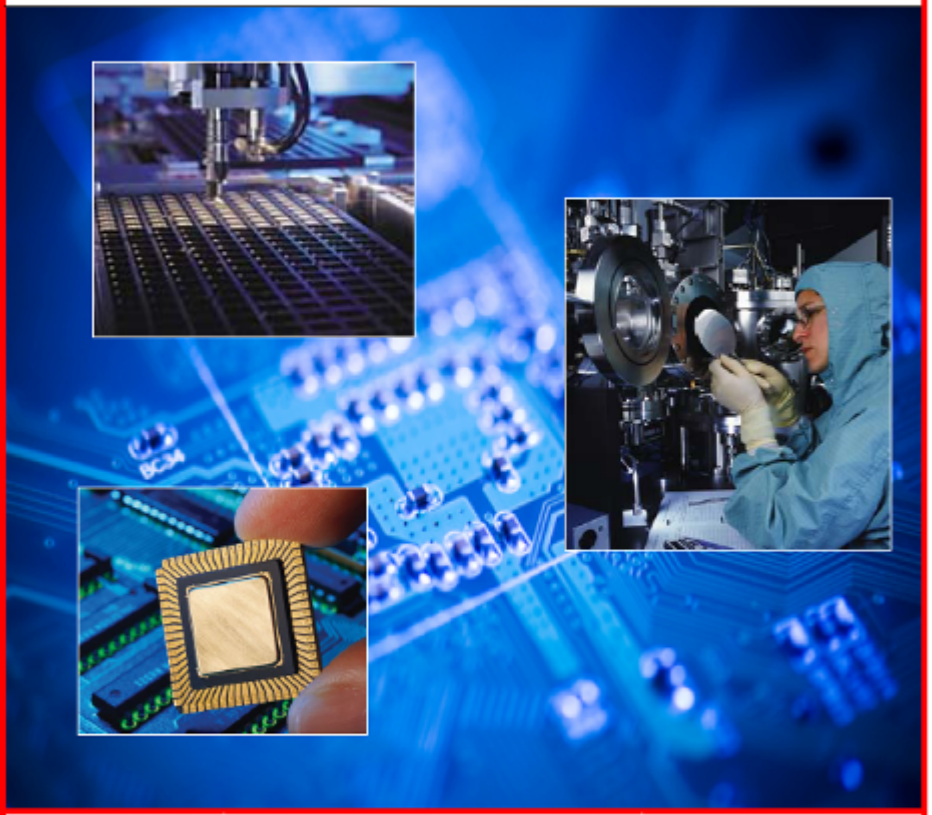
The American military faces a growing threat of potentially fatal equipment failure—and even foreign espionage—because of counterfeit computer components used in warplanes, ships, and communication networks. Fake microchips flow from unruly bazaars in rural China to dubious kitchen-table brokers in the U.S. and into complex weapons. Senior Pentagon officials publicly play down the danger, but government documents, as well as interviews with insiders, suggest possible connections between phony parts and breakdowns.

In November 2005, a confidential Pentagon-industry program that tracks counterfeits issued an alert that "BAE Systems experienced field failures," meaning military equipment malfunctions, which the large defense contractor traced to fake microchips. Chips are the tiny electronic circuits found in computers and other gear.

The alert from the Government-Industry Data Exchange Program (GIDEP), reviewed by *BusinessWeek* (MHP), said

Defense Industrial Base Assessment:

U.S. Integrated Circuit Design and Fabrication Capability



U.S. Department of Commerce
Bureau of Industry and Security
Office of Technology Evaluation

March 2009

DEFENSE INDUSTRIAL BASE ASSESSMENT: COUNTERFEIT ELECTRONICS

PREPARED BY

U.S. DEPARTMENT OF COMMERCE
BUREAU OF INDUSTRY AND SECURITY
OFFICE OF TECHNOLOGY EVALUATION

January 2010

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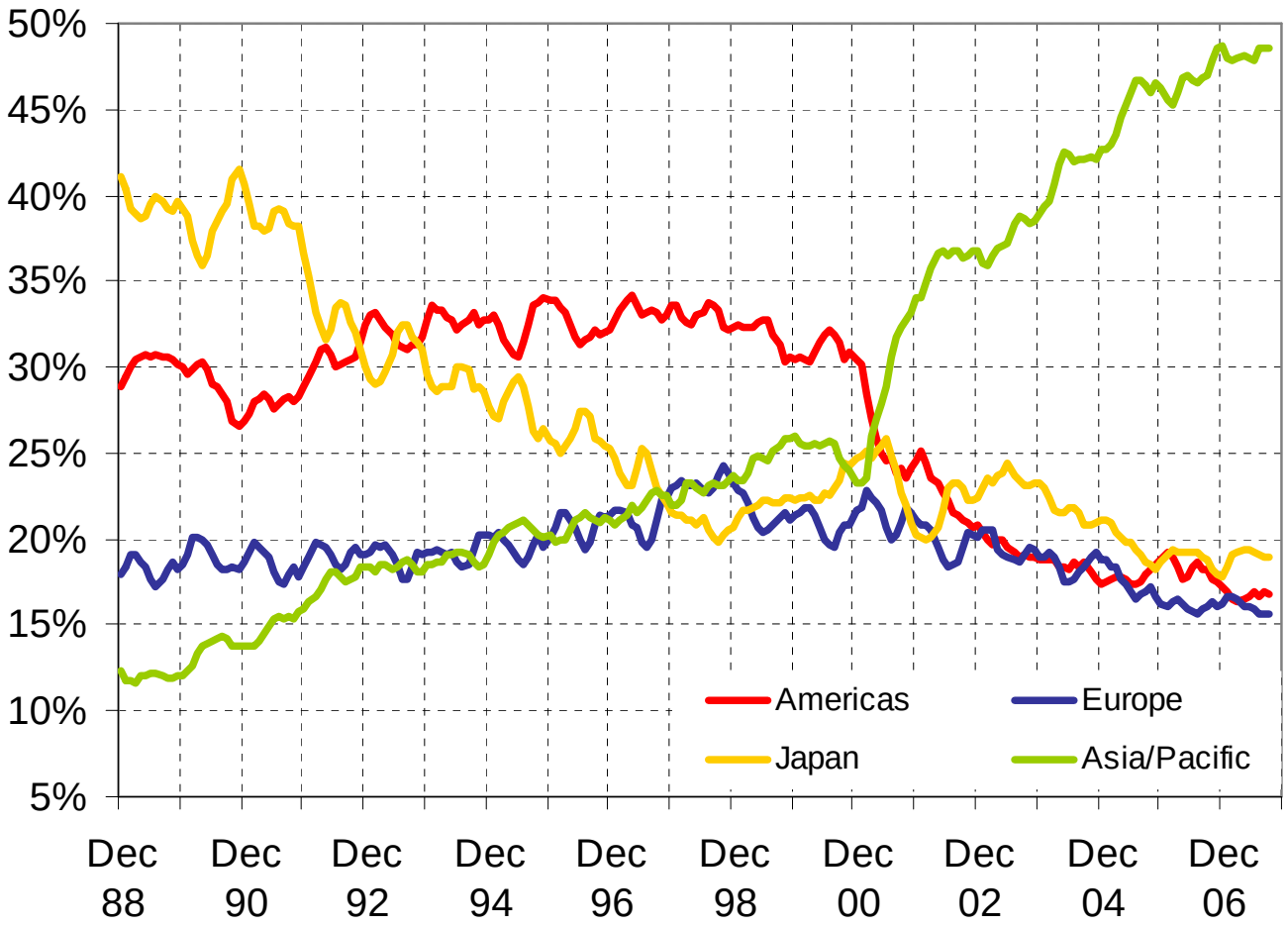
Email: bbotwin@bis.doc.gov
Fax: (202) 482-5361

For more information about the Bureau of Industry and Security, please visit:
http://www.bis.doc.gov/defenseindustrialbaseprograms/index.htm

Manufacturing delocalization trend due to strong incentives



Typical incentive package

National Microelectronics Institute

Chinese Incentive Program For Foreign Fabless Design

- Grants of up to $30m over 4 years
- 15% cap on Corporation Tax
  - Likely to be 0%
- Rent free premises for first 2 years
  - Negotiable for following 2 years
- Staff living expenses for 2 years
- 100% refund on personal income tax for up to 5 years
- "Improved access" to the Chinese market

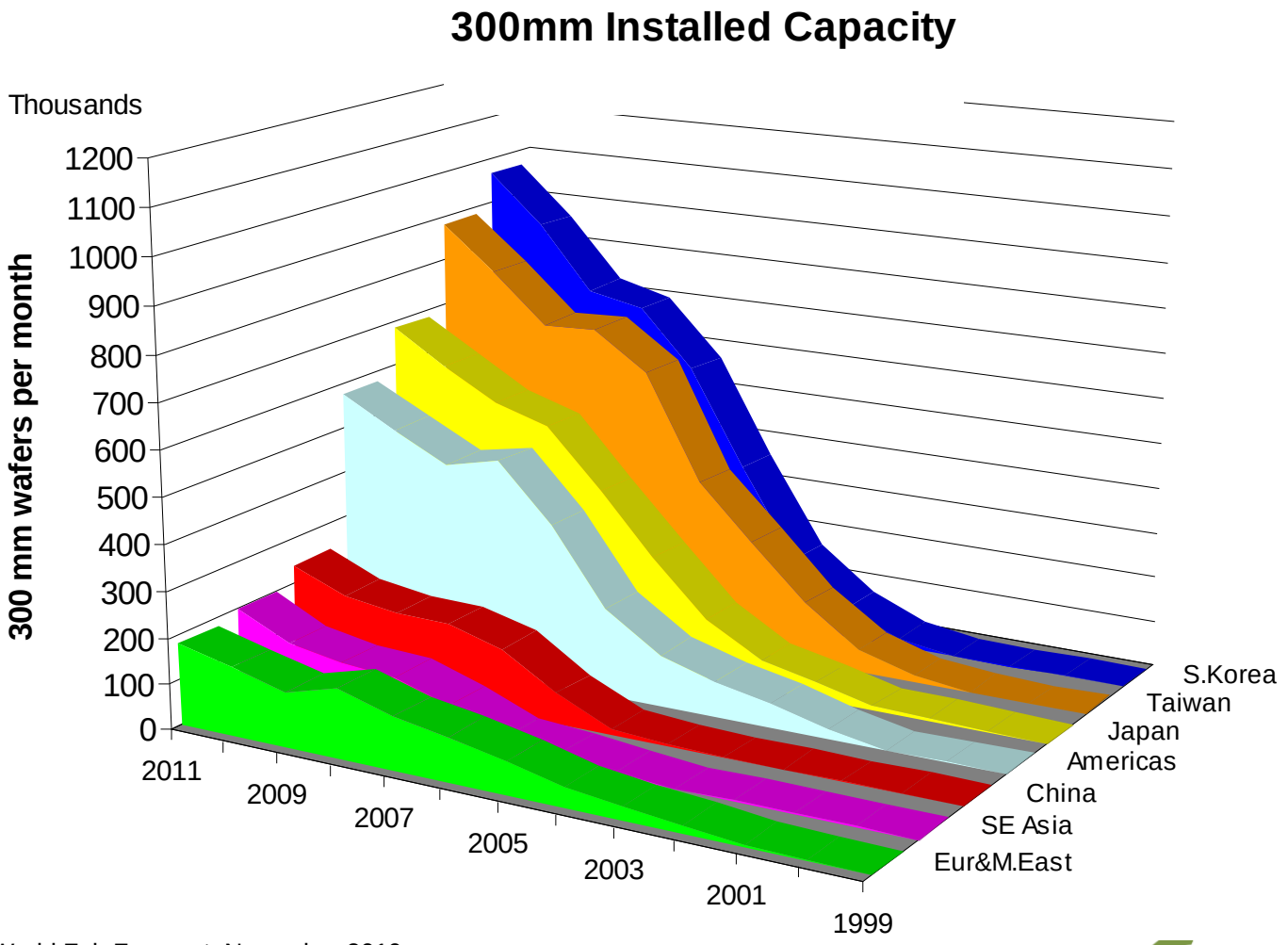
- Conditions
  - Set-up a design site in one of 6 Chinese cities
  - Work with SMIC as your fab

Typical Incentive Package Asia

(source A) (*name removed for confidentiality)*

- Land, building, facilities
  - Land for free
  - Loan for 20 /25 years covering Building Facilities investments, with free leasing up to 5 years
  - Land reserved for future expansion over next 10 years
- Low rates for public utility fee
  - Electricity, Water and Gas : Fixed rates for a period from 5 to 10 years:
  - Rates below 20% at least from Market Price
- Corporate Income Tax (CIT)
  - Years 1 to 10 : exemption between 50% and 100%
  - Years 11 to 20 : partial refunding
- Business Tax : From year 1 to year 5 : 100% of local retention of the business tax returned to the Company
- Individual Income Tax : From year 1 to year 5, at least 50% of local part refunded to the Company
- Local VAT rebate : From year 1 to year 5 : exemption up to 100%
- Subsidies for Environment protection : 10% of Investment deducted from CIT
- Subsidies for R&D : 150% of cost for development of new technologies, new products, deducted from CIT
- Cash subsidies for training, environment, interest for bank loan and others to support start up of the project
- Preferential conditions for operators housing
- Preferential conditions for new suppliers implementation
- Customs:
  - Free trade zone with preferential tax and duties exemption in certain location
  - Preferential conditions on importations
  - Clearance procedures simplified
- Commitment from the Authorities to provide at least a similar incentive package for further extension project

Global 300 mm Fab Capacity



Source: SEMI® World Fab Forecast, November 2010

"Power" Ranking of the 300mm Wafer Capacity Leaders (2010)

300mm "Power" Ranking	Company	Headquarters Region	300mm Capacity Rank for 2010	Capital Spending Rank for 2010	300mm "Power" Rating*
1	Samsung	Korea	1	1	2
2	Hynix	Korea	2	4	6
3	Intel	U.S.	3	3	6
4	TSMC	Taiwan	5	2	7
5	Toshiba/SanDisk	Japan/U.S.	4	6	10
6	Micron	U.S.	6	9	15
7	GlobalFoundries/AMD	U.S.	10	5	15
8	Nanya Technology	Taiwan	9	8	17
9	Elpida Memory	Japan	7	11	18
10	UMC	Taiwan	12	7	19
11	Renesas	Japan	14	13	27
12	Texas Instruments	U.S.	17	10	27
13	IBM	U.S.	13	15	28
14	ProMOS	Taiwan	11	19	30
15	SMIC	China	18	14	32
16	STMicroelectronics	Europe	20	12	32
17	Powerchip	Taiwan	8	26	34
18	Fujitsu	Japan	16	21	37
19	Winbond	Taiwan	15	25	40
20	Panasonic	Japan	19	22	41
	TOTAL	—	—	—	—

