

OPTOI on ESCC and ECI observations from and information on *a new European space component supplier*

Speaker: Mr Matteo Bregoli

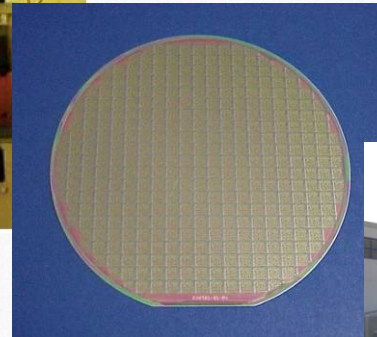
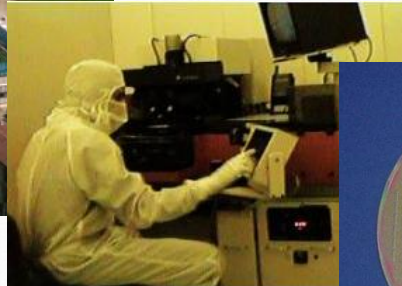
Outline

- Optoi Microelectronics
- Devices under development
- Considerations on ESCC and ECI

Optoelettronica Italia Srl



Fondazione Bruno Kessler (FBK)



Optoi new plant, Trento



- **1995** - Foundation **spin-off** company from FBK activity and **small production start-up**
- **2000** – Industrial projects and production, **international trade mark OPTOI Microelectronics**
- **2004** – New production plant project and international customers **Quality System Certification ISO 9001:2008**
- **2005** – **New production plant** established company headquarters moved
- **2006** – First 10 years, Trentino **Green Consortium Habitec**, increased Optoi staff and partnership with FBK
- **2011** – Evolution of **Optoi Group as network of high-tech companies**
Innovasens: Optoi, Advansid, Eoptis



Microsystem Packaging

Technology

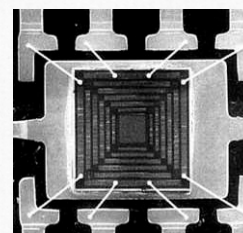
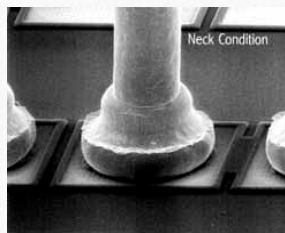
- COB (Chip On Board)
- CSP (Chip Scale Package)
- MCM (Multi Chip Module)
- Stack 3D
- SiP (System in Package)
- SMT (Surface Mount Technology)

