



Design for Micro & Nano Manufacture (PATENT-DfMM) www.patent-dfmm.org

Andrew Richardson – Lancaster University
(coordinator)

Apr-07

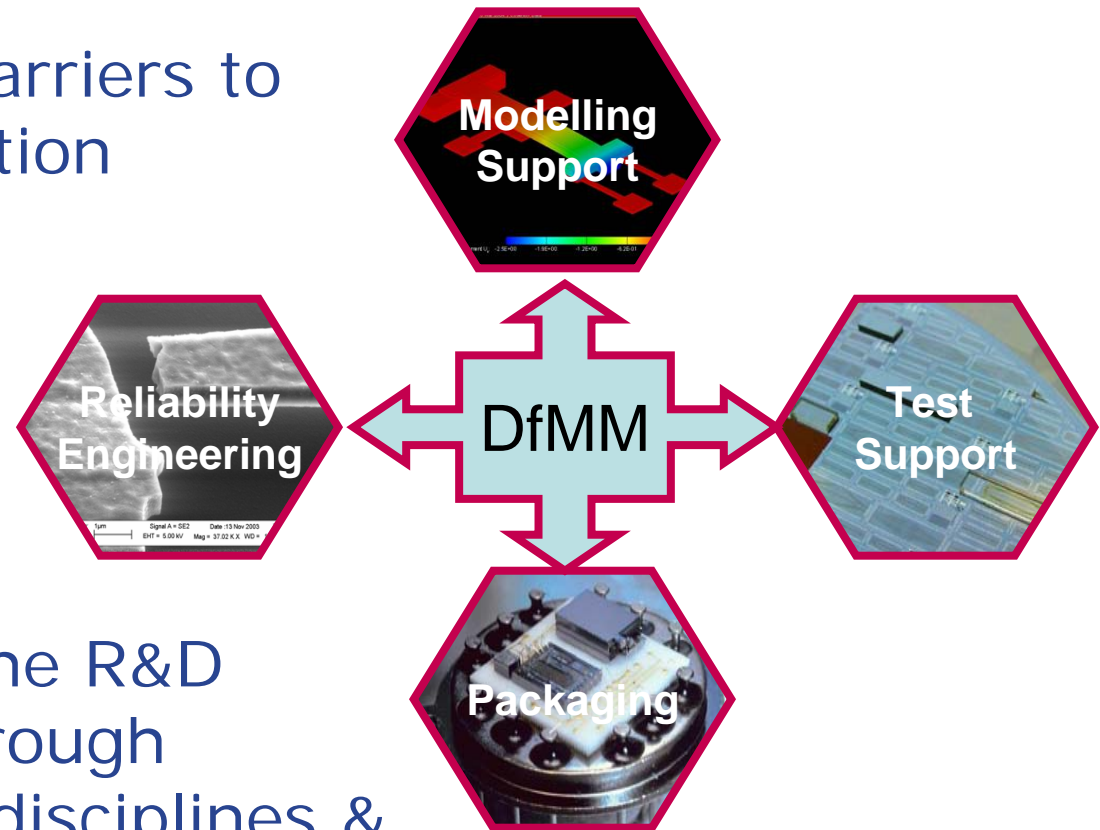
«Design for Micro & Nano Manufacture (NoE PATENT-DfMM)»
Network of Excellence funded by the European Commission (EC FP6: IST, Unit C2, Contract 507255)

□ Motivation

- Address key barriers to commercialisation

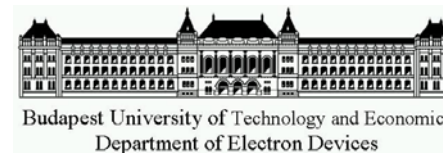
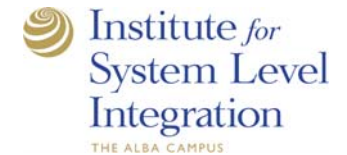
□ Goal