*Combined capacity and capital spending rankings (lower figure is best)

Source: Companies, IC Insights

Semiconductor Leaders

2010 Top 10 Semiconductor Sales Leaders ($M)

2010F Rank	2009 Rank	Company	Headquarters	2009 Total Semi	2010 Total Semi	10/09 % Change	Business Model
1	1	Intel	U.S.	32,325	40,154	24%	IDM
2	2	Samsung	South Korea	21,273	32,455	53%	IDM
3	6	TSMC	Taiwan	8,989	13,307	48%	Foundry
4	3	TI	U.S.	9,697	13,037	34%	Fab-lite
5	5	Toshiba	Japan	9,537	13,028	37%	Fab-lite
6	4	Renesas*	Japan	9,649	11,650	21%	Fab-lite
7	9	Hynix	South Korea	6,320	10,432	65%	IDM
8	7	ST	Europe	8,466	10,212	21%	Fab-lite
9	10	Micron	U.S.	5,450	9,057	66%	IDM
10	8	Qualcomm	U.S.	6,409	7,204	12%	Fabless

*The merged entity of Renesas and NEC

Source: IC Insights, company reports

2010 Major IC Foundries

2010 Major IC Foundries

2010 Rank	2009 Rank	Company	Foundry Type	Location	2008 Sales ($M)	2009 Sales ($M)	09/08 Sales (%)	2010 Sales ($M)	10/09 Sales (%)
1	1	TSMC	Pure-Pla	Taiwan	10,556	8,989	-15%	13,307	48%
2	2	UMC	Pure-Pla	Taiwan	3,070	2,815	-8%	3,965	41%
3	4	GlobalFoundries	Pure-Pla	U.S.	0	1,101	N/A	3,510	219%
4	5	SMIC	Pure-Pla	China	1,353	1,070	-21%	1,555	45%
5	6	Dongbu	Pure-Pla	South Korea	431	378	-12%	512	35%
6	9	TowerJazz	Pure-Pla	Europe	252	300	19%	509	70%
7	7	Vanguard	Pure-Pla	Taiwan	511	382	-25%	508	33%
8	8	IBM	IDM	U.S.	400	335	-16%	430	28%
9	10	Samsung	IDM	South Korea	340	290	-15%	420	45%
10	12	MagnaChip	IDM	South Korea	346	262	-24%	405	55%

Source: IC Insights, company reports

Wafer – Technology – Product

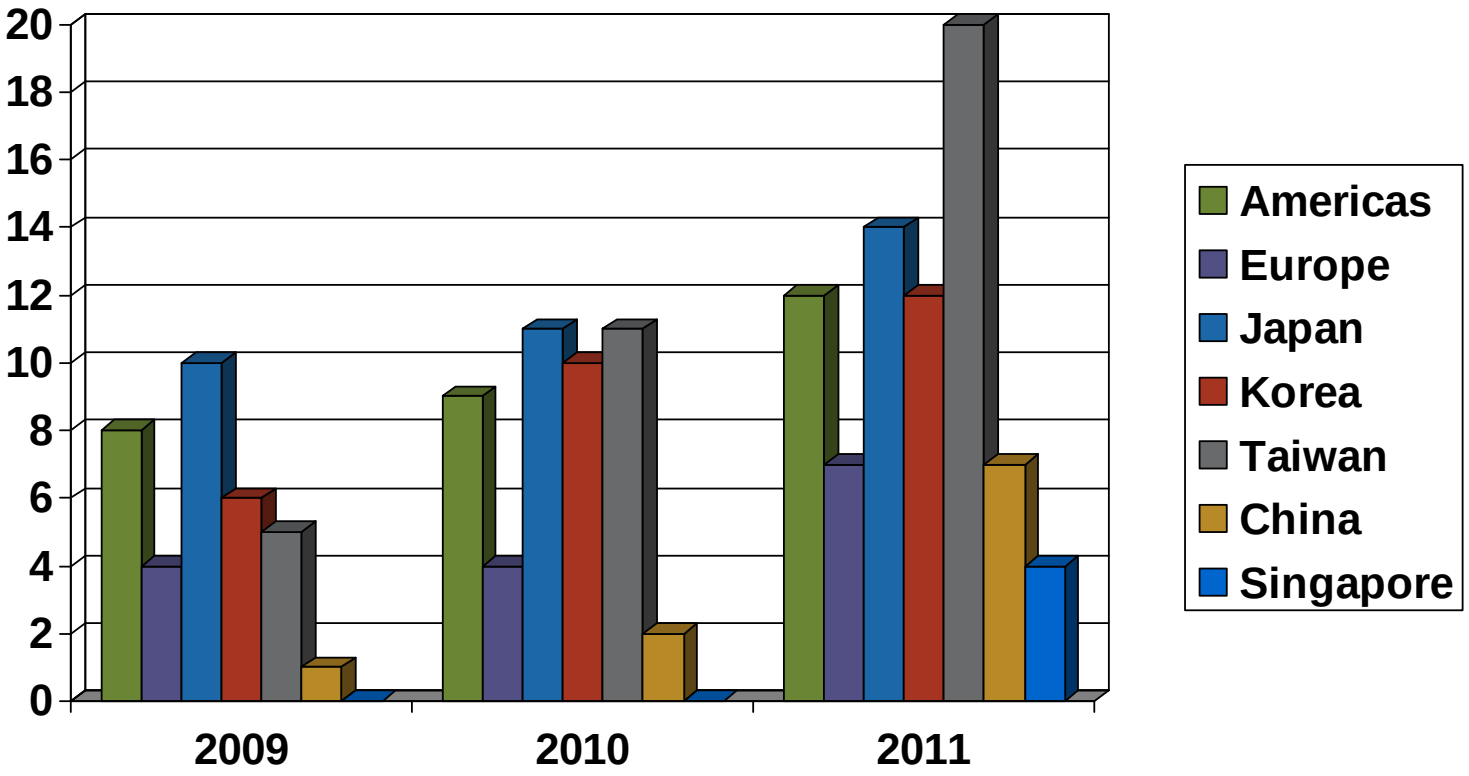
Source: Future Horizons

Wafer Size	Share
300mm	49.6%
200mm	34.9%
150mm	12.9%
125mm	2.2%
100mm	0.4%

Technology	Share
<60nm	30.9%
60-80nm	15.5%
80-120nm	10.5%
0.12-0.20um	15.5%
0.20-0.40um	10.8%
>0.40um	16.8%

Product	Share
Analog	9.1%
Memory	38.4%
Logic	12.7%
Micro	11.6%
Foundry	24.4%
Other	3.8%

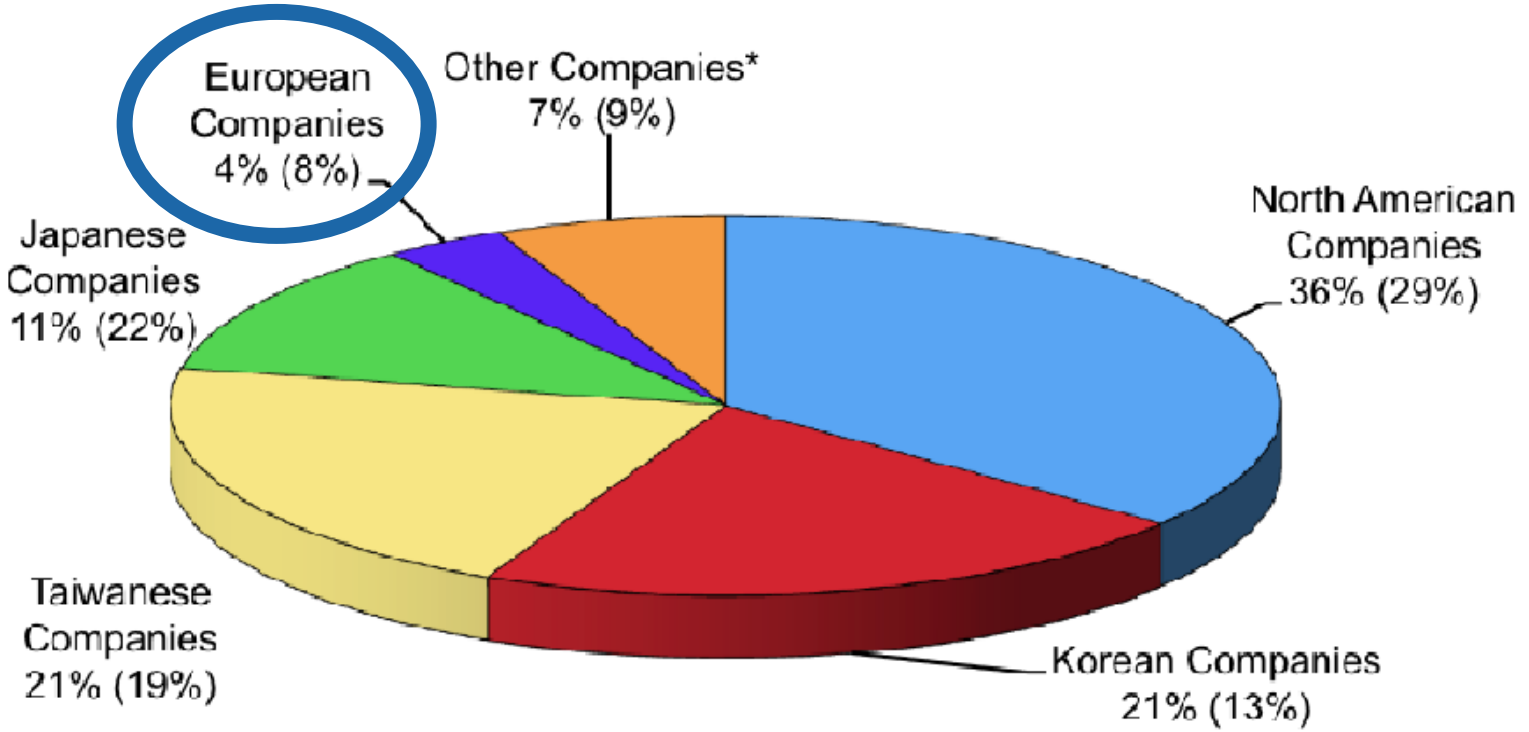
Fabs with 45 nm and below technology capability



Note: Covers production fabs with at least 10,000 wafers per month capacity

Source: SEMI World Fab Forecast, November 2010

2011 Forecast (2005) Share of Capital Spending



Source: IC Insights

( ) = 2005 Share

*Includes contract assembly and test houses

Further Considerations

- EU funding is far below other regions in the world(US), it does not look like we can afford funding several competitive projects.
- Europractice and support education in micro-electronics.
- Ensure smaller countries access to EU funding.

- Space industry is too small for IC manufacturers to be attractive by itself.
- But dual sourcing is welcome.
- ESA to help new entrants in getting up to speed in design rules for RadHard devices, ITAR/Export control regulations, …. for example via consulting?

The Fabless/Fab-Lite Extrapolation

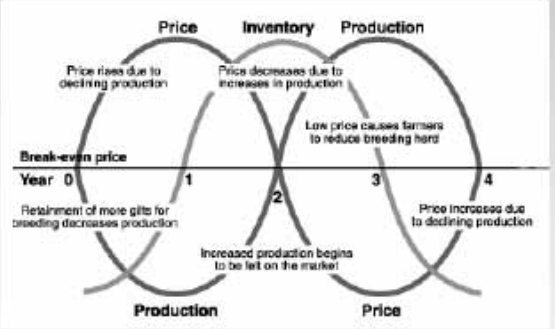
(PS … There's Not Much Choice At 45nm & Below)

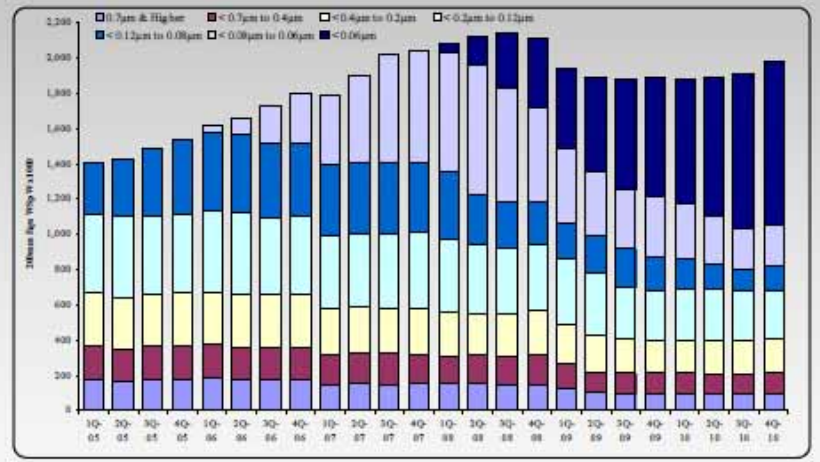
Industrial Fundamental #3 - Fab Capacity

IC Manufacturing Fundamentals … 4 Qtr Min. Lag From Decision To Impact

- Total Equipment Cap Ex = 85% Of The Total Cap Ex
- Wafer Fab Cap Ex = 70% Total Equipment Cap Ex
- Order Today = Wafer Fab Cap Ex One Quarter Later
- Wafer Fab Cap Ex = Additional Capacity Two Quarters Later
- Additional Capacity = IC Units Out One Quarter Later

Pig Cycles & Cobwebs … Due To Long Supply-Side Lead Times
(4 Months - Production / 2 Years - Fabs / 5+ Years - Design)