Materials

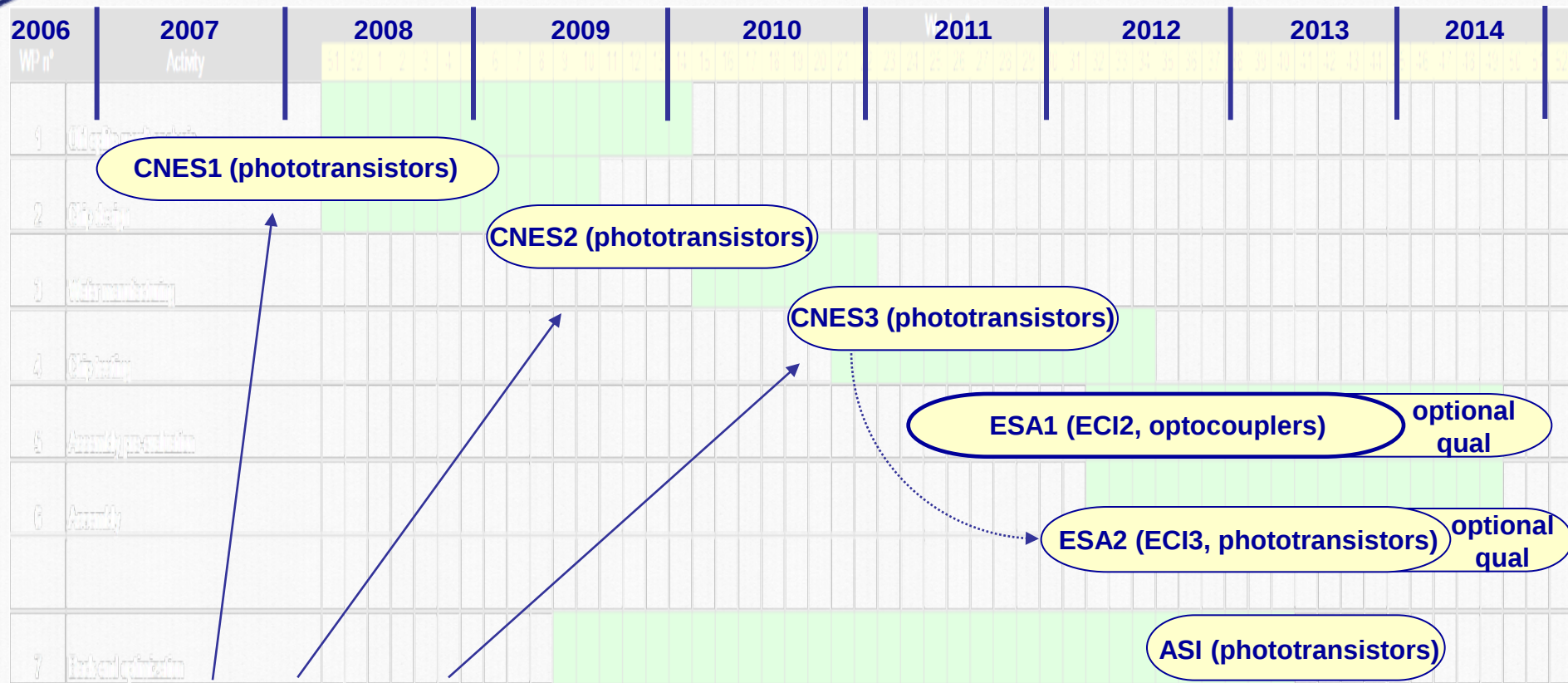
- Polimers: G200
Kapton
Teflon
FR4
- Ceramics: Alumina
LTCC
Glass
- Metals: Kovar
Al-clad
Inox

Capability

- direct die bonding
- wire bonding
- hermetic welding
- encapsulation
- oven curing
- sensing layer printer
- substrate dicing
- microsystem dicing
- thick film deposition
- SMD assembly line
- die shear test
- wire pull up test
- functional test
- temp. & hum. test



The optoelectronic activity line: Optoi projects funded by Space Agencies



Crescendo of reliability:
E-O phototransistor characteristics and
radiation hardness were achieved
relatively quickly

Optoi clean room upgrades

- Upgrade to class 1000 (ISO 6) summer 2012 - investment > €100k
- New internal regulations and procedures
- New specific equipment



Optoi clean room



*Metallographic microscope
ESA-related purchase*

TABLE I - Classification based on number of particles allowed per cubic meter, according to three different systems (United States Federal Standard - USFS)

USFS - 209D (1988) Class	USFS - 209E (1992)	ISO 209 (1997)	Maximum number of particles / m ³	
			0.5 to 5 µm	>5 µm
1	M1.5	3	35.3	ND ^b
10	M2.5	4	353	ND
100	M3.5	5	3,530	ND
1,000	M4.5	6	35,300	247
10,000	M5.5	7	353,000	2,470
100,000	M6.5	8	3,350,000	24,700

^aSource: Moorfield, 2006. ^b Not defined.

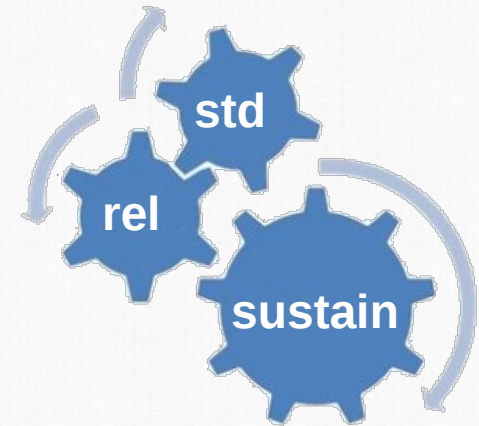
General impressions: effort

- Long **duration** of manufacturing procedures - intermediate quality checks
- Raw **materials** are expensive - need care for proper use
- Production **yield** is limited - each reject is a loss of money and time
- Customized production **tools** are mandatory
- **Contamination** level control is demanding

