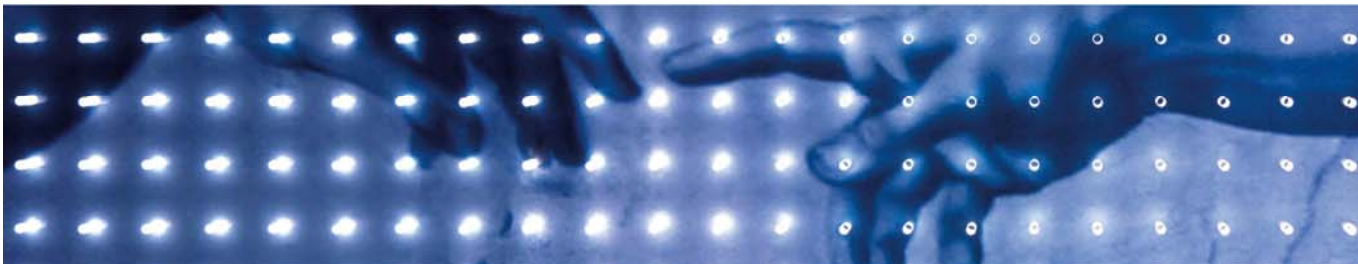


# Bereitstellung von Infrastruktur am Beispiel GENNESYS

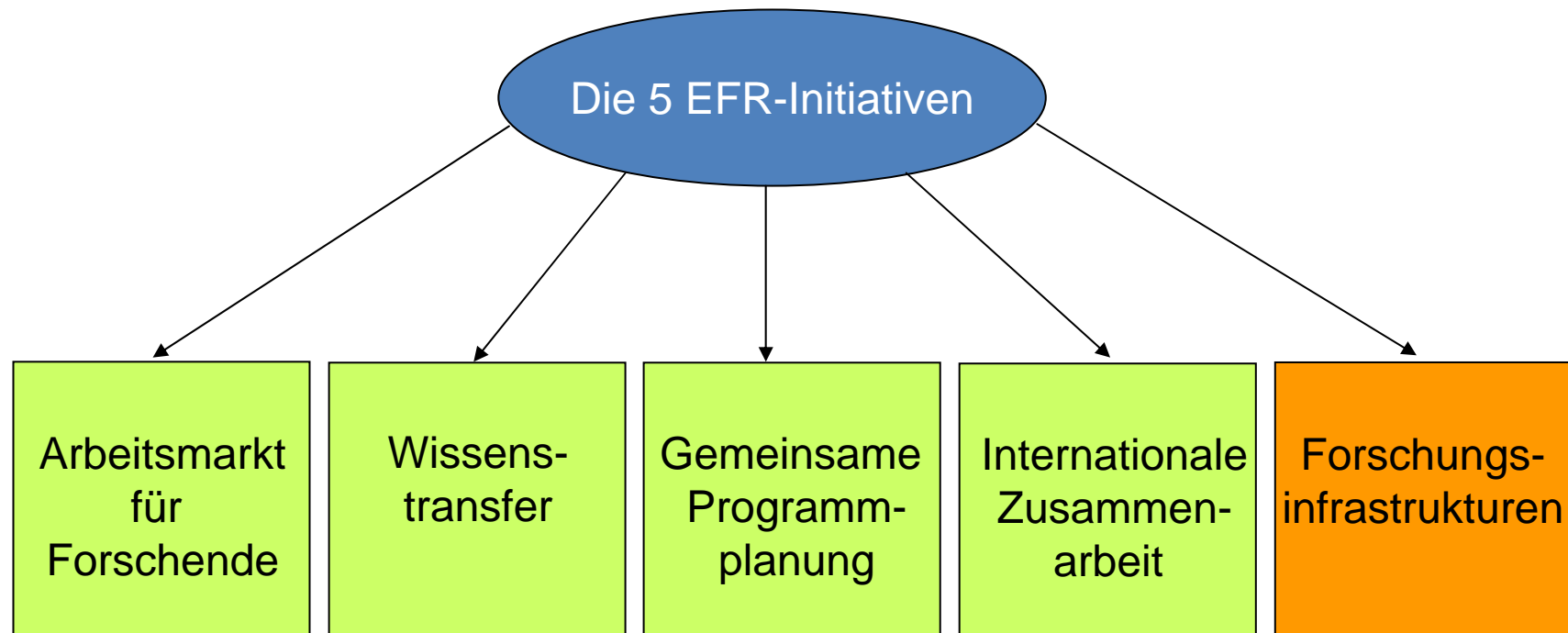
Wolfgang Kaysser

GKSS-Forschungszentrum Geesthacht GmbH

Neue Chancen für Materialwissenschaft und Werkstofftechnik im Europäischen Forschungsraum?  
DFG/acatech 24.8.2010



# Der Europäische Forschungsraum (EFR)



# Die EFR-Initiative

## Forschungsinfrastrukturen



### Ziel: Schaffung von Forschungsinfrastrukturen von Weltniveau

- **ESFRI-Roadmap:**  
Errichtung **neuer** Infrastrukturen (derzeit >40 Vorhaben, darunter deutsche Projekte wie XFEL, FAIR und Aurora Borealis)
- **Förderung von Infrastrukturen im Forschungsrahmenprogramm**  
(Designstudien, Infrastrukturprojekte, Ausbau und Entwicklung Informations- und Kommunikations-Technologie (IKT)-basierter Infrastrukturnetze)
- **Gemeinschaftlicher Rechtsrahmen** für ein europäisches Konsortium für eine Forschungsinfrastruktur (ERIC) → erleichtert die Umsetzung der Vorhaben der ESFI-Roadmap, seit Ende August 2009 in Kraft

# Beispiele großer Forschungsinfrastrukturen für die Materialwissenschaft: **ESFRI-Liste**



## Liste der ESFRI Roadmap-Projekte (44 Projekte in unterschiedlichen Stadien)

### Materials and Analytical Facilities (6 Projekte)

#### 1. Projects under implementation:

ESS (European Spallation Source), Lund/Schweden

European XFEL, Hamburg

ESRF upgrade (European Synchrotron Radiation Facility), Grenoble

ILL 20/20 upgrade, Grenoble

#### 2. Projects in progress:

EuroFEL, Hamburg decentralized)

