EURIMUS

EUReka Industrial Initiative for Microsystems Uses

EURIMUS I & forward EURIMUS II

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Director Major Programs MEMSCAP
Chairman of EURIMUS & NEXUS

Contents

STUCTURE of MEMS R&D PROGRAMS in EUROPE

European Union Programs

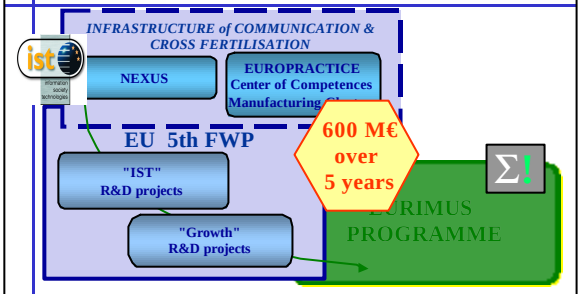
EU PROGRAMS FP 6 "IST - NMP"

National funding | *National funding* | *National funding* | *National funding*

EUREKA PROGRAMMES
EUCLID EUROFINDER

Transnational European Programs

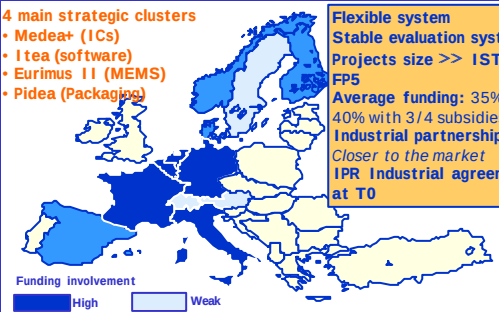
EUROPEAN PROGRAMS, FP5, NEXUS, EURIMUS 1998-2003



ROUTE to INDUSTRIAL SYSTEMS

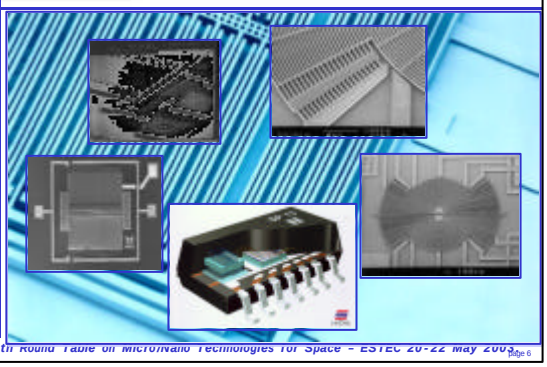
European civil projects : Eureka

4 main strategic clusters
- **Medea+ (ICs)**
- **Itea (software)**
- **Eurimus II (MEMS)**
- **Pidea (Packaging)**

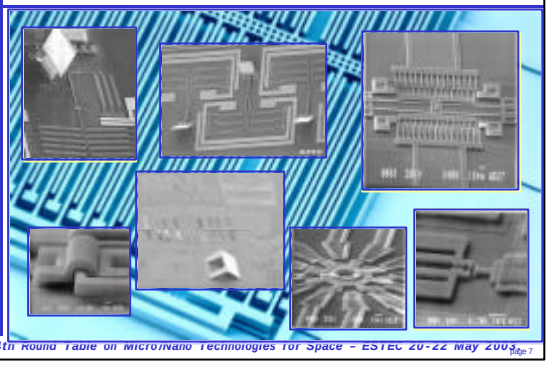


Flexible system
Stable evaluation system
Projects size >> IST FP5
Average funding: 35% to 40% with 3/4 subsidies
Industrial partnerships
Closer to the market
IPR Industrial agreement at T0

