

GRAPHENE FLAGSHIP

– *Working together to convert
scientific excellence to
technological impacts*

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Outline

- Timeline
- Flagship goals and contents
- Implementation
- Consortium expansion stages
- Next steps

Background and Timeline

- 2010, April: Workshop on Future and Emerging Technology Flagships
“One billion euro, 10 year research programs with focus on Information and Communication Technology, funded jointly by the EC and the member states.”
- 2010, May: Present the idea of a Graphene Flagship in Brussels
- 2010, June: Compose small consortium (9 partners) for the pilot project
- 2010, October: Submit pilot proposal
- 2011, Jan.: Six pilots approved. Pilots running May 1, 2011 – April 30, 2012
- 2012, Oct.: Flagship proposal submitted, hearing Dec 10, 2012
- 2013, Jan.: *Graphene and the Human Brain Project* selected
- Now: Negotiations with the EC**
- 2013, Oct 1: Project start with a 30 month ramp up phase
Ramp up phase: EC funding 54 M€ for 2.5 years;
initially 18 M€/yr, after consortium expansion 23 M€/yr
After 2.5 years: EC funding 50 M€/yr plus national funding

GRAPHENE: *Translational nanotechnology*



(Video: A. Ferrari, Cambridge)

ICT

consumer and high performance electronics, optoelectronics



(Figure: BASF)

MATERIALS

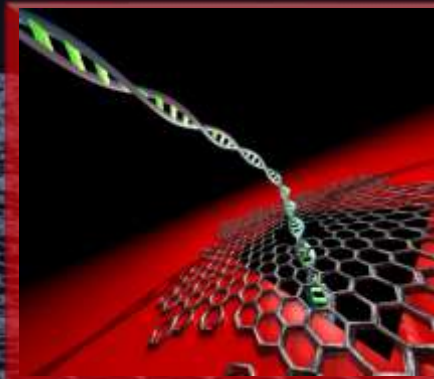
ultralight, strong composites for, e.g., aerospace and cars, conductive inks



(Figure: Chalmers)

ENERGY

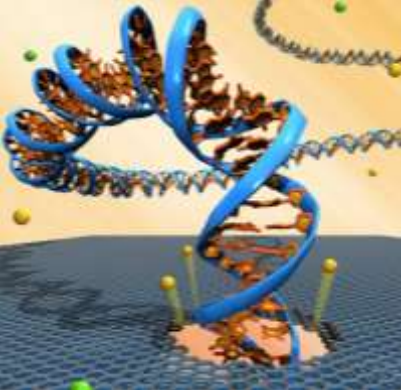
advanced batteries and supercapacitors for cars and portable appliances



(Figure: C. Dekker, Delft)

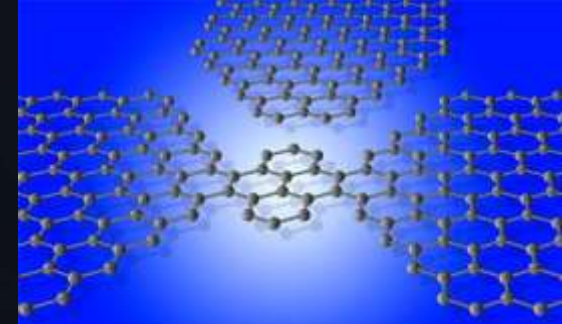
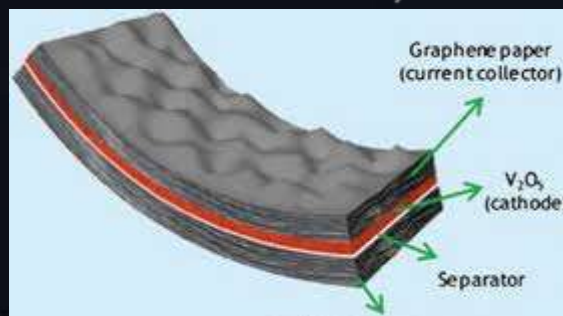
HEALTH