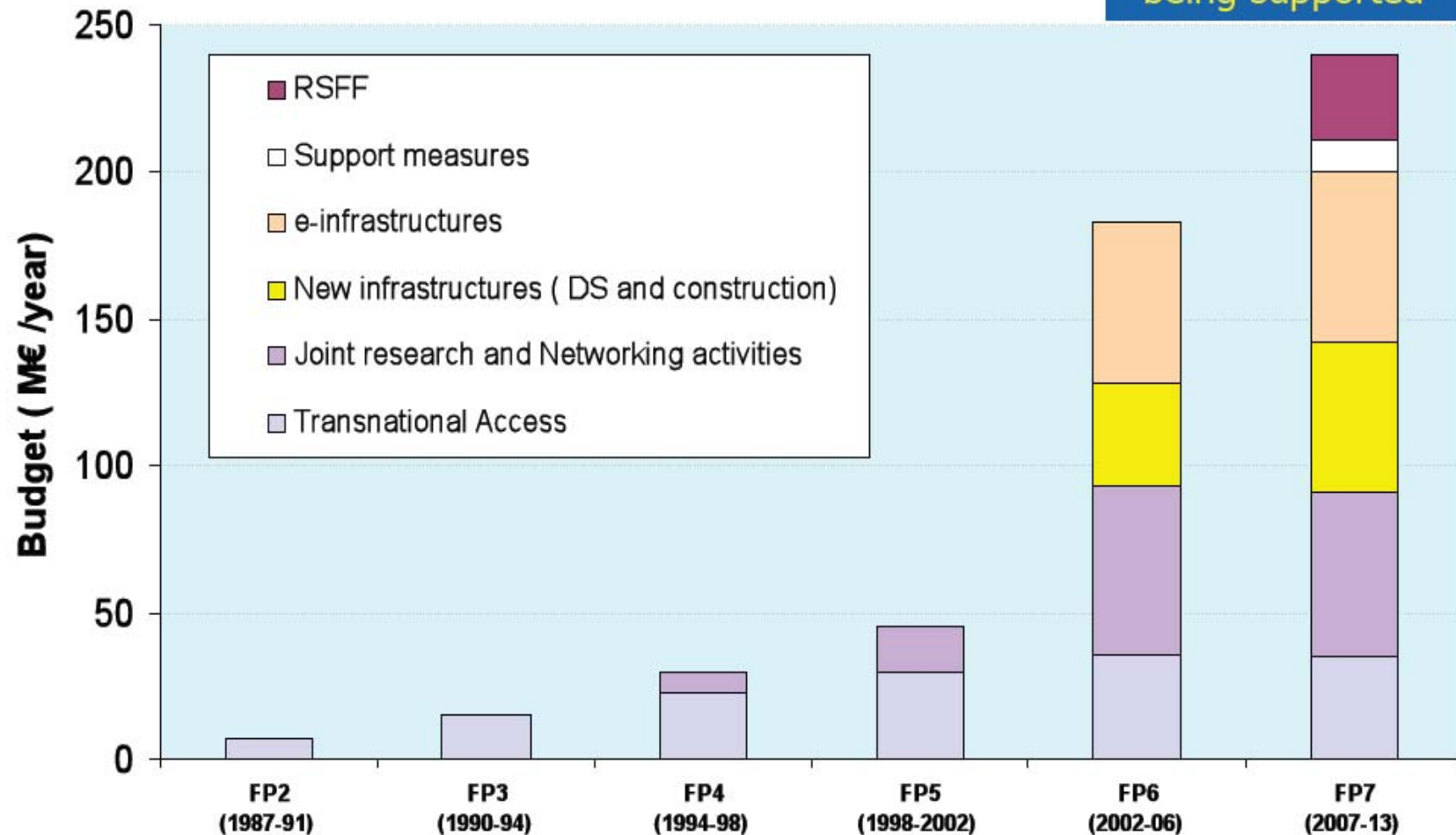
#### 3. Projects from the recent roadmap update 2008:

EMFL (European Magnetic Field Laboratory, Grenoble decentralized)

### Physical Sciences and Engineering (8 Projekte)

# A steady evolution since 20 years...

About 550 RIs  
being supported



# Need for European roadmap for RIs



Good networks of analytical facilities  
(e.g. synchrotrons, neutrons, lasers, microscopy, ICT)

Is this sufficient?

- How to link better research and innovation
- How to address better grand challenges?

**Problem currently identified:**

- No European roadmap for RIs in the **nano-science and technology field**
- Difficulties of integrating national RI-nanoactivities within a pan-European system

## A joint vision should be agreed

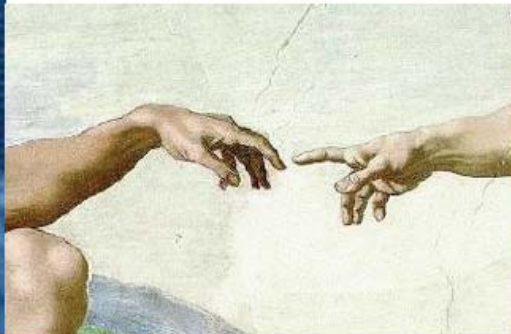
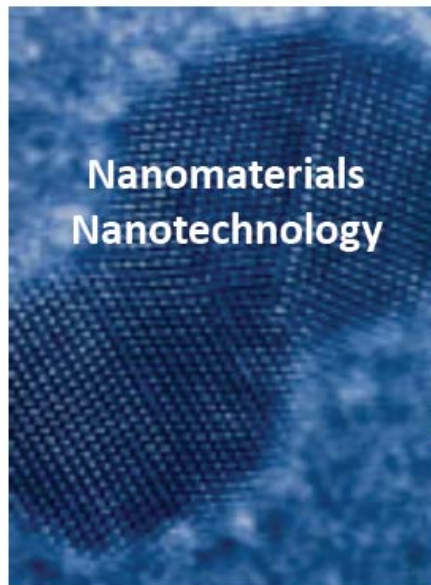