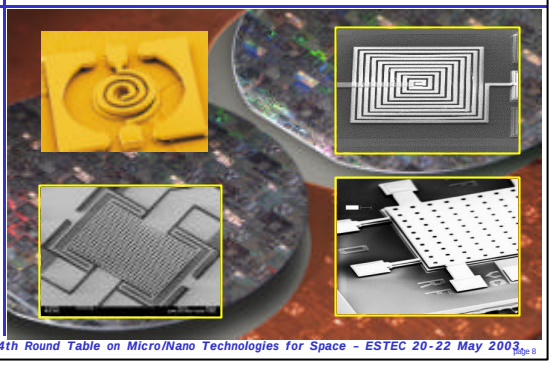
Some actual 3D MEMS sensors



Some actual 3D MEMS actuators optical, mechanical



Some actual passive MEMS mounted on µelectronics



Themes of Eurimus

- **Application Products and Systems**
  - Multimedia & communication
  - Automotive & transport
  - Medical & biochemical
  - Energy management
  - Industrial process control
  - Aeronautics & aerospace
  - Geo-science
  - Environment
  - e-commerce
  - Consumer products
  - Computer games
- **Enabling Technologies & Processes**
  - Materials
  - Design & simulation techniques
  - Microtechnology basic processes
  - Manufacturing Technologies
  - Packaging, Assembly & Test

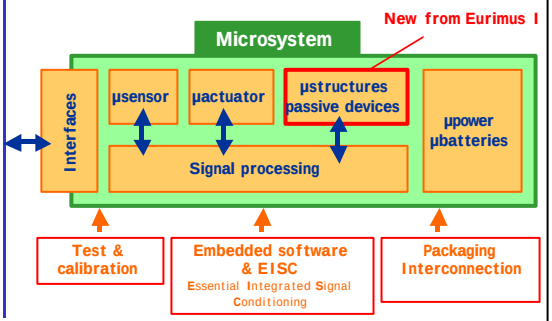
Eurimus Policy

- Industrial program driven
  - ➔ Board involving LEs - SMEs
- Industrial project targets
  - ➔ going closer & quicker to the market
- Industrial projects labelled by industry
  - ➔ technical committee: involving LEs - SMEs & institutes

Objectives of Eurimus regarding markets

- **Increase the share** of European companies in the global microsystems market
- **Create new products** and markets segments using microsystems
- **Trigger economy of scale** by encouraging the reuse of key microsystem components across projects in Europe

Objectives of Eurimus regarding industrial prototypes



Outcome of Eurimus I

- Objectives
- Organisation
- Results
- Success stories

Towards Eurimus II

- Microsystems market vision
- Objectives of Eurimus II
- Themes in Eurimus II

Positioning Eurimus II in the ERA

Tasks distribution within Eurimus

Eurimus Association

Board industrials	**Project labelisation** Links with national authorities and EC
Technical Committee industrials & institutes	**Evaluates proposals** Makes recommendations to the Board
Office	**Operates the association**

Board members

Colibrys (CH)	S. Neylon
EADS (F/D)	O. Melamed
Fiat (I)	P. Perlo
Memscap (F):	G. Menozzi - Chairman
SonionMEMS (DK)	M. Müllenborn
Mondragon (E)	S. Alvarez
Olivetti I-Jet (I)	A. Bellone
Schlumberger (F/N)	G. Marquette
SensoNor (N)	P. Gloersen
STMicroelectronics (F/I)	B. Vigna
Temic (D)	A. Engelhardt
Thales Avionics (F)	C. Dussurgey
CEA-LETI (F)	C. Axelrad (Board Advisor)

Technical Committee members

Companies		*Institutes*	
EADS (F/D)	G. Kroetz	**CNM (E)**	C. Cane
Fiat (I)	G. Innocenti	**CNR (I)**	C. Corsi
Memscap (F)	B. Wenk	**CSEM (CH)**	A. Perret
SonionMEMS (DK)	U. Klein	**IMEC (B)**	K. Baert
Mondragon (E)	S. Wainwright	**CEA-LETI (F)**	D. Duret
Schlumberger (F)	V. Nouazé	**SINTEF (N)**	R. Bernstein
Olivetti I-Jet (I)	A. Bellone	**MIC (DK)**	A. K. Menon
SensoNor (N)	C. Merveille	**VDI-VDE (D)**	Y. Kaminorz
ST (F/I)	P. Gola		
Temic (D)	tbd		
Thales Avionics (F)	O. Lefort		