Rapid electronic DNA sequencing, new biosensors



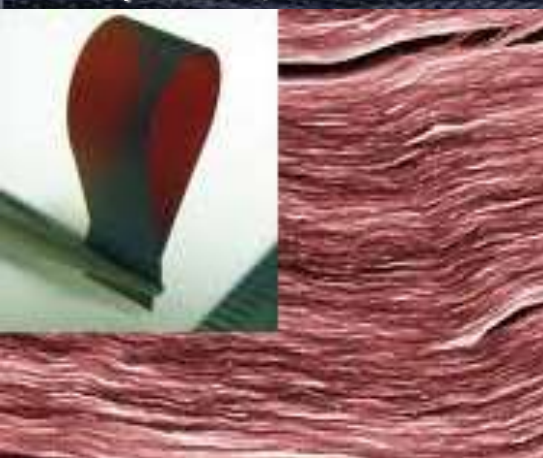
medical applications:
drug delivery;
lab-on-chip;
DNA sequencing

batteries; supercapacitors
conductive inks; etc.



graphene electronics

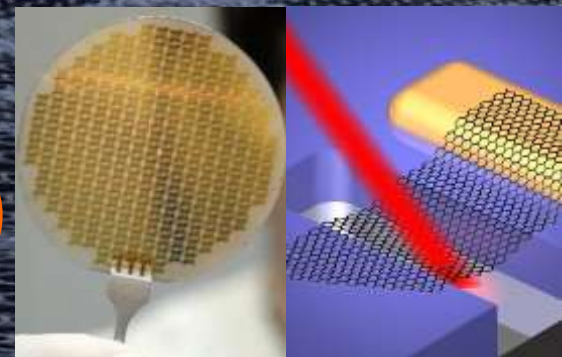
composites; barrier films



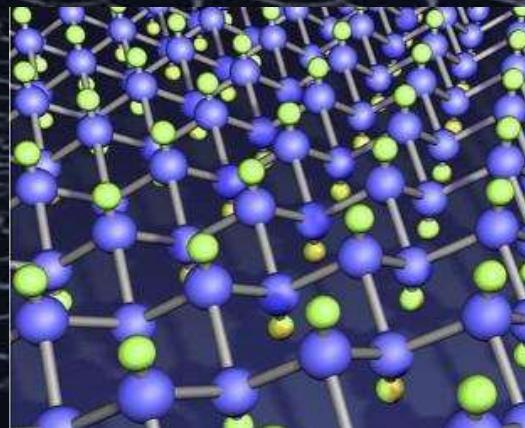
MEMS; various sensors



graphene applications



ultra-high frequency
electronics;
optoelectronics



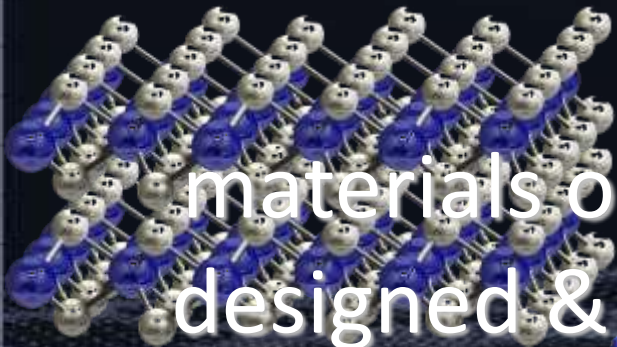
graphene derivatives;
e.g., 2D analogue of Teflon