- A fully integrated, consistent, efficient **System of Research Infrastructures**, serving researchers and society in all S&T fields (broader approach than just FP8)
- **Research Infrastructures as knowledge industry** for the knowledge society: Source of innovation and **source of attraction** for world leading scientists
- Based on / feeding excellent universities and widely used & efficient e-infrastructure (need for increased inter-ministries / inter-agencies cooperation)



# GENNESYS

Grand European Initiative on Nanoscience and Nanotechnology  
using Neutron and Synchrotron Radiation Sources



Mission: To establish a strategic partnership between nanomaterials research laboratories, universities, industry and the European research infrastructures

# GENNESYS White Paper



## European Roadmap for -



- mastering the grand challenges



- fundamental research in nanoscience



- nanomaterials development

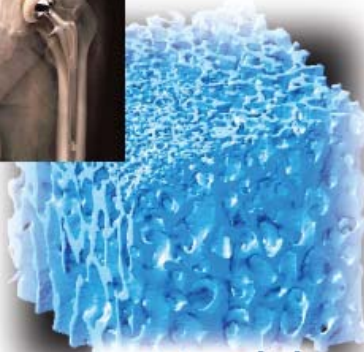


- integrating RIS into European hightech strategy



- creation of European Centres of Excellence

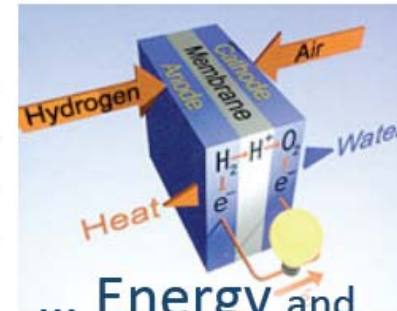
# Global Grand Challenges



... Health

new drugs  
tissue engineering  
bone replacements  
nanotoxicology

fuel cell materials  
energy harvesting materials  
fusion reactor materials  
H-storage materials



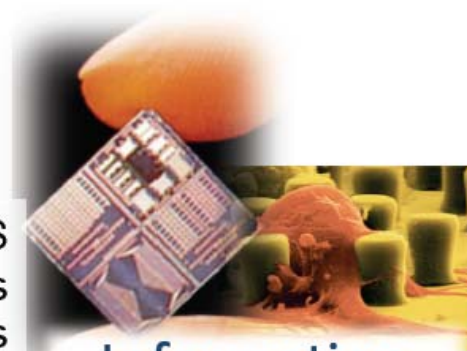
... Energy and Environment

## Advanced Materials Design for ...



... Transport

light weight/high strength materials beyond CMOS  
thermal barriers  
smart coatings  
bio-info-interfaces  
nonvolatile memories



... Information Communication

# Challenges for Transport Technologies

- Automotive and Aeronautics -

## Reduced CO<sub>2</sub> emissions

- aircraft: CO<sub>2</sub> - 50%, NO<sub>x</sub> - 80%
- car: < 100g CO<sub>2</sub>/km