Outcome of Eurimus I

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Positioning Eurimus II in the ERA

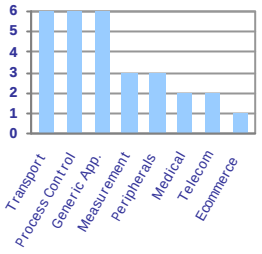
Results at Q4 2002

- 76 Project Outlines submitted
- ➔ 49 PO selected
- ➔ 38 Full Project Proposals submitted
- ➔ 29 projects labelled
- = 154 M€

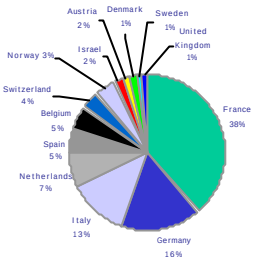
- **For the 76 Projects Outlines**
  - 240 partners in 19 countries
  - Projects in the fields of Transport, Process and Generic applications dominate (6 labelled projects each)
  - 2 projects transferred to EU
- **Average size of project: 5 M€**
- **Maximum project size: 19 M€**
- **Average number of partners / project: 6**

Repartition of labelled projects

Number of labelled projects by theme



Budget by country



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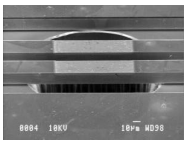
Positioning Eurimus II in the ERA

DIAGNOSIS
Digital Gauge Network System

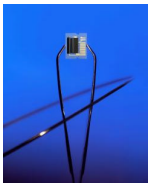
- **Application: permanent monitoring of oil wells**
- **Innovation: miniature, low cost and reliable networked sensors**
- **Budget: 6 M€**
  - France (66%)
  - Belgium (16%)
  - Germany (18%)
- **Duration: 3 years**
- **Project leader: Schlumberger**
- **Start: 01/09/99**
- **End: 31/07/02**
- **Status: running**



Gauge

NIR Near InfraRed portable microspectrometer

- **Application: Non-destructive in-line control of industrial process**
- **Also potential application in biomedical analysis**
- **Innovation:miniaturisation of the spectrometer**
- **Budget: 4.15 M€**
  - France (61%)
  - Germany (39%)
- **Duration: 3 years**
- **Project leader: Atmel**
- **Start: 21/03/00**
- **End: 31/08/02**
- **Status: successfully finished**



Microspectrometer

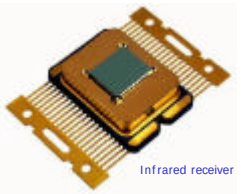
UVIP
Ultrasound Versatile Imaging Probe

- **Integrates micro-motorisation and positioning means**
- **Application: Echocardiology**
- **Innovation: 3D probe of same size as conventional 1D imagers**
- **Budget: 3.23 M€**
  - France (58%)
  - Norway (14%, not funded)
  - Austria (28%)
- **Duration: 4 years**
- **Project leader: Vermon**
- **Start: 01/01/01**
- **End: 31/10/03**
- **Status: running**

Transthoracic probe

ICAR
Infrared Camera for CAR

- **Application: cardriver vision**
- **Potential applications in security, safety, comfort and medical improvements, pollution detection.**
- **Innovation: far infrared silicon microbolometer**
- **Budget: 5.7 M€**
  - France (66%)
  - Italy (17%)
  - Germany (17%)
- **Duration: 3 years**
- **Project leader: Ulis**
- **Start: 01/01/01**
- **End: 31/06/03**
- **Status: running**



Infrared receiver

AUTODOOR Microsystem for Automotive Door Module

- **Application: optimise current door electronic modules for automotive applications**
- **Innovation: contains temperature and magnetic sensors, compatible with power actuators and bus interconnections**
- **Budget: 1.76 M€**
  - Spain (64%)
  - Austria (36%)
- **Duration: 3 years**
- **Project leader: Lear**
  - Other participant: AMS
- **Start: 01/10/99**
- **End: 30/09/02**
- **Status: running**

