A journey with the European Space Agency

• John O’Donoghue
Company Snapshot

Emerging Leader in Surface Modification Technology
Founded in 2006 by John O’Donoghue
Cluster Member of a World-class Engineering & Material Science Campus & Facilities base.
Partner to European Space Agency for Satellite Surface Coatings.
Investigation projects undertaken with Fortune 500 companies outside of Space sector
20 Employees – based in Dublin, Ireland.
Brief History – a Reality Check

High’s & Lows
- 2006 Won InterTradeIreland All-Island SEEDCORN competition
- 2007 First Internal Crisis & recovery
- 2009/10 Second Internal Crisis & major policy shift

Funding
- BES
- EI & State
- Industrial Investment
- ESA - Work Package

From Inner Space to Outer Space
- Cash Flow Crisis looming
- Futile Engagement with a major Medical Device Company
- Need to Change Policy Fast
  - Spin-in to UCD
    - Pivot to Industrial Applications – particular focus on Space
    - A New Beginning and a New Team
COBLAST

Transform metal’s **performance, function, value**

- Remove the oxide layer
- Roughen the metal surface
- Apply unique Skins in one step process

*Cross-section of a SolarBlack CoBlast Skin on a titanium substrate*
CoBlast: A Unique Metal Oxide Replacement Technology

Coating of screws for medical implants
Solar Orbiter

To perform close-up, high-resolution studies of our Sun and inner heliosphere, Solar Orbiter is intended to brave the fierce heat and carry its telescopes to just one-fifth of Earth's distance from our nearest star.
SOLARBLACK

- TRL 7
- Inorganic
- Electrically conductive
- High emissivity and absorbance
- Extreme UV and thermal stability
- Baseline for Solar Orbiter heatshield

*ESA Solar Orbiter SWA-PAS component coated with SolarBlack*
CLOSEST MANMADE OBJECT TO THE SUN

Solar Orbiter 3 x 3 m heatshield
ENBIO’s SolarBlack on titanium foil

Qualified for use in 2012
TRL 1 to 7 in less than 3 years
Flight hardware coated
Most demanding thermal application

Unique thermal management coatings for the most demanding space mission.
Solar Orbiter manufacturing facility in 2012.
Second EU production facility in 2014.
Our thermal coatings are used on ESA’s Rosetta probe which recently landed on a comet.
SUBSTRATES AND GEOMETRIES

SUBSTRATE MATERIALS

- Nitinol
- Magnesium
- Aluminium
- Titanium
- Metallic Glasses
- Steels
- Copper
- Cobalt Chrome
- Inconel
- and more

GEOMETRIES

- Simple to complex geometries
- Thin or thick (25 um foils possible)
- Foams
- Inner and outer diameters

SELECTIVE COATING

- Simple contact masking
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Solar Orbiter components

Mounting resin

SolarBlack

G5 titanium

3D Geometries

Foils

Tubes
Solar Orbiter components
APPLICATIONS

Corrosion Resistance
Cosmetic Coatings
Lubrication
Hydrophobicity
Unique Primers or Tie-layers
Thermal Control
Adhesive Bonding
Electrically Conductive/Insulative Coatings
Secondary Coatings
PTFE via CoBlast

Mechanically deposited PTFE coating at room temperature
Super hydrophobic properties (water contact angle $> 150^\circ$C)
Low friction and wear resistant
Deposited on Aluminium, Stainless steel and Titanium
COATINGS

Ceramics
Metal Oxides
Rare Earth oxides
Polymers
Epoxies
Primers
Metals
Secondary Coatings

Ceramic coatings on titanium

PTFE on Nitinol wire
SECONDARY COATINGS

• By overcoming the adhesion obstacle presented by metal oxidation metal CoBlast enables new opportunities and improved performance for a wide range of secondary coatings.