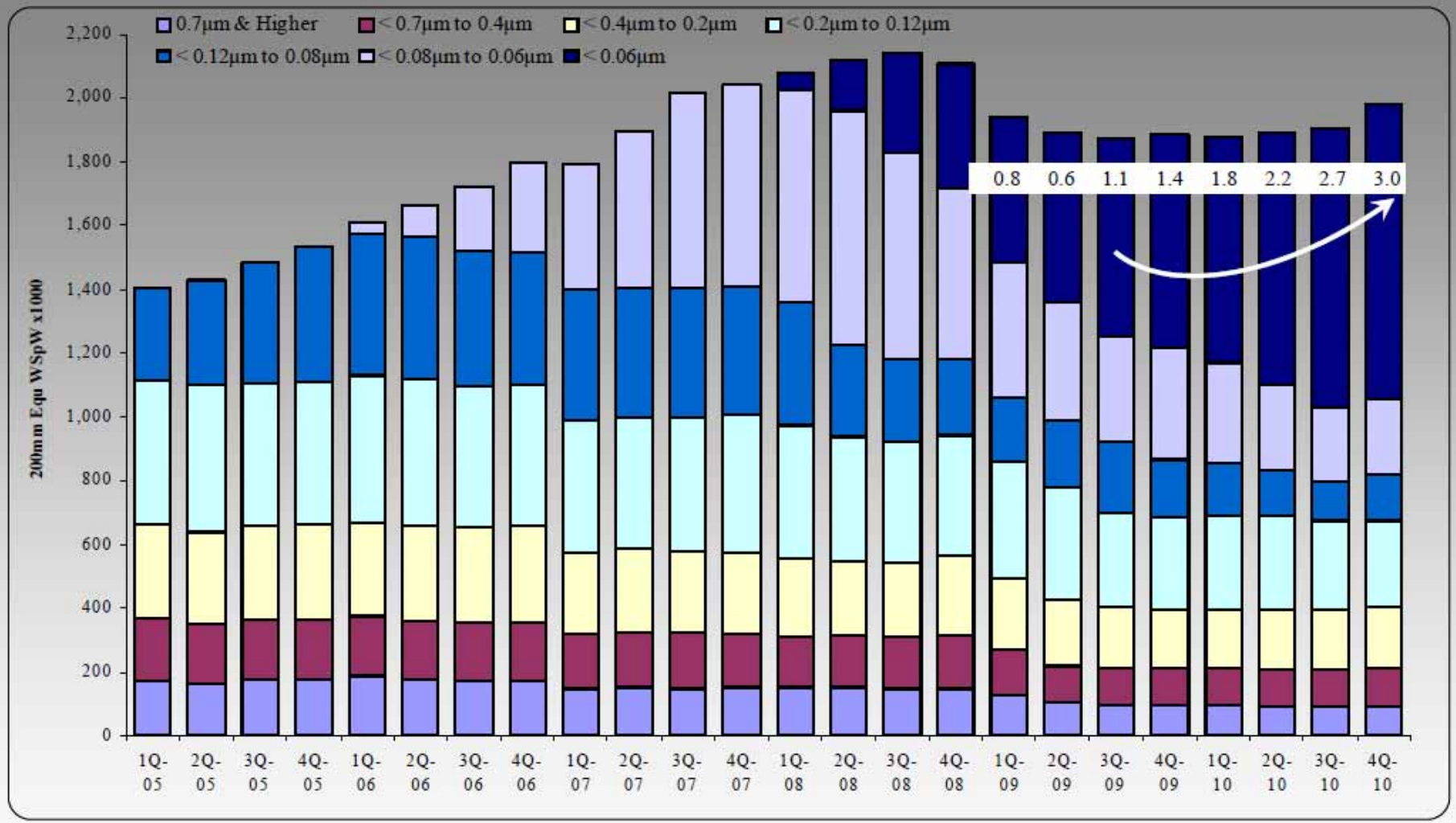




Fab Capacity Still Seriously Tight: Q4-10 Still Down 7.5% vs Q3-08 Peak
First Relief Q4-10 (From Q3/Q4-09's Spend) Following Six Flat Quarters

Source: SICAS/SEMI/Future Horizons

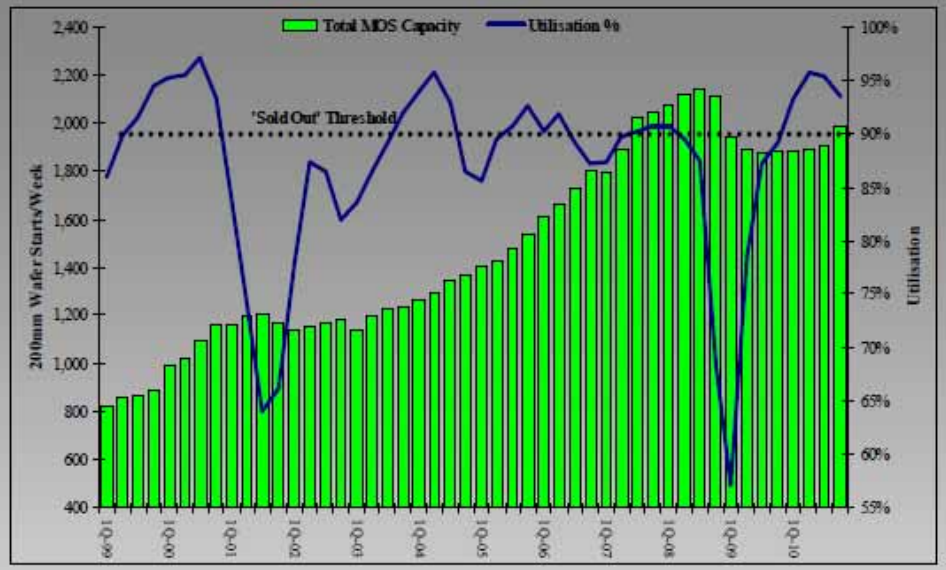
IC Wafer Fab Capacity

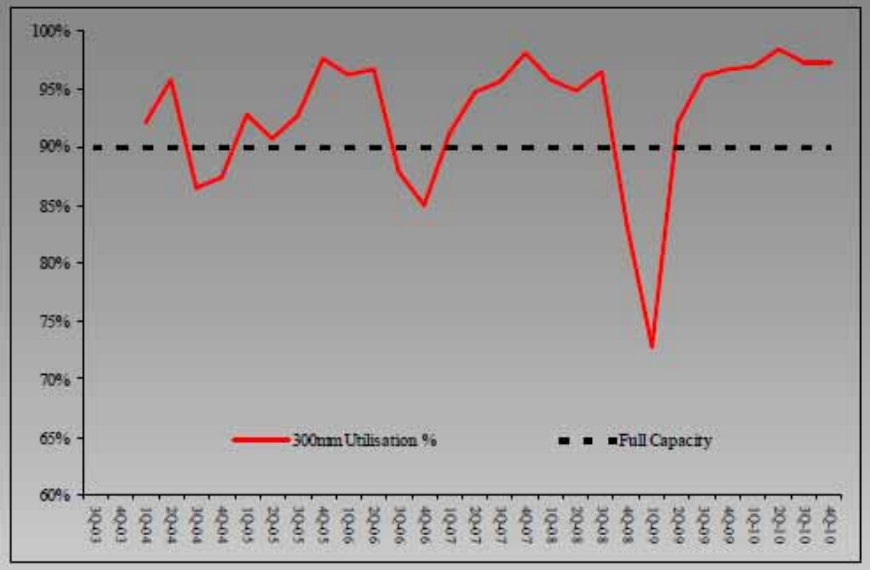


Q3/Q4-09 Spend = +80k ws/w In Q4-10

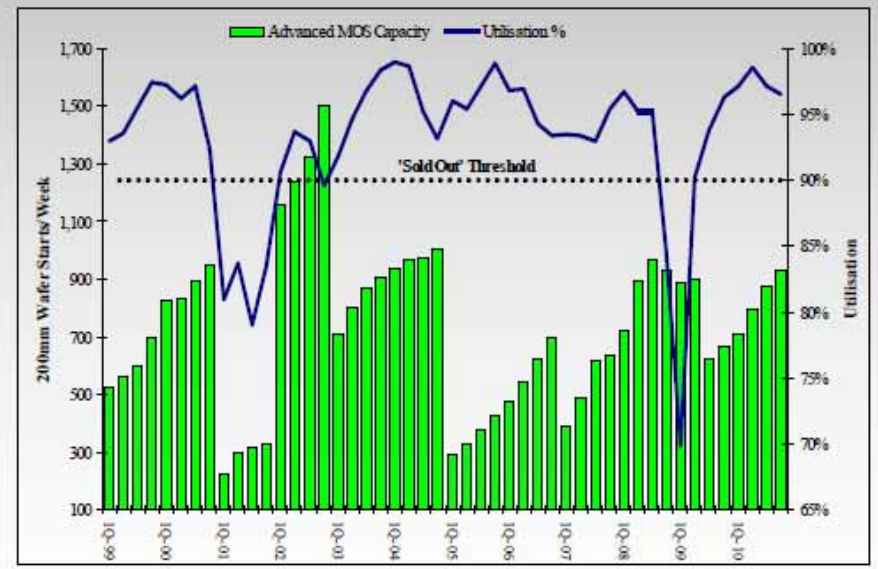
2010 Spend = ~400k ws/w Additional By Q4-11?

Units Are Up ... Fab Utilisation's Still High



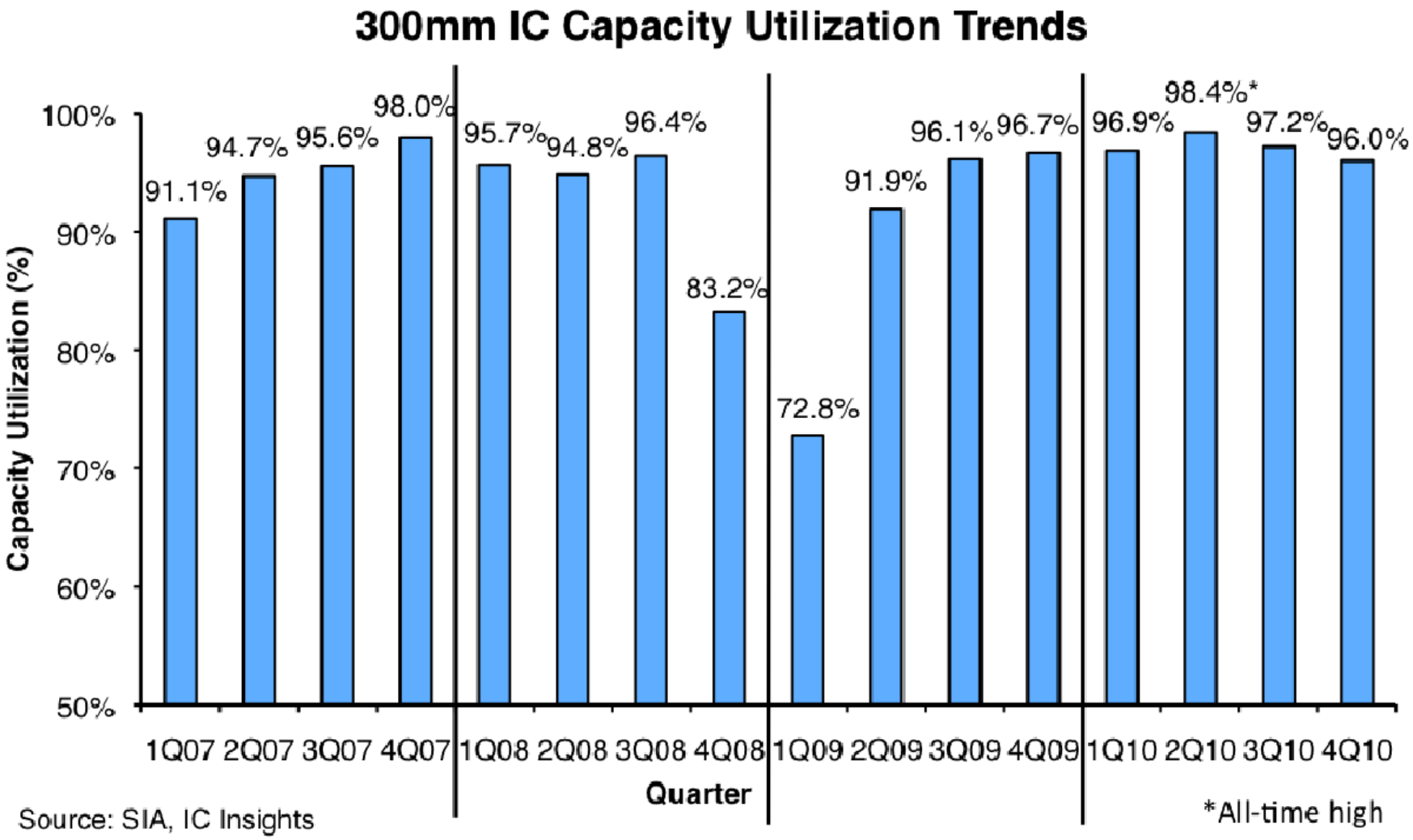


Quarter	IC Units (B)	Capacity (k ws/w)	Utilization (%)
Q4-07	39.9	2045	91%
Q4-08	34.0	2110	68%
Q4-09	42.4	1880	89%
Q4-10	46.6	1985	94%
Q4-11	52.0	~2400	~90%