Prototype module

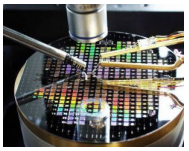
GYROSIL Micromachined Silicon Gyrometer

- **Application: automotive and avionics**
- **Innovation:**
  - Accurate micro-machined silicon micro-gyros for stabilisation and navigation systems
  - Accurate micro gyros for the second ESP systems generation
- **Budget: 18.8 M€**
  - France (54%)
  - Germany (46%)
- **Duration: 4 years**
- **Project leader: Thales Avionics**
- **Start: 01/01/01**
- **End: 31/12/04**
- **Status: running**

Silicon surface micromachined

MICROTEST Wafer level Testing of Microsystems

- **Application: microsystems testing**
- **Innovation:**
  - sensor specific test modules for microphones and accelerometer
  - a number of non-electrical stimuli and measurement probes for pressure sensors and gas sensors
- **Budget: 3.17 M€**
  - Denmark (66%)
  - Germany (34%)
- **Duration: 3 years**
- **Project leader: Delta**
- **Start: 01/01/01**
- **End: 31/08/04**
- **Status: running**



Wafer with microsystems being tested

Outcome of Eurimus I

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Towards Eurimus II

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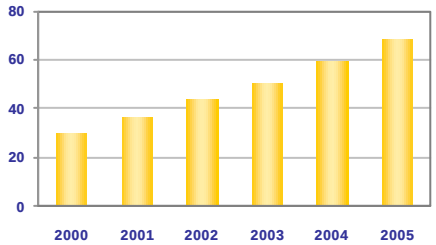
- Objectives of Eurimus II
- Themes in EURIMUS II

Positioning Eurimus II in the ERA

Microsystems markets grow 20% annually

Total World Sales for MEMS 2000-2005 (billion $)



Source: NEXUS Market Analysis formicrosystems2000-2005

Typology of microsystems markets

Established markets
~10 bio.$ range

- Inkjet, read/write heads
- In vitro diagnostics
- Pressure sensors

Emerging markets
~1 bio.$ range

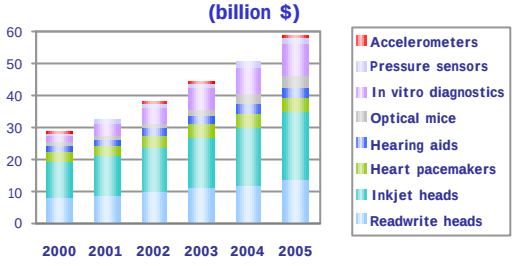
- RF MEMS
- Biometrics
- Gyrometers
- Displays
- MOEMS

Niche markets
~0.1 bio.$ range

- Chemical analysis
- Flow sensors
- Inclinometers
- Micromotors
- Microspectrometers
- Magnetooptical heads

Established markets

World sales for microsystems established markets (billion $)



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Comparison of Eurimus I & II

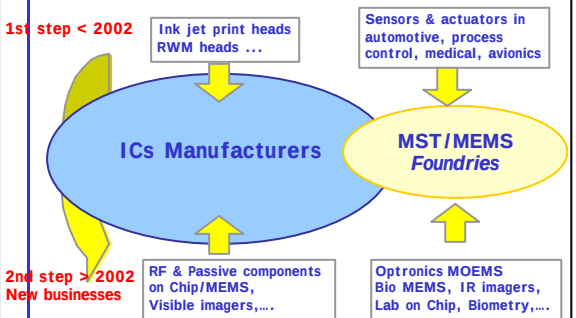
Eurimus I		*Eurimus II*
Get some (any?) microsystem to the market	Purpose	*Open more high volume markets for microsystems*
Single products based on a microsystem	Scope	*Systems exploiting micro subsystems*
Transport, process,	Special attention to	*Medical, Disabled care, Biotechnologies, Telecom*
Board + technical committee	Organisation	*Improved evaluation process and broader expertise*
154 M€ on Q4 2002	Budget	*500 M€ over 2003-2008*

