The 8th IUMRS International Conference on Advanced Materials Symposium A-10



2nd Workshop on Nanotechnology Networking and International Cooperation

Co-organized by Nanotechnology Researchers Network Center of Japan and Northwestern University

> October 11-12, 2003 Yokohama, Japan

Organizers: N. Kishimoto, NML-NIMS, Japan R.P.H. Chang, Northwestern University, USA A. Nishijima, AIST, Japan T. Kunitake, University of Kitakyushu, Japan



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EXECUTIVE SUMMARY

The 2nd Workshop on Nanotechnology Networking and International Cooperation was held in Pacifico Yokohama, Japan on October 11-12, 2003, as Symposium A-10 of the 8th International Union of Materials Research Societies – International Conference on Advanced Materials (IUMRS-ICAM). The Workshop was organized by the Materials Research Society of Japan (MRS-J). and chaired by Dr. N. Kishimoto (NML-NIMS, Japan), Prof. R.P.H. Chang (Northwestern University, USA), Dr. A. Nishijima (AIST, Japan) and Prof. T. Kunitake (University of Kitakyushu, Japan) and was devoted to planning the development of a Global Nanotechnology Network. The Workshop was financially supported by the Nanotechnology Researchers Network Center of Japan, the U.S. National Science Foundation and the U.S. Office of Naval Research.

Approximately 60 invited participants attended the workshop, which allowed effective planning discussions in small groups. The following countries were represented: Canada, China, France, Germany, India, Ireland, Japan, Korea, New Zealand, Singapore, Spain, Taiwan, United Kingdom, United States. (An attendance list is included in Appendix 2).

Workshop Background and Goal

This workshop was the second in a series of workshops on a Global Nanotechnology Network (GNN). Nanotechnology leaders from around the world worked together to formulate plans and practical strategies for building the Network, aiming to facilitate an effective exchange of scientific, technical and educational information, and actively promote collaboration and access to critical resources in the field of Nanotechnology. This dynamic development process is expected to energize interactions and create novel synergies among scientists, educators and government representatives from all parts of the world.

Informational briefings were followed by hands-on working group sessions. Brief status reports from international Nanotechnology leaders helped participants to identify existing networks and to learn how they function. Government representatives discussed support for networking and research collaborations in their countries and regions. Focus talks highlighted successful models, strategies and tools. International working groups met on both days to identify critical goals, functions and capabilities for a GNN, and to discuss ways to establish the GNN as a reality, linking local, national and regional networks. Recommendations were compiled into a written report to serve as the basis for a roadmap for action to develop the GNN.

Workshop Theme

The critical field of Nanotechnology was chosen for this Workshop. The organizers planned to build on the enthusiasm engendered by recent developments in the nanoscience field, although the participants were committed to ultimately applying their ideas to the broader interdisciplinary fields of materials. The presentations described both the infrastructure and implementation of nanotechnology programs. Researchers from nine countries presented reviews on the state of nanotechnology projects in their countries. Representatives of funding agencies and policy institutions described the context in which research is undertaken and supported.

The organizers invited nanotechnology leaders from around the world to report on nanotechnology investments and planning in their respective regions. The participants described programs that ranged

from heavy investment in nanotechnology to identifying a strategy of investment. The summary of the workshop programs and presentations is given in the next section.

Following the presentations, the participants divided into breakout groups, which discussed issues related to expanding opportunities for international networking. The groups also considered how the infrastructure to support such a network should develop.

In particular, the participants agreed that universal participation in nanotechnology networking will be the key to success, and that easy and free access to information will have a significant impact on the success of nanomaterials research and on the development of successful international collaborative projects. One of the new key issues emerging from this Workshop was the necessity of a usercontrolled organizational structure for the GNN.

Working Group Conclusions

The large attendance and animated participation in the Workshop, including both the briefing presentations and the breakout sessions, clearly indicated a broad and international base of support for the concept of developing a GNN, with a goal to implement a system that functions well at an exploratory level in the near future.