## Noise reduction

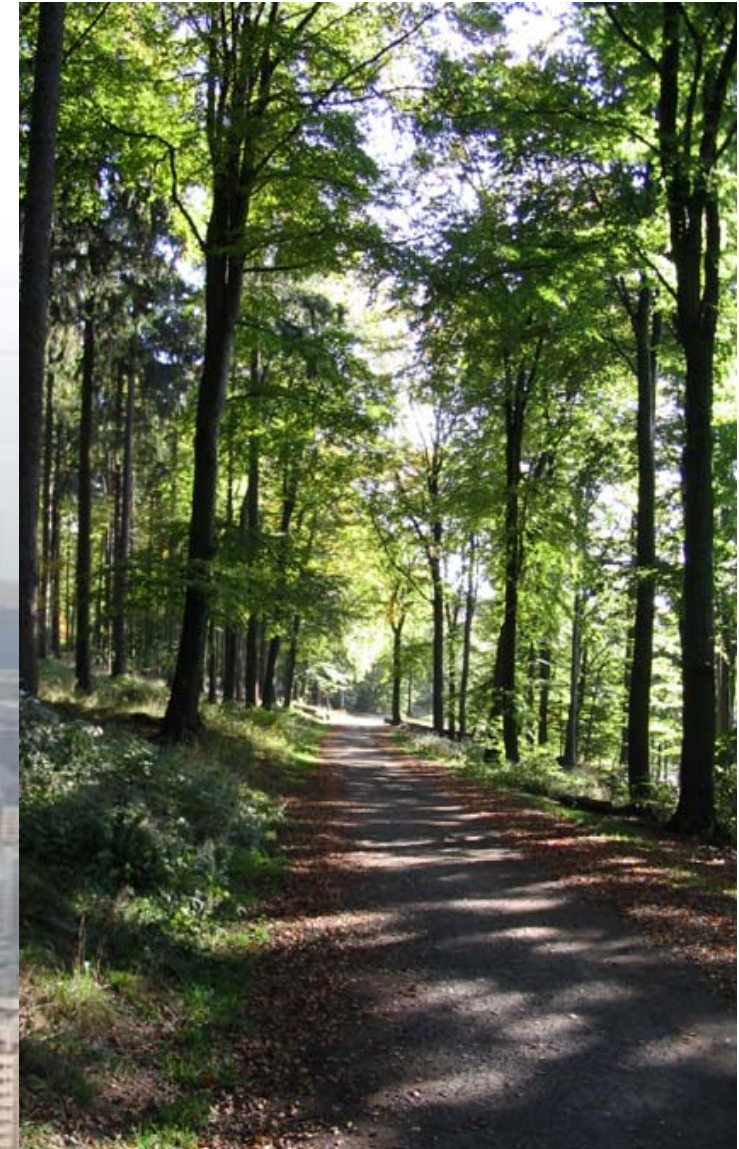
- aircraft: halving the noise  
engine: - 10 dB

## Safety and comfort

- aircraft accident rate - 80%

## Cost effectiveness

- aircraft and car  
time to market: - 50 %



# Necessary Achievements for Transport Technologies



## Necessary Tools

- Synthesis
- Modelling
- Characterization

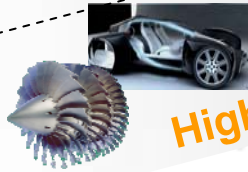
Necessary achievements, Barriers to overcome



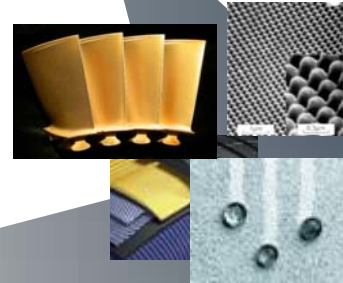
Corrosion, Friction and Wear.  
Easy to clean, Anti-reflection, Thermal control  
**High-performance Surface Design and Coatings**