The need for Eurimus II

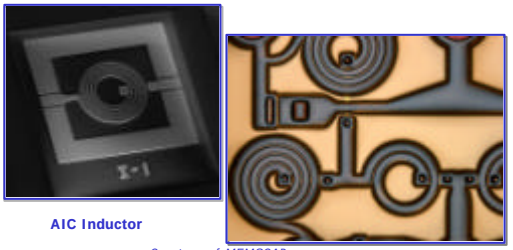
- Microsystems have known successes → but the full potential of isystems remains unexploited
- Eurimus I has shown the feasibility of single microsystem products, → now the industry is moving to microsystem-based systems
- Macro, micro and nano technologies are increasingly intertwined → implying new integration challenges for MNT

Strong existing European microsystems industry must be nurtured and developed to create further jobs and business

MEMS manufacturing: towards new businesses



SOC AIC Above IC technology



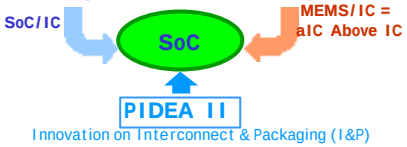
AIC Inductor

Courtesy of MEMSCAP

GSM/DCS filter module

EURIMUS II/MEDEA+/PIDEA II

	MEDEA+	EURIMUS II
Innovation	ICs	MNT
Processes	Microelectronics	ìmachining, ìelectroforming,etc
	2D 2.5D	3D
Materials	Si, SOI, GaAs, etc	Si, Q, polymers, metals, etc
Quantities	>10^7 / year	<10^6 / year



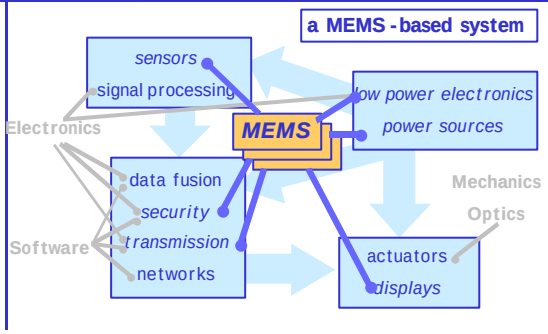
PIDEA II

Innovation on Interconnect & Packaging (I&P)

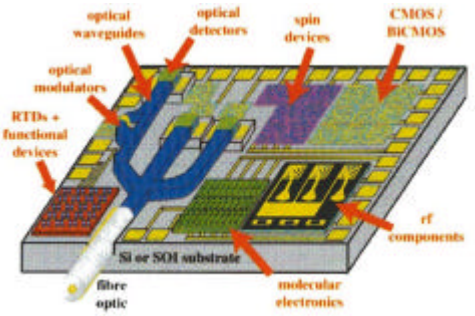
Type of projects for themes

Themes	Type of project	What is developed	Typical team & result
Enabling Technologies	Generic	Microsystems components and processes, likely available to the industry on a licensing/ service basis	1-3 industrials 1+ institute e.g. sensor
Application domains	System	Microsystems to be integrated only in the systems of the partners	1-2 companies 1 large company 1+ institute e.g. anti-collision radar
	Large	Major unifying project impacting overall European competitiveness	2-3 large companies 1+ institute e.g. remote multi-patients monitoring and care system