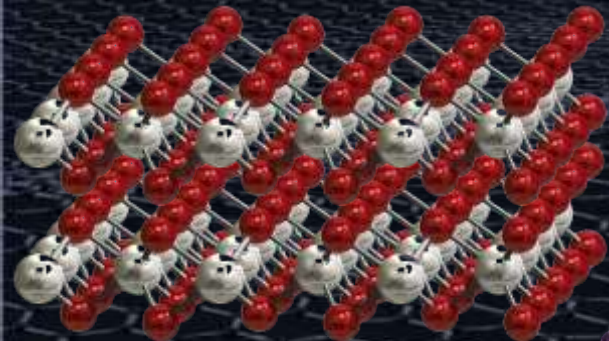
flexible
LCD and LED
wall lightning

Other layered materials

materials on demand:
designed & built with
single atom precision

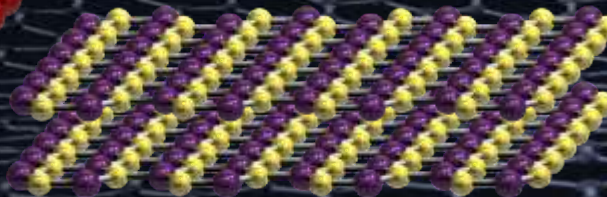


graphene

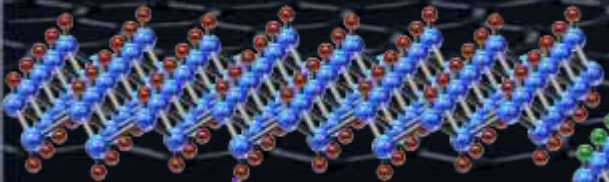


WS₂

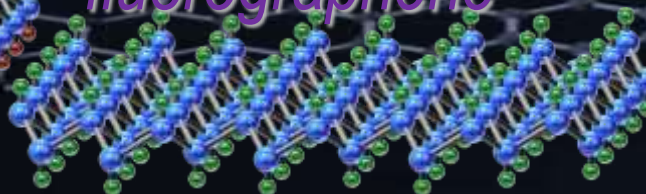
boron nitride



fluorographene



graphane



Flagship goals

Scientific objectives

- *Material technologies for ICT and beyond*
 - Identify and explore new layered materials (LMs) and assess their scientific and technological potential.
 - Develop reliable, reproducible, sustainable and safe large scale production technologies for LMs.
 - Broaden the applications of graphene and other LMs beyond ICT
- *Component technologies*
 - Identify new device concepts enabled by graphene and LMs.
 - Develop component technologies that utilize the potential of these new materials platforms.
- *Systems integration*
 - Integrate graphene-based components to systems that provide new functionalities.
 - Integrate graphene and other LMs with existing technology platforms.

