µSAPIENT

Synergetic Process Integration for

Efficient Micro and Nano

Manufacture

http://www.microsapient.org

Final Activity Report

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1.0	22 May 2009	Draft version sent to PMB for approval.
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EXECUTIVE SUMMARY

The driving forces, business needs and requirements behind the establishment of this Consortium were the necessity to broaden the range of microsystems-based products and at the same time to multiply their capabilities by introducing new materials and processes that are reasonably compatible with currently broadly used IC-based, batch-fabrication processes.

The µSAPIENT CA project has aimed to create a far more focused and sustainable European-wide infrastructure for coordination of research activities, linking of relevant national and international projects, organisations and initiatives and dissemination and promotion of results in facilitating a new level of synergetic integration of micro- and nano- manufacturing technologies in support of a number of critical EU sectors .

The key objectives identified were:

- To carry out a critical analysis of emerging Micro and Nano Technology (MNT) that result from many complementary EC, national and industrially funded Research and Development projects. The aim of this analysis is to create roadmaps for their effective integration in new manufacturing platforms, underpinning the development of new multi-material MST-based products (technology roadmaps vs. product-driven MNT roadmaps).
- To identify gaps in emerging MNT that prevent their effective integration and up-scaling, and thus to assist national and EC funding bodies in defining the priorities of their future R&D programmes.
- To create a forum for coordinating the efforts of many complementary R&D projects in ERA and thereby ensuring that technology and application challenges are addressed concurrently. This should facilitate and speed up the development of MNT-based manufacturing platforms that are necessary for full scale fabrication of micro-components and multi-material micro-systems.

In delivering the µSAPIENT and MINAM Roadmaps and Strategic Research Agendas, the project has provided a strategic European vision embedding specific national and sectorial perspectives critical to the sustainability of MNT research and application in Europe. By identifying gaps in emerging MNT, it has also helped to inform future funding priorities at a high level for the sector.

The µSAPIENT CA project has also been responsible for the creation of the project website http://www.microsapient.org and the production and publishing of the project newsletter 'MNT Future Vision', both of which have been aligned with MINAM, thus ensuring that many of the activities will be ongoing. In addition, the involvement of partners in a number of relevant conferences and workshops has contributed effectively to dissemination and networking activities across the community.

Finally the µSAPIENT CA project has played a major role in the establishment of the MINAM platform. Micro- and nanomanufacturing is a highly resource and knowledge intensive sector and capitalising on the latest technological developments can only be achieved by a concerted effort of industrial stakeholders, research and academic organisations and public bodies. The MINAM SRA has and will further outline key challenges and research priorities with the objective of accelerating the development of new micro- and nanomanufacturing technologies and their rapid transformation from laboratory based prototypes into volume manufacturing applications.

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1 INTRODUCTION

To meet the project aim and objectives the following specific activities were planned:

- To create a forum for coordination and efficient exchange and exploitation of the results of national and EU funded projects in the domain of emerging disruptive technologies for micro- and nano- manufacturing and their efficient integration in new production platforms;
- To act as a catalyst for the implementation and commercialisation of new MNT manufacturing platforms by industry;
- To conduct in-depth analyses of emerging and disruptive micro- and nano- manufacturing technologies and trends in their future development and adoption in order to prepare European industry for implementing them in manufacturing platforms for new multi-material meso and micro products;
- To provide support and coordination for benchmarking and marketing studies in order to facilitate the up-take of new disruptive MNT by European industry;
- To identify critical industrial needs and gaps in emerging MNT and thus to assist national and EC funding bodies in defining the priorities of their future R&D programmes and to stimulate the development of new research proposals;
- To develop a community of industrialists and researchers in emerging MNT and thus to integrate existing technology clusters and networks;
- To collect, categorise and continuously demonstrate the available micro- and nano-manufacturing technologies and manufacturing platforms that effectively utilise them to a wider industrial and academic community via different electronic and paper media and annual exhibitions;
- To form a European-wide virtual competence centre in the field of emerging and disruptive MNT to facilitate and speed up the development of production platforms by European industry which are necessary for full scale fabrication of micro-components and multi-material micro-systems.

2 WORK PROGRESS SUMMARY

Del. no.	Deliverable name	WP no.	Lead particip-ant	Delivery (Month)	Status	Date	Remarks
1.1	Micro manufacturing Technology Roadmap	1	UNOTT	6	Done	15/5/06	Early delivery
1.2a	Establishment of cross-project MINAM roadmapping activities	1	FZK	18	Done	Sept 07	
1.2b	Roadmapping methodology agreement	1	FZK	24	Done	March 08	
1.2c	Launch of online MINAM survey	1	FZK	30	Done	Sept and Nov 2008	Revised version in M32
1.2d	Processing of MINAM Market and Technology Survey, resulting in Micro-manufacturing Technology Roadmap	1	FZK	34	Done	Dec 08 Feb 09	Intermediate results: M34 Final Results: M36
1.3	MINAM Strategic Research Agenda and Vision – Second Version	1	UNOTT	36	In progress	May 09	Publication of draft by end May
2.1a	Micro and Nano manufacturing Portal	2	Tekniker	6	Done	May 06	
2.1b	Overhauled Micro manufacturing Portal	2	Tekniker	30	Done	Aug 08	
2.2a	Micro and Nanomanufacturing Newsletter, No.1	2	STR	6	Done	Dec 06	Electronic version
2.2b	Micro and Nanomanufacturing Newsletter No.2	2	STR	12	Done	March 07	Electronic version
2.2c	Micro and Nanomanufacturing Newsletter No.3	2	STR	18	Done	Oct 07	Electronic & printed version
2.2d	Micro and Nanomanufacturing Newsletter No.4	2	STR	24	Done	April 08	Electronic & printed version

2.2e	Micro and Nanomanufacturing Newsletter No.5	2	STR	30	Done	Sept 08	Electronic & printed version
2.2f	Micro and Nanomanufacturing Newsletter No.6	2	STR	36	Done	Feb 09	Electronic version
3.1a	At least one special session at relevant conferences	3	UNOTT	12	Done		Special session organised within 4M2006
3.1b	At least one special session at relevant conferences	3	UNOTT	24	Done		Special sessions organised within 4M2007 and EUSPEN
3.1c	At least one special session at relevant conferences	3	UNOTT	36	Done		Special sessions organised at ANTEC 2008 and 4M 2008
3.2a	Two workshops in Micro and Nano-Manufacturing Technology	3	CEA	12	Done	March 07	
3.2b	Two workshops in Micro and Nano-Manufacturing Technology	3	CEA	24	Done	March 08	Six workshops organised and held
3.2c	Two workshops in Micro and Nano-Manufacturing Technology	3	CEA	36	Done		Three workshops organised and held
4.1	Clusters of experts with program of activities	4	TNO	12	Done	June 07	SIG meeting held in Dusseldorf
4.2	Programme for collaboration with the USA and the Far East	4	Cardiff	12	Done	Feb 07	
4.3	Organisation of International Collaboration Activities	4	Cardiff	24	Done	March 08	

4.4a	First meeting of the EU Nano-manufacturing forum	4	FHG	6	Done	12/05/06 and 14/09/06	Meeting held 12 May and 14 Sept 06
4.4b	Formation of EU Nano-manufacturing forum	4	FHG	18	Done	Jan 08	MINAM Launch
4.5	Technology Maturity Level Analysis	4	Cardiff	36	Done	26/02/09	On time
5.1	Project Handbook	5	UNOTT	6	Done	Dec 06	Updated Dec 07
5.2a	Periodic Activity Report	5	UNOTT	6	Done	Dec 06	
5.2b	Periodic Activity Report	5	UNOTT	18	Done	Feb 08	
5.2c	Periodic Activity Report	5	UNOTT	30	Done	Aug 08	
5.3a	Annual Activity and Management Report	5	UNOTT	12	Done	April 07	
5.3b	Annual Activity and Management Report	5	UNOTT	24	Done	May 08	
5.4	Annual Activity and Management Report, Final Report	5	UNOTT	36	Done	May 09	

NB: For deliverables and related activities, please see CD enclosed with this report.

3 TASK SUMMARIES

3.1 Work Package 1 – Performance of studies, analyses and benchmarking

Milestones & Deliverables:

Del. no.	Deliverable name	Delivery date	Objective of task	Responsible
1.1	Micro manufacturing Technology Roadmap	6	To provide first-hand information to industry and support for R&D by producing a coherent long-term vision for micro and nano manufacturing in Europe	UNOTT
1.2a	Establishment of cross-project MINAM roadmapping activities	18	To provide a broader scope for linking activities in the domain and cooperating with roadmapping activities in other related areas. To build a comprehensive MicroNano production community.	FZK
1.2b	Roadmapping methodology agreement	24	To pave the way for a sustainable MINAM roadmapping process	FZK
1.2c	Launch of online MINAM survey	30	To build up the technological basis for top-down/bottom-up roadmapping in MINAM	FZK
1.2d	Processing of MINAM Market and Technology Survey, resulting in Micro-manufacturing Technology Roadmap	34	To identify the needs and hurdles of NMP as a key to the production of micro-subsystems serving as key components of macro world applications	FZK
1.3	MINAM Strategic Research Agenda and Vision – Second Version	36	To provide an updated identification of key trends and funding priorities in Micro and Nano Manufacturing in the EU	UNOTT

3.1.1 Task 1.1: Produce first-stage Roadmap for Synergetic Micro- and Nano- manufacturing

Achievements

Task 1.1 was delivered ahead of schedule in May 2006.

Prior to starting the project we were requested by the EC to conduct an accelerated roadmapping exercise in order to inform the ongoing preparation of the FP7 Work Programme. As a result a new task was created and the PMB approved a new delivery schedule and change of priorities or the first six months of the project. The project coordinator assumed the role as task leader for this urgent task and the first version of the Micro-Nano Manufacturing roadmap was successfully delivered on time on 15 June 2006. Due to the short time available the UNOTT worked with consultants to produce the first draft of the roadmap ahead of schedule. Roadmapping data capture forms were drafted following an initial meeting at the University of Nottingham in March 2006. Industrial participants were then invited to air their views on the future of micro and nanotechnology at three roadmapping workshops held in Eindhoven (NL), Karlsruhe (D) and Stansted (UK). The data gathered at the workshop was analysed and a report was produced which was sent to the EC as input for drafting the FP7 priorities. An additional dissemination event was organised in Amsterdam to present the result of the 1st stage roadmapping activities to those that participated. All workshops were well attended by partners and industrialists.