Policy and Structure

In the discussion sessions, several important philosophical consensus opinions emerged, including the following:

- 1. The GNN can significantly benefit the success of nanotechnology research and education, through its international linkages and its internationally developed programs, projects and services.
- 2. The GNN must develop as a responsible organizational entity, structured to be User-Controlled in terms of its content, its programs, its management and its infrastructure.
- 3. The GNN should operate as a "Not-for-Profit" organization, acquiring its financial support from government, industry and institutional funding sources and foundations, and if necessary from its users and formal members.
- 4. Selection and maintenance of high-value, appropriate and up-to-date content is a key criterion for success. The GNN must be 'living', accessible, and actively managed.
- 5. Submission of new input must be simple.
- 6. The GNN web site must represent a user-friendly, readily navigable portal for access to other linked sites and resources. It must include an excellent search engine.
- 7. The GNN must link effectively and easily to existing and developing nano-networks; and redundancy should be minimized. This can only happen in the presence of thoughtfully developed shared protocols.

Features and Programs

The GNN should aim to provide effective global links among nanotechnology researchers, research projects, and research facilities, and to provide powerful access to publications, research reports, educational resources, and databases. In addition, the Workshop Groups discussed several ambitious possibilities for important new programs that could only be possible with the resources of the GNN.

These possibilities included the following:

- 1. Facilitate the development of Nanotechnology Industry Pre-competitive Roadmaps.
- 2. Develop an evaluated database of nanotechnology standards.
- 3. Catalyze and promote R&D partnerships.
- 4. Develop a global database of human resources and facilities for nanotechnology research.
- 5. Initiate educational programs that will command international recognition.
- 6. Promote student and faculty exchange programs, including access to critical research facilities.
- 7. Become a resource for information on global nanotechnology research efforts, policies and practice, and funding resources.
- 8. Maintain posting of items of hot news, and a gallery of research highlights.

Action Item

In order for the GNN to evolve to accomplish such ambitious yet vital programs as these, it is considered critical that a GNN organizational structure should be formalized soon, in a way that combines enterprise and flexibility with responsible, user-driven management. Above all, its purpose and function must be readily understood and supported by its users. A provisional development plan now needs to be clearly articulated, and a startup organizational structure identified, with appropriate initial funding anticipated.

A Realistic Picture of the "GNN"

The Discussion Group Sessions, collectively, served to paint a detailed picture, for the first time, of exactly what functions and physical structure would constitute the entity called GNN. The attached Reports from the three independent Groups address the following topics:

- the GNN Participant Community,
- the GNN Functions and Goals,
- the GNN Organizational Structure,
- Future Possibilities,
- Issues to be Resolved.

The three Reports are presented as **Appendix 1**, **Attachments A**, **B and C**. The reader is strongly urged to browse these very comprehensive documents.

Considered together, these Reports clearly respond to the challenge "What will GNN enable you to do that you couldn't easily do right now with the aid of Google and e-mail?" Further, the recurrence of many of the items cited indicates substantial consensus about priorities and vision. Groups A and C conspicuously differ on the extent of central management desirable for the GNN. Group A would establish a Board of Directors, and an Advisory Board of Users, each being representative of the GNN Members and User community. The Board would then be responsible for executing the wishes of the Members by hiring appropriate staff and doing whatever is needed to manage the GNN in a businesslike way, as a not-for-profit institution. Group C would propose a fully distributed organization, in deference to regional sensitivities. Such differences remain to be resolved. Nonetheless, these Reports offer thoughtful and realistic models for organizational structure and management, in sufficient detail to charge a representative Steering Group with preparing explicit startup plans and a timetable to secure funding, identify a base location, and appoint qualified management for the GNN entity.

SUMMARY OF THE WORKSHOP PROGRAM AND PRESENTATIONS

October 11, 2003

WELCOME AND OPENING REMARKS

- -. Opening remarks were given by the Chair of IUMRS-ICAM2003 T. Kishi (NRNSJ; NIMS, Japan) and Organizers of the Workshop Dr. N. Kishimoto (NML-NIMS, Japan), Prof. T. Kunitake (University of Kitakyushu, Japan) and Dr. A. Nishijima (AIST, Japan).
- -. Prof. R.P.H. Chang (Northwestern University, US) presented the Workshop's history and current goals.