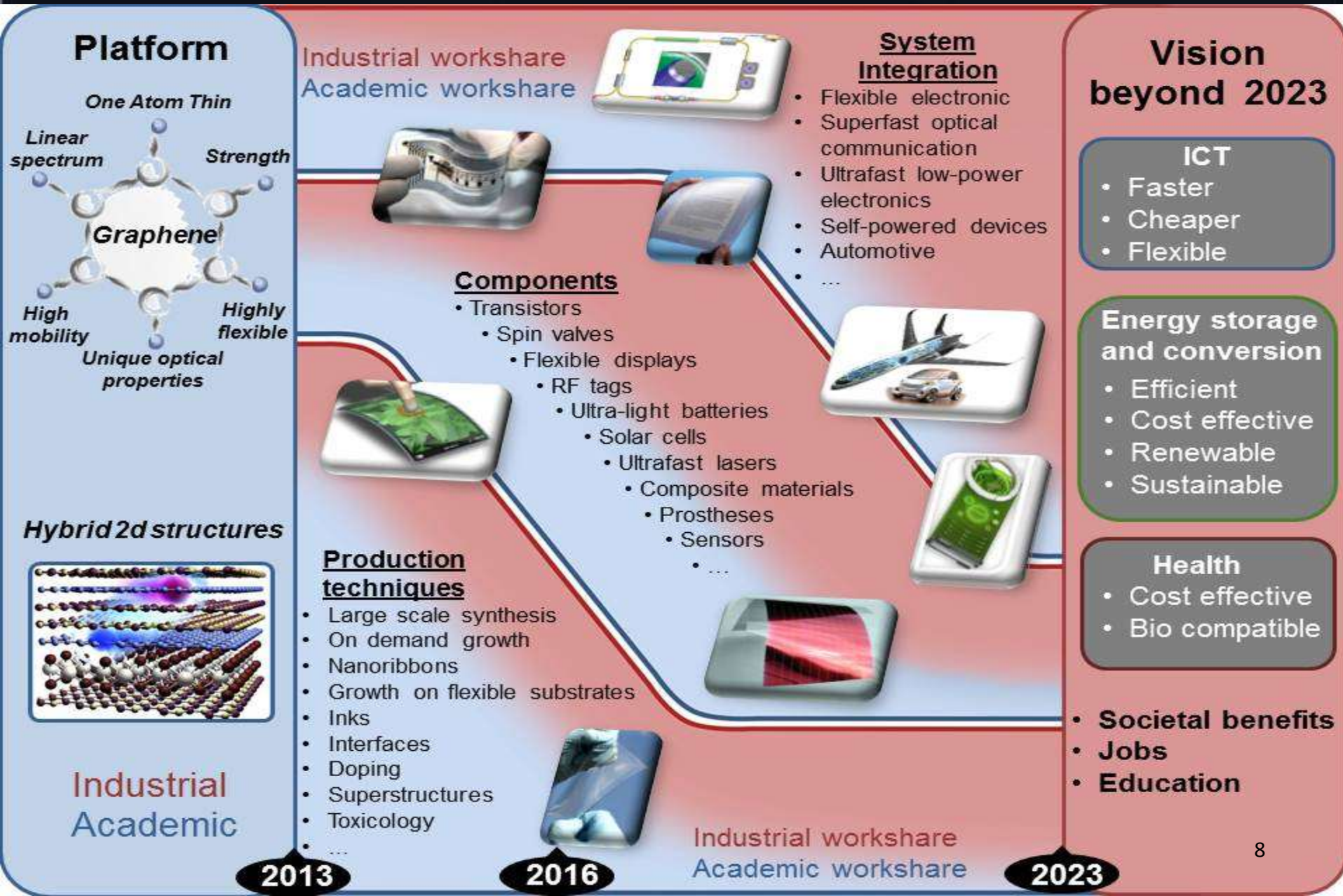
Operative targets

- Bring together a large core consortium of European academic and industrial partners,.
- Create a highly effective technology transfer highway.
- Align the Flagship with European and national priorities (**ERA-NET**).
- Engage the European societies with the Flagship.