The Eindhoven industrial workshop was organised and hosted by TNO, and the Karlsruhe industrial workshop by FZK. Both partners also participated in the first-stage roadmapping results in Amsterdam. TNO, FZK, CEA and FhG IPA in particular supported the development and dissemination of the First Stage Roadmap by attending relevant meetings and events.

For example on 20-21 June 2007, Bertrand Fillon from CEA presented the Roadmap results (focus on Nanosurfaces) from µSapient, 4M, IPMANN and MINAM 2006 activities in Dusseldorf during the Euronanoforum Conference, where industries, universities, research institutions and government participated. The participants also benefited from the conference as a networking event by discussing collaboration ideas and initiatives relevant to their industrial needs with other delegates. After the conference, a workshop with industries and research laboratories specifically to prepare roadmap activities on micro-components was organised and Bertrand Fillon participated.

3.1.2 Task 1.2: Support for Synergetic Micro- and Nano- manufacturing Roadmapping

Achievements

Month 12:

The µSAPIENT midterm roadmapping activities coordinated by FZK were launched at M7. A first step toward a continuous support of roadmapping was supported by the identification of the state of the art through identification of relevant roadmaps and studies. The partners within the µSAPIENT consortium had been involved in the initial roadmapping process through bilateral discussions and a joint WP1 workshop at the Karlsruhe, 8 November 2006.

In M12 the support of roadmapping activities in the MINAM context again led to a re-adjustment in terms of a broadening of the scope of the roadmapping activities. In this second step µSAPIENT adopted the coordination of the joint roadmap activities within MINAM, focusing on a common cross project understanding of roadmapping goals and methodology. To ease the communication with the other projects FZK set up a shared collaboration environment for interaction with IPMMAN and a videoconferencing environment with 4M.

Month 24:

FZK as task leader contributed as follows:

- Organisation and initialisation of project overlapping roadmapping activities between µSAPIENT, 4M and IPMMAN, coordinated by µSAPIENT WP1.
- Development and agreement of roadmapping methodology for analysis of already existing studies and roadmaps. The challenges of the integration approach were identified as follows:
  - As well as the primary target to pave the ground for a qualified look into the future of NanoMicroProduction through the collection of information on present and future NanoMicro trends, the MINAM roadmapping methodology aimed to enable industry and research institutions to better understand the relations between application requirements and technological capabilities.
  - The approach having been developed by the roadmapping team could be seen as a combination of surveys, which follow the basic logic of market pull and technology push approach.
  - To integrate the views of the two main communities - Nano and Micro - into a joint strategy also supporting the convergence of technologies.

  With the above, the methodology paved the way for a holistic view on NMP, aiming to identify relationships between market pull and NM-technology push. It would also allow for an analysis of partial results from NMP related studies.
- Preparation and proceeding of two roadmapping workshops in Grenoble and a workshop in Stuttgart – agreement on roadmapping methodology and jointly elaboration of classification schemes towards a revised questionnaire.
- Preparation of 1st MINAM online survey addressing the MINAM roadmapping methodology. The survey will finally represent a combination of three partial surveys for the evaluation of MicroNano markets/applications and national, international and European trends.
- Development and implementation of relational database as a basis for survey results and future evaluations of existing surveys. Development and web-based user interface to support the survey and the evaluation of studies.
- Presentation of basic roadmapping methodology at Commercialisation of Microsystems Conference 2007 and MINAM OSG meetings.

Month 36:

The third year was mainly dedicated to the preparation and production of the MINAM survey and the analysis of the results. At two workshops in Stuttgart (03/08) and in Oyonnax (11/08) the roadmapping team agreed on the top down-bottom up methodology, building the basis for a sustainable MINAM roadmapping. For data acquisition two tools were modified / developed to support the MINAM roadmapping.

- A full text analysis tool for context specific data mining in studies and other strategic documents has been modified according to the requirements of the team. 40 relevant European documents were cross checked against the eleven key innovation fields, having been identified as of relevance for European industry.
  - The in-depth analysis of the documents available to the roadmapping team led to the identification of relevant statements from industry and R&D dedicated to 11 specific

areas of interest (innovation fields) and related to different times of introduction into the market

- The first MINAM survey was set up and run. The results were analysed in a two stage approach and the following activities were carried out:-
    - Micro nano production related structuring schemes, building the basis for the definition of the underlying data model of the survey (02/08-04/08)
    - Set-up and programming of almost user friendly and self explaining web front ends (04/08-08/08)
    - Extensive test phase (08/08-10/08)
    - Processing of the survey (10/08-02/09)
    - Promotion of the survey (09/08-12/08)
    - Detailed analysis of the intermediate results status: 12/08
    - Detailed analysis of the final results 03/09

More than 220 companies and institutions took part in the survey. The participants provided information of an outstanding level of detail to the roadmapping team which led to an extensive set of data (more than 10.000 datasets), thus building a significant basis for the production of the final report. The first results were presented at the COMS2008 conference and at the MINAM OSG Meeting in Brussels in January 2009.

Other partners contributed to the task as follows:-

CEA representatives were involved in various events to build up the next roadmap and SRA for the MINAM association. Bertrand Fillon participated in the roadmapping meeting in Stuttgart on 20 March and FZK on 14 May, and the CEA team were involved generally in the various stages of the survey set-up in teleconference and face-to-face meetings.

UNOTT representatives attended Roadmapping meetings in Stuttgart, Oyonnax and Eindhoven, and have contributed to the revised roadmap and online survey.

Cardiff representatives attended the following meetings: Roadmapping meeting in Stuttgart 20 March 2008; MINAM OSG meeting in Stuttgart October 2008; MINAM Roadmapping meeting in Oyonnax November 2008. They also provided input for the updated roadmap and SRA.

TNO contributed to setting up, formulating, testing and analysing results of the second MINAM on-line questionnaire, and participated in MINAM roadmapping team meetings at Stuttgart (21 March) and Oyannax (21 November), as well as contributing to the set-up and content of the MINAM SRA update.

Cranfield provided sensor and actuator expert input to the findings derived from the MINAM survey, feeding into the updated SRA.

KTH was in contact with FZK to perform two activities. Firstly it coordinated the transfer of knowledge from the EUPASS Roadmap effort to the MINAM Roadmap effort. Secondly, it is now engaged in assisting FZK with its Survey by collecting data on Swedish and Scandinavian companies. KTH was also engaged in an exchange of development data, with FZK, on micro-assembly standards.

Festo presented industrially relevant assessment criteria; classified realistic efficiency statements; discussed the gap between research (universities) and industrial production; supported MINAM activities by completing the online survey.

Deviations from work schedule

Due to necessary readjustments of the online survey the launch of the online survey was postponed to end of October 2008. As a consequence the termination of the survey needed to be delayed by two month until the end of February. This delay again led to a delay in the delivery of the roadmap report of about 6 weeks until mid-April.

Planned activities after project end

The only remaining activity after project close at the end of February will be the finalisation of the roadmapping report.

3.1.3 Task 1.3: MINAM Strategic Research Agenda and Vision

Achievements

During the third year, once this redefined deliverable was agreed, UNOTT as task leader attended meetings at MiNaT Stuttgart, Oyonnax and Eindhoven, and liaised with all partners and MINAM Expert Group leaders for contributions, in order to prepare and produce a revised version of the original MINAM SRA. This version is more strategically focused than the first and will be launched (in draft form) as part of a special workshop at the EuroNanoForum 2009 in Prague in June.

Deviations from work schedule

No deviations to report.

Planned activities after project end

Work on the revised MINAM SRA to continue until publication and launch.

3.2 Work Package 2 – Formation of Community of Practice in Micro and Nano Manufacturing for Dissemination of Project Results and World Best Practices

Milestones & Deliverables:

Del. no.	Deliverable name	Delivery date	Objective of task	Responsible
2.1a	Micro and Nano manufacturing Portal	6	Web portal implementation for:- - dissemination of µSAPIENT and other related R&D project results - support for the community of practice in micro and nano manufacturing	Tekniker
2.1b	Overhauled Micro manufacturing Portal	30	Fully operative external web portal with internal infrastructure for collaboration	Tekniker
2.2a	Micro and Nanomanufacturing Newsletter, No.1	6	Newsletter to include:- -information on common activities and initiatives -results of R&D projects, studies and surveys -specialised articles and MST news	STR
2.2b	Micro and Nanomanufacturing Newsletter No.2	12	Report on on-going activities of µ-SAPIENT, IPMMAN and MicroNanoWorking Group. News focused on the European roadmapping and MNT community of experts.	STR
2.2c	Micro and Nanomanufacturing Newsletter No.3	18	To be redesigned as MINAM Newsletter: - new logo and design - 8-page document (printed and electronic) comprising News, Feature and Calendar of Events -to be circulated within MINAM as well as µ-SAPIENT	STR
2.2d	Micro and Nanomanufacturing Newsletter No.4	24	Produced with the collaboration of MINAM, IPMMAN, 4M and EU-funded projects. Aims to provide a broader range of	STR

Del. no.	Deliverable name	Delivery date	Objective of task	Responsible
			information on EU initiatives in micro and nano manufacturing.	
2.2e	Micro and Nanomanufacturing Newsletter No.5	30	Produced with the collaboration of MINAM, IPMMAN, 4M and EU-funded projects. Topics covered included: FP7 news (next calls and feedback on the previous calls), MINAM news, special features on MINAT Stuttgart and the online survey.	STR
2.2f	Micro and Nanomanufacturing Newsletter No.6	36	Produced with the collaboration of MINAM, IPMMAN, 4M and EU-funded projects. Report of major achievements from these results, latest activities from MINAM, EU FP7 call, etc.	STR

3.2.1 Task 2.1 Micro and Nano Manufacturing Community of Practice Web Portal

Achievements

With Tekniker as workpackage and task leader, the construction, maintenance and use of the web portal was carried out as follows:

Month 6:

- First version for the public portal to be used as a dissemination channel for µSAPIENT and other related R&D project results was running.
- The intranet area was available to support the workgroup of specialists. This platform was used to share information during work for the first roadmap.