- Re-structure the R&D community through integration of disciplines & Launch a industrial support service



- Duration: 1 Jan 2004 – 31 Dec 2007
- EC Budget: 6.2 M€ (over 4 years)
- Partners: 24 (21 research, 3 commercial)
- People: 145 (120 researchers, 25 PhD)
- MB: 8 WP leaders + IAB chair
- IAB: 22 members

- Novel strategy for control of project financial allocations through an "internal call scheme"
- Focus on creating a new community and commercial services



- ❑ Chairman: Alistair Sutherland, BCF Designs

- ❑ Members:
 - **Tools (EDA)** : Coventor, Dolphin Integration, SoftMEMS, Flowmerics.
 - **System Integrators** : Philips, Alcatel Space, NXP, Infineon / Sensoror, ST Microelectronics, BAE Systems, Renishaw
 - **Component & Design Houses** : MCE, IMEGO, Oxley, Colibrys, BCF Designs, Novamems, LioniX
 - **Equipment Providers** : SUSS MicroTec AG, Polytec GMBH,
 - **Consultants** : P & A Europe, Enabling 3M

- ❑ The IAB is coordinated by Patric Salomon 4M2C

- Year 1
 - Strengthen collaboration between experts in 4 key disciplines
- Year 2
 - Initiate cross-disciplinary actions, put in place teams able to address key industrial challenges
- Year 3
 - Focus new teams on demonstrators and key challenges (Flagships)
- Year 4
 - Role capability out to industry – attempt to achieve a degree of sustainability



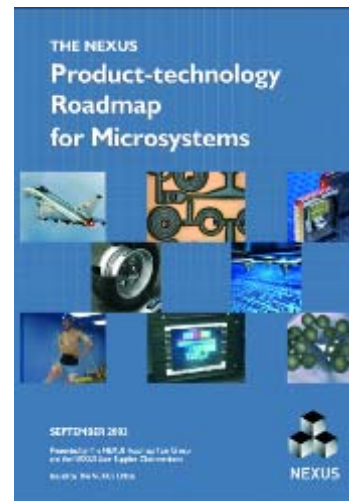
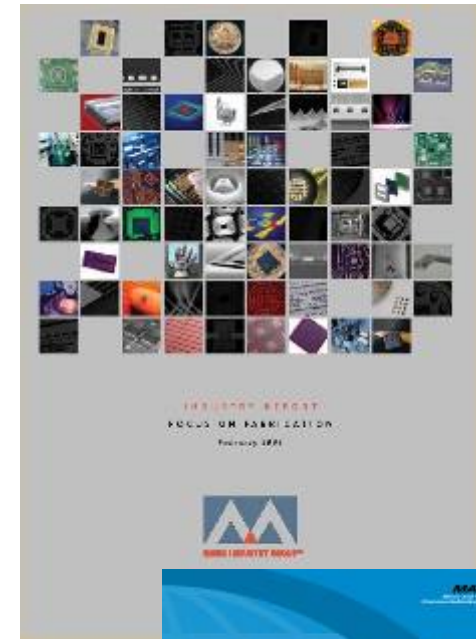
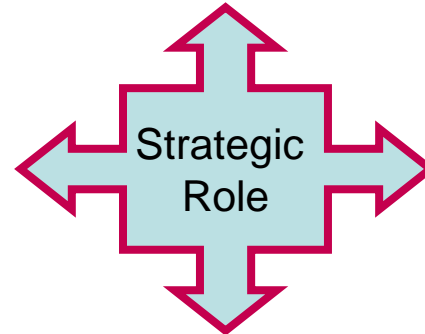
**Organised by
PATENT-DfMM:**

**NEXUS MWG Reliability
and Test Workshop**

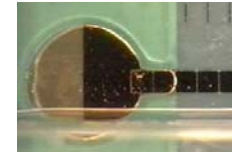
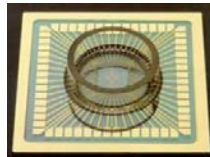
27-28 Nov 2006, Milan