A compromise between standards, reliability and sustainability needs to be reached

Developments always imply investments

Sustainability is not straightforward for a business-oriented company



Optoi as a newcomer ESCC requirements

- need for guidance and support
- gathered knowledge
 - radiation tests
 - ETP procedures
 - technological analyses
 - preferences for materials, technologies, suppliers

Benefits

- Quality
- Repeatability
- Control
- Methodology (PID)
- Improved traceability (Lot Travellers)
- Know-how on reliability
- Tendency to constant improvement
- Continuous training for the personnel

but

- production line has to be interrupted
- poor yield and small throughput
- results obtained after years
- small business volume



Space market vs. others

- lower control needed in the manufacturing
- limited analysis of failure modes
- more unpredictability in the related market
- less protection of the market

} Optoi
standard
production

vs.

- niche market but more international
- added-value devices
- clearer perspectives and strategies
- possibility to build a recognized reputation
- technologies can be exported to other domains

} space
market
pros

but

- slower developments
- subject to global conditions (procurement continuity)
- difficult sustainability, demanding workload

} space
market
cons

Market perceptions and trends

- European companies support the **rise of a new supplier**
- Difficulties in **getting in contact** and being considered
- More responses from **Northern Europe**
- Technical **requirements** vary considerably
- Relevant interest from **China** and **India**



European strategy ??

Expectations from the end-users

- Privilege **reliability** and **strategic vision**
- **Target price** sensitivity for standard production
- Most of them prefer **component qualification** before involvement

Management of our suppliers

- Key partners need to be identified
- Long-term availability of products
- European sources first
- Some Japanese partners

Two problems:

- attract suppliers in a niche business with low volumes, only developers benefit from the added-value
- customization is not justified by big manufacturers

Optoi expectations and conclusion

- Niche and limited business
- Strong effort needed
- Increase of visibility
- Increase of respectability



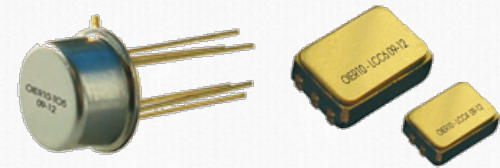
Optoi main target

- successful evaluation of **optocouplers** and **phototransistors**
- concrete results expected 2013 - 2014