Month 12:

- Formal and aesthetics aspects of the web portal were improved, particularly the public area.
- A general contents enrichment followed with the collaboration of other µSAPIENT partners:
  - Description of the project and activities
  - Consortium description
  - Links of interest and links to relevant related projects
- µSAPIENT News - relevant news about the project were published in this section.

- Micro and Nano news - automatic surveillance of relevant news related to Micro and Nano technologies automatically performed by means of RSS syndication, then filtered and automatically published on the web site.
- Conferences - information about conferences and other events was made publicly available though the web site. Some partners collaborated actively on this work.
- MNP Newsletter - the 'MNT Future Vision' newsletter provided by IPMMAN and µSAPIENT projects was made available at the web site.

  A subscription mechanism was set up in order to facilitate the subscription for the forthcoming issues of the newsletter.
- Reference Documents - public documents produced in the µSAPIENT project are uploaded in this section.
- Intranet. The intranet section was used for the management of working documents, internal meetings information management, etc.
- Roadmapping - the Roadmapping section was used by the Roadmapping group for the management of working documents, Roadmapping meetings, information management, etc.
- SIGs - the Special Interest Groups template site was defined.
- Subscription mechanism implemented - the subscription mechanism developed for the Newsletter subscription was used to facilitate online registration for the Brokerage Event by additions to the web portal and could also be used for subsequent events.

Months 13 – 24:

- Efforts were focused on promoting the MINAM portal and identifying synergies between both sites in order to provide common contents. Three relevant topics were identified for this purpose:
  - Share news and events using RSS mechanism to integrate both sites
  - Share subscriptions to the "MNT Future Vision" newsletter
  - Coordinate restricted areas to support the working groups
- Web portal content maintenance, mainly in:
  - Events
  - News - Maintenance based on subscription to:

Nanotechnology News	http://www.azonano.com/
Nanovip - Latest nanotechnology companies, products, news...	http://www.nanovip.com/
PHANTOMS FOUNDATION NEWSLETTER	http://www.phantomsnet.net/Resources/news.php
PHANTOMS FOUNDATION – NEWS	http://www.phantomsnet.net/Foundation/newsletters.php
Events | I*PROMS	http://www.iproms.org/events
Home page | Multi Material Micro Manufacture Network of Excellence	http://www.4m-net.org

I*PROMS Newsletter | I*PROMS	http://www.iproms.org/node/181
MINOS-EURONET Events	http://www.minos-euro.net/future_events.htm
Napolyde –News	http://www.napolyde.org/whatsnew.htm
I*PROMS News	http://www.iproms.org/news
News From the Web | I*PROMS	http://www.iproms.org/aggregator/categories/3
press release | I*PROMS	http://www.iproms.org/taxonomy/term/13

- SIGs – support for the Special Interest Groups (SIGs). Three were set up and supported by the workgroup platform:
  - Combined additive and subtractive laser processing
  - Microfactory
  - Process design and knowledge management
- A new subscription mechanism (based on a subscription form) for the SIGs has been implemented.
- Cardiff implemented links between the MINAM and 4M websites.

Months 25 – 36:

Tekniker continued to maintain the web portal content and carried out some maintenance to ensure that the portal is fully operative for external users. The internal infrastructure for collaboration with MINAM contents was also improved.

As discussed at M24, during the final year ITIA was involved in the definition, implementation and administration of the MINAM web portal. Efforts were concentrated on collaborating with the MINAM Working Group to ensure that the portal provides efficient communication and information exchange among partners, as well as public presentation. Contributions from other existing projects connected with MINAM (IPMANN, 4M, EUPASS, etc.) were merged, and the µSapient web portal has been synchronised with the MINAM portal.

Deviations from work schedule

The first version of the web portal and intranet was available before the planned delivery date, as it was needed for work on the first roadmap.

Planned activities after project end

It was agreed at the Final General Assembly that the µSAPIENT web portal will be continue to be hosted and maintained for two years from the end of the project. ITIA will continue to maintain the MINAM Portal after the end of the µSAPIENT project. The agreement for sharing the cost is under definition.

3.2.2 Task 2.2 Newsletter and articles

Achievements

The University of Strathclyde, in collaboration with the University of Nottingham and Tekniker, produced the µSAPIENT newsletter. The newsletter was distributed electronically and hard copies could be produced for specific events when requested.

Month 12:

Initially Strathclyde suggested a title and a strap line for the newsletter summarising the objectives of both the µSAPIENT and IPMMAN projects: **MNT Future Vision,** ***Mapping the future of Micro and Nano Manufacturing in Europe***. An agreement was reached between the two projects to disseminate in a coherent newsletter the results of actions and studies carried out. The µSAPIENT consortium focused in each issue on the dissemination of new and exclusive information resulting from the project studies and analyses.

Communication with EU projects relating to MNT was developed. Ten EU projects were contacted for collaboration and insertion of news in the Calendar of Events section of the newsletter. EU projects were strongly invited to communicate results and major events through the newsletter as readers with a special interest in technology developments and guidance for future research and investments were the target audience.

The first newsletter was published in December 2006. It was sent out to 74 subscribers and a Subscription button was set up on the µSAPIENT website for collection of further registrations. The newsletter was also available electronically on the Micro and Nano Working Group and Masmicro websites, and listed on the MNT Directory: www.mnt-directory.org/profiles/review.asp?DirID=1820

MNT Future Vision provided in the first instance industrialists, stakeholders and research communities with forecasts and information on networking platforms in order to improve strategic planning in the micro and nano technology field.

Month 24:

Further to discussions at the General Assembly in March 2007, Strathclyde successfully revamped the newsletter to become the MINAM newsletter. A new graphic design gave the newsletter a strong identity and a more professional look.

The newsletter has been produced with the collaboration of MINAM, IPMMAN, 4M and EU-funded projects, aiming to provide a broader range of information on EU initiatives in the field of micro and nano manufacturing.

The newsletter increased in content, with detailed information on initiatives and events and in-depth presentation of EU-funded projects in the MNT. In each newsletter, four pages were dedicated to projects that can explain their objectives, target and outcome to the MINAM community.

As planned, two newsletters were produced in the second year. 500 copies were printed in October 2007 and distributed through IPMMAN, µSAPIENT and at the MINAM launch. The newsletter was also emailed to the MINAM mailing-list and made available online.

Month 36:

To prepare the newsletters, the following was performed by Strathclyde:

- Close collaboration with MINAM association in order to gain latest news and plan for future activities from the association, especially the outcome from its annual meeting;

- Close collaboration with IPMMAN and 4M with a view to gaining latest information on their roadmapping activities in micro/nano-manufacturing;
- Gained support from µSAPIENT partners for newsletter contents, especially partners from WP1, on roadmapping activities and outcome;
- Keeping contact with major EU-funded projects to encourage dissemination of their results through the MINAM newsletters;
- Keeping contact with the EU officer to gain latest news on the call information and strategic plan for funding EU micro/nano-manufacturing activities;
- Conducting information search and study of other similar dissemination activities world-wide, from which the experience and impact were learnt for improving the MINAM newsletters;
- Conducting a review on the micro/nano-manufacturing activities with a view to ensuring that the contents to be published in the newsletter represent the state of the art in the micro/nano-manufacturing field;
- Exploring new channels to disseminate the newsletter with a view to maximising its publicity and creating more awareness on EU micro/nano-manufacturing among a broader range of audience.

The newsletter is the result of an excellent collaboration between µSAPIENT, IPMMAN and the MINAM IMG and secretariat. It provides more content, detailed information on initiatives and events and space for detailed presentation of EU-funded projects in MNT. Since the 2008 annual meeting, two more newsletters were produced. 500 copies were printed out in October 2008 and distributed through µSAPIENT and at the MINAM session in Stuttgart fair, as well as through other individual contacts. The newsletters were also emailed to the MINAM mailing-list and available on-line.

Deviations from work schedule

The first newsletter was released later than initially planned, December instead of September. This was due to the difficulty in collecting articles from partners for this first issue.

Planned activities after project end

After the project, Strathclyde will continue to publish the newsletters for MINAM, using its own resources. This has been discussed with the MINAM Secretariat and other people concerned in the MINAM Association.

3.3 Work Package 3 - Conferences, seminars and meetings

Milestones & Deliverables:

Del. no.	Deliverable name	Delivery date	Objective of task	Responsible
3.1a	At least one special session at relevant conferences	12	To support the dissemination and promotion for improved awareness of the latest research results	UNOTT
3.1b	At least one special session at relevant conferences	24	To support the dissemination and promotion for improved awareness of the latest research results	UNOTT
3.1c	At least one special session at relevant conferences	36	To support the dissemination and promotion for improved awareness of the latest research results	UNOTT
3.2a	Two workshops in Micro and Nano-Manufacturing Technology	12	To support the rapid adoption of newly developed and potentially disruptive micro- and nano-technologies	CEA
3.2b	Two workshops in Micro and Nano-Manufacturing Technology	24	To support the rapid adoption of newly developed and potentially disruptive micro- and nano-technologies	CEA
3.2c	Two workshops in Micro and Nano-Manufacturing Technology	36	To support the rapid adoption of newly developed and potentially disruptive micro- and nano-technologies	CEA

3.3.1 Task 3.1 Support for a Coordinated Calendar of International Conferences and Seminars in Micro and Nano Manufacturing

Achievements

Month 12:

UNOTT drafted an initial list of conferences to form part of this calendar, which was subsequently circulated to other partners for them to add conferences that they are aware of.

From this list several conferences were highlighted and the EUSPEN conference (May 2007) was approached to include a special session from µSAPIENT.