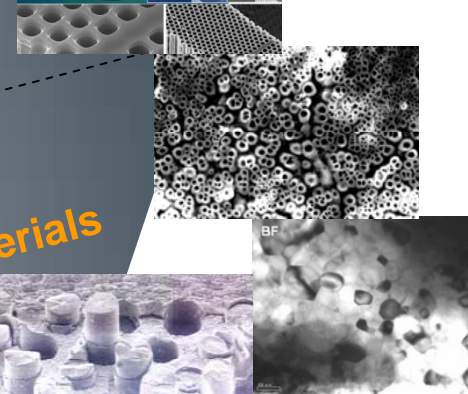
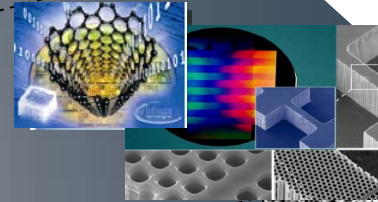
Lighting and Displays, Sensors and Actuators  
On-board control of materials  
properties & engine parameters  
**High-performance Functional Materials**



Ultralight safe Frames  
Ultralight high-temperature Components  
**High-performance Hierarchical Engineering Materials**



## New Nanomaterials required !



State of the art

Challenges

Breakthroughs

# Necessary Tools to obtain new Nanomaterials for Transport Technologies: **Synthesis, Characterization, Modelling**



## → Synthesis

- Nanoparticle Preparation
- Deposition Techniques
- Removal Techniques
- Modification Techniques
- Deformation Processing
- Joining

## → Modelling & Simulation

- Multi-scale modelling capabilities
- Bridging atomic and nano scale
- Electron, spin, molecular transport
- Simulating directed self-assembly
- Modelling proximity effects

## → Characterization

- Characterization at the nanoscale
- Time-resolved measurements
- In-situ observations
- Nano- and microtomography

# Necessary Characterization Tools

High neutron and photon fluxes  
beams

Highly-brilliant and stable



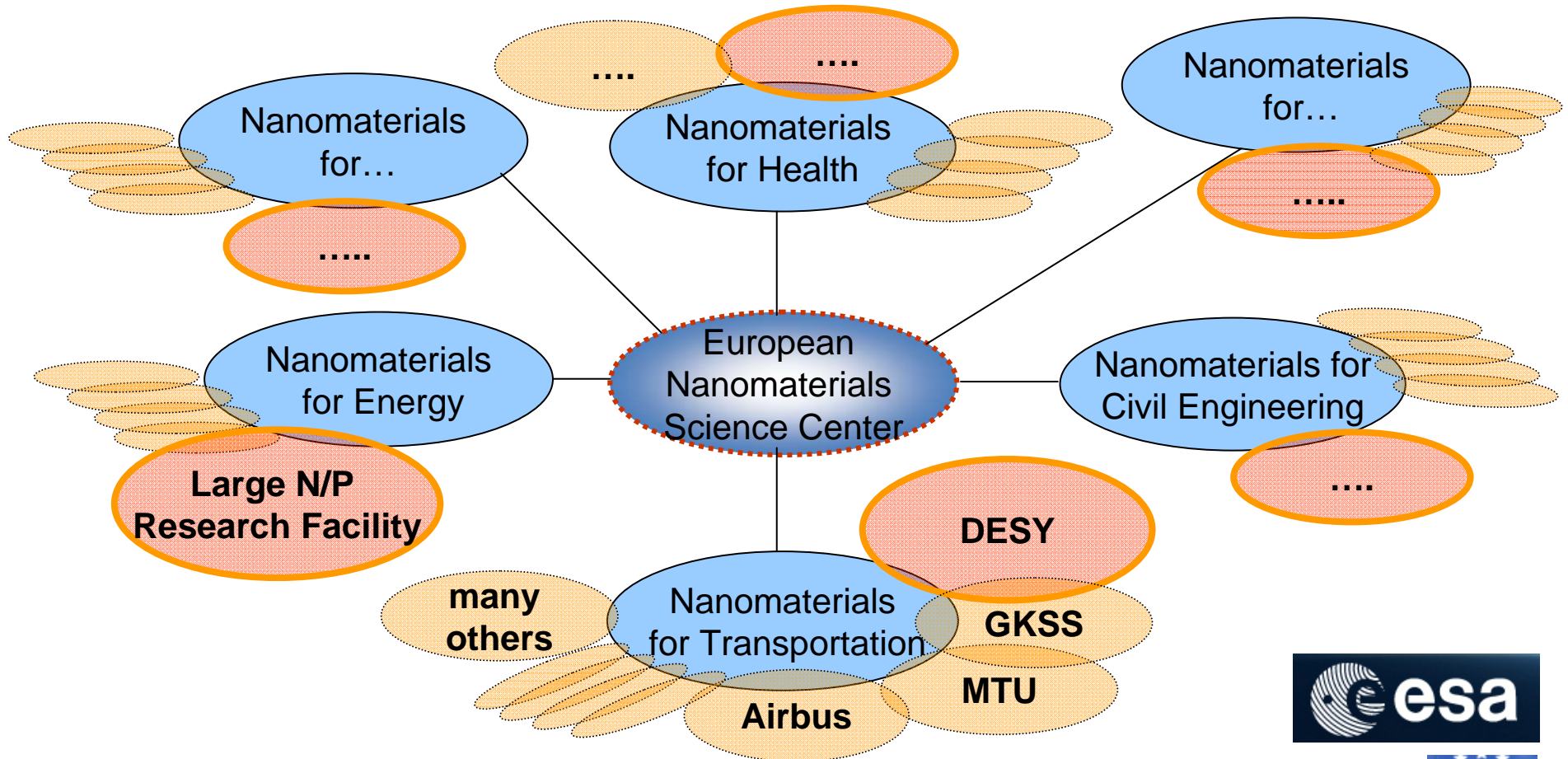
Ultra-fast detectors    Time-resolved neutron spin echo techniques  
X-ray strain diffraction with  $< 100\text{nm}$  spatial resolution