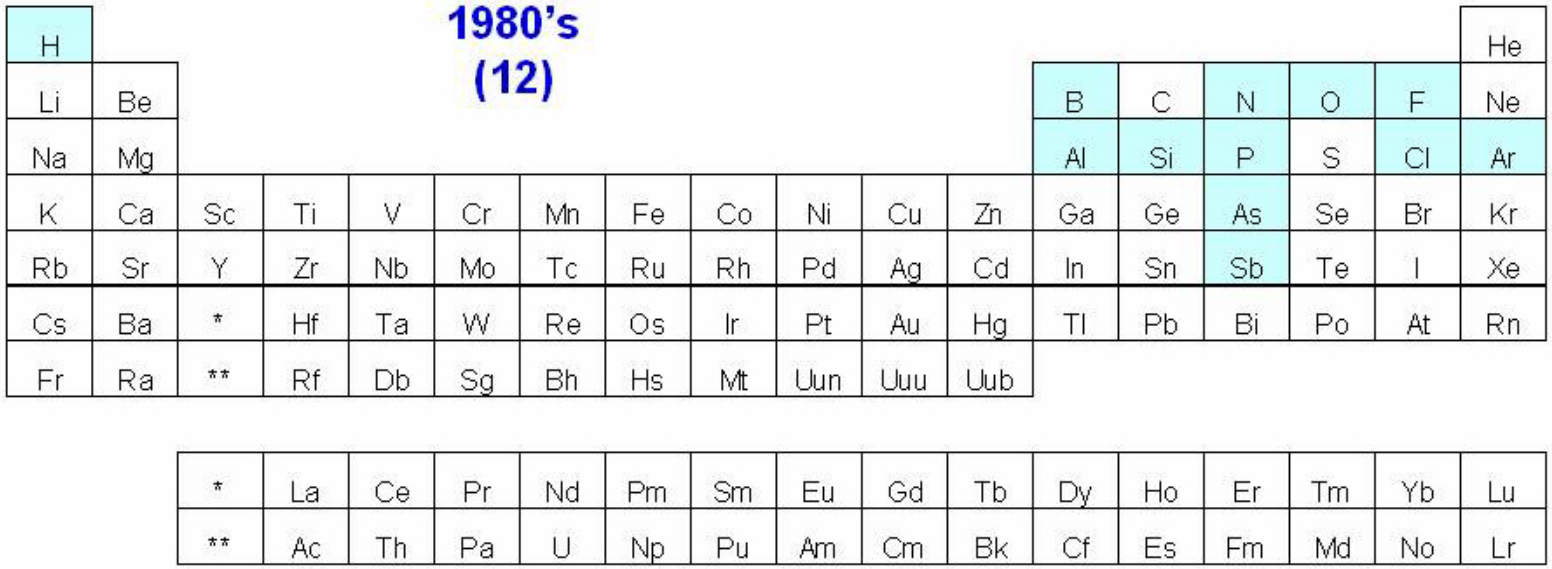
Source: WSTS/SEMI/SICAS/Future Horizons

Capacity Utilization Trends



Increasing Process Complexity

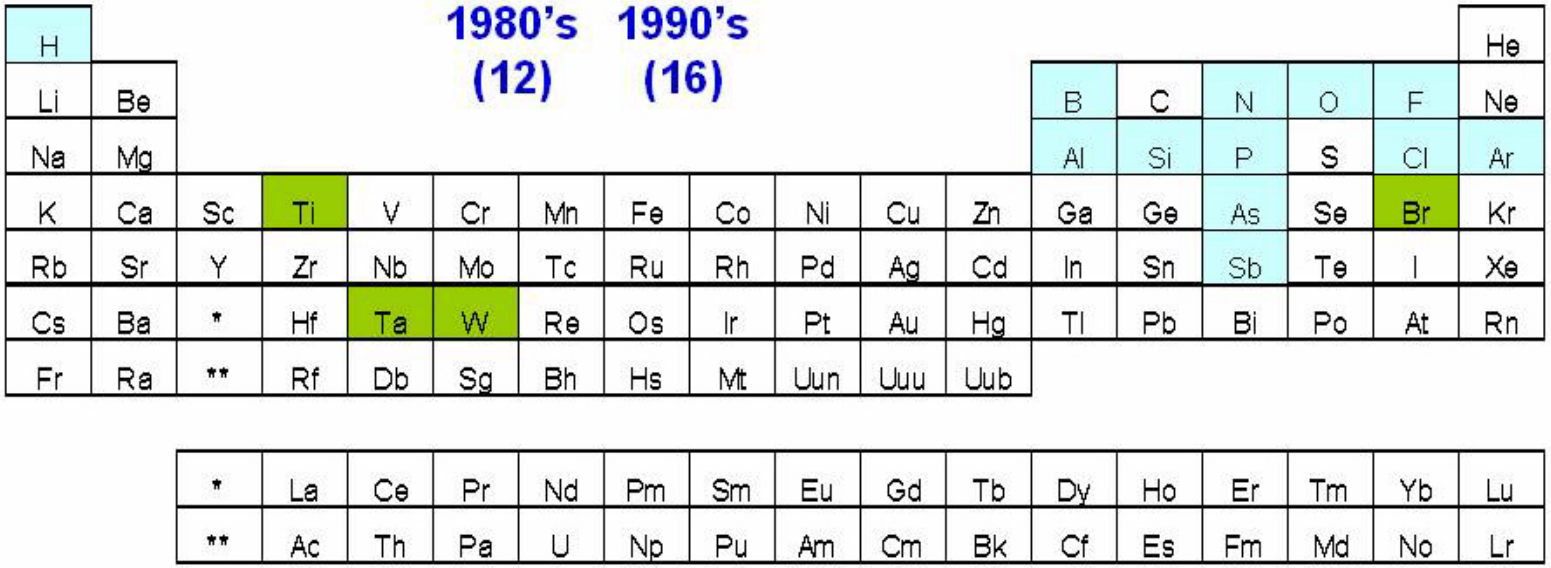
Elements Used for IC Fabrication



Source: Applied Materials, Intel IDF '03

Increasing Process Complexity

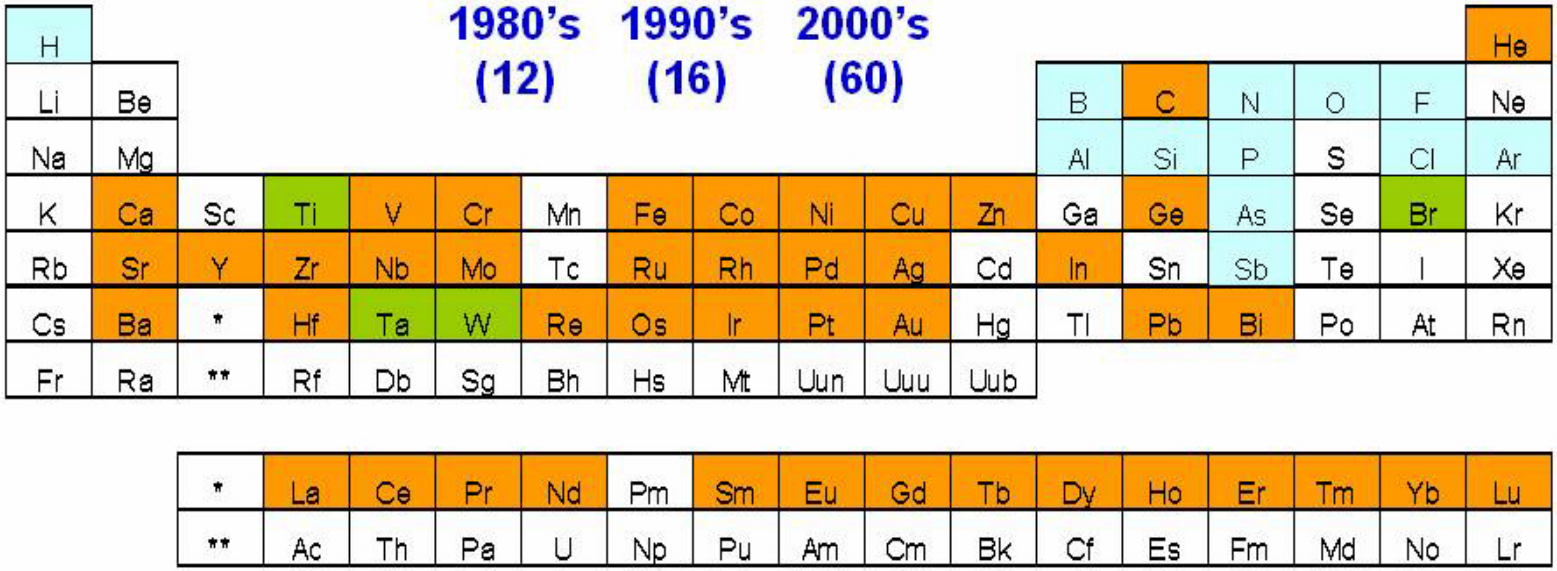
Elements Used for IC Fabrication



Source: Applied Materials, Intel IDF '03

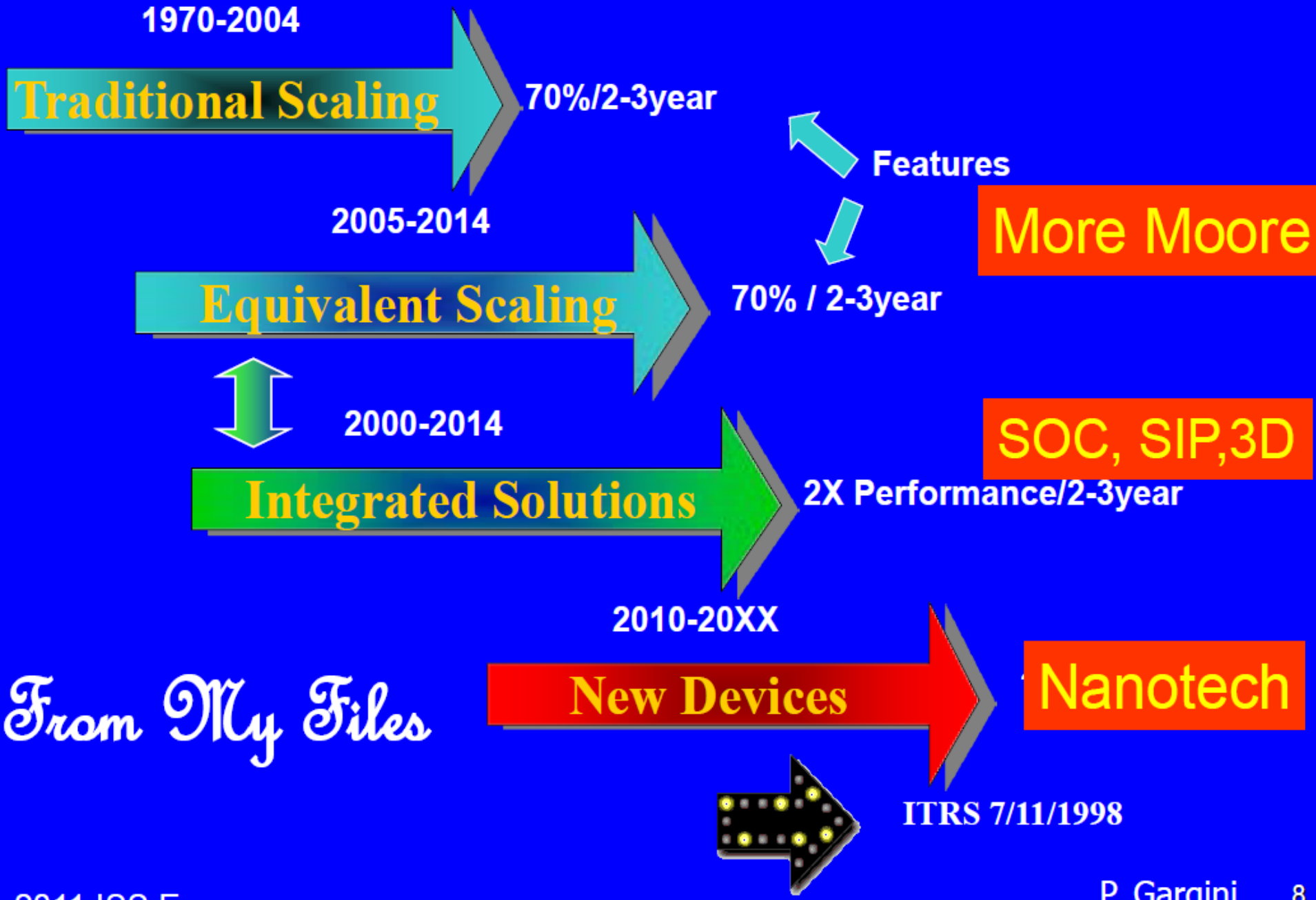
Increasing Process Complexity

Elements Used for IC Fabrication



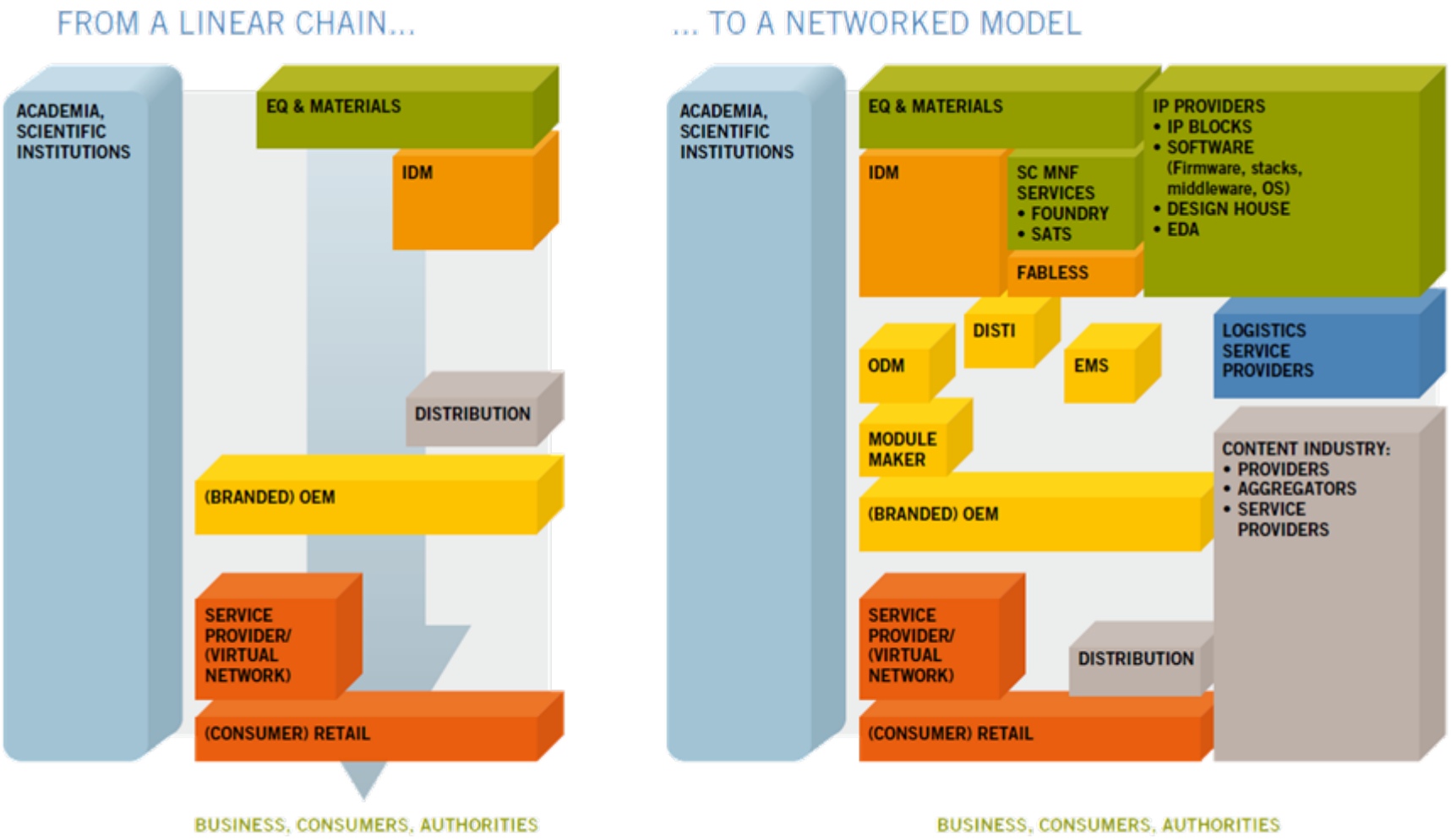
Source: Applied Materials, Intel IDF '03