In addition to this µSAPIENT was represented at the 4M conference held in Grenoble between 20th and 22nd September 2006.

A first long list of current EC projects has been established by CEA. This list was completed and validated with the EC officer.

An initial list of international events was also established. A questionnaire was set up by CEA to complete this list and to identify the best opportunities to disseminate and coordinate the latest developments in Micro and Nano manufacturing and technology mapping. This list aimed to ensure at least one µSAPIENT representative at every important event. All the collated results and implications were discussed and prioritised at the WP meeting in October 2006.

Based on these lists some experts were identified to participate at two conferences (4M and Micronora), reinforcing interaction with current EC project such as SEMOFS, CHARPAN, NAPA, Nanofunpoly, Smart and 4M.

1) For the 4M conference (Minatec – Grenoble France, 20th-22nd September 2006) Charpan, Smart, Nanofunpoly, and SEMOFS projects were active through presentations and panel discussions. All these four FP6 projects presented their latest developments and some complementary themes could be identified. Some synergies were identified, and additional workshops were scheduled for 2007 (SEMOFS, Smart), emphasising the opportunity to build up added value projects in FP7.

A NoE meeting was also scheduled during the 4M conference to highlight the best practices of NoE projects and the main issues involved. Nanofunpoly, NEMO, Softcom and 4M participated. This helped to improve the NoE establishment for FP7, and there was also discussion about the future of these NoEs once they have ended.

Cardiff University publicised the 4M Conference on the µSAPIENT website and offered µSAPIENT a special session at the conference.

2) The second conference was Micronora (Besançon France, September 2006) at which three existing EC projects were involved (Charpan, 4M and Nappa). The goal was to provide the latest developments in Nanomanufacturing to industry and scientific organisations.

Month 24:

UNOTT co-ordinated a Calendar of Events (based on CEA's updated questionnaire) updated on a 2-monthly basis with input from all partners. The calendar gives details of relevant past and future events and existing EC activities, and is available on the µSAPIENT website.

Three special sessions at conferences took place as follows:-

1) CEA managed a special µSAPIENT session at the HARMST-007 (High-Aspect-Ratio Micro-Structure Technology) Conference in Besançon (7-9 June 2007). There were 160 participants from 17 countries as follows: 54% from Europe (28% Germany, 17% France); 33 % from Asia (24%

Japan, 6% Korea); 10 % from North America (US 7.5%). 27 PhD students participated in HARMST. This venue encompassed 37 oral presentations and 111 posters covering various aspects of the manufacture of ultra-precise micro and nano-structures in materials as diverse as polymers, metals, ceramics and silicon.

The purpose of HARMST is to share information on all aspects of high-aspect-ratio technology including design, modelling, fabrication, testing, and applications. This workshop has established itself as the premier forum for reporting progress on high-aspect-ratio micro-structure technology (HARMST).

HARMST-007 has continued a series of biennial workshops that began in 1995 and rotate between Europe, North America and Asia. It provides a forum for experts from academia and industry, researchers and end-users in the field of high-aspect-ratio microfabrication, to communicate on the latest results of their investigations. It also fosters scientific and technical discussions about the successes, issues and challenges concerning high-aspect-ratio technologies and processes and related fields.

2) UNOTT as co-ordinator represented µSAPIENT at EUSPEN 2007 (Bremen June 2007) and chaired a round table session, contributing to the dissemination and promotion of project activities.

3) The 3rd 4M conference took place on 3-5 October 2007 in Borovets, Bulgaria. A µSAPIENT special session was organised by Cardiff, plus one specific activity based on µ-bio devices. Svetan Ratchev and Michele Turitto were the representatives from Nottingham, and Jérôme Gavillet and Etienne Bouyer from CEA.

Month 36:

UNOTT continued to update the Calendar of Events on a 2 to 3-monthly basis using inputs from all µSAPIENT partners. The updated calendar continues to be available on the µSAPIENT web portal.

Bertrand Fillon from CEA participated in the ANTEC annual conference in Milwaukee (USA) on 3-5 May. The program was excellent, providing attendees (from Asia, Europe and the USA) with the most up-to-date information about developments and innovations in the plastics industry. The ANTEC technical program offered 615 technical papers and 27 commercial papers on a broad range of topics. A one-day session with 20 presentations was organised on micro replication - FZK published two papers and Bertrand Fillon chaired the session. MINAM and µSAPIENT activities were introduced explaining how Europe is structured to prepare the roadmap and research in the micro-replication business. Following this, a meeting was organised with the ANTEC staff to discuss the possibility of holding a special session for European industries at the next ANTEC conference in Chicago on 20-22 June 2009. As a result, various European industrialists and research institutes in the field of micro replication were contacted to submit papers for the conference. The medium term plan is to organise a special session on micromanufacturing in Europe under the ANTEC umbrella.

Several µSAPIENT partners participated in the 4M conference held in Cardiff on September 2008, where Stefan Dimov acted as Chair.

Cranfield organised the dissemination of the EU project 'Q2M' at the conference and also gave a presentation.

In the BACUS Newsletter (March 2008 issue) the new technique of PMLP – Projection Mask-Less Patterning - was outlined as a major highlight. IMS had presented sub-20nm resolution results at the SPIE Photomask BACUS 2007 conference.

In invited talks IMS presented the PMLP results, as achieved with the CHARPAN integrated FP6-NMP project at the following conferences in the reporting period:

- MSW 2008 (Micro Systems Workshop), Göteborg, Sweden, 6-7 May 2008
- EIPBN 2008 (52nd International Conference on Electron, Ion and Photon Beam Technology and Nanofabrication), Portland, Oregon, USA, 27-30 May 2008
- FEBIP 2008 (2nd International Workshop on Focused Electron Beam Induced Processing), Thun, Switzerland, 7-8 July 2008

There was the possibility to present outstanding results, e.g. exposure of HSQ non-chemically amplified resist with 16nm lines&spaces resolution and resistless nanopatterning of Si and GaAs surfaces.

A major achievement was also reached in the CHARPAN project by producing the first functional programmable Aperture Plate System with integrated CMOS electronics (CMOS-APS) – see Figure 1.

In context with CHARPAN project presentations at the SPIE Photomask BACUS 2008 conference (Monterey, California, Oct 7-10, 2008) as many as three awards were received:

Elmar Platzgummer / IMS Nanofabrication – 2nd Best Oral Presentation

Florian Letzkus / Institute for Microelectronics Stuttgart – Best Poster Price

Jörg Butschke / Institute for Microelectronics Stuttgart – 2nd Best Poster Price

In addition the Best Poster Price publication was issued on page of the BACUS Dec 2008 Newsletter.

Deviations from work schedule

None.

3.3.2 Task 3.2 Project specific workshops and dissemination events

Achievements

As task leader, CEA organised a number of workshops (in excess of the prescribed 2 per year) that have contributed effectively to dissemination and networking.

Month 12:

The first workshop was organised on 6-7 December 2006 in Minatec on "Nanomaterials from laboratory to industry". Etienne Bouyer and Luc Federzoni from CEA represented µSAPIENT. Luc Federzoni did a presentation on nanomaterial for µ-systems. More than 120 attendees, 80% from industry, took part to the workshop. Plant visits were also organised (Baikwski chimie and Eurotungsten).

A second workshop was organised on 23 March 2007 in Dijon, where the focus was on Nanopowder manufacturing.

Month 24:

CEA organised six workshops as follows:-

1) A first workshop called MaterialsEuroRoads was co-organised by Research Centre Jülich and IOM in Paris on 29 March 2007 through the specific support action SMART (For**s**ight Action for **M**ultifunctional M**a**terials **T**echnology). This dissemination event was attended by more than 50 representatives of Ministries and funding agencies. Dr. Jose-Lorenzo Valles, the Industrial Technological Materials Unit head at the European Commission, gave the welcome address. Ten presentations were given relating the activities implemented within the frame of European roadmapping projects and/or European platforms (MATERA, ESTEP, EUMAT, NANOMAT etc). Etienne Bouyer presented the µ-Sapient project, and the manufacturing topic addressed within the project was complementary to the other presentations mainly dealing with material (ceramic, steel) and even nanomaterials. A large impact was expected due to the quality of the attendees.

2) A second workshop (supported by PIRA/Intertech) was organised at the Printed Electronics 2006 Conference in Dusseldorf in May, chaired by Bertrand Fillon. The topic was Nanopower business and technology bottlenecks.

3) A third workshop was organised during the HARMST-007 **High-Aspect-Ratio Micro-Structure Technology Workshop**, the premier international event devoted to the advancement of high-aspect-ratio manufacturing technologies and their applications (Besançon, 7-9 June http://harmst-007.femto-st.fr).

The workshop was chaired by FEMTO-ST and co-chaired by CEA. Major institutions with activities in the field of high-aspect-ratio microstructures were represented as follows:

- The research centre of Karlsruhe (FZK),
- The microsystem IMTEK laboratory of Freiburg
- The technical research centre of Finland (VTT)
- The technical university of Denmark (DTU)
- The royal institute of technology of Sweden (KTH)
- The Japonese university of Ritsumeikan
- The University of Louisiana (LSU)
- The Korea Advanced Institute of Science and Technology (KAIST)
- Several research institutes from Korea, Taiwan, Singapour and China

together with companies such as Sumitomo Heavy Industries and Zyvex Corporation.

4) CEA prepared a fourth workshop for the 4M conference in Borovets on 2 October 2007. The EU project SEMOFS, focusing on µ-fluidic/µ-optic components for bio applications, was identified to organise the event and partners agreed to use 4M and µ-sapient as a platform to disseminate the latest development in their area of research, 4M as a network of major scientific and technical organisations working on MultiMaterial MacroMachining, and µ-SAPIENT as a forum for facilitating such project interactions.

