Tyndall National Institute
Space Component Analysis

Finnbarr Waldron
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Tyndall National Institute

- Located in Cork, Ireland.
- Micro / Nano Electronics, Photonics & Microsystems
- Ireland’s Largest Research Institute
- Excellence in Scientific & Engineering Research.
Tyndall in Numbers

- €230m Infrastructure investment
- 500 researchers, engineers & support staff
- 271 peer-reviewed publications in 2017
- €36m annual income
- 85% from competitive contracts
- 12 incubating technology spin-outs
- 30% industry project funding
- >120 graduate students (MSc, PhD)
- 47% of Ireland’s H2020 ICT funding
- 50 nationalities on-site
- 200 industry partners world-wide
- 20 industry Researchers-in-residence
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Highly-differentiated Research Approach

From atoms to systems

- Materials Research & ALD
- Atomistic Modelling & Simulation
- Synthesis & Processing

- Semiconductor wafer fabrication
- Nano materials and device processing

- High performance RF & mixed-signal circuits
- Data converters
- Ultra wideband radar
- RF circuit design
- Photonic light sources & detectors
- Power supply on Chip

- Smart sensors and systems
- Optical communication systems
- Microelectronic and photonic integration
- Application-specific Packaging

Conceive – produce – characterise – deploy

in Chemistry, Physics, Biology, Engineering & Manufacturing disciplines
Tyndall - Key Laboratories & Facilities

- **Electronic Packaging & Reliability Analysis:**
  - Wire/die bond, flip-chip assembly, DPA, CA, Environmental testing, failure analysis, burn-in, shock & drop, X-ray analysis.

- **Electron Microscopy Analysis Facility:**
  - (EMAF) – SEM, TEM, FIB, EDAX analysis, cryo-stage enabled SEM for biological sample analysis

- **IC Design Technology Evaluation (DTE):**
  - CA, IC re-engineering, patent infringement, circuit design analysis, analogue, digital & mixed signal diagnostic measurements

- **Fabrication Facilities:**
  - Silicon CMOS, Compound Semiconductor MEMS, E-beam Lithography, MOVPE materials growth, Training Fab.
Tyndall – Reliability Test Laboratory

Activities:
- Test programme design
- Commercial services
- Support to R&D projects

Facilities:
- Air-to-air thermal shock (X2).
- Temperature cycling (X3).
- Temperature / Humidity (X3).
- High/ Low temperature storage.
- Vacuum storage.
- LDS Shock & Vibration.
- Free Fall Shock Test.
- Salt Spray Test.
- Burn-in Tests
- Seal tests, PIND (hi-rel /space components)
Tyndall – History of Space Activities

- Tyndall working with ESA since 1980’s.
- MTSL helped establish new test facilities at Tyndall:
  - Reliability Test Laboratory.
  - Micro-packaging Analysis Facilities (component CA & DPA)
  - Integrated Circuit Test & Analysis.
- Renewal in 1993 & subsequent years (5-year contract).
- Development of direct component DPA business with Space industry customers.
ISO17025 Accredited Space Component DPA

ISO 9001:2015 (Tyndall – All Activities)

ISO 17025 (Tyndall – Space Component DPA)
ISO17025 Accredited Space Component DPA

Scope of Accreditation

- Radiography - Mil-Std-883K, Method 2012.9
- Seal – Helium Fine Leak Test - Mil-Std-883H, Method 1014.13, Condition A1
- Seal – Perfluorocarbon Gross Leak Test - Mil-Std-883K, Method 1014.13, Cond C1
- PIND (Particle Impact Noise Detection) Test - Mil-Std-883K, Method 2020.9, Cond A
- Internal Visual & SEM Inspection – Mil-Std-883K, Method 2013.1
- Wire Bond Pull Strength Test – Mil-Std-883K, Method 2011.9
- Die Shear Strength Test – Mil-Std-883K, Method 2019.9
ISO17025 Accredited Space Component DPA

**Equipment Highlights**

- Keyence VHX 2000 3D Optical Inspection system.
- Nordson-Dage Diamond II XD7600NT – X-ray & CT-Scan System
- PTI 4501A PIND Test system
- Leybold Phoenix L300i Helium Leak Detector
- Royce Microtesters (wire bond pull & die shear)
- FEI Nova 650 Nano SEM (EDS)

3-D Optical Inspection System

CT-Scan (Lead-frame Package)

SEM Inspection of Wire Bonds
ISO17025 Accredited Space Component DPA - Examples

- CT-scan of ceramic packaged device
- Al wedge / wedge bonds
- De-cap of plastic packaged device
- Capacitor stack micro-section
- Inspection of power ICs in hybrid circuit
- RF cable CA
- Control IC in hybrid component
- CT-scan of isolator component
Other Recent Space Component Activities

- Hybrid Microcircuit Construction Analysis.
- Microsystems Component Construction Analysis.
- CCD Construction Analysis.
- Schottky Diode Development.
- Reliability Evaluation of Novel DC-DC Converter Units.
- Thermal & Electrical Simulation of 3D SDRAM Modules.
- Supply of Si Test Structures.
- Characterisation & Supply of RADFET Dosimeters.
- Reverse Engineering of PWM devices.
- GaN Materials Investigations (MMIC).
- PoL DC-DC Converter Evaluation Programme.
- BME Capacitor Evaluation.
Summary

- Comprehensive component DPA & CA services.
- Long history working with ESA / ESTEC.
- NDA to assure customer confidentiality.
- Competitive pricing.
- Quick turn-around.
- ISO17025 Accreditation – Space Component DPA.
- Happy to facilitate customer visits.

Dr. Franco Ongaro (ESTEC) visiting the Tyndall Component Analysis Laboratory in Nov. 2018. Pictured with Prof. William Scanlon (Tyndall CEO) & Mr. Finbarr Waldron.