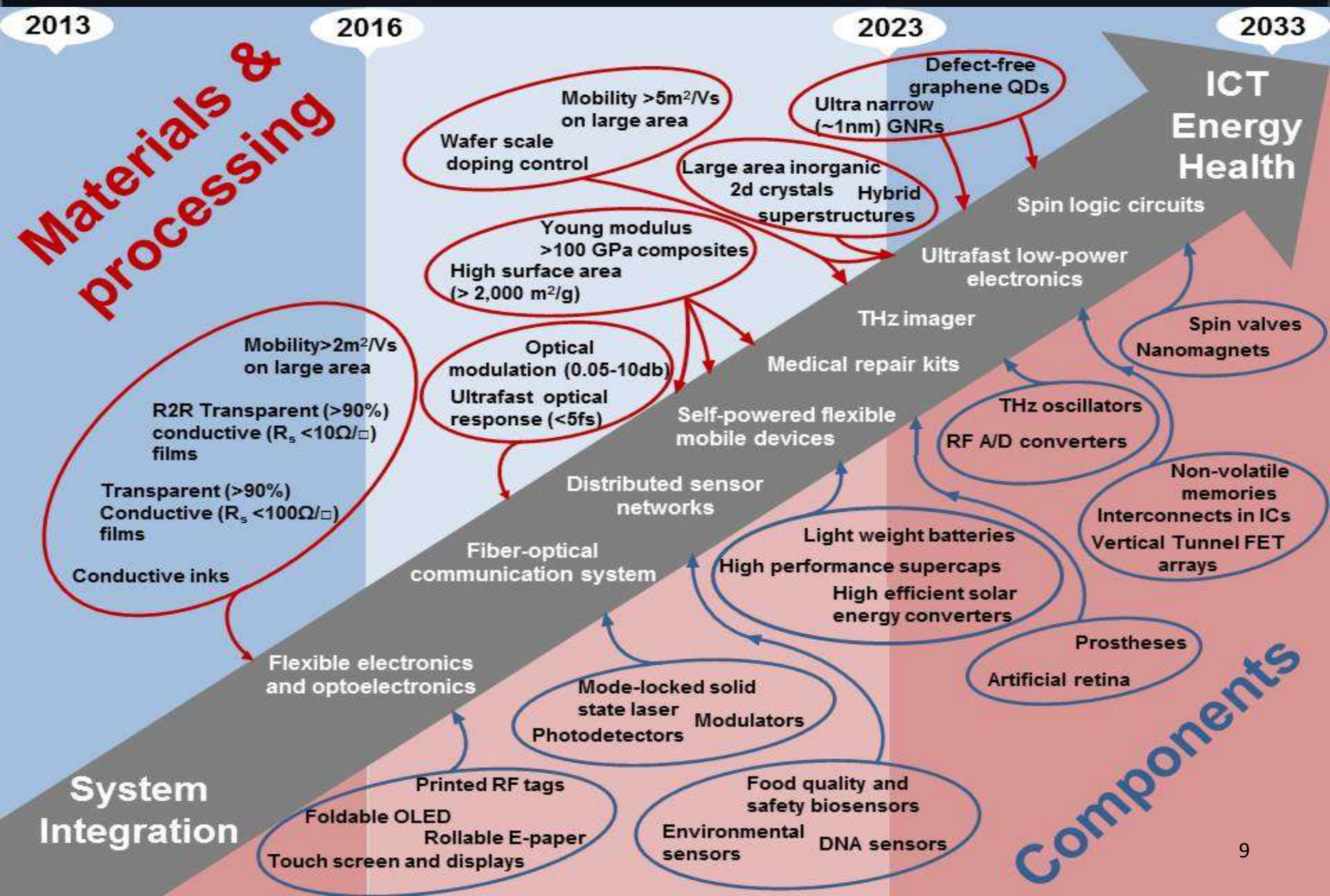
Societal goals

- Contribute to sustainable development based on abundant, safe and recyclable natural resources.
- Boost economic growth in Europe by creating new jobs and investment opportunities.

Scientific and technological roadmap



Scientific and technological roadmap