5) A fifth workshop was organised on 6 November 2007 in Besançon with a French polymer excellence clusters “Plastipolis”. The goal was to disseminate µ-manufacturing applications for French SMEs. More than 30 participants were involved with half from very small SME’s (<100p). Matthias Heckele from FZK gave a presentation on the latest developments in hot embossing processes, the French cluster gave a presentation on µ-injection moulding and one SME presented the main bottlenecks they are facing in polymer µ-replication. During discussion it was highlighted that the main requirements for SMEs are innovation and high added values business. SMEs are

looking for people with good competencies in the field of µ-replication, and training sessions focusing on polymer µ-replication need to be developed.

6) A sixth workshop was organised in Dijon on 13 December 2007. The goal was to disseminate µ-manufacturing of polymers with conductive nanofillers and active organic polymers for applications such as OLED and OPV for French SMEs. More than 90 participants attended, and presentations on the latest developments in polymer/nanofiller blends were given. There was some discussion about the need to produce polymer devices or µ-devices with functions such as a complete active system based on organic electronic materials. To reach such a target, the future replication process will be a convergence of technologies between injection moulding with functional film produced by printing technologies.

Month 36:

Bertrand Fillon from CEA organised a micro-tooling workshop at the French tooling exhibition in Paris on 4 April 2008 (**more than 1000 visitors and over 200 exhibitors from more than 30 countries**). The goal was to disseminate the results of the 4M project on the micro tooling round robin test. It was an opportunity to promote, extend and benchmark the 4M expertise all around the world. More than 30 participants, mainly SMEs, were involved in the workshop. Two machine suppliers, Haas and Makino, presented their new generation of micro milling machine capabilities through different trials. During the discussion it was highlighted that the main requirement for micro tooling SMEs is based on tool life during micro milling which becomes very limited when the micro structure reaches the sub micro scale. In the future Makino will be involved in various round robin tests to develop and improve their machine and tool capabilities in order to meet customer requirements.

A second workshop was organised in Budapest in April with a presentation on Nanosurfaces. Christian Woegerer from Profactor gave a presentation prepared by the MINAM nanosurfaces working group.

A third workshop was organised in Basel on 20 June in the CIBA/CSEM laboratories with the support of the French polymer excellence clusters “Plastipolis”.

The goal was to disseminate µ-manufacturing applications for Swiss SMEs. More than 40 participants were involved including 30 from very small SME’s (<50p). Alexander Stuck from CSEM gave a general presentation on the micro replication process. The French cluster gave a presentation on the µ-injection moulding business in France and identified the main bottlenecks the French companies are facing in polymer µ-replication. The top five main issues are:

- Better reliability of µ-injection processes with better results after demoulding
- Improvement of throughput
- Online process control
- Multimaterial µ-components must be produced to decrease the assembly cost which is 70% of the total cost
- The production of active µ-components leads to polymer µ-devices with functionality

A Swiss SME (Dr Willy Meier, Injector SA) presented their activities and also the improvement they are looking for. Cost is the main issue but for some Swiss applications (i.e. luxury) this is very minor. Online control and multimaterial components have also been identified as a future requirement.

A major issue for all SMEs is finding people with good competencies in the field of µ-replication, therefore training sessions focusing on polymer µ-replication need to be developed.

Cardiff and Cranfield jointly organised a workshop "Multi-Material Micro-Manufacture of RF-components" at the MMLive event in Coventry on 21 October 2008. The purpose of the workshop was to bring together experts in micro-manufacture and microwave technology to investigate the possibilities for new fabrication technology in this high volume product area. About 30 participants took part to this event.

A regional workshop was co-organised on November 20th 2008 by CEA and the European pole of polymer processing in Oyonnax (France) under the umbrella of the French polymer cluster of excellence (Plastipolis). The main topic was micro polymer processing. This event attracted more than 80 participants from four countries (Germany, France, Switzerland, United Kingdom), and 40 companies were represented as well as 35 R&D Institutes.

CSEM contributed as follows:

- by collecting and sending informations to partners
- participation to events
    - organisation of a workshop dedicated to vision with one topic dedicated to micro-nano manufacturing
    - participation to a business forum (Robot-X) manufacturing session dedicated to end effectors
    - SWISSMEM conference on European Factory Automation
- Participation to experts meeting for setting EU proposals (IP Nanosurface, Sensolight, NoE Tinman, SMS SelfMEM, cleanmax)
- Courses focused to industrial participants (high level management & specialists)
    - Polytechnique Paris (nov 2008)
    - Higlights in micronano technology (june 2008)
- Focused direct contact with industry (Glass, polymer, paper industries)

Deviations from work schedule

None.

3.4 Work Package 4 Common initiatives and formation of expert groups

Milestones & Deliverables:

Del. no.	Deliverable name	Delivery date	Objective of task	Responsible
4.1	Clusters of experts with program of activities	12	The clusters to support the formulation and execution of short and mid term EU research agenda in micro- and nano- manufacturing	TNO
4.2	Programme for collaboration with the USA and the Far East	12	To provide links to the latest global developments and integrate centres of excellence from the USA, Japan and Korea.	Cardiff
4.3	Organisation of International Collaboration Activities	24	To contribute mechanisms for benchmarking European countries against the rest of the world in relation to MNT	Cardiff
4.4a	First meeting of the EU Nano-manufacturing forum	6	To provide a platform for the development of the Strategic Research Agenda and bring together the NanoManufacturing stakeholders	FHG
4.4b	Formation of EU Nano-manufacturing forum	18	To set up MINAM as a European Technology platform	FHG
4.5	Technology Maturity Level Analysis	36	To obtain a picture of the distribution of the research efforts along a maturity scale for MNT	Cardiff

3.4.1 Task 4.1 Development of clusters of industrial experts and researchers

Achievements

Month 12:

As task leader, TNO attended the µSAPIENT brokerage events in November 2006 at FZK and of MINAM in January 2007 in Brussels. TNO also collected information, expressions of interest for the formation of Special Interest Groups and defined the approach for their realisation.

TNO and TUT mapped centres of excellence and listed topics of SIGs in micro and nano manufacturing technologies as part of the Roadmapping, Manufuture and FP7 preparation activities.

UNOTT, with the help of FZK, organised the Brokerage Event at FZK Karlsruhe in November 2006. The aim of the event was to bring industrialists and technical specialists together to discuss new research ideas, with a view to forming special interest groups that will support the formulation and execution of short to mid term EU research agenda. In a dedicated session, the following possible (supported by industry) topics for Special Interest Groups were identified:

(a) Raising awareness of massively parallel beam technologies for nanostructuring
(b) Material improvement for existing (mouldless) shaping processes for micro-optic integrated components
(c) Fast high integrated manufacturing for multi-scale (micro-nano) hybrid systems
(d) MNT applications and technologies for improvement of traditional industry
(e) Microfactory concepts
(f) Design tool for integrated packaging
(g) Combined additive and subtractive laser processing

The general aim of the SIGs was to:
- support the formulation and execution of short to mid term EU research agenda in micro- and nano- manufacturing.
- offer specialised knowledge and advice to industry in different priority areas of technology adoption and fast implementation of the latest R&D results into production.

This included e.g.:
- promotion of the SIG interests (field, technology)
- promotion of cooperation and information exchange (promoting best practice, identifying knowledge gaps, missing standards).
- supporting MINAM expert groups with information and opinions from the SIG topic field and domain
- initiatives for cooperation in the SIGs field with regard to research and knowledge transfer.

It was envisaged that the (mainly web based) activities and further formation and programming of the SIGs would be brought in line with that of MINAM's expert groups.

Finland hosted the MANUFUTURE 2006 Conference on 9^{th}-10^{th} October in Tampere (www.manufuture2006.fi). µSAPIENT was well represented at this conference which gathered together major stakeholders from industry, universities, research institutions and government to discuss and exchange ideas of a practical technological, organisational and industrial nature, relating to the implementation of the Manufuture Technology Platform strategy and research agenda. Micro and nano manufacturing technologies form an essential part of the Manufuture platform and research agenda.

Following the Manufuture Vision 2020, the Strategic Research Agenda (SRA) and the active ongoing work in the development of the detailed RTD Roadmaps for Manufuture, the Manu*future* 2006 Conference in Tampere focused on the implementation plan, answering the priorities of main industrial sectors, proposing actions at European, national and regional levels. The conference gave the participants the latest actual information of the 7^{th} Framework Programme preparation and its manufacturing-related NMP and IST research themes, thus improving awareness of the implementation opportunities in FP7.

The participants also benefited from the conference as a networking event by having discussions with other delegates about collaboration ideas and initiatives relevant to their industrial needs. One of the six workshops of the conference focused on micro and nano manufacturing technologies.

Month 24:

Information, as well as expressions of interest, was collected for the formation of Special Interest Groups. In order to kick-off and form these SIGs, TNO (with the support of TUT and UNOTT) organised an event on 21-22 June in the Düsseldorf Arena, just after the Euronano Forum. The aim of this meeting was to make plans for the promotion of SIG interests and also to exchange ambitions and information. The meeting was attended by 15 people (9 of whom were from industry) from 8 countries.

Special attention was given to their relationship with and positioning within MINAM. In effect, the SIGs could contribute directly to the activities of the MINAM Operation Support Groups' activities by giving input and opinions for the MINAM roadmaps. Three parallel sessions were held on Micro-actuator & Micro-factories, Additive & subtractive laser processes, and Process Design. Also comments were collected on the NMP 2008 call texts in preparation (and conveyed to the secretariat of MINAM)

SIG microfactory
Microfactory means a small-size production system suitable for the fabrication and manufacture of small size parts and products. It is also a general philosophy to minimise production systems and processes and to integrate them. In order to develop anything useful, the position of the micro-factory or micro-production modules should be carefully thought through. It was observed that if they are not carried out in a coordinated way, resulting in isolated solutions e.g. for micro-actuation and micro-factory planning software, it does not readily contribute to the full development of the micro-factory idea. This SIG could work on aligning these and providing an overview.

SIG additive & subtractive laser processes
Possible ways to use lasers were introduced e.g. ablation, polymerisation, cleaning, material transfer, deposition, sintering, micro bending. It was proposed that the SIG will look into how an integrated laser technology system / cell could contribute to high throughput micro-fabrication. This will include listing state-of-the-art techniques and their projection forward in the next five years. With regard to the SIGs field it was decided to exclude IC-manufacturing applications.