CMOS Future Directions



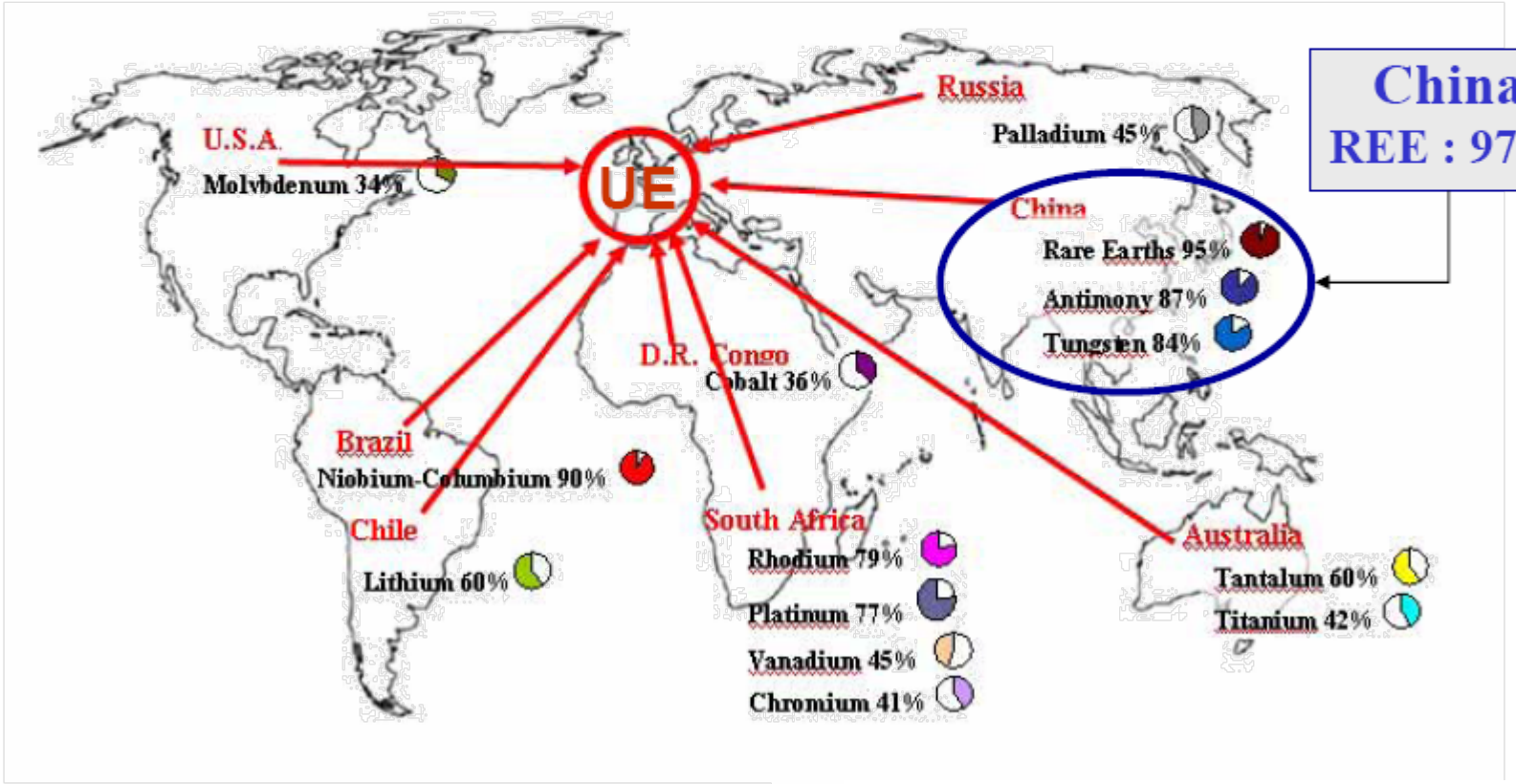
From My Files

Semiconductor landscape more complex



Rare Metals

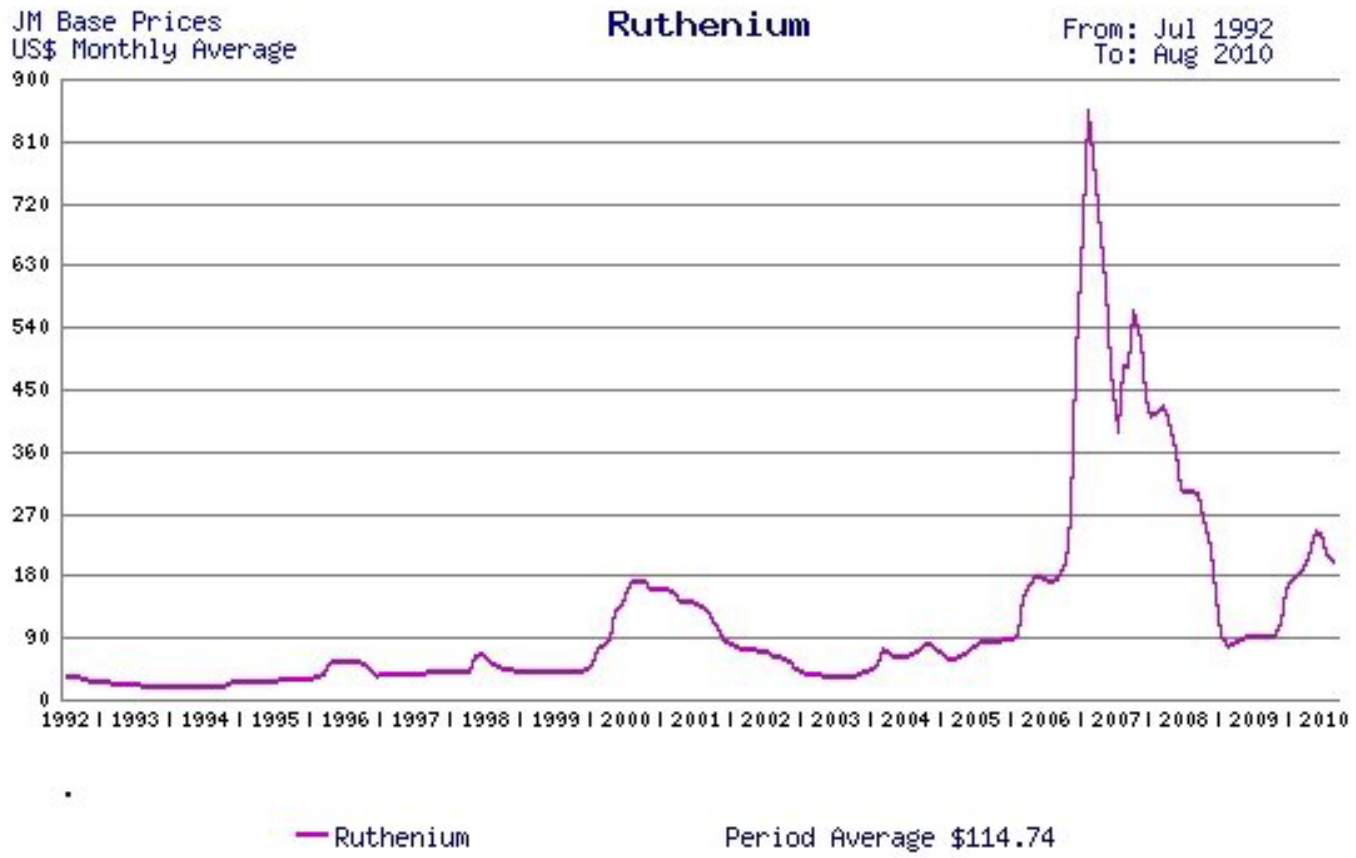
A strong UE importation dependancy &
Some countries with a monopolistic production



Christian Hocquard

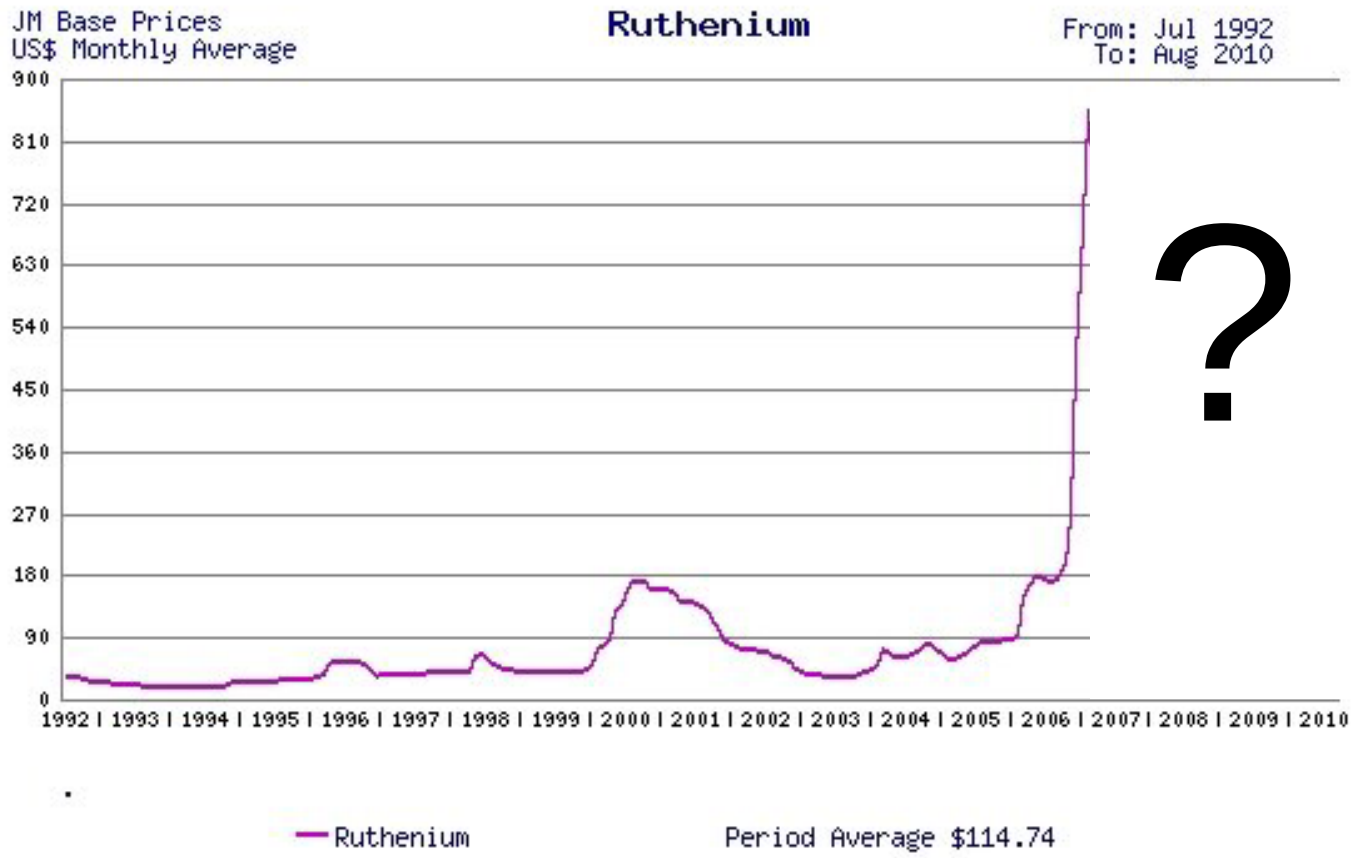
Ifri Energy Breakfast Rountable, May 20 th, 2010, Brussels

Raw Materials
Timely access at stable price



Example: Ruthenium, used in the semiconductor back-end of line for metallization, as well as applications in magnetic disc recording.

Raw Materials
Timely access at stable price



Example: Ruthenium, used in the semiconductor back-end of line for metallization, as well as applications in magnetic disc recording.

What impact of the European aerospace, security and defence markets?

- Access to key technologies
  - Origin?
  - Time?
  - Cost?
  - Quality control?
  - Content control?

- For security and defence: Trust cannot be added to integrated circuits after fabrication

Aerospace requirements of semiconductors / avionics

- Sensors and Actuators
- Radars
- Electric Brakes
- Oil and Fuel Pumps
- Landing Gears and Flaps
- General Energy Consumption Reduction

➔ For which elements is it critical to retain expertise in Europe?

