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Microtechnology Report 2000

EUREL is the Convention of National Societies of Electrical Engineers of Europe, being founded 1972. Today there are 17 Member Societies from 15 European Countries. In Switzerland, the Swiss Electrotechnical Association (SEV) is the representing organization, and their CEO, Dr. E. Jurczek, is Member of the Executive Committee of EUREL. EUREL's mission consists in facilitating the exchange of information and fostering a wider dissemination of scientific, technical and other information relevant to Electrical Engineering between members and other interested bodies. On September 7, 1999, the EUREL Micro- and Nanotechnologies Society has been founded with Members from AEI (I), IEE (UK), SEE (F), SEP (P), VDE (D) and SEV (CH). Switzerland is represented by Dr. E. Jurczek personally. In February 2000, a Micro-Tech Forum has been held at Brussels (B), and some extracts of the Microtechnology Report 2000 have been presented and discussed at EU level.

This Microtechnology Report, which is based on investigations undertaken by the Microelectronics, Micro- and Precision Engineering Society of VDE/VDI, has been prepared by the EUREL Micro- and Nanotechnologies Society. It highlights the great potential which microsystems engineering has for creating new products, and describes the challenges in opening up new markets as well as the consequences for research, development and training.

Microsystems are devices combining electrical, mechanical, fluidic, optical, chemical, and biological functions. They are fabricated using integrated circuit compatible batch-processing techniques, and they range in size from micrometres to millimetres. Microsystems merge computation into sensing and actuation to change the way we perceive and control the physical world and, who knows, more and more the biological world, too.

There are many benefits offered by microsystems, for example compactness, low weight and low energy consumption, high reliability, multifunctionality and, not least, low cost. This means that microsystems will enable new applications in all industry sectors, which is of high significance for Europe's highly developed economy. In a market analysis published in 1998, the European Network of Excellence in Multifunctional Microsystems, NEXUS, concluded that the world market for microsystems is expected to grow to 38 billion US-$ by the year 2002. At present, highly significant application areas for microsystems are automotive engineering, optical communications technology, medical engineering building and security technology, and microreaction technology. On the other hand, we simply have to admit that, especially considering the situation in Switzerland, we lack any systematic approach to overcome the difficulty summarized in Figure 1: to educate professionals who know both sides of the medal at best, i.e. the completely technical side of microcomponents as well as the completely marketing-driven side of information and communications technology (ICT), real market needs and potential market opportunities. Only the combination of these skills will actually allow to put microsystems into practice.

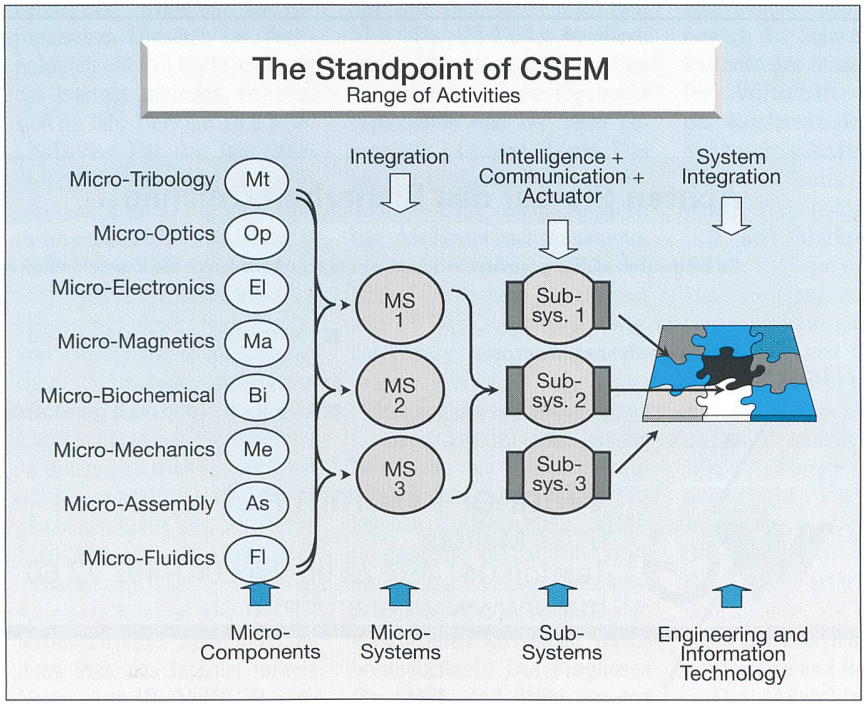

Fig. 1 **The Microsystem Puzzle** (courtesy of CSEM, Neuchâtel)

In recent years a wide range of different technologies and laboratory samples developed by universities and research institutions has highlighted the great potential of microsystems engineering. In order to fully exploit this potential for opening up new markets, we need to accelerate the translation of existing microtechnologies into marketable products. However, microsystems are currently facing technical and non-technical difficulties. Especially small businesses are therefore delaying their entry into this new technology.

In many areas the number of produced units is still too small to make full use of cost-intensive technology lines, resulting in high unit costs. In addition, there is a lack of appropriate design and simulation tools resulting in long development times. Further shortcomings can be identified in the fields of microassembly, packaging techniques, assembly automation, testing and quality assurance, and market launch.

This analysis of difficulties yields a whole range of specific recommendations for innovation promotion for microsystems:

- limitation to a small number of production technologies in which the company is proficient and where modularized interfaces reduce the development times and cut costs
- market launch of microsystems in small steps helps establish microtech-

nologies rapidly. This means substitution of existing functions by microsystems in a first step, then, in a second step, development of microsystems with new functions and a higher level of integration
- increase of the number of units in production runs by means of standardization and modularization, which renders the cost for small and medium-scale production reasonable
- opening up of industry standard processes by making offers as foundry for microsystems or partial processes, which can be further developed by small and medium-sized companies into innovative systems products
- development of necessary automation technologies for the assembly of microsystems
- optimisation of transfer activities.

In recent years, there has been a considerable cut-back of research, both industrial and institutional. This means that the highly-regarded European research infrastructure is under grave threat. To overcome these deficiencies and to advance innovation in microsystem engineering, optimum preconditions must be created. This can be done by organizing the microsystems engineering scene, supporting medium-term research tasks and managing long-term research tasks.

Furthermore, suitably qualified employees are required both as engineers and as technicians. This gives rise to the following recommendations:
- a Europe-wide approach to teaching is desirable
- industry should be involved in defining the syllabus
- universities should establish their own profile in the field of microtechnologies
- a close cooperation with industry in the field of continuous training is crucial
- European continuing education programmes should be initiated
- training programmes should be developed to provide skilled technicians with training.

A new professionalism should come up which I personally would like to call the ability of «the Synchronizer» (Fig. 2) who enables to synchronize the articulated from science to market with the unarticulated from science to market and vice versa.

In summary, one can say that microsystems technology is rapidly advancing into the commercial market, and that strategic issues must be addressed to ensure continued commercial growth.

EUREL Micro- and Nanotechnologies Society will work intensively on the promotion of microtechnologies by
- forming working groups on open topics
- organizing workshops and congresses,
- defining interdisciplinary topics and product visions
- initiating strategic partnerships and networks
- defining and promoting training and continued education
- ranking for a new professionalism with the aim of «The Synchronizer» as suggested by Dr. E. Jurczek.

Dr. Edmond Jurczek
CEO Swiss Electrotechnical Association (SEV)

Fig. 2 Science-to-Market Synchronization