# Realization



Local sectoral Science and Technology Centers and one coordinating central European Nanomaterials Science Center



8th, 9th EU Framework Programm, EU- COST, EU-EUREKA  
Aeronautic and Space Programm

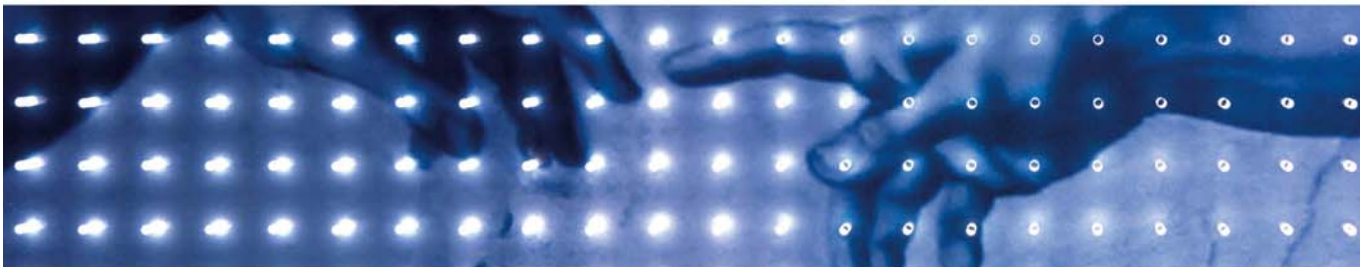
# Next steps



Platform for Research and Commercial Technology for Industry, Science and Government  
→ European Nanomaterials Science and Technology Centre  
→ Installation of a Secretariat and a Task Force



Platforms for Sectoral Research and Commercial Technology for Industry, Science and Government  
→ Sectoral local Nanomaterials Science and Technology Centers  
→ Form sectoral consortia of industry, science and providers of neutron and synchrotron facilities





**Thank you**