The complexity of MEMS-based systems requires a system approach



Eurimus II projects can address embedded devices

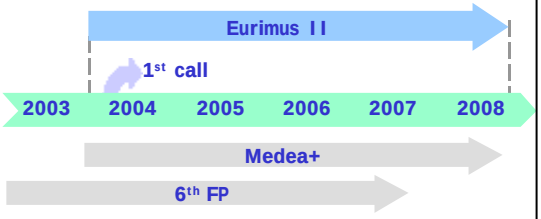


Eurimus II & SMEs

- **Eurimus II recognizes the importance of SMEs for the microsystems market**
  - The current microsystems market is mostly addressed by SMEs
  - Agile SMEs are able to quickly deliver innovations
  - SMEs are more likely to turn growth into value and job creation
- **SMEs are well-represented in Eurimus board**
  - 36% in Eurimus I, 36+10% in Eurimus II
- **Special for SMEs will be through the national funding policies**

Planning

- **Launch of Eurimus II in June 2003**
- **Quarterly calls, first call in October 2003**
- **End in June 2008**



Budget

Projects	Nb of expected projects	Expected cost/project	Target budget
Generic MEMS	30-40	5-10 M€	150 M€
MEMS System	10-20	10-20 M€	200 M€
Large projects	3-5	20-50 M€	150 M€
Total	45-55	n.a.	500 M€

Outcome of Eurimus I

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Towards Eurimus II

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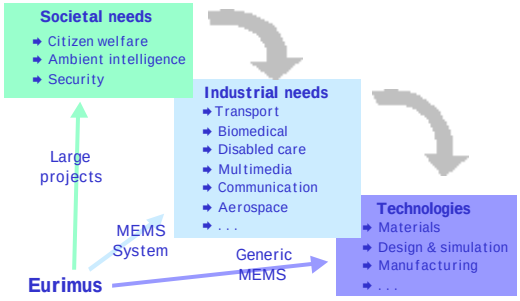
Positioning Eurimus II in the ERA

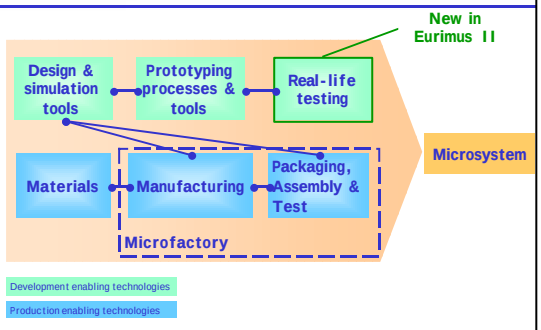
Eurimus II themes match the concerns of society and industry



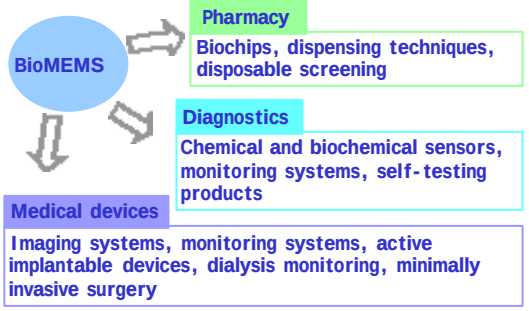
Themes of Eurimus II

- **Application Products and Systems**
  - Multimedia & entertainment
  - Automotive & transport
  - Medical & biochemical
  - Disabled care
  - Energy management
  - Industrial process control
  - Aeronautics & aerospace
  - Geo-science
  - Environment
  - Ecommerce
  - Consumer products
- **Enabling Technologies & Processes**
  - Materials
  - Manufacturing Technologies
  - Packaging, Assembly & Test
  - Design & simulation techniques
  - Prototyping
  - Real-life testing

Enabling Technologies & Processes for microsystems



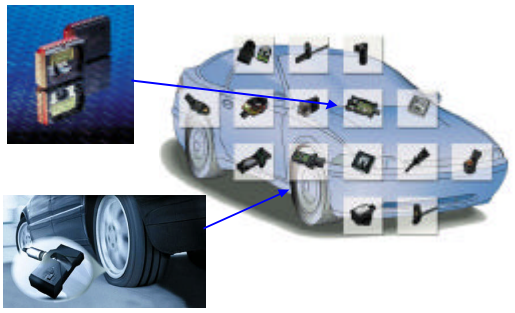
BioMEMS



Application theme: Automotive & transport

- **MEMS**
  - All type of sensors (pressure, temperature, acceleration, rotation, flow, gas, biometric, sound)
  - OLEDs
  - IR imagers
  - RF MEMS
- **MEMS-based systems**
  - Airbags
  - Displays
  - HVAC
  - Awareness monitors
  - Anticollision radars
  - Security
  - Smart tires
  - Communication systems
  - Active noise control

