MANCHESTER 1824

The University of Manchester

GRAPHENE

From Lab to Market

The Route to Commercialisation of Graphene and other 2D Materials

James Baker

CEO
Graphene@Manchester

November 2019

5th HVM New Materials 2019, 6-7 November Cambridge, UK
www.cir-strategy.com/events

Graphene@Manchester

2010 Nobel Prize in Physics.

Prof. Andre Geim, FRS

Prof. Kostya Novoselov, FRS

“For groundbreaking experiments regarding the two dimensional material Graphene.”

What we do

Graphene@Manchester works to **accelerate** the **commercialisation** of graphene and other 2D materials, by directly supporting startups, spin-outs, SMEs and large corporates, with **advice**, **expertise,** and access to **world class facilities**

NATIONAL GRAPHENE INSTITUTE (NGI)

The NGI focus is on academic led research (TRL 1-5) into graphene and related 2-D materials in partnership and collaboration with Industry:
"Explorative Research"

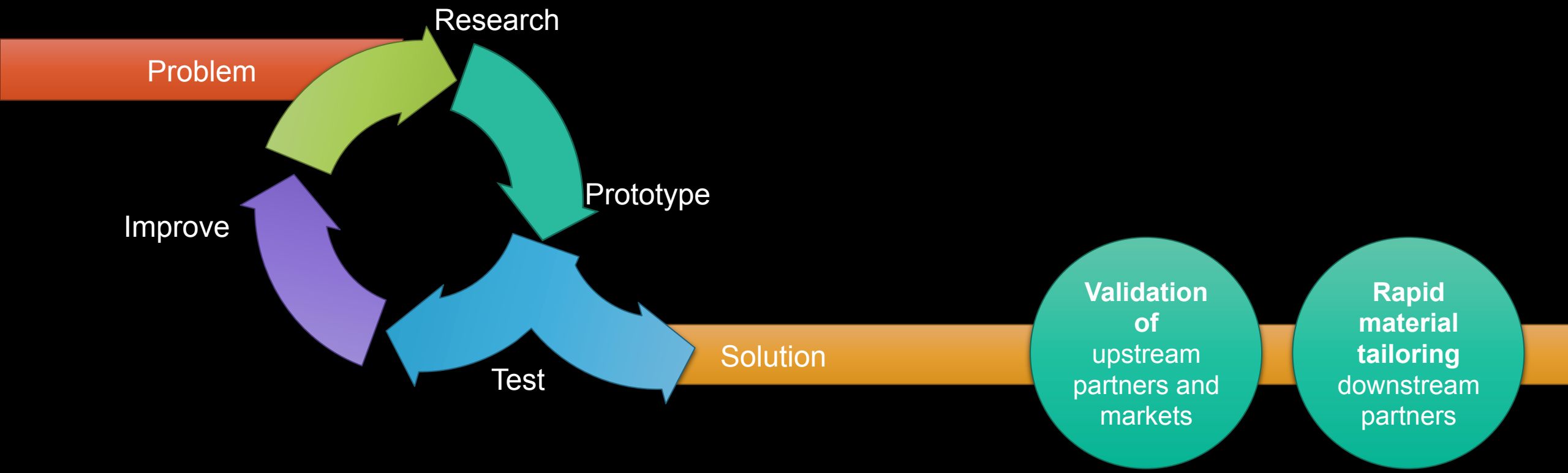
Demonstration of:

- New concepts/new applications/fundamental studies
- Graphene potential by producing new concept products and processes

Development of:

- Low cost and scalable manufacturing methods for high quality graphene
- Process stabilisation, achieving reproducible quality, high manufacturing yields
- Standardisation, Characterisation, Quality Certification and Health and Safety

Design, Make, Evaluate, Repeat



Graphene Engineering Innovation Centre (GEIC)

The GEIC **focus** is on **industry led technology development** (TRL 3-6) in **graphene and related 2-D materials** in **collaboration** with **academia**

“Exploitative Research”

- Manufacturing scale pilot production and process scale-up of graphene and related 2D materials, its measurement and characterisation and application development in structures and composites, membranes and coatings, electronics and sensors, inks and formulations and energy.