SIG process design
The focus of this session was micro-fabrication process design and dedicated systems and/or software. A parallel was drawn with the development of micro-electronics and especially IC-industry in the sixties. A growing market, shorter product cycle, and designers no longer being able to keep up, have all led to the development of design methodologies and standards. History seems to be repeating itself with micro-nano development, but there is now the possibility of avoiding the mistakes of the IC industry 30 years ago. The importance of knowledge management in academia was stressed for speeding up knowledge transfer and linking their work to industry.

The SIG meeting was also attended by partners from Festo, CEA and Cardiff (coordinating 4M support for the Special Interest Groups). TNO has also acted as chair of the MINAM Expert Group - Manufacturing of Microcomponents. Members of this Expert Group contribute to the MINAM SRA document.

Month 36:

A link has been maintained for the three established Special Interest Groups (SIGs) on the µSAPIENT website i.e. 'Combined additive and subtractive laser processing', 'Microfactory', and 'Process Design and Knowledge Management'.

Cooperation and coordination with the 4M Association which has four SIGs; i.e. '4M-Polymer Processing', '4M-Micro-Optics Interest Group', '4M-Ceramics Interest Group', and '4M-Metrology Interest Group' was also agreed.

At the end of 2007, the policy of µSAPIENT shifted from setting up separate µSAPIENT SIG events and groups to supporting and contributing to MINAM Expert Group (EG) activities. The following activities took place during the reporting period:

- Workshop on Integration in Micromanufacturing at MiNaT in Stuttgart (9 October 2008)
- Workshop on micromoulding organised at Plastipolis in Oyannax, France (20 November 2008)
- MID (Moulded Interconnect Devices) seminar at DTU, Denmark (26 November 2008)
- MINAM EG on Manufacturing of Microcomponents workshop on contributing to the updated MINAM Strategic Research Agenda in Eindhoven (21 January 2009), hosted by TNO and attended by representatives from Cardiff and UNOTT.

Cranfield has been an active participant in the MINAM Microcomponent expert group attending an expert group meeting in Frankfurt, 3 April 2008.

Deviations from work schedule

D4.1 'Clusters of experts with program of activities' was delivered approximately 3 months late at M15.

No deviations to report.

Planned activities after project end

A larger meeting in Spring 2009 will provisionally be organised by MINAM in cooperation with the µSAPIENT and 4M communities.

The MINAM Operation Support Group (OSG) and Expert Groups (EG) will support the continuation of activities already started up. The EGs are more permanent groups with a wider scope compared to the µSAPIENT SIGs which are more dynamic and focused on special technologies. Promotion of both SIGs and EGs will offer better value for industrial partners as a company can belong to many EGs and SIGs.

3.4.2 Task 4.2 International collaboration with the USA and the Far East

Achievements

Month 12:

Cardiff as task leader held discussions with the 4M Network of Excellence regarding a common 4M / µSAPIENT approach to international visits. Moreover the programme for collaboration with the USA and the Far East was defined and international visits were coordinated (see below).

Prof Tuokko from TUT visited the USA on 20th-24th March 2006. The visits were organised under the Finnish Technology Programme 'SISU 2010 –Innovative Manufacture', for which Prof Tuokko is the coordinator. During this technical tour Prof Tuokko met major US players in the field of micromanufacturing and gained a good overview of the situation in the USA. During the visits preliminary plans for organising some joint workshops were discussed. The following list gives an overview of the main contacts made during this technical tour:

University of Illinois at Urbana-Champaign, Illinois
Department of Mechanical and Industrial Engineering, www.mie.uiuc.edu

- Prof Richard E deVor, College of Engineering Distinguished Professor of Manufacturing; Research Professor, Member of National Academy of Engineering

- Prof Shiv Gapol Kapoor, Grace Wicall Gauthier Chair; Director, the Center for Machine Tools Systems Research
- Prof Plcid M Fereira, Grayce Wicall Gauthier Professor; Director, the Nano-CEMMS Center

Purdue University at West Lafayette, Indiana

- Prof Yung C Shin, School of Mechanical Engineering, Director of Center for Laser-Based Manufacturing, Director of Intelligent Manufacturing Lab
- Prof Richard Liu, School of Industrial Engineering, Director: Photon Processing Lab, High Speed and Hard Machining Lab, Surface Engineering and Reliability Lab

Northwestern University, Evanston, Illinois

Department of Mechanical Engineering, http://www.mech.northwestern.edu

- Prof K Ehmann, AML (Advanced Manufacturing Laboratory)
- Profs E Colgate & M Peshkin, LIMS (Laboratory for Intelligent Mechanical Systems)
- Prof J Wang, Center for Surface Engineering and Tribology
- Prof W Chen, IDEAL (Integrated Design Automation Laboratory)
- Prof J Cao, AMPL (Advanced Materials Processing Laboratory)

University of Michigan at Ann Arbor, Michigan, College of Engineering

- Prof Jun Ni, Deputy director of the NSF Engineering Research Center of Reconfigurable Manufacturing Systems, http://erc.engin.umich.edu/ and Director of SM Wu Manufacturing Research Center
- Prof Yoram Koren, Paul G Goebel Professor of Engineering, Director, NSF-ERC/RMS
- Mr Dragan Djurdjanovic, Assistant Research Scientist, Associate Director, NSF-I/UCRC/IMS

Prof Tuokko also gave a Doctoral Seminar for UMICH PhD-students and research staff.

In July 2006 Prof Tuokko was invited to Korea to give a keynote presentation at the 2nd International Workshop on Next-Generation Microfactory System, July 6-7, 2006. This event gathered together the core researchers from Korea together with two invited speakers from USA, two from Japan and Prof Tuokko from Finland. This event and later visits to several Korean universities provided a good opportunity to build the basis for further collaboration. The following contacts were made during this visit to Korea:-

Pusan National University

- Prof Deug-Woo Lee, <dwooolee@pusan.ac.kr>

Yonsei University

- Prof Byung-Kwon Min <bkmin@yoensei.ac.kr> (Deputy Director, Nano Manufacturing Research Center)
- Prof Hyun-Seok Yang <hsyang@yonsei.ac.kr> (Chairman of the School of Mechanical Engineering)
- Prof Sang-Jo Lee sjlee@yonsei.ac.kr (Mechanical Engineering)

Prof Tuokko also gave a Doctoral Seminar for the PhD-students and research staff of the Yonsei University.

CISD -Center for Information Storage Device (Yonsei University)

- Prof No-Cheol Park <pnch@yonsei.ac.kr>
- Prof Young-Joo Kim <yjkim40@yonsei.ac.kr>

Ajou University

- Dong-Yeol Lee <engdoc@ajou.ac.kr>, Director, Office of International Affairs
- Prof Soo-Hun Lee <slee@ajou.ac.kr>, President of Ajou Motor College <president@motor.ac.kr>

Changwon National University

- Prof Young-Hyu Choi <yhchoi@changwon@ac.kr>
- Prof Dae-Sun Hong <dshong@sarim.changwon.ac.kr>, Head, NURI

- Prof Geun-Jong Yoo <gjyoo@changwon.ac.kr>, Director of ILIC
- Prof Won-Jee Chung <wjchung@changwon.ac.org>, School of Mechatronics, Vice Director, Machine Tool Research Center, Vice Director, Knowledge-based Mechanical Parts and Materials R&D Cluster

Korea Institute of Machinery and Materials , KIMM

- Jong-Kweon Park, Dr(Korea Institute of Machinery and Materials, KIMM, email: jkpark@kimm.re.kr), Program director of the Korean Microfactory Programme
- Dr Jun-Yeob Song <sjy658@kimm.re.kr>, Team leader, U-Manufacturing Team
- Seung-Kook Ro <cniz@kimm.re.kr>, Senior Researcher, Ultra Precision Machines Team ks. www.itep.re.kr (Joint Program Call)
- Dr Dong-Hoon Kim <kdh680@kimm.re.kr>
- Dr Hyun-Yong Lee <lhy635@kimm.re.kr>
- Dr Taeho Ha <taehoha@kimm.re.kr>

Pohang University of Science and Technology, POSTECH

- Prof Dong-Woo Cho <dwcho@postech.ac.kr>, Department of Mechanical Engineering http://ims.postech.ac.kr
- Han-Ul Lee <polarb@postech.ac.kr>, Intelligent Manufacturing Systems Lab

Korea Institute of Industrial Technology, KITECH,

- Dr Nak-Kyu Lee, Principal Researcher (email: nklee@kitech.re.kr)

Yeungnam University

- Prof Tae-Jo Ko <tjko@yu.ac.kr>, School of Mechanical Engineering

Doosan Infracore C, Ltd.

General Manager Jae-Yong Ha <jaeyong.ha@doosan.com>, R&D Team 1, Machine Tools & FA BG

Month 13 - 36:

At the first year review, it was the decision of the EC to stop the originally planned International Visits (Deliverable 4.2) and associated travel money. It was also the decision of the EC to stop the corresponding linked visits within the 4M Network, one of the projects integrated into µSAPIENT. Consequently this task was re-focused towards integration with the MINAM Roadmap and questionnaire of Task 1.2, to which it has contributed questions benchmarking European countries against the rest of the world. It has also been re-focused towards a Technology Readiness Level analysis of European projects, in collaboration with another project integrated within µSAPIENT. Further details of this have been reported in Deliverable 4.5.

However, the task has seen it important to provide links to the latest global developments, and so a specific effort has been made in integrating centres of excellence from the USA, Japan, Korea and other parts of the world with specific unique expertise in micro- and nano-manufacturing. The consortium has already established working links with a number of research centres and institutions in these countries which will provide the basis of the development. The cooperation has involved joint events as well as fact finding missions and exchange of researchers.

Partnerships with international research institutes and industrial companies have been strengthened in order to study the possibility for new international research programs on micro- and nano-manufacturing. Our network has given a good background and operational framework to find strong international and EU partners for demanding new research programs.

