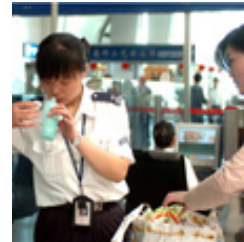
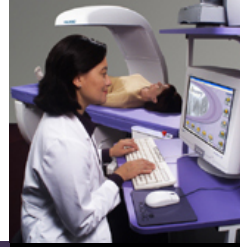


Development of Mutually Beneficial Industry-University Relationships

Bela Green & Ian Radley
20th May 2015



Kromek Group PLC



Overview

- Kromek Background
- Technology road mapping
- Funding sources
- Industry-University relationship
- Securing impact
- Examples of collaborations
- Q&A

Who we are

- We deliver solutions for materials identification and imaging using x-ray, gamma ray and neutron detection. We manufacture photon counting, energy discriminating detectors.
- Leading developer of radiation detectors based on Cadmium Zinc Telluride (CZT)
- Formed in 2003, spinout of Durham University – listed on the London AIM (KMK.L)
- Focused on 3 markets with strong adoption drivers
 - Medical Imaging, Security Screening and Nuclear Detection
- Branched business model:
 - Supplier of OEM subsystems
 - Kromek branded end user products
- 5 sites: (UK, US + Germany), ~100 employees, 247+ patents
- Growing revenues and blue chip customer base