- “***Make & break***” prototype development and integration facility

Capability (& Research) Themes

Material Production

Energy Storage

Membranes & Coatings

Printing & Formulations

Composite Materials

Measurement & Characterisation

Cross cutting — **Partner materials**

Verticals — **Application Focus**
Market Pull

Cross cutting — **Developing QC tools**

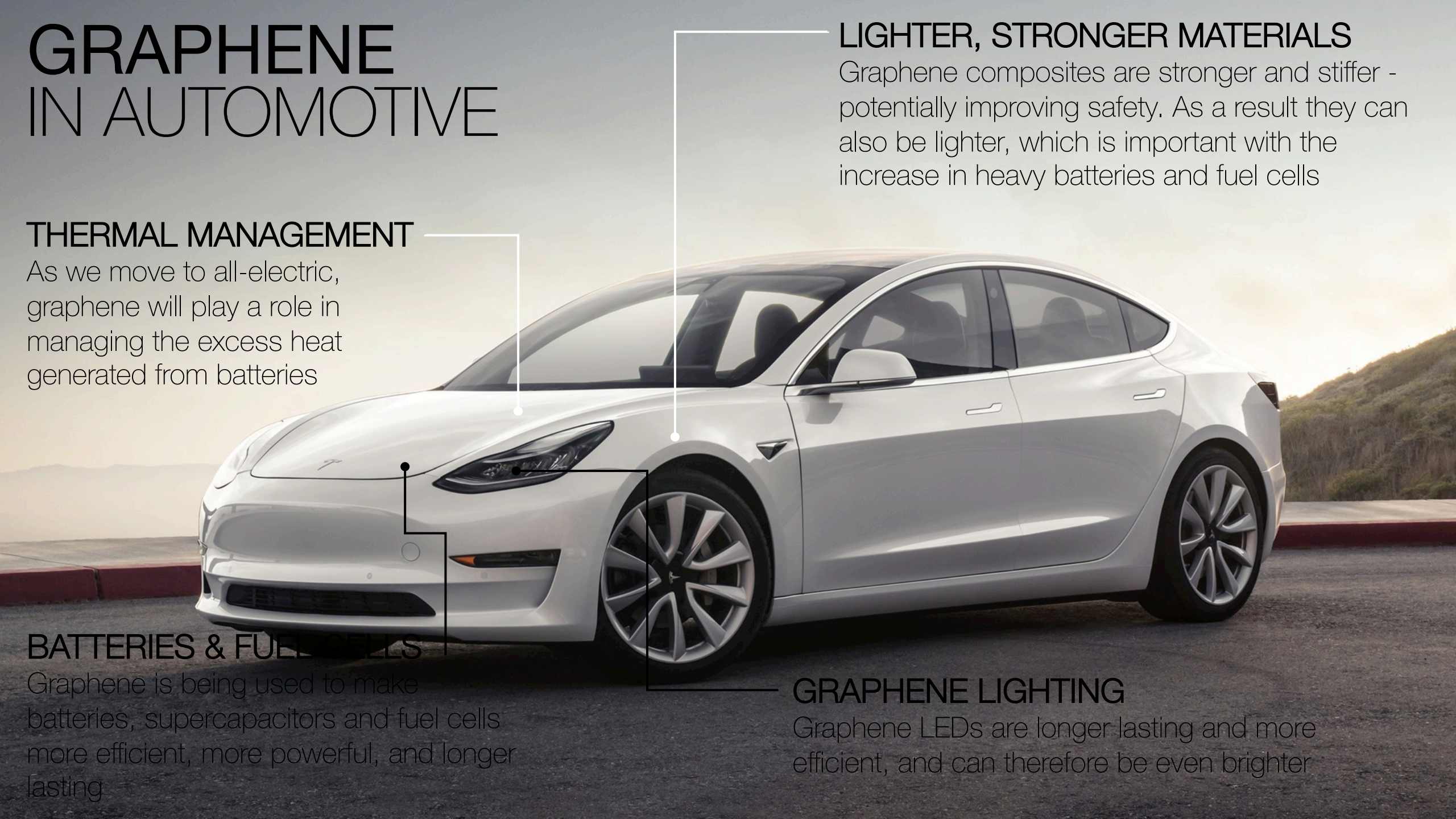
GRAPHENE IN AUTOMOTIVE

LIGHTER, STRONGER MATERIALS

Graphene composites are stronger and stiffer - potentially improving safety. As a result they can also be lighter, which is important with the increase in heavy batteries and fuel cells

THERMAL MANAGEMENT

As we move to all-electric, graphene will play a role in managing the excess heat generated from batteries



BATTERIES & FUEL CELLS

Graphene is being used to make batteries, supercapacitors and fuel cells more efficient, more powerful, and longer lasting

GRAPHENE LIGHTING

Graphene LEDs are longer lasting and more efficient, and can therefore be even brighter

GRAPHENE PRODUCT CASE STUDY

BAC haydale

GRAPHENE ENHANCED CFRP FOR STRONGER, LIGHTER COMPONENTS

20% WEIGHT SAVED

50% IMPROVEMENT IN STIFFNESS & TENSILE STRENGTH

<1% GRAPHENE

Graphene-enhanced carbon fibre is now used in racing bikes, sports cars,, hockey sticks and tennis raquets, but aerospace is thought to be the big industry for GCFRP to make an impact