Information gathering missions have also been organised to the USA and Far East to find out the level of development and key trends in micro- and nano- manufacturing technologies as well as market potential and maturity. These missions have been organised in connection with international events such as:-

- 6th International Workshop on Microfactories (IWMF'08, 5-7 Oct 2008, Evanston USA)

- 3rd International Conference on MicroManufacturing (ICOMM'08, 9-11 Sept 2008, Pittsburgh USA)
- 4th International Workshop on Microfacory Technology (IWMT 2008, 10-11 July 2008, Jeju, South Korea)
- 2nd lnternational Forum on Desktop Factory in Suwa (DTF 2008, 25-26 August 2008, Suwa Japan)

The theme of the DTF 2008 forum was "exchanging information on the activities in the field of micromanufacturing and micromanufacturing systems looking for establishing business and technical partnership". Mr. Hans Hartmann Pedersen from European Commission was one of the keynote speakers and gave a presentation on 'MINAM and the European Micromanufacturing Market'. Prof. Reijo Tuokko from Tampere University of Technology was invited as a panelist in the panel discussion which followed the keynote presentations. The panel concentrated on contemporary R&D and emerging applications of micro and desktop manufacturing. Prof. Tuokko's topic was 'Microfactory –Dream or Reality?'. There were also representatives from Switzerland and Germany at the forum. An interesting one-day business workshop was organised after the forum at Techno Plaza Okaya. On the third day the host, representing the DTF Research Consortium, organised interesting technical visits including 'Precision Technology Research Institute of Nagano Prefecture', 'DAIYA SEIKI Co., Ltd.', and 'Hiraide Precision Co. Ltd.', followed by an additional business networking meeting. This visit provided a good opportunity to deepen and strengthen the contacts between Japan and Europe, and for increased cooperation between business and research.

As explained above, additional activities carried out within this task now relate to D4.5 Technology Maturity Level Analysis, coordinated by the Manufacturing Engineering Centre at Cardiff University.

In the last µSAPIENT Periodic Activity Report at Month 30, the methodology adopted in this task to identify the maturity of MNTs was described. In particular, it was explained that access to data from R&D projects carried out in the field of MNTs by partner organisations in the µSAPIENT and 4M consortia had been performed to evaluate the maturity phases targeted by each project and as a result to extract the maturity profiles for given technologies. It was also stated in the report that data from 82 projects had been collected from a survey developed to achieve the goal of this task and that the data analysis was on-going. The first results from this analysis have now been obtained and have also been reported in a paper submitted to the 4M/ICOMM 2009 conference. The paper is entitled "Technology maturity assessment of micro and nano manufacturing processes". A summary of the main findings and conclusions reached in the paper is given below:

- The proposed methodology for assessing technology maturity is inspired by the Technology Readiness Level (TRL) concept developed in the 1980s by the National Aeronautics and Space Administration (NASA). However, it is designed to overcome some of the limitations of this concept. In particular, the adopted methodology was developed to simplify the maturity evaluation procedure in order to combine a large number of inputs from a rich and validated knowledge repository in the form of an R&D project portfolio.
- The method results in a maturity assessment output containing an increased information content and it also allows the identification of a broad picture of technology maturity that is not specific to a particular organisation.
- The results obtained show that in the field of MNTs, R&D efforts exist to support the integration into production environments of the most important future manufacturing technologies, as identified by a roadmapping study carried out in 2006 by the 4M

community. However, the proportion of these R&D activities is lower compared with those focused on the less mature phases of their development.

- The percentage of R&D efforts from the 4M and µSAPIENT partner organisations that are targeted at phase 7, "mass production/serial production", the highest phase along the adopted maturity scale, are consistently low between all the selected manufacturing technologies. This is not surprising considering that the results are based on data obtained from R&D projects carried out by a research community while it is expected that such a high maturity level should be the focus of industry-funded projects.
- The study also highlighted the fact that among the selected manufacturing technologies, micro milling and micro injection moulding received the highest level of attention from the research community both in terms of funding and the number of projects targeted at their development.
- It was also not surprising to observe that among the polymer replication processes, the maturity reached by micro injection moulding was higher than that of Nano Imprint Lithography (NIL) and nano imprinting. In addition, when considering micro tooling processes only, the maturity of micro milling was ranked higher than that of laser ablation. This fact tends to support the real impact of these technologies in the context of the micro tool making industry.
- The maturity profiles of injection moulding, 3D printing, powder injection moulding and milling showed similar characteristics. In particular, the percentages of R&D efforts are varied between 10% and 30% for all phases from 1 to 6. This shows that the R&D focus on these technologies spans a wide spectrum relatively evenly from "basic technology research" to "integration in a production environment and validation". It was also observed that the profiles of NIL, nano imprinting and metal forming are similar in shape as they all exhibit a strong focus phase 1 R&D activities: "basic technology research". The profile for laser ablation seems unique among the selected technologies as the R&D efforts of the projects developing this technology are mainly directed at phases 2, 3 and 4.
- The technologies that gathered the highest number of industry partners on average were Nano Imprint Lithography (NIL) and laser ablation. This result could be indicative of the fact that industry is currently showing an interest in exploiting and taking up such technologies in the future.

Deviations from work schedule

Due to the decision of the Commission at the Year 1 review to stop the originally planned International Visits (Deliverable 4.2) and associated travel budget, Task 4.2 (International Collaboration) was re-focused toward integration with the MINAM Roadmap and questionnaire of Task 1.2.

Planned activities after project end

The relationships and contacts established during the project will be maintained and strengthened by the project partners and will be utilised e.g by MINAM.

Further work on the Technology Maturity Level Analysis should be focussed on increasing the number of responses collected with the questionnaire in order to confirm the initial findings. In addition, based on the questionnaire data, the analysis of maturity profiles associated with particular funding agencies or funding programmes should be carried out in order to help policy makers in identifying funding gaps along the adopted maturity scale.

3.4.3 Task 4.3 Formation of EU Nano-manufacturing Forum

Achievements

IPA was instrumental in supporting the formation of the Micro and Nano Manufacturing European Technology sub-platform. This involved the following:

a) Coordination of a Nanomanufacturing Meeting on 12 May 2006

b) Meeting on 14 September 2006 working group Micro and Nanomanufacturing Preparation in collaboration with the projects µSAPIENT and IPMANN.

Results of the meeting were as follows:

- There is a big interest in industry and in industrial networks to set up a Micro and Nanomanufacturing platform
- The working group would be made up of: industrial management group, support group and EU Advisory group (details described in www.micronanomanufacturing.eu in the member area)
- The new name of the working group is MINAM (MIcro and NAno Manufacturing)
- Criterion of the MINAM logo and dissemination

c) Preparation of an Information and Brokerage event for the MINAM community on 24 January 2007 in Brussels; preparation in coordination with VDMA, EUSPEN, IPMANN and 4M.

d) Secretariat of the Operation Support Group (OSG) of the MINAM platform

Month 24:

The MINAM community planned to establish a European Technology platform. This platform would cooperate strongly with the existing platform Manufuture. In order to set up the MINAM platform, stakeholders from industry and research in particular prepared the future activities of MINAM. To coordinate these activities, IPA managed the Secretariat of the MINAM Operations Support Group (OSG). The tasks of the OSG Secretariat were e.g. work on requests of MINAM members, coordination between OSG and IMG (MINAM Industrial Management Group), coordination of OSG activities, updating the MINAM member list.

The following MINAM meetings and activities were prepared by FhG IPA:

- 1st OSG-Meeting on 7 March 2007: The µ-Sapient, IPMMAN and 4M projects exchanged ideas to set up the new MINAM platform. A structure with responsible persons for OSG was developed and decided.
- 2nd OSG Meeting on 27 June 2007: It was decided to set up teams for the MINAM activities on expert groups, Roadmapping, SRA and Vision document, research activities relations, implementation and public relations. First work plans for these teams were discussed. It was decided to work out work plans for these activities.
- 1st IMG Meeting on 29 June 2007: The Industrial Management Group (IMG) elected a board and a chairperson. It was decided to support all the activities in OSG. IMG members are joining the OSG activities as so-called “directors”.
- 3rd OSG Meeting on 8 October 2008. Establishing Expert Groups with industrial directors, Alignments in MINAM Vision and SRA, decisions on events and public relations.
- 4th OSG Meeting on 18 January 2008. Final preparation of the MINAM launch event and decisions for future MINAM activities

- MINAM launch event on 23 January 2008. Organisation of this event in cooperation with IMG Secretariat. Publishing the successful MINAM launch on the MINM web portal and in the press.
- MINAM Brokerage event on 24 January 2008. Organisation of this event in cooperation with IMG Secretariat.

As well as IPA, several µSAPIENT partners also attended the MINAM launch (e.g. UNOTT, Cardiff, TNO, FZK, CSEM, TUT, CEA, Tekniker, Festo, Cranfield, Strathclyde) and contributed to the Strategic Research Agenda (UNOTT - editor, Cardiff, FZK, CEA, TNO, Cranfield).

Month 36:

The MINAM community established a European Technology platform. This platform cooperates strongly with the existing platform Manufuture. In order to set up the MINAM platform, stakeholders from industry and research in particular have prepared the future activities of MINAM. To coordinate these activities, IPA is managing the Secretariat of the MINAM Operations Support Group (OSG). The tasks of the OSG Secretariat are e.g. work on requests of MINAM members, coordination between OSG and IMG (MINAM Industrial Management Group), coordination of OSG activities, updating the MINAM member list, preparing exhibitions and presentations.

The following MINAM meetings and activities were prepared by FhG IPA during Year 3:

• 2nd IMG Meeting on 6th June 2008 in Brussels. Following topics were discussed: MINAM association – next steps; promoting new partners from industry; JTIs.
• 5th OSG Meeting on 6th June 2008 in Brussels. Following topics were discussed: Report from IMG Board meeting; reports from the expert groups; report on roadmap coordination; report on implementation; Report on public relation. The MINAM OSG secretariat is shifted from Dr. Schäfer to Dr. Gommel, Fraunhofer IPA.
• Preparation of 6th OSG Meeting and 3rd IMG Meeting on 8th October 2008 in Stuttgart at the MiNaT fair
• Preparation of the MINAM booth on 8th October 2008 in Stuttgart at the MiNaT fare: posters, stand layout, presentation, participation at the MiNaT hotspots
• Preparation and organization of the 7th OSG and 4th IMG Meeting on the 14th of January in Brussels
• Contributions to the forming of the MINAM association in Brussels

Deviations from work schedule

No deviations to report.