**NEXUS MWG Design
Modelling Simulation
Workshop**

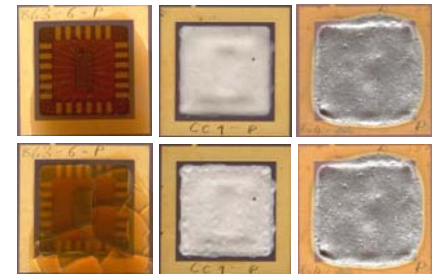
25-26 Jan 2007, Berlin



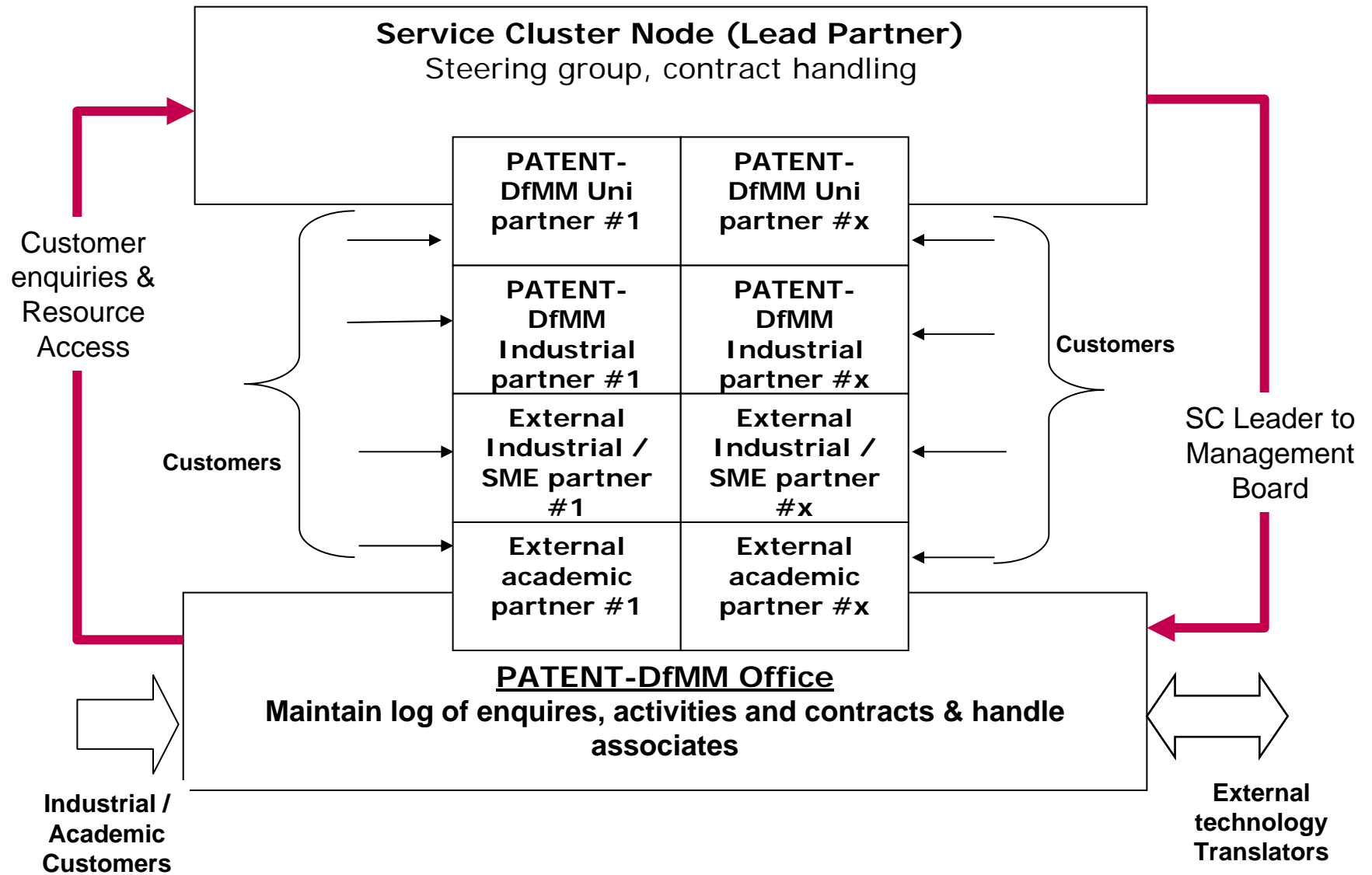
- BioDROP: Addresses Health Monitoring, Test & Reliability in drug discovery and synthesis platforms
 - MESA+, ULAN, QinetiQ, CCLRC, LIRMM, Pepscan, MultiSynTech,