GRAPHENE-PU COMPOSITE ENGINE COMPONENTS

20% ↑ MECHANICAL PROPERTIES

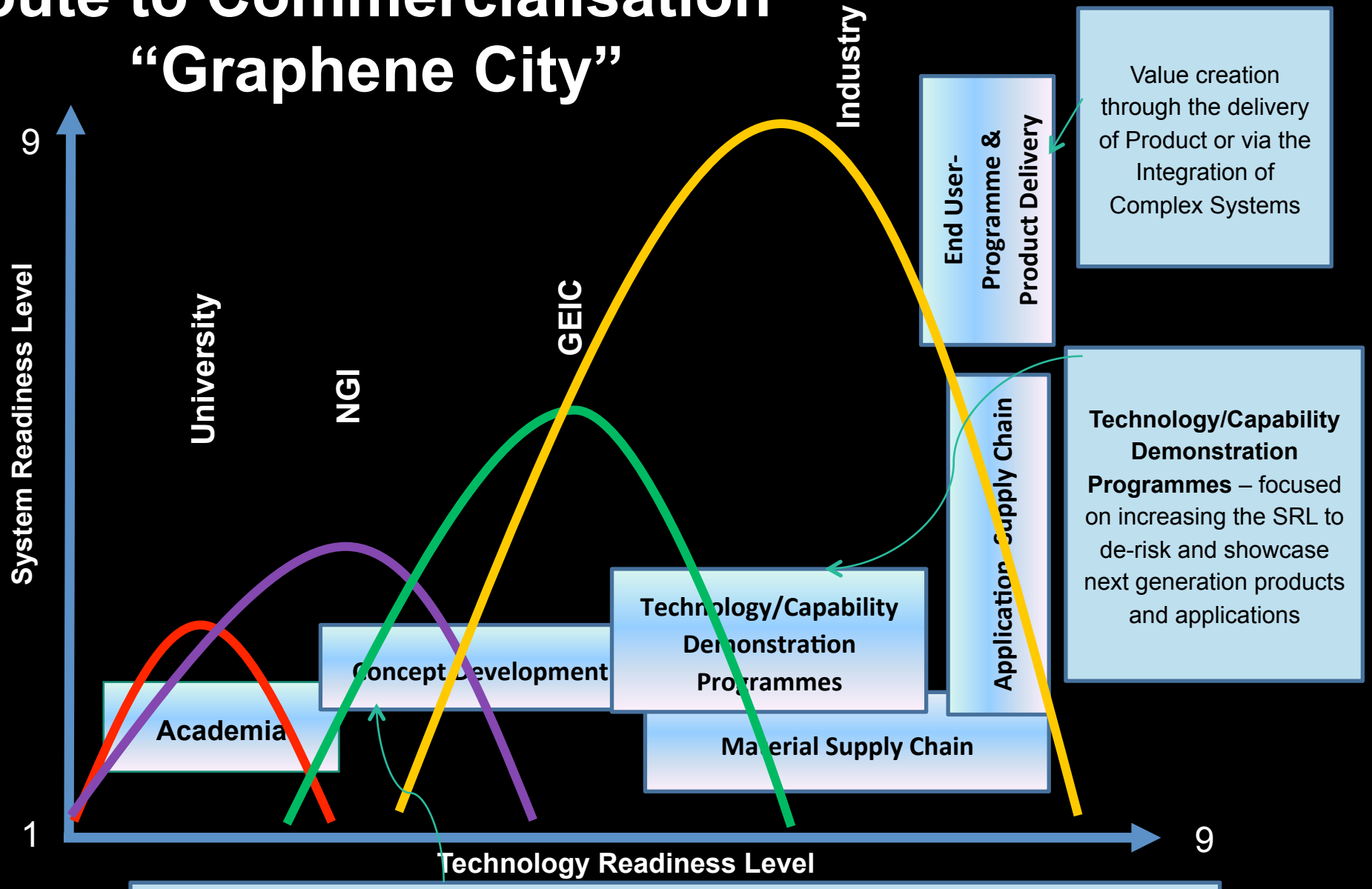
30% ↑ HEAT ENDURANCE

17% ↓ CABIN NOISE

"We are able to use a very small amount of graphene, to help us achieve significant enhancements in durability, sound resistance and weight reduction"

Debbie Mielewski, Ford Senior Technical Leader

Route to Commercialisation – "Graphene City"



Concept Development – focus is on a) increasing the technology development TRL – manufacturing scale up, characterisation and measurement, b) experiment with the art of the possible future applications and concepts and c) provide inputs to Concept Development.


THIS IS THE START OF
GRAPHENE CITY