Ambition

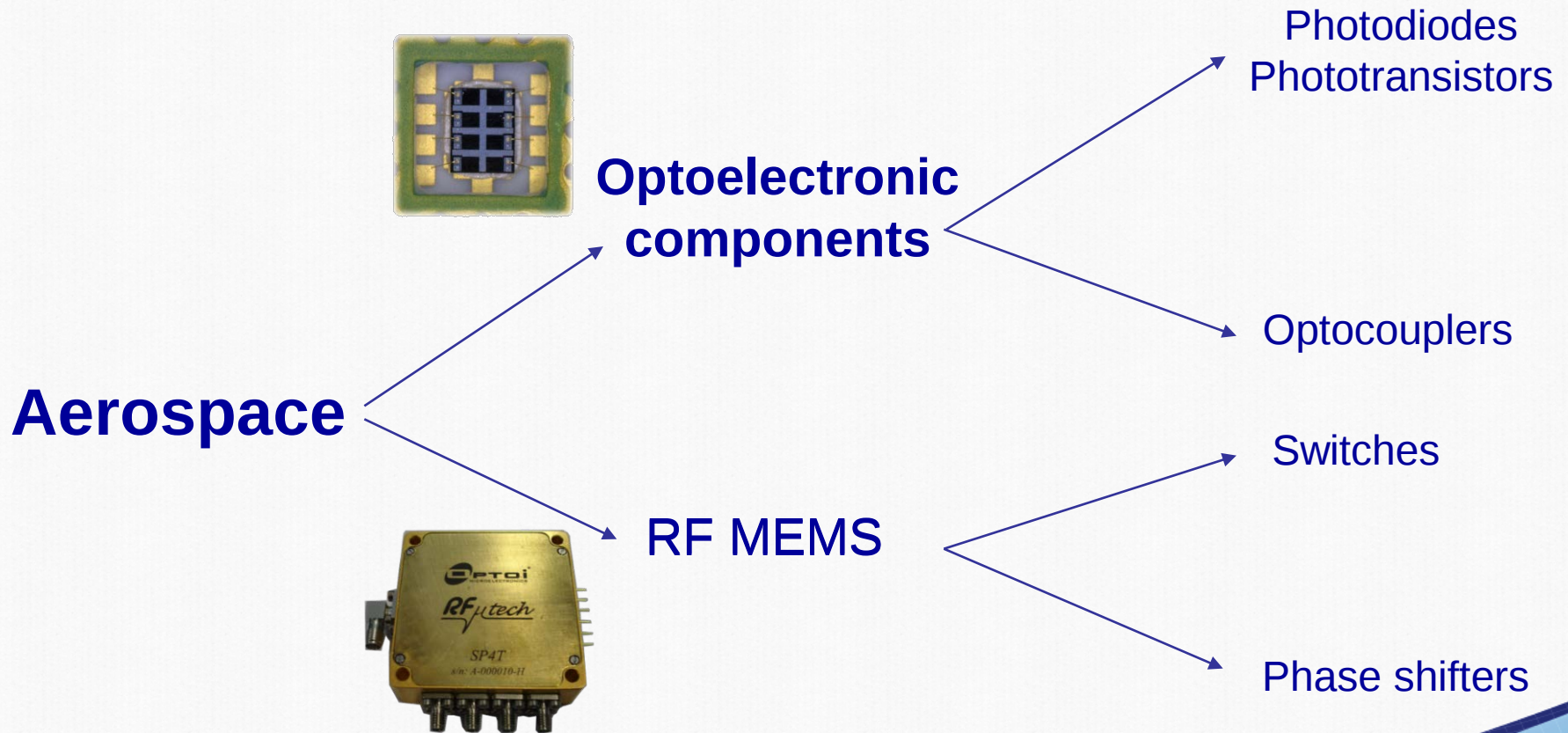
reference European company for **space optoelectronics**
photodiodes, SiPM, FBG interrogators and related sensors

Thank you for your attention



Matteo Bregoli
Contact email: research@optoi.com

Overview of the *aerospace* activity line



Very rapid growth of activities in the last few months

ESCC eval and qualification of an European rad tolerant optocoupler

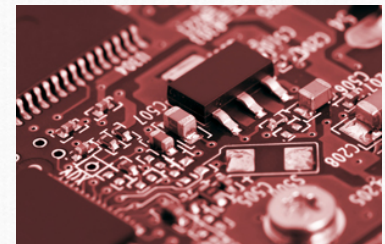
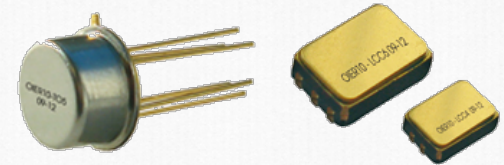
- Ref. AO/1-6300/09/NL/EM - ECI phase 2
- Project started in Jan 2011

Microelectronic technologies *fully automatic assembly line*
for devices assembled in

Assembly **process flow**, compliant with *MIL-STD-883*

Typical applications

- electrical circuits, where one section has to be isolated from another in terms of current / voltage signals (galvanic isolation)
- electrical circuits, where signal noise has to be minimized or voltage transients have to be prevented, so that there is no interference between circuit sections sharing the same circuit reference



ESCC approval of an European source of 8-ch Si phototransistors

- Ref. ITT/AO/1-6836/11/NL/RA - ECI phase 3
- Project started in Nov. 2011

Microelectronic technologies *fully automatic assembly line featuring wafer dicing, die bonding, wire bonding, dispensing, glass lid sealing, oven polymerization*

Assembly **process flow**, compliant with *MIL-STD-883* and *ESCC Basic Spec n. 2049000*

Assembly **pre-evaluation activities** for back-end qualification

Typical applications

- angular optical encoders, determining rotational speed, angular position, acceleration and number of cycles
- actuators of control moment gyros, part of motorized gimbals of last-generation satellites
- optocouplers
- optical switches