FP7 focus: *communication*

Information

Morph is a concept demonstrating some of the possibilities nanotechnologies might enable in future communication devices

New, more versatile and powerful information processing and communication devices

Physical



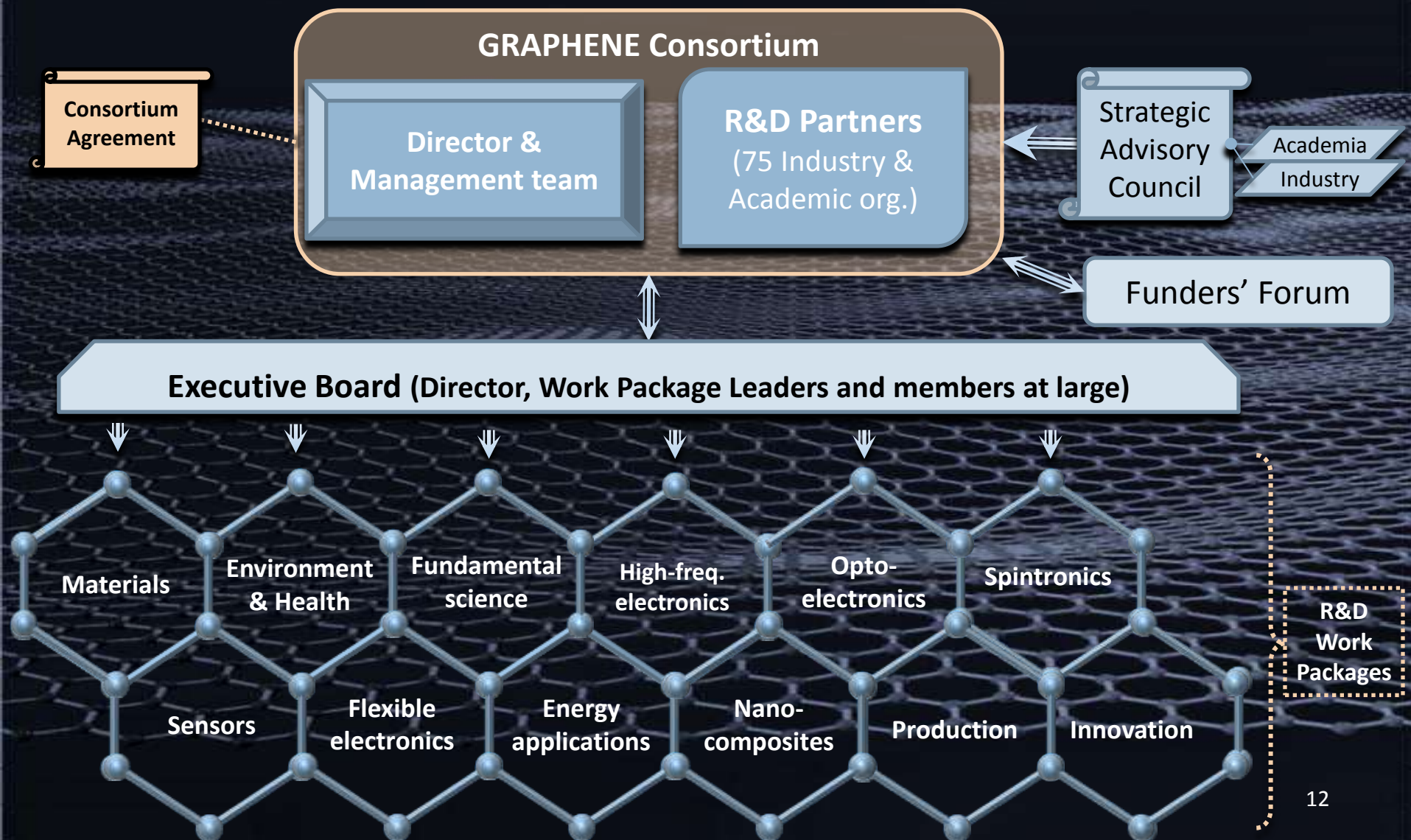
Smartforvision
(BASF &
Daimler)