A European issue

- Affects all European countries
- Affects many key sectors for Europe (automotive, telecom, medical equipment, industrial machinery, photovoltaic, military, …)

- **Issue needs to be addressed by all stakeholders**

Opportunities for Advanced Wafer Manufacturing in Europe

- **Expand our Leadership in R&D**
  - World-Class industrial Institutes (Fraunhofer, IMEC, LETI…)
  - High census of PhD's in process development & design
  - High level of R&D efforts from IDM's and equipment/materials sector
  - Significant funding support from National & EU Authorities
- **Clustering**
  - Regional Excellence Centers in R&D, Design & Manufacturing with proximity of Suppliers and Application Centers
- **Market**
  - European leadership in strategic markets where IC's are providing innovation (Medical, Power, Automotive, Environment ect)
  - European Leadership in the Equipment, Materials and Design areas.
- **Human Resources**
  - Undisputed technical expertise, stability & engagement

SEMI White Paper

Release October 2008, available on
www.semi.org/europewhitepaper

SEMI® WHITE PAPER

6 Recommendations to the European Union and National Governments to Increase Europe's Microelectronic Industry Competitiveness

SEMI White Paper

www.semi.org/europewhitepaper

6 Recommendations to the European Union and National Governments to Increase Europe's Microelectronic Industry Competitiveness

1. Develop a European Vision for the Industry
2. Increase Funding for R&D and Manufacturing
3. Promote the Microelectronics Supply Chain
4. Cultivate Education and Welcome Talent
5. Protect and Enforce Intellectual Property
6. Involve SEMI Europe in New EHS Legislation

European Commission
Key Enabling Technologies

http://ec.europa.eu/enterprise/sectors/ict/key_technologies

- High Level Group established July 2010
- Interim report completed Feb 2011
- Final report scheduled for July 2011

Theme supported by many stakeholders! 24 May 2011 - www.semi.org/BrusselsForum

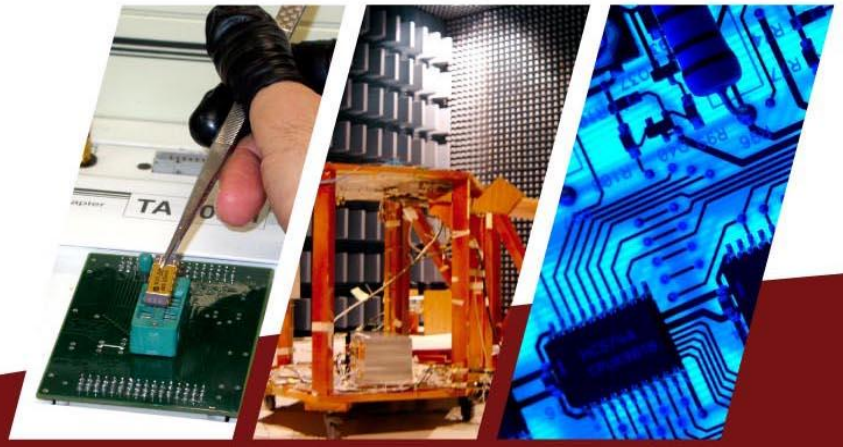
Confirmed Partners

Summary

- A critical issue
- Concern of dependency
- Affects entire supply chain
- A European issue, question of regional security!
- Opportunity to cooperate
- SEMI looking forward to continue the dialogue

ESCCON 2011

ALTER
TECHNOLOGY GROUP



Specialised and Advanced Parts Procurement Services

EUROPEAN SPACE COMPONENTS CONFERENCE
17th March
ESA, ESTEC, Noordwijk, The Netherlands

TOPICS

- EEE Components for Space
  - The market
  - Background
  - Challenges
- Parts Procurement Concept.
- Specialized & Advanced Parts Procurement

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GLOBAL MARKET

Small Geo. Courtesy: ESA

- Use of standard industry practices are being imposed.
- Recurrent equipment and projects.
- New challenges and needs define a new and specialised approach.

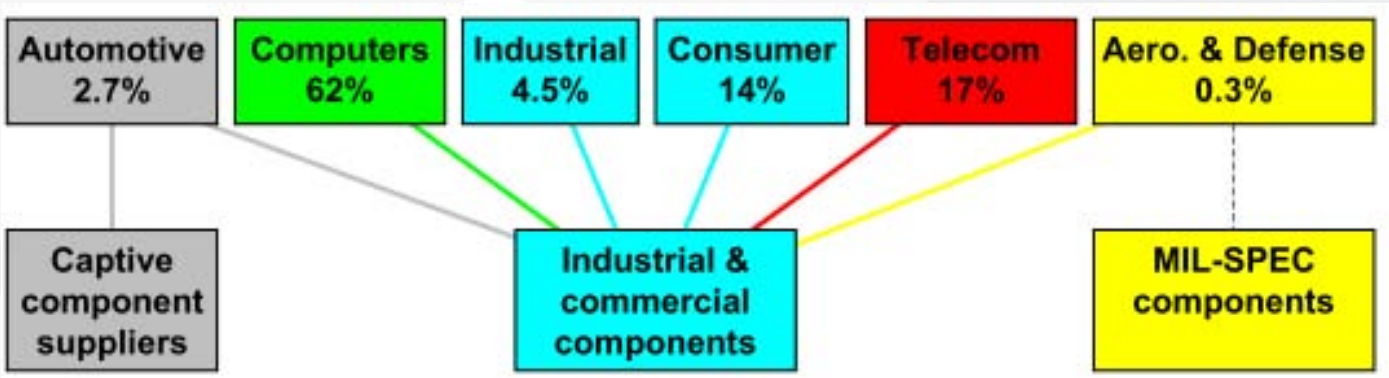
- Driven by competition, pressure on prices reaches all links in the supply chain.
- Customer demand push up on performance requirements.

ATV. Courtesy: ESA

HTV. Courtesy JAXA/NASA

BACKGROUND

- Operators and scientific community are requiring higher performance systems.
- Global market demands more services with lower prices while keeping or increasing overall reliability figures.
- The use of state of the art technologies is needed.
- In the past most of the EEE parts for Space were specifically produced with specific processes. It is not the case currently!
- Space market is not a significant player in the global demand for EEE components.

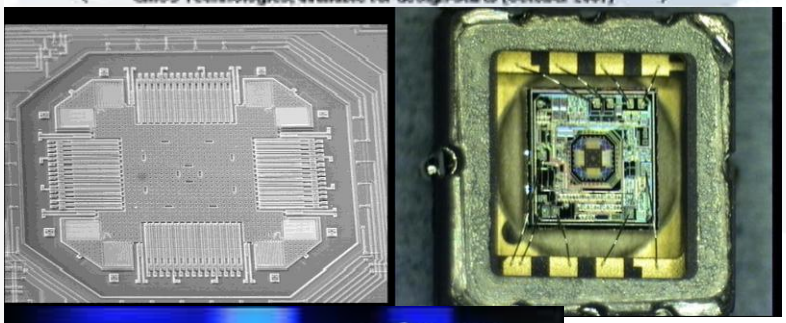


NDIA Paper, Lloyd Condra, Convenor, IECQ-CMC Avionics Working Group. Year 2000 data.

CHALLENGES – TO OVERCOME

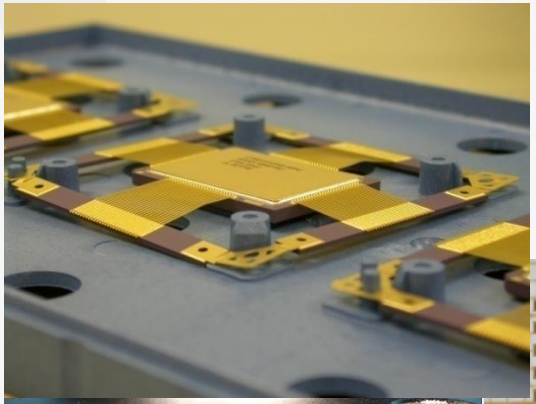
- Product availability of high reliability parts is becoming an issue in space projects since:
  - Market requires shorter lead times.
  - Space level products storage is not always economically feasible.
  - Export regulations prevent generation of strategic stocks.
  - State of the art technologies and functions are not qualified for space on time.
- New projects separated from classical approach are demanding low cost practices.

CHALLENGES – TECHNOLOGIES



- Mass market demands impose continuous improvement in performance and cost.
- Technology evolution and short life time cycles prevent long space evaluation and qualification flows.
- Newer technologies may exhibit new failures mechanisms.
- Some important families of products are not manufactured following space rules but are needed:
  - Optoelectronics
  - MEMS
  - Nanotechnology

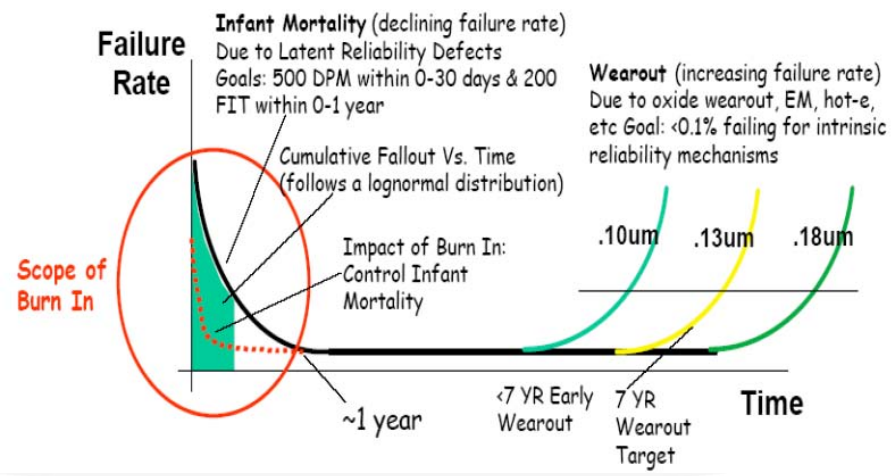
CHALLENGES – MANUFACTURERS



- EEE Parts manufacturers must be involved in space needs.
- Investment on new parts and technologies are needed.
- Growing opportunities in partnership with enhanced relationships.
- Approaching space needs from a global point of view.
- Proper communication channels must be established.

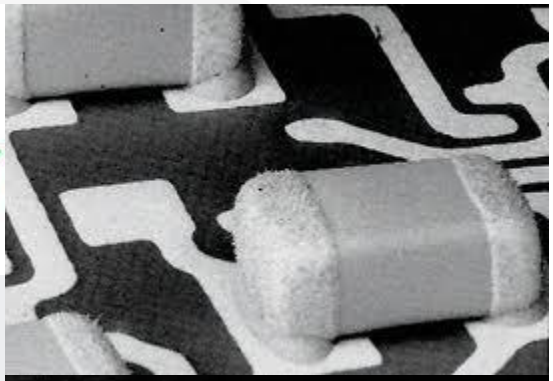
CHALLENGES – COTS

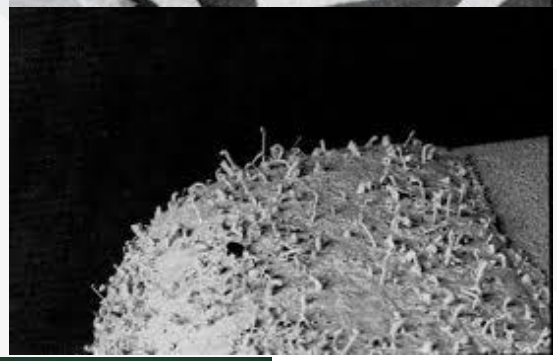
- Required for new technologies, not available at space level yet.
- The use of COTS parts has inherent risks due to lack of experience and new concerns (RoHS, counterfeit, etc.).
- A key factor is the identification of reliability concerns based on space environment and needs.
- Deep technological knowledge and manufacturer involvement is required to evaluate the risk.



ENHANCES THE NEEDS OF A SPECIFIC APPROACH AND EXPERIENCE CUMMULATION

CHALLENGES – RoHS





- Mass production tries to adapt the most used approach avoiding singularities.
- RoHS provides a common playground for commercial productions but damages space needs.
- Not only COTS are concerned about RoHS.
- RoHS is not only tin whiskers:
  - Long terms storage conditions for new terminations.
  - Modification of PCB population and manufacturing process.
- Assessment of different mitigation techniques are required:
  - Conformal coating.
  - Annealing.
  - Others.

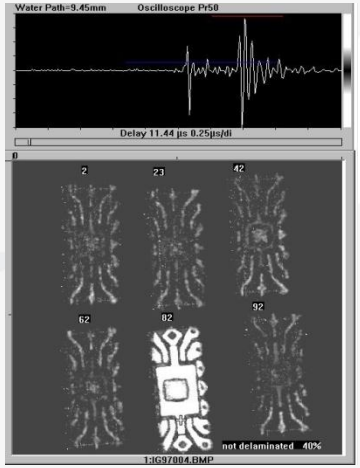
CHALLENGIES – COUNTERFEIT

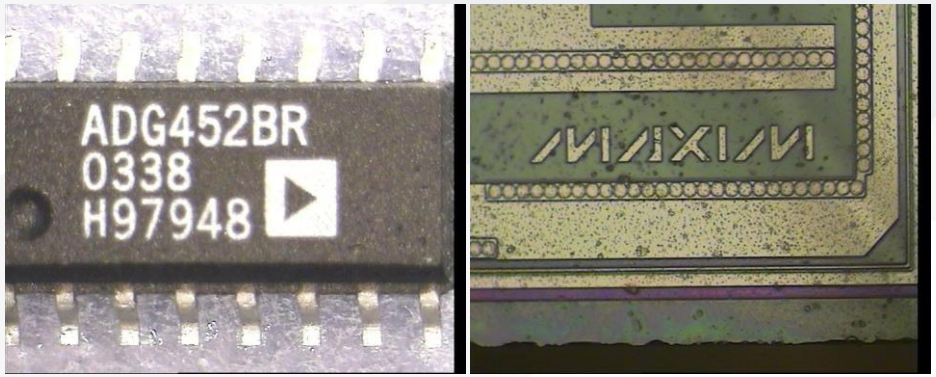
- The use of non qualified and specialized procurement channels may lead to increase the problems derived from counterfeits

- Counterfeit problems are well known at industrial levels and increasingly affecting high reliability markets.

- Proactive approach and detection techniques can save enormous amounts of time and money.

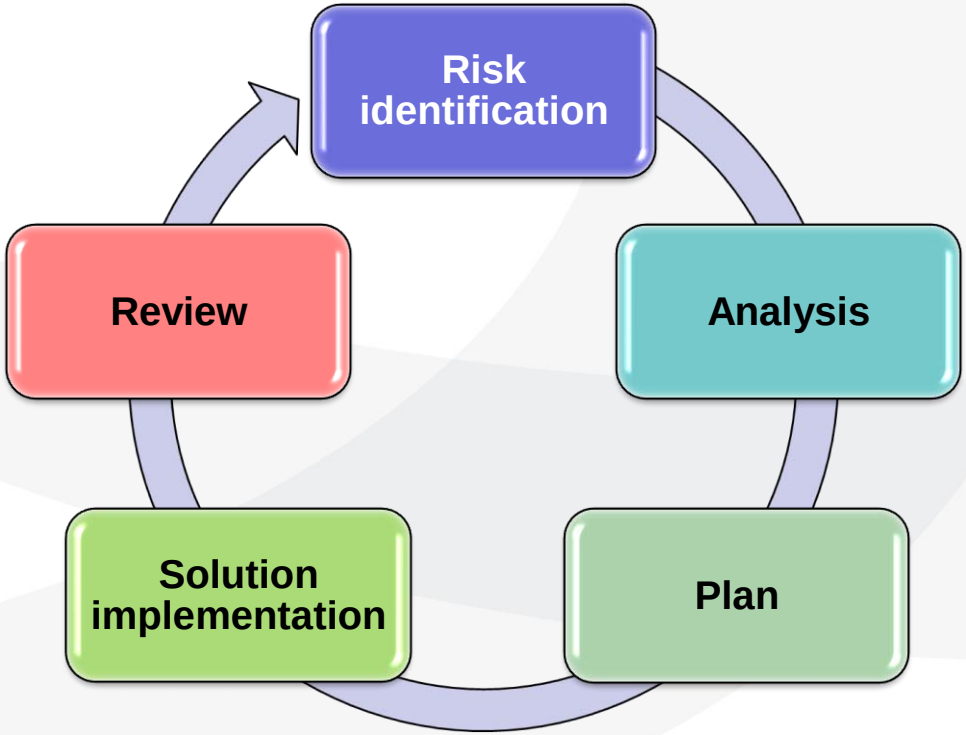
Different Plastic (CSAM)





OTHER CHALLENGES

- Space industry must respond to concerns not previously addressed.
- Risk management tools and proactive problem anticipation techniques are mandatory.
- Active monitoring and obsolescence mitigation techniques, allowing re-use of cumulated data are required.
- The use of specialised channels provides a dedicated approach tailored for space needs.