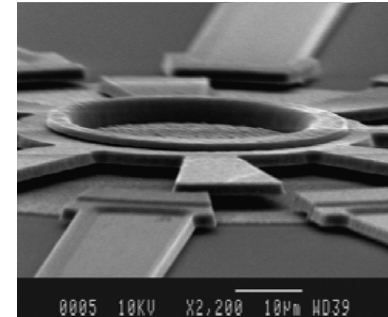
- Reliability Cluster : activities in accelerated ageing (RELMETH), Vibration & shock in harsh environments (VIBSHOCK) and humidity / hermeticity monitoring (HERMETICITY)
 - Tyndall, IXL, IEF, LAAS, LIRMM, QinetiQ,
 - BUTE, IMT, POLIMI, CEA-LETI, ULAN



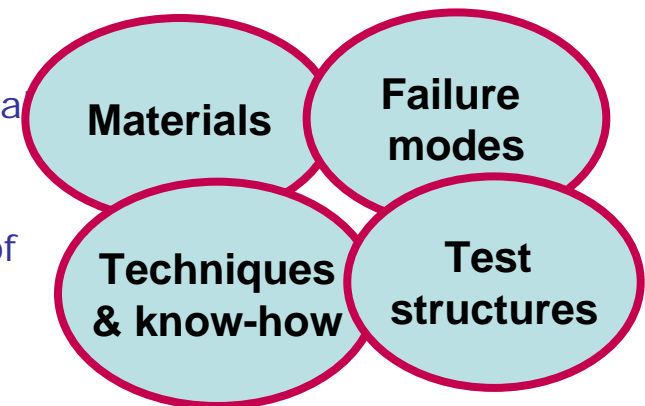
- HUMS (Health and Usage Monitoring MicroSystems)
 - HWU, ULAN, LIRMM, BUTE, ISLI, BCF Designs



- ❑ Accelerated Life Testing (ALT), FMEA & Failure rate / MTBF prediction.
- ❑ Induction, measurement and analysis of MEMS Failure Mechanisms
- ❑ A cluster of experts:
 - international team (15 European research institutes and universities),
- ❑ Services to include:
 - ALT: constant stress tests, executed on 3-5 samples (of 10-20 items each), for extended time (or number of cycles), till a significant number of failures occurs (typically, 50% of the sample). Final result: Failure rate / MTBF vs. time / stress
 - HALT: a step-stress test, with increasing stress, typically, 3-5 days, executed on a single sample of 10 items. Final result: functional and destruction limits of the product.