New structural and functional composites, batteries, solar cells *etc.*, integrable in larger systems

Initial Flagship (CP-CSA) consortium

- 75 partners (128 groups) from 17 countries, selected by WP leaders based on their contributions to flagship goals
- Universities, research centers, companies (*e.g.*, Nokia, Airbus, Philips, Repsol, ST Microelectronics, Alcatel Lucent, AMO GmbH, Graphenea, Aixtron, Oxford Instruments)
- Focus on value chains:
 - **Intellectual value chain:**
fundamental research – applied research – industrial research (– development)
 - **Industrial value chain:**
materials-components-systems

Flagship organization



Strategic Advisory Council

Andre Geim



2010



Konstantin
Novoselov



2010

HELSINKI



Tapani Ryhänen
NOKIA

MANCHESTER



Albert Fert
THALES



2007

TOULOUSE

Klaus von Klitzing
MPI



1985

STUTT GART



Byung Hee Hong
Seoul National U.

MADRID



Francisco Guinea
CSIC

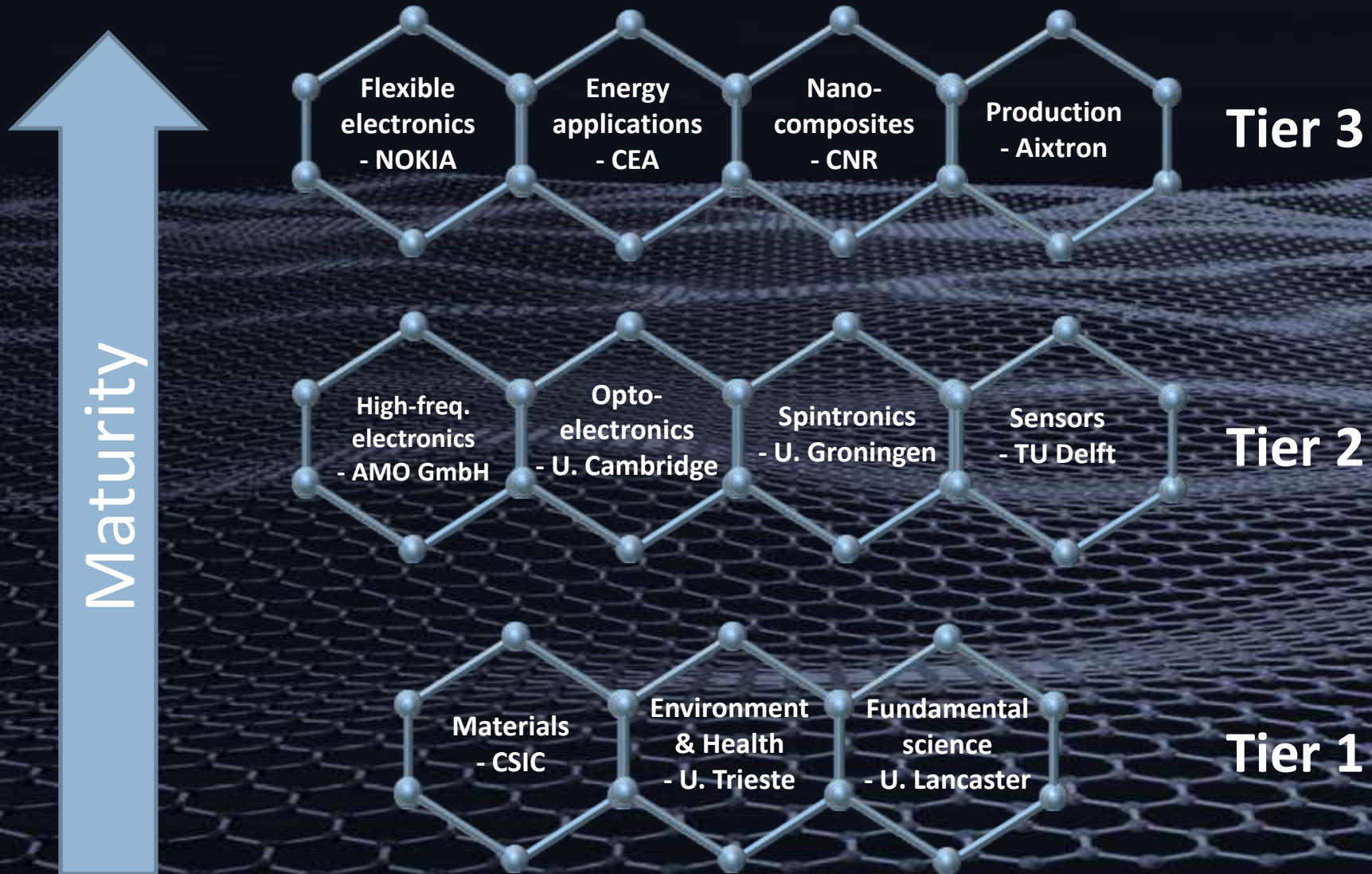


Gareth Williams
AIRBUS



Luigi Colombo
Texas Instruments

Different maturity levels

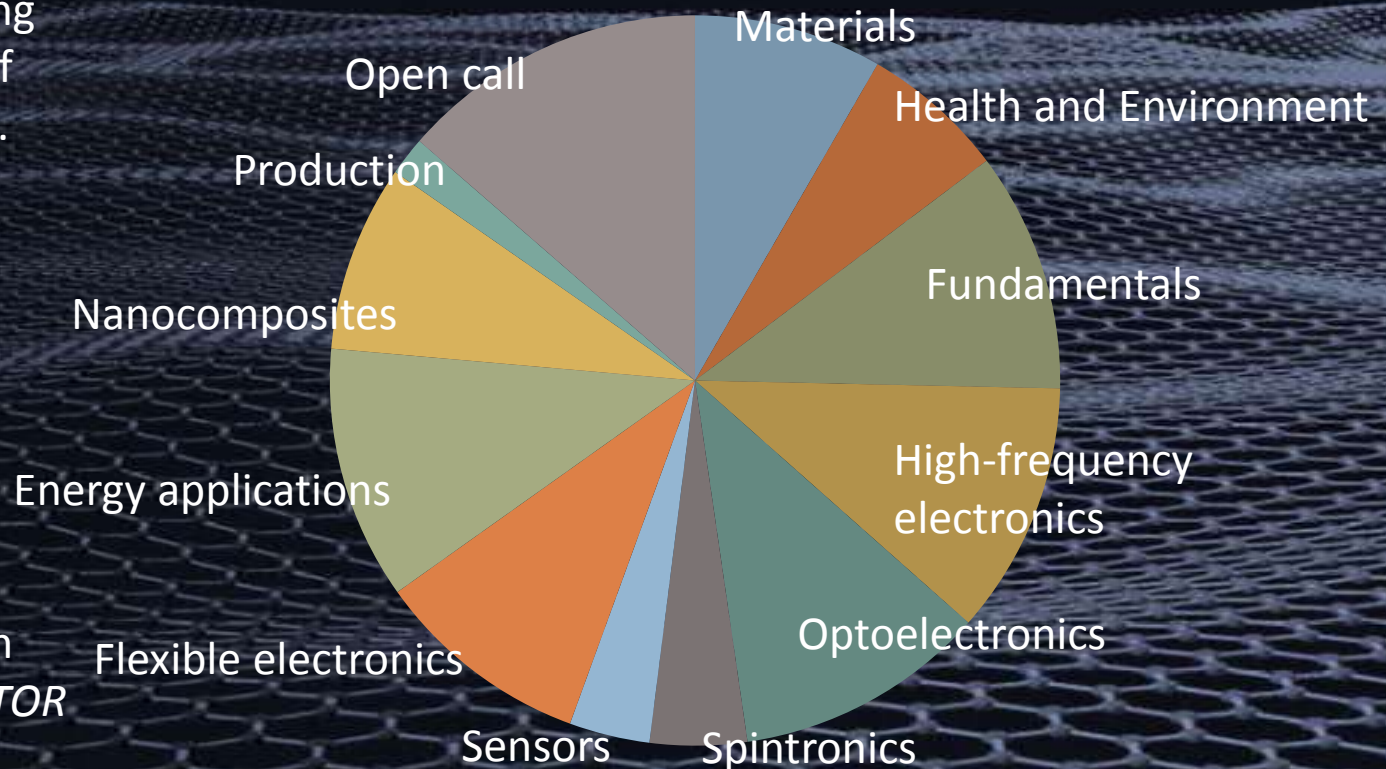


Budget (CP-CSA)

Total project cost during 30 months is 75 M€, of which EC funds 54 M€.

On the right: distribution of *total cost* per S&T WP.

Note: Production is mostly funded through an NMP call – *GLADIATOR* and ???



Support WPs

- Innovation (WP12)
 - Maximize impact and coordinate technology transfer
 - Organize industrial workshops (together with WP13)
 - Develop integrated IP handling for the H2020 phase
- Dissemination (WP13)
 - Internal dissemination (conferences, winter schools, newsletters)
 - External dissemination (reports, exhibitions etc.)
- Alignment (WP16)
 - Coordinate with member states and other programs
- Management (WP14 & WP15)

Consortium expansion

- Open call, to be published on Nov. 27, 2013
 - Budget about 9 M€, *focus on engineering*
 - 11 technical topics to be specified, plus 1 bottom up topic, 700 k€/topic
 - E.g., standardization, chemical sensors, other layered materials, and engineering modeling have been proposed (most suggestions in *Materials* and *Nanocomposites*)