Vertical integration

Materials to Solutions



Materials & Detectors

Detector Fabrication

ASICs & Electronics

Bonding & Hybridisation

Application Development

Algorithms & Software

Systems Engineering

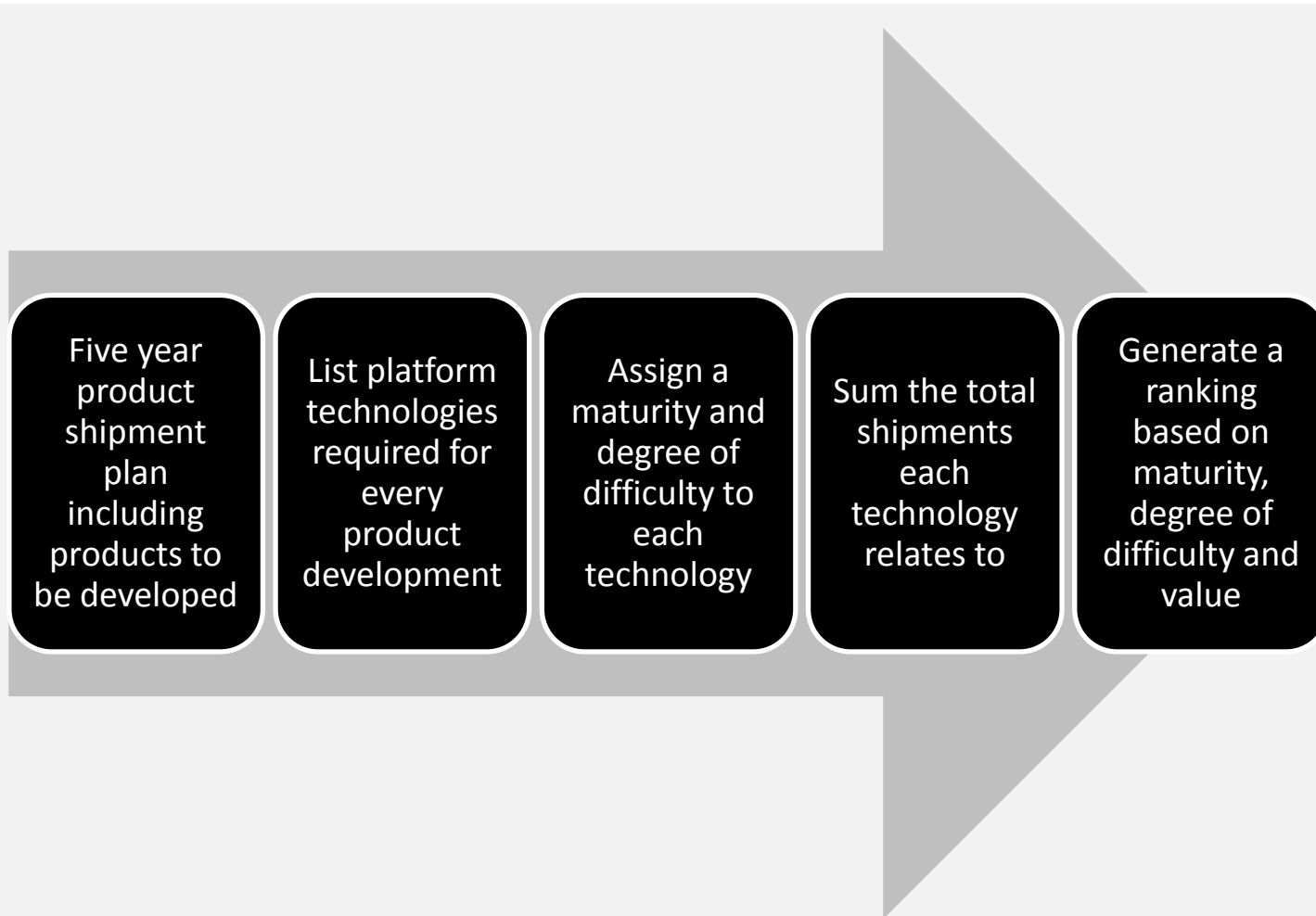
End User Products



OEM Components



Kromek technology roadmapping process



Focus on ensuring the delivery of high value technology by funded research and development, internal research and development and collaborations

Research links



UK and overseas funding

- **What do we target**
 - Funding opportunity must match the company roadmap or if not, be validated by in-house Evaluation Board
 - Academic collaborators are more expensive than internal R&D. If meeting a target requires academic contributions make sure there is enough available for them to be effective.
- **Funding sources**
 - **UK (SME led, Academic led)**
 - **Innovate UK:** Very good experience. Multi stage programmes help significantly in gaining feedback and ensuring that the company can find the right targets that meet the funders' objectives whilst matching the company's roadmap. Panel reviews can be very disruptive, there is no view of criteria or agenda. Very high scoring applications can fail at panel.
 - **Mini IPS, IPS, CLASP, KTP:** Excellent methods of getting fundamental technologies proved in concept and adopted into a company.
 - **European**
 - **ESA ITI:** Excellent method of proof of concept demonstration.
 - **Horizon 2020 and Eurostars:** important vehicles but can be daunting but are achievable even for small SMEs. The multiparty collaborative environment is very positive for all parties and leads to creative solutions. Roles are important since a very wide range of TRL levels may be explored.
 - **USA**
 - A very important funding source for Kromek.
 - 100% of fully overheaded costs covered. For sources that are open to foreign bids then results are really on merit. A positive source of funds to support the UK academic community

Industry-University relationship development

- Academic collaborations are not the place for final market ideas.
- The requirements of industry can constrain the creative process and the academic community needs the space to flourish creatively.
- Industry-University relationship needs cultivating
- Industry involvement in the recruitment of university team members for project
- University needs to be industry's efficient route to keeping up to date with what is state of the art
- If you want to ensure that the funding is solving what you see as the problem then you must be involved at a grass roots level. Different people see things in different ways and we should all learn from each other.
- Recognise constraints on university for industry's rapidly changing requirements/priorities

Securing impact

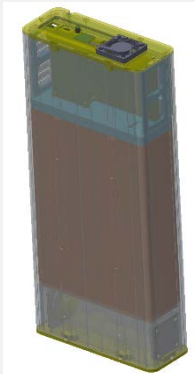
- It is important to match every partners view of the work impact as part of the bidding process.
 - Some funding schemes only require this after the bid is funded, its better to share a view before hand.
- Funded research impacts
 - It leads to further funding and stronger relationships
 - It leads to know-how and patent licensable income
 - It strengthens partner profiles and track record, both essential in bringing in new opportunities
- For industry its important that impact comes in a way that is synergistic and not in competition. This is why understanding each other's view of impact very early is essential.

Case Studies

▪ Portable Neutron Detectors



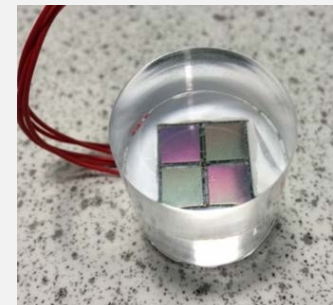
- Drivers
 - Shortage of helium-3 gas tubes
 - Detection of illicit trafficking of radioactive material that could be used to make nuclear and dirty bombs.
- Technology
 - Novel approach to neutron detection based on ^6Li enriched thin screens
- Application
 - Handheld and backpack detectors



▪ DTRA SiPM Arrays High Performance Low Cost Scintillation Detectors



- Drivers
 - Low cost, high performance scintillation detectors
 - Silicon photomultipliers vs photomultiplier tubes
- Technology
 - Next generation SiPM devices
 - Advanced scintillator materials
- Application
 - Fast isotope identification in portable security systems



Thank you



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