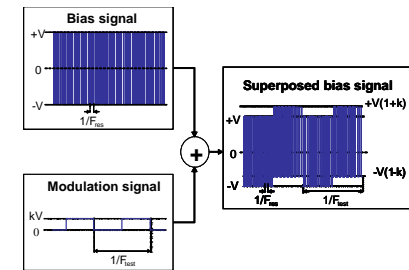
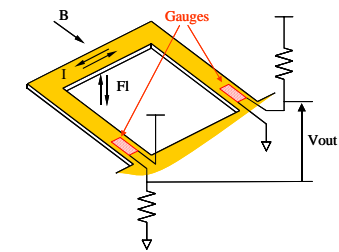


FMEA work on a range of MEMS devices

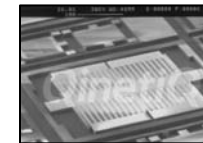


Access to an dedicated extensive database

- ❑ Embedded electrical only test solutions for functions with non-electrical interfaces
- ❑ **A Cluster of experts :**
 - Lancaster University. CNRS, Montpellier, QinetiQ
- ❑ **Services :**
 - Feasibility studies on embedded test solutions for microsystems and system-in-package technology featuring functions with non-electrical interfaces
 - Access to extensive information database and consultancy
 - Design service for self-test or condition monitoring functions
 - Prototyping facility (silicon and board based)

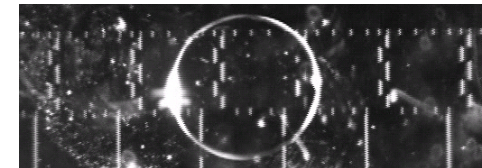
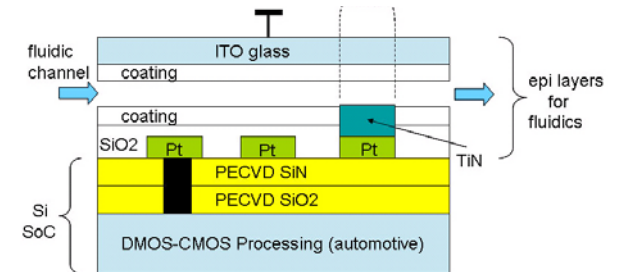


Injection of test signals into bias structures to test magnetometers

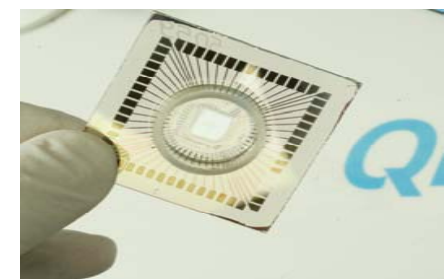


Prototype solution for accelerometers

- Integration of testability / robustness / condition monitoring in **Micro-Electronic Fluidic (MEF)** systems
- An expert cluster
 - University of Twente, CTIT MESA, QinetiQ Ltd, University of Lancaster, MultiSynTech GmbH, University Montpellier II (LIRMM), CCRLC C3M
- **Background credibility**
 - Design, implementation and test of digital MEF
 - Design of localization and contents electronics
 - FEM as well as high-level digital MEF modelling
 - Feasibility research of suitable bio applications
- **Services**
 - Design, implementation & test of MEF biosystems
 - Modelling of Micro-Electronic Fluidic Systems
 - Related consultancy

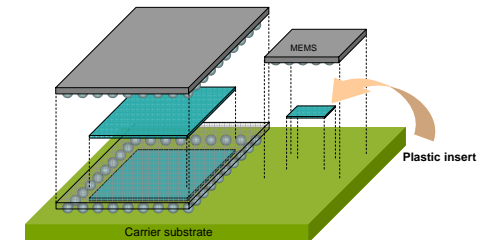


Work on droplet transport for drug analysis / synthesis

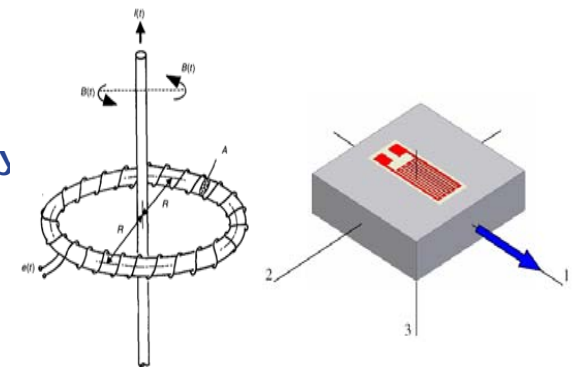


Integration of uFluidic transport in Micro-electrode arrays for analysis of living cell activity (COURTESY OF QINETIQ).