 - Suggestions solicited from WP leaders, Strategic Advisory Council, Graphene Alliance (industrial), national agencies, and decide by the Executive Board
 - Received proposals will be evaluated and ranked by external, independent experts: *Flagship leadership cannot pick and choose new partners at will*
 - **EC rule: existing beneficiaries are not eligible to apply (PIC)**
 - *Information booklet available*
- ERA-NET project *FLAG-ERA*
 - Proposal submitted on April 16 by 22 national agencies (14 member states and 3 associated countries) plus 10 organizations that may join later (9 member states)
 - Multinational call(s) planned, maybe in 2015
 - The CP-CSA will work closely with the ERA-NET to create synergies
- Horizon 2020 expansion in 2016
 - A flagship call is expected to be published with a closing date in 2015
 - EC contribution increases by a factor of 2-3, no details known about the national contributions
 - Expect that 150-200 partners will be included in the H2020 project

Associated members

- Groups funded by sources other than the CP-CSA may become Associated Members (AMs)
- AMs are not partners in the CP-CSA but will have access to those functions of the CP-CSA that do not require confidentiality (winter schools, publication databases, information material)
- AMs are selected by the Executive Board (*does the proposed AM contribute significantly to the flagship goals?*)

What is next?

- Circulate and sign Consortium Agreement
- Preparatory work: open call topics, prepare dissemination activities, define administrative routines
- Discuss Horizon 2020 implementation with the EC (June 13)
- Administrative kick-off meetings on October 10-11 in Gothenburg – invitations will be sent out in a few weeks
 - Strategic Advisory Council, General Assembly, and Scientific Board
 - Distribute administrative routines and decide the topics for the open call
- WP specific meetings in early fall, to be called by the WP leaders
- First winter school and industrial workshops in spring 2014
- GrapheneWeek 2014 as the first large scale scientific event, organized by the flagship



Graphene disruptive technologies

- *from European laboratories to Europeans*