Sensors are the main application field for microsystems in the car



Application theme: Aeronautics & space

- **MEMS**
  - All type of sensors (pressure, temperature, acceleration, rotation, gas, flow, magnetic, radiation, optical)
  - RF MEMS
- **MEMS-based systems**
  - Earth monitoring instruments
  - Micro-drones
  - Micro-satellite platforms

Civil Aircraft: main systems & functions

Structure monitoring
HUMS
Vibrations
Stabilisation
Structure fatigue

Navigation
Air Data, Instruments, Flight Control,
Inertial Measurements Units
GPS receiver & antennas

Air conditioning
Generation monitoring
Pressure, Humidity..

Landing systems
Hydraulic pressure ,
Tire pressure, etc..

Engine and reactors
FADEC
Hydraulics

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Positioning Eurimus II in the ERA

European MEMS programmes Total expected budget costs

NMP: Nano, materials, production, devices, *industrial breakthrough research* (2600 M€)

IST: Components and microsystems (500 M€)
NEXUS **Europractice**

Eurimus II Pidea (500 M€)

Medea+ Itea (4000 M€)

National initiatives
MESA+, Minatec, MST2000+

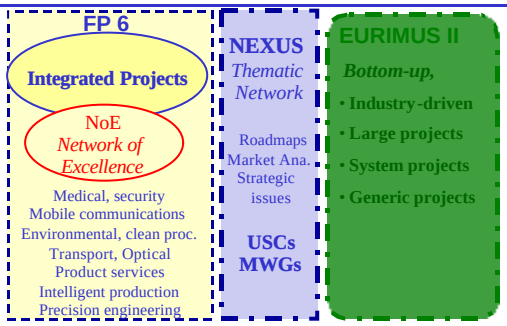
Comparison of Eurimus/FP6 IST key elements

Programme	FP6	Eurimus II
Typology	Applied research with an application vision	Applied research closer to the market including process development, manufacturing…
Tools	Few major IP's	Mix of bottom-up approach and focused calls in areas complementary to FP6
Applications in	2008-2010	2006-2008
Context	Ambient intelligence	What is good for industry is acceptable
Funding	European Union	National authorities

Comparison of Eurimus/FP6 NMP key elements

Programme	FP6/NMP	Eurimus II
Typology	Applied research with a long term break through vision	Applied research closer to the market including process development, manufacturing…
Tools	Major IP's and NOE's plus STREP at frontier of knowledge, CA in conjunction with Eureka	Mix of bottom-up approach and focused calls in areas complementary to FP6
Time frame	Applications in 2010-2015	Applications in 2006-2008
Context	Transformation of EU industry towards KB and networked organisations	What is good for industry is acceptable
Funding	European Union	National authorities

FP 6 – EURIMUS – NEXUS 2003-2008



To conclude: Eurimus II at a glance

- **Industry-driven**
  - Project evaluation made by industry
  - Projects squarely aimed at solving industrial problems
- **Emphasis on macro systems that integrate micro nano technologies and their usage**
- **Close cooperation with 6th Framework Programme**
- **50 labelled projects expected**
- **500 M€ over 5 years**

http://www.eurimus.com

Collaboration FWP 6/EURIMUS is important for structuring the ERA

EU + EURIMUS II will double the European MEMS R&D funding

FP 6 IST/MNT: 2003-2008

- IP funding budget: 200 M€
- Other MEMS funding: 50 M€

Total costs: (X2) target 500 M€

EURIMUS II budget: 2003-2008

Total costs: target 500 M€

EU/IST+EURIMUS II budget: target 1000 M€