- Miniaturised HUMS units containing sensors & on-line test functions
- Library of MEMS and Electronic self-test functions for bespoke HUMS
- A Cluster of experts :
 - Heriot Watt University, Lancaster University. CNRS, Montpellier, BCF Designs, ISLI and BUTE
- Services
 - Feasibility studies on embedded HUMS solutions systems where periodic or continuous diagnostics or condition monitoring is required
 - Access to extensive information database and consultancy on methods to achieve on-line test, fault tolerance and diagnostic capabilities.
 - Design service for HUMS sensors based on microtechnologies (temperature, stress, humidity, EM fields etc) and electrical self-test functions
 - Prototyping facility (silicon and board based)

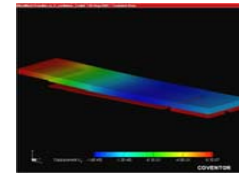
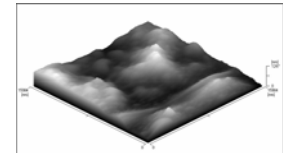
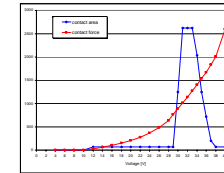


Integration into SiP systems with Philips Semiconductors

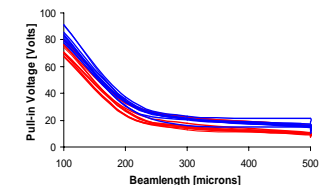
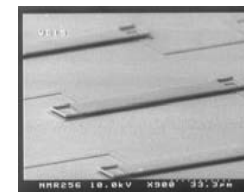


Microsensors for aircraft wiring monitoring – UK AiGT

- MEMS / Integrated MEMS design service targeting high quality, high reliable and economic designs through DfM
- Added Value through experts in key MEMS design challenges inc : stiction, damping, thermal-mechanical, package interaction, electromigration, degradation mechanisms
- An Expert Cluster :
 - ISLI, QinetiQ, CEA-LETI, Tyndall, POLIMI Coventor, BUTE, Lancaster University, IMT, Heriot-Watt, LAAS, ITEM, WUT, Liege
- Services
 - MEMS & uFluidics Design
 - Modelling / Analysis of key Design challenges (Packaging, damping, degradation)
 - Design for robustness, testability , reliability



Skills and IPR in accurate modeling of surfaces and simulation of contact effects in MEMS



Thermomechanical modelling – package interaction

- ❑ Service Clusters MUST roll out State-of-the-art technologies and skills to industry else academic partners will not engage
- ❑ The USP is that service clusters provide a higher level service than the competition.
- ❑ Some university groups see the benefits to core research and teaching in engagement with the clusters – need trials to convince the others.
- ❑ Staffing, especially at university and research sites needs to be supported until a revenue stream is secured.
- ❑ Initially the service clusters will not proactively "sell" services outside the "known" community due to resourcing overheads rather, they will build the clusters will key customers and expand based on success.

- Coordinator - Andrew Richardson, Lancaster University (ULAN) A.Richardson@Lancaster.ac.uk
- WP6 Dissemination – Patric Salomon, 4M2C, Patric.Salomon@4m2c.com
- WP9 Integration of Research
 - Pascal Nouet, LIRMM, nouet@lirimm.fr - Mobility & DfT Focus Group
 - Marta Rencz, BUTE, rencz@eet.bme.hu Joint Research & training
 - Marius Bazu, IMT, MBazu@imt.ro WP9 Leader and FP7 bids
 - Alan Brown, QinetiQ, agbrown@taz.QinetiQ.com Infrastructure and resource sharing
- IAB Chair – Alistair Suherland – BCF Designs