• ENBIO’s proprietary aqueous ceramics:
  – Enhanced adhesion and thermal shock resistance for ceramic coatings
  – Thick (>100µm)
  – Additive ceramic coatings cured below 250 °C
  – Suitable for CFRP and C/C composites

*SolarWhite (left) and uncoated titanium (right) after heating to 900C*
COBLAST ADHESIVE PRIMERS

- CoBlast offers unique adhesion for metal
  - Metal-to-metal bonding
  - Metal-to-composite bonding
  - Metal-to-glass bonding

- Adhesive strength of CoBlast metal surface to adhesive exceeds cohesive strength on bonding material

- Lap-Shear Strength (ISO 2243-1)

- Substrates
  - Titanium Grade 5 (Ti-6Al-4V)
  - Carbon-Fibre/Epoxy Composite
  - Prepared with wet peel ply for all lap-shear tests
COBLAST VERSUS AEROSPACE ADHESIVE PRIMER

*ENBIO solutions can only be matched using hazardous wet chemistry.

Surface Treatment

Blank | Grit-Blast | CAA + Primer | SolarBlack | CoBlast Solution A (Metal Salt) | CoBlast Solution B (Polymer)

Hazardous chemistry. On the way out due to REACH
CORROSION INHIBITING PRIMERS

- Substrates
  - Mild Steel CAE 1008

- Surface Treatments
  - Zinc Plated
  - CoBlast Primer

- Paint
  - Two-part Epoxy

- Salt Spray Test (ISO 9227)
  - ‘T’ Scratch ISO 18782
  - 56 days (8 weeks)

**NO under-cutting observed on CoBlast surfaces**
ESA SolarBlack Facility – in NovaUCD!

Installed & Commissioned
In 6 Weeks – Sept 2012

Designed, Built & Integrated
By Domestic Companies
Today space activities are pursued for the benefit of citizens, and citizens are asking for a better quality of life on earth. They want greater security and economic wealth, but they also want to pursue their dreams, to increase their knowledge, and they want younger people to be attracted to the pursuit of science and technology. I think that space can do all of this: it can produce a higher quality of life, better security, more economic wealth, and also fulfil our citizens' dreams and thirst for knowledge, and attract the young generation. This is the reason space exploration is an integral part of overall space activities. It has always been so, and it will be even more important in the future.

Jean-Jacques Dordain
ESA Director General
ESA INDUSTRIAL POLICY

- Meet ESA program needs
- Promote Space science, research and technology, and applications for exclusively peaceful purposes
- Co-ordinate ESA's technological & research activities with EU focus
- Increase the competitiveness of European industry internationally
- Develop the capacity of European industry to efficiently and economically react to market demands
- Harmonise tasks between European and national space activities.
- Foster the participation of SMEs in ESA procurements by restricting some actions to SMEs only and encouraging non-SMEs to team up with SMEs
- Set rules relating to geographical distribution or fair return - ratio between the share of a country in contracts and its share paid to the Agency by the end of a given period.

ESA devotes much time and effort in trying to meet all these requirements while maintaining technical excellence and economy.
ESA’s budget for 2011 was 4 billion Euro. Close to 85% of this budget was transformed into contracts with European industry mainly for research and development activities.
“Some of the materials, processes and coatings we work with are environmentally dirty and hazardous for health and safety. The challenge is to find green replacements that have the same performance as the nasty ones”.

Tommaso Ghidini Head of ESA’s Materials Technology section

- Green Economy
- Additive manufacturing
- Design for Demise
• Closest manmade object to the sun in 2020
• ESA SolarBlack Coating facility in NovaUCD, new SolarWhite coating facility pending
• 3 x products introduced in 2.5 years
• Baseline surface technologies in ESA for next 20 years!
• CoBlast in top 3 technologies currently studied by ESA
• EnBio has hosted 3 thermal management Workshops in UCD attended by top scientists engineers & technology managers
• ESA & Astrium advocating CoBlast to associates
• EnBio selected by EI in top 20 hi-tech companies. Featured on PBS, Discovery Channel, RTE, BBC, Scientific and academic journals.
• Representing UCD’s branding for Innovation
• Terrestrial thermal management opportunities pending
• Wider industrial and commercial inquiries coming in.
Transforming Surfaces at the frontiers of Industry & Science
NovaUCD, Belfield Innovation Park
Dublin, Ireland
Where next??

"To infinity and beyond!"

It IS rocket science, actually!
Thank you!

ONE STEP SURFACE TRANSFORMATION

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