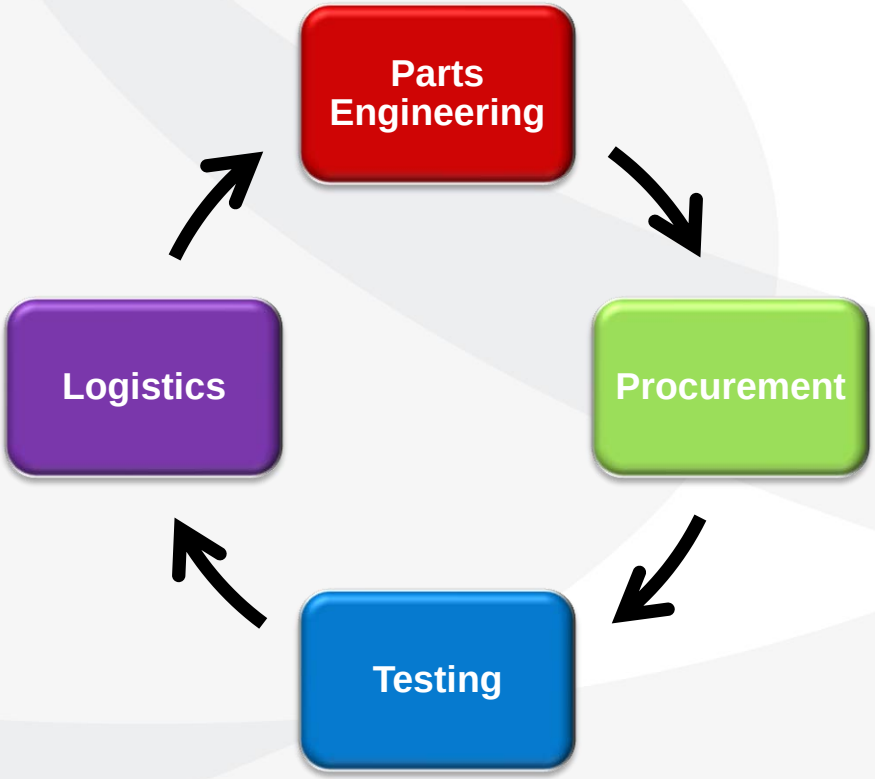
EEE PARTS CHALLENGES

- Space environment presents unique concerns not addressed by mass market industry.
  - Lead time. Definition of schedule critical item (SCI).
  - Lot validation failure. What happens if a SCI fails during lot validation?
  - Radiation performance. Can we wait until complete characterization?
  - Export restrictions. Jurisdiction modification during procurement.
  - Production shortages. Can we anticipate problems?
  - Inability to meet project quality requirements. Which are my alternatives?
- EEE parts are in the critical path of the satellite manufacturing.
- Failures on a simple component can lead to lose the complete mission.

TOPICS

- EEE Components for Space
  - The market
  - Background
  - Challenges
- **Parts Procurement Concept.**
- Specialized and Advanced Parts Procurement

PARTS PROCUREMENT



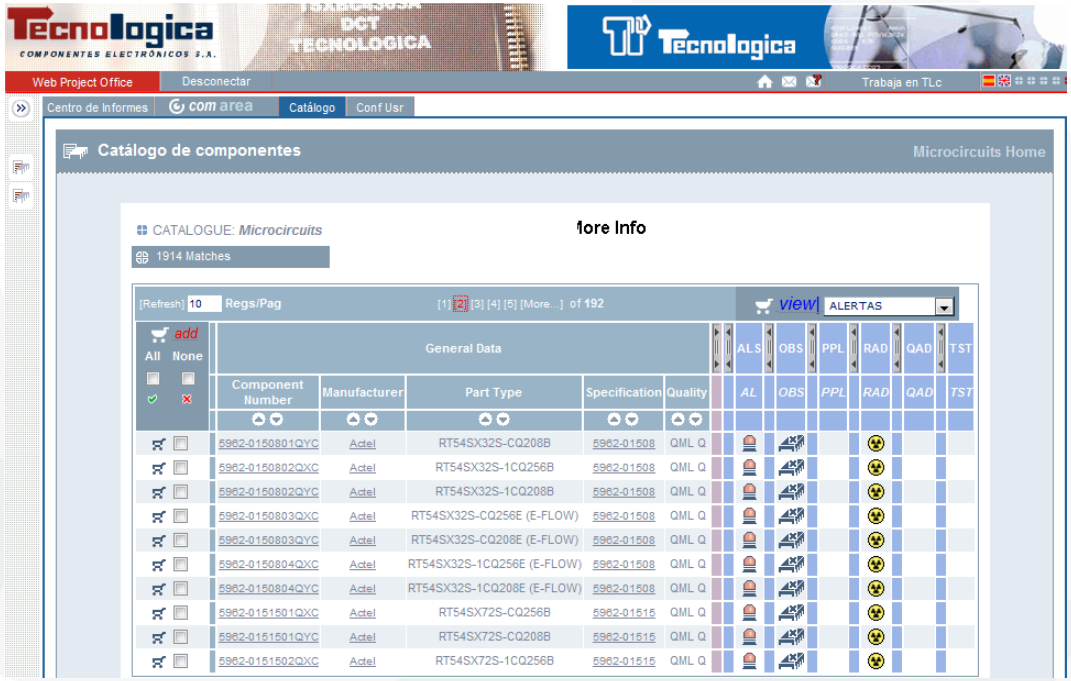
- EEE parts are the foundations of a satellite.
- Parts Engineering and Testing is providing the right tools to the proper selection and subsequent use of EEE parts.
- Parts procurement and testing companies / organizations are giving solutions to the problems derived from the new industrial environment.
- EEE Parts product assurance, requirements understanding and specific services are key factors in the project success.

PROCUREMENT AS A COMPLETE CYCLE ACTIVITY

Parts Engineering	Parts and suppliers identification, definition and selection. obsolescence	DCL complete analysis Specific project analysis Identification of most appropriate scheme
Procurement	PO Placement Logistics and Follow-up ITAR Management	Selection of procurement scheme Active manufacturing monitoring Export licence control
Testing	Incoming Inspection Testing implementation DPA, RVT, SEE, Screening, etc	Preparation of testing plans and documentation Complete characterization and verification Lot validation (RVT, LVT, specific testing)
Logistics	Parts delivery Non conformance Management Kitting, storage, relifing,	Long term storage Active mitigation management Specific logistic flow

PRODUCT SELECTION

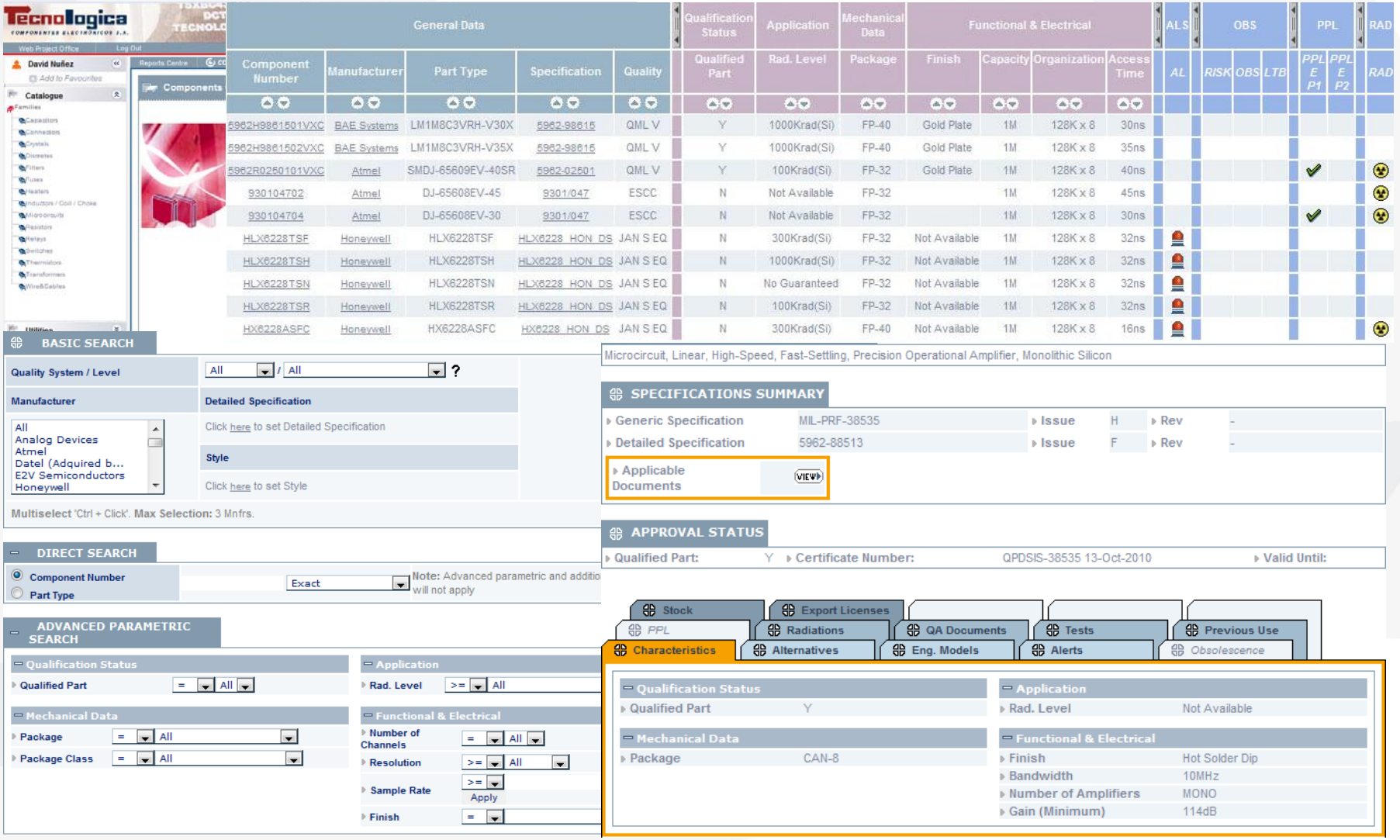
- Proper product selection requires access to key information and continuous monitoring.
- Integration of experience from other market segments.
- Appropriate reporting systems allows a right decision taking process.



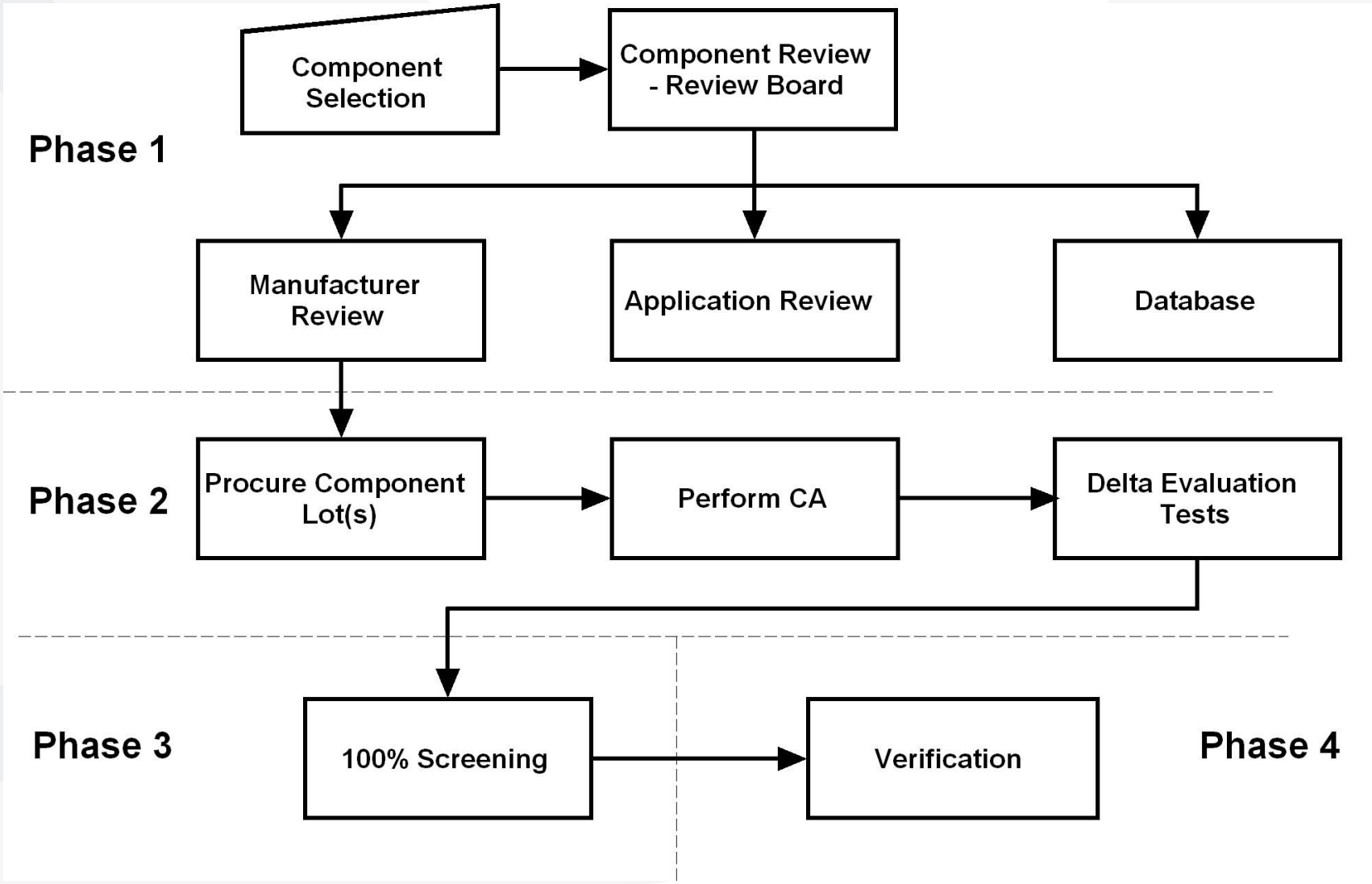
Alter EEE Parts Catalogue

- Detailed controls and risk mitigation analysis and plans must include actions for:
  - Obsolescence
  - Alerts monitoring
  - Export control needs
  - Long lead and critical schedule items
  - Manufacturers and products evaluation
  - Counterfeit detection