Planned activities after project end

IPA will continue with the work for the MINAM Secretariat for an undefined period after end of the project.

3.5 Work Package 5 Project coordination and management

Milestones & Deliverables:

Del. no.	Deliverable name	Delivery date	Objective of task	Responsible
5.1	Project Handbook	6	To define the project standards and guidelines with respect to administrative, financial and technical issues	UNOTT
5.2a	Periodic Activity Report	6	To report the status of the project to all partners and the EC	UNOTT
5.2b	Periodic Activity Report	18	To report the status of the project to all partners and the EC	UNOTT
5.2c	Periodic Activity Report	30	To report the status of the project to all partners and the EC	UNOTT
5.3a	Annual Activity and Management Report	12	To report the status of the project (both activity and financial) to all partners and the EC	UNOTT
5.3b	Annual Activity and Management Report	24	To report the status of the project (both activity and financial) to all partners and the EC	UNOTT
5.4	Annual Activity and Management Report; Final Report	36	To report the status of the project (both activity and financial) to all partners and the EC; to provide a summary of activity and spend for the whole project.	UNOTT

3.5.1 Task 5.1 Project management

Achievements

A robust and lean project management structure was introduced in the project to provide a responsive and quality management and leadership. The Project Management Board (PMB) has met and communicated regularly to review progress and take decisions on issues such as support for the establishment of MINAM, approval of deliverables, planning and calendar management.

UNOTT, as co-ordinator, has ensured that all deliverables were met according to the Description of Work (where appropriate, any delays or deviations were noted).

Month 12:

The project was started with a kick-off meeting held in Nottingham on 9 – 10 March 2006.

While the work started on 1 March 2006, the actual contract for the project was signed in August 2006.

A major deviation from the originally proposed activities was the allocation of funding and inclusion in the work programme of the Working Group on Nano-Manufacturing led by FhG IPA upon a request by the project officer. The WGNM was later closed and became part of the wider Micro- and Nano- community MINAM.

UNOTT on behalf of the µSAPIENT project consortium was a founding member of the Micro and Nano Manufacturing European Technology sub-platform MINAM. Consequently, from the start µSAPIENT has had a strong position within MINAM with a number of µSAPIENT partners being involved in the overall coordination of the sub-ETP.

A six-monthly µSAPIENT members' meeting took place on 7 November 2006 with the objective to review progress and set priorities and plans for the next period. This was combined with a "brokerage event" which was well attended with fruitful discussions based on clear industrial statements. As a result, several proposals for forming special interest groups in specific areas were put forward to circulate to the wider community.

Overall UNOTT as coordinator represented µSAPIENT at the following events: IEEE Micromanufacturing Seminar (Urbana Champaign, USA, Sep 2006), FP7 event in Brussels (end January 2007), Cardiff FP7 event (mid January), 4M Conference in Grenoble, UK Manufuture event (Roadmap presented).

Month 24:

UNOTT, as co-ordinator, chaired the General Assembly held in Grenoble on 26-27 March 2007. The meeting was hosted and co-organised by CEA. It was attended by nearly all partners and presentations were given on the status of all workpackages. Plans for the remainder of the project were agreed and there was much useful discussion on the way forward for µSAPIENT activities in relation to MINAM.

UNOTT acted as editor/contributor/co-ordinator for the MINAM Vision/SRA, and attended the following meetings in support of MINAM: µSAPIENT /MINAM roadmapping/SRA meeting (Grenoble 20-21 Sept. 07); MINAM meeting (Brussels 8 Oct. 07); µSAPIENT /MINAM roadmapping/SRA meeting (Grenoble 22-23 Nov. 07); MINAM OSG meeting (Brussels 15 Jan. 08); MINAM Launch event (23-24 Jan. 08).

UNOTT supported Strathclyde with their successful redesign of the µSAPIENT newsletter to become the MINAM newsletter. The new format and distribution ensured that the newsletter reached a wider audience.

UNOTT, as co-ordinator, represented µSAPIENT at special sessions at EUSPEN 2007 (Bremen June 2007) and the 3rd 4M conference (Borovets October 2007), contributing to the dissemination and promotion of project activities.

On the basis of the indications gathered at the Brokerage Event in November 2006, a Special Interest Group event was held in Dusseldorf in June 2007, hosted by TNO and co-organised by UNOTT, and was well attended by representatives from both academia and industry.

Month 36:

UNOTT, as co-ordinator, chaired the General Assembly held in Cadarache on 7-8 April 2008. The meeting was hosted and co-organised by CEA. It was attended by nearly all partners and

presentations were given on the status of all workpackages. Possible revisions to the workplan to reflect the recent alignment of µSAPIENT with MINAM activities were discussed and ways forward agreed.

A mid-year project meeting was also held at the MiNaT Trade Fair in Stuttgart (7-9 October 2008), to coincide with the launch of the MINAM online survey.

The final General Assembly was held in Garmisch Partenkirchen on 16-17 February 2009. The meeting was co-organised by FZK and was well attended by the majority of partners. Presentations were given summarising activities on all workpackages, and the project was brought to a successful close. Our new project officer, Mr Kai Peters, also attended and gave positive feedback on the project generally.

UNOTT has been task leader for WP1.3 MINAM Strategic Research Agenda and Vision and the new document (draft version) will be published by the end of May, ready for launch at the EuroNanoForum in Prague in June 2009.

UNOTT, in consultation with the PMB, co-ordinated the revision of the Description of Work.

UNOTT supported Strathclyde with Issues 5 and 6 of the MINAM newsletter, and continued to attend MINAM OSG and other meetings on behalf of µSAPIENT.

Deviations from work schedule

No deviations to report.

3.5.2 Task 5.2 Project administration

Achievements

The project office has provided professional project administration support to the partners and PMB throughout the project, assisting with meeting and event organisation, collating and producing reports and financial claims as required, circulating documents and keeping all partners and the PMB informed of progress and issues.

Month 12:

The following were organised:-

1) Kick-off Meeting in Nottingham, 9 - 10 March 2006

2) Project Management Board Meeting in Nottingham, 29 September 2006

3) (In collaboration with FZK) Project Members' Meeting and Brokerage Event in Karlsruhe, 7 - 8 November 2006

4) Roadmapping workshops (see WP1)

UNOTT compiled and submitted the project handbook to the EC.

Month 24:

The project office provided support as follows:-

1) Organisation of the General Assembly at Minatec, Grenoble in March 2007 (together with CEA)

2) Assisted in reviewing drafts of newsletters (see WP2)

3) Together with TNO, organised the SIG Event in Dusseldorf in June 2007

4) Assisted with the printing and distribution of MINAM SRA documents

Month 36:

The project office provided support as follows:-

1) Organisation of the General Assembly at Cadarache in April 2008 (together with CEA)

2) Organisation of the mid-year project meeting at the MiNaT Trade Fair in Stuttgart (7-9 October 2008)

3) Organisation of the final General Assembly in Garmisch Partenkirchen on 16-17 February 2009 (together with FZK)

4) Requesting and collating submissions for the MINAM SRA v2, and liaising with the publishers

5) Assisted in reviewing drafts of newsletters

6) Collating and circulating drafts etc in relation to the revised DoW

7) Liaising with the project officer regarding the Contract amendment

Deviations from work schedule

None.

Planned activities after project end

The project office will continue to support the editing and publication of the MINAM SRA v2 (draft version scheduled for end May 2009).

3.6 Contracts

At an early stage, Philips Applied Technologies decided not to join the project due to internal priorities and resourcing. Their budget was therefore re-allocated to the dynamic budget and used to support MINAM-related activities in particular.

At the end of Year 2 it was agreed that EPFL would withdraw from the project. In addition, as already outlined, some tasks were re-aligned to provide additional support for the formation and activities of MINAM. Revisions to the contract were therefore needed in terms of:

1. Consortium changes

2. Amendments to deliverables

3. Budget re-allocation

The revised Description of Work was agreed by all partners, and a copy together with a brief summary sent to the project officer. UNOTT has continued to liaise with the Commission since then and the amendment to the Contract and Annex 1 is nearly complete.

4 SUMMARY

The µSAPIENT consortium has delivered all required results as specified in the Description of Work. The activities within the project have evolved during the 36 month period in order to achieve better utilisation of resources and delivering value to both the partners and to the wider Micro and Nano Manufacturing community in Europe. A key development and outcome has been the establishment of the ETP (European Technology Platform) in Micro and Nano Manufacturing (MINAM) which was supported by the µ-SAPIENT consortium. After the first year some of the tasks have been modified and integrated with similar tasks within the IPMMAN and 4M NoE consortia to streamline activities and make effective contributions to MINAM.

The key achievements of the µSAPIENT project include: two editions of micro-nano-manufacturing technology roadmap which were delivered on time and used for formulating the relevant sections of the FP7 work programme and related calls for proposals; two versions of the EU MINAM Strategic Research Agenda and Vision; a number of brokerage and dissemination events organised and sponsored; a functional and informative web portal established and managed; Micro-Nano-Manufacturing newsletter published jointly with other consortia as a MINAM newsletter; clear strategy, plans and delivery of special interest groups in Micro-Nano-Manufacturing; a set of promotional activities carried out including presentation at key EU, US, Japan and Korea forums.

Overall, the project has achieved its objectives and delivered useful value for money results in terms of coordination and consolidation of EU wide research effort in the area of Micro and Nano Manufacturing. A lasting legacy of the µSAPIENT project is the formation of the MINAM ETP in Micro and Nano Manufacturing, the EU MINAM Strategic Research Agenda and supporting roadmapping activities.