PRODUCT SELECTION



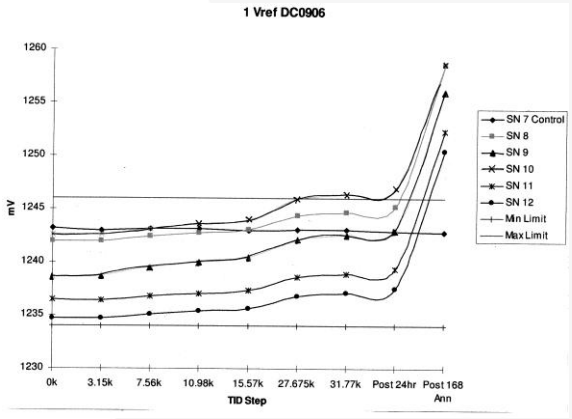
NON SPACE LEVEL PARTS

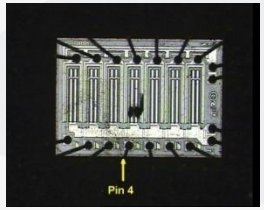


SPECIFIC SCREENING

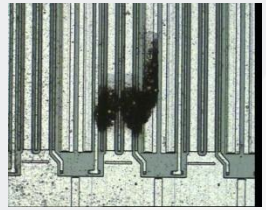
- Parts neither designed nor manufactured to consider space environments.
- Specific knowledge on the space environment and characteristics are required in order to generate proper testing scheme and results validation.
- Radiation characterization versus radiation testing.
- Specific analysis per component, radiation effects and application.
- Accelerated testing is a valid tool to obtain confidence.
- Many factors involved in the analysis of the results.
- Not skilled analysis may lead to inconclusive results.

ELDRS – Results for a COTS Low Voltage (1.24V) Adjustable Precision Shunt Regulator



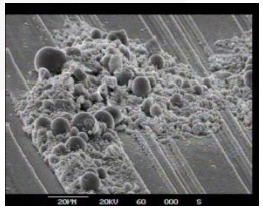


Die Surface



Failure Site

Pyrolised Plastic



SPECIFIC SOLUTIONS

PROBLEM	SOLUTION			
	COTS (Evaluation + Upscreening)	ECI programme	ASICS development	OTHER
Availability of Space Qualified Parts is reduced and decreasing	X	X	X*	
ITAR/ European dependence	X	X	X*	
OBSOLESCENCE/ Technology life-cycle	X	X	X*	Obsolescence management programmes
COMPETENCE •Power reduction needs •Mass reduction needs •Performance increase needs.	X	X	XX*	

* Depending on the function

Mixed signal ASICs can be an alternative solution to procurement issues.

TOPICS

- EEE Components for Space
  - The market
  - Background
  - Challenges
- Parts Procurement Concept.
- **Specialized and Advanced Parts Procurement**

SPECIALISED APPROACH

To face these challenges, procurement will move towards to:

- technical approach (deeper knowledge on parts)
- topics to control (life cycles, technology changes, terminations)
- integrated (design, engineering, logistics, manufacturing)

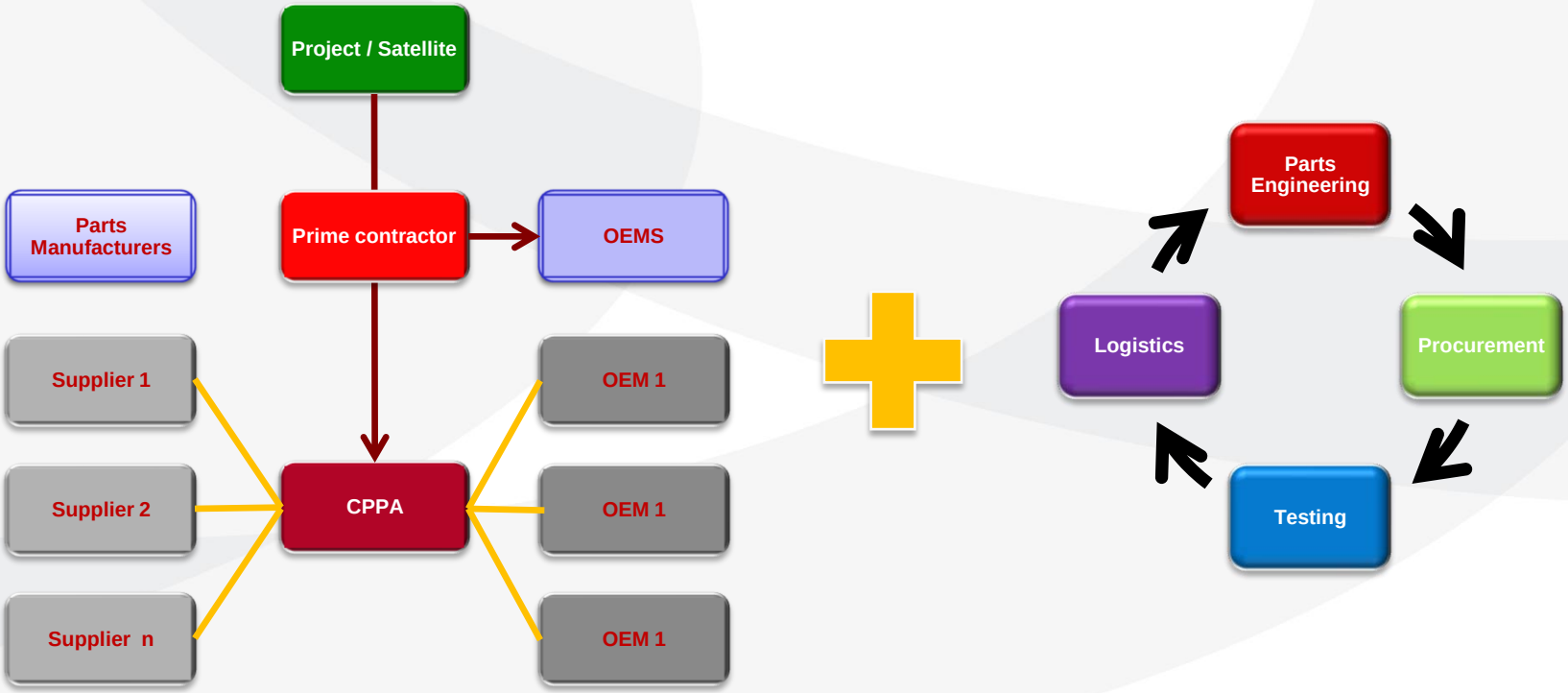
SPECIALISATION

SPECIALISED APPROACH

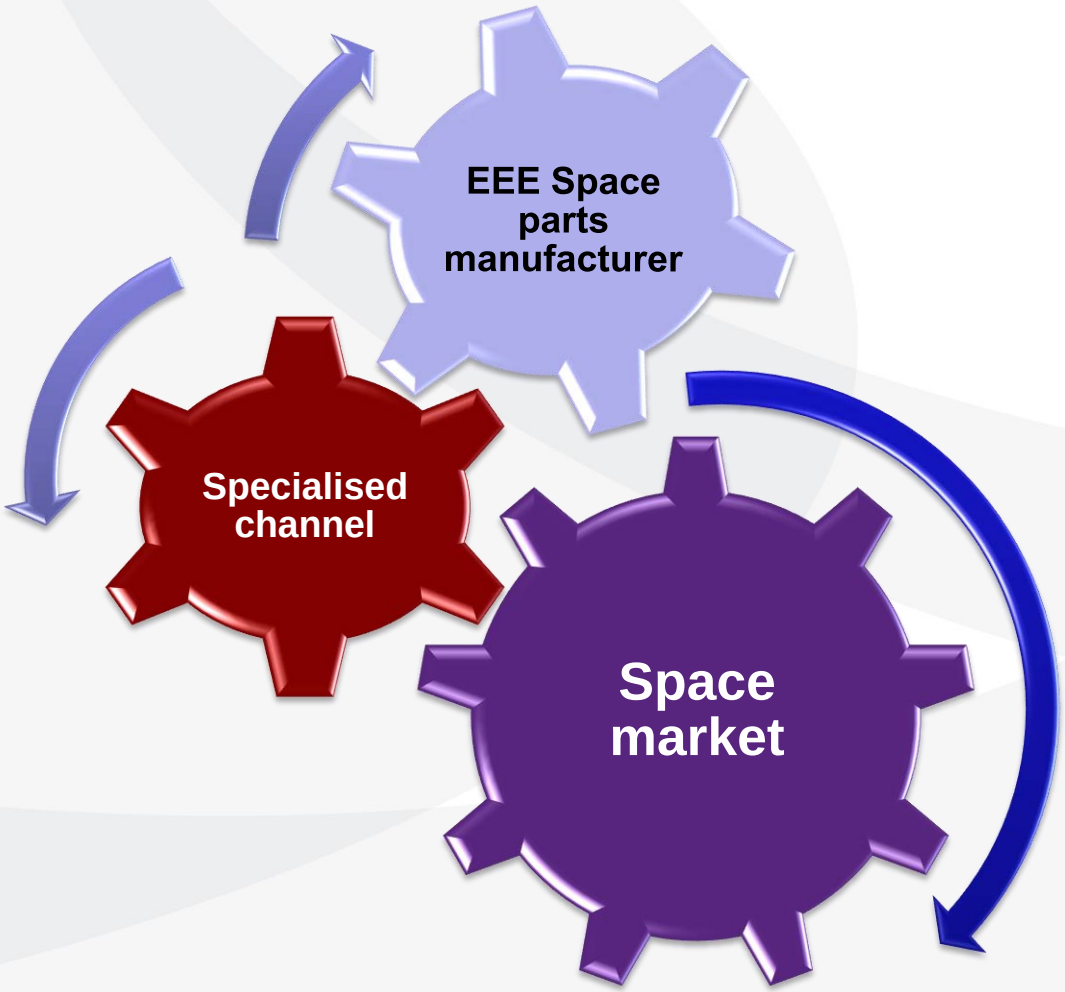
- Different approach based on organization type and project:

SPECIALIZED APPROACH

- CoPPA concept is evolved to a specialized approach.
- Classical advantages are kept while increasing the level of service and support to new activities.



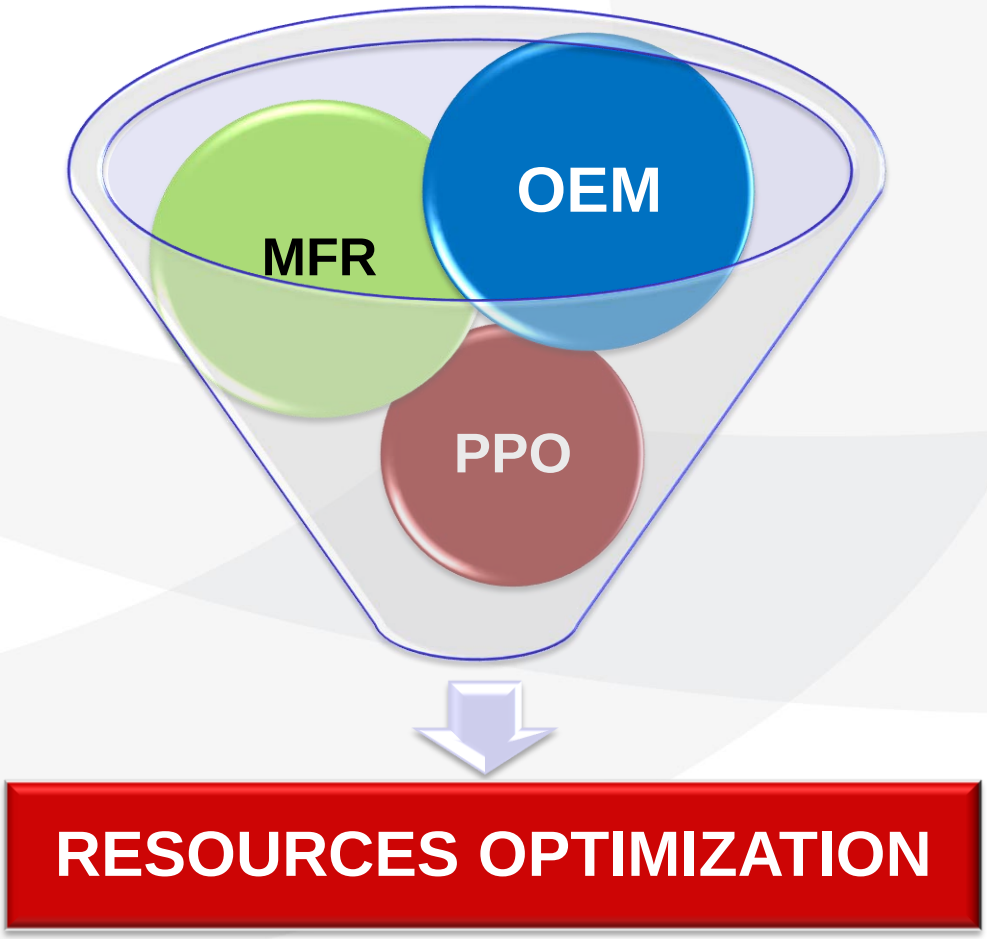
SPECIALIZED APPROACH



- Simplification of supply chain increases visibility of space level manufacturers.
- Extensive use of specialised channels provides more efficient bi-directional information flow, ensuring the right feedback is provided.
- Orientation on global market demands helps to focus developments allowing required return on investments and coverage of key functions.

SPECIALIZED APPROACH

- Each actor is focused in their core activity.
- Results are optimized combining resources and common needs (i.e. advanced testing requirements).
- Knowledge accumulation accessible to all actors.
- Parts procurement organizations (PPO) are the evolution towards a specialized approach.



THANK YOU FOR YOUR ATTENTION

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