SPEAKER PANEL-I: Reports on Nano Research and Networking

Chair: A. Nishijima (AIST, Japan)

Two reports from Nanotechnology leaders:

Dr. A. Kamiya (NEDO, Japan)

"Japanese Nanotechnology Networks"

Dr. Kamiya presented current Japanese initiatives in nanotechnology research collaborations, networking and strategy in NEIDO (New Energy and Industrial Technology Development Organization), Japan. He introduced some attempts on systematization of Nanotechnology Materials Research Programs, information exchange through conferences and exhibitions, and regional nanotechnology collaboration with industry.

Prof. R.W. Siegel (Rensselaer Polytechnic Inst., USA)

"U.S. Nanotechnology Networks"

Prof. Siegel overviewed US nanoscale science and technology centers including the Nanoscale Science Research Centers funded by the US Department of Energy (DOE), the Nanoscale Science and Engineering Centers funded by the National Science Foundation (NSF), and the nanotechnology University Research Education Technology Institutes funded by NASA. He explained how they interacted with one another and how they were linked to other centers and networks around the world.

SPEAKER PANEL-II: Reports on Nano Research and Networking

Chair: T. Kunitake (University of Kitakyushu, Japan)

Four reports from Nanotechnology leaders:

Prof. Z.G. Khim (Korean Nano Researchers Association, Korea)

"Korean Nanotechnology Networks and Funding"

Prof. Khim discussed the history of several research networking initiatives related to nanotechnology in Korea starting in 1995 and followed in 1999. After the nanotech research wave from leading countries, a strategic national R&D program was created in 2002. The program establishes a nanofabrication center in Daeduck science town, and supports nanotechnology, governmental and civilian sources of funding. These investments in R&D in nanotechnology have yielded remarkable results.

Prof. G.L. Rochon (Purdue University, USA)

"Nanotechnology Research, Education, Infrastructure, and Collaboration at Purdue University" Prof. Rochon focused on Computation and Simulation issues of US Nanotechnology Networks. He discussed the networks established at Purdue University (Nanohub NCN Network for Computational Nanotechnology and e-Enterprise Center) and their interaction with other networks over the world.

Prof. C.N.R. Rao (Jawaharlal Nehru Centre for Advanced Scientific Research, India)

"Nano Research and Networks in India"

Prof. Rao discussed the action in India that has started a national nano-initiative, and provided funds for equipment and infrastructure improvement in the last year, and has started providing research project grants. India is establishing centralized national facilities for certain specialized techniques. Workshops to train research students and teachers in nanoscience are being held.

Prof. J.M. Yacaman (University of Texas at Austin, USA)

"U.S./Latin American Nanotechnology Networks"

Prof. Yacaman spoke about current US-Latin nanotechnology collaborations. He explained economic and educational situations in these countries, and discussed their potential. He discussed some advantageous and disadvantageous points, and pointed out the importance of nanotechnology and networking for developing Latin countries.

FOCUS TALK-I

Chair: N. Kishimoto (NML-NIMS, Japan)

Prof. H. Tokumoto (Hokkaido University, Japan)

"Toward International Collaborations in Nanotechnology Research"

Prof. Tokumoto discussed the importance of international collaborations in nanotechnology research and interdisciplinary issues. Recently some symposia/workshops were held across the fields of biology, chemistry, electronics, mechanics, materials science, optics, theoretical simulations, etc. He presented some discussions arising at such symposia/workshops. He stressed the importance of tools and metrology for Nanotechnology, and of the understanding of precision and reproducibility.

FOCUS TALK-II

Chair: N. Kishimoto (NML-NIMS, Japan)

Prof. C. Ziegler (University of Kaiserslautern, Germany) and Prof. H. Schmidt (Institute for New Materials, Germany) shared a talk on "German Nanotechnology Networking Model":

"German Nanotechnology Networking Model".

-. Prof. Ziegler described the most important features of the German Nanotechnology Networking Model. She highlighted the strength of the German networking structures and showed their activities as an example of European success.

-. Prof. Schmidt explained about "BMBF Networks of Competence: Nanotechnology". Seven important network fields, viz. CC-NanoChem, Nanoanalytics, NanOp, Upob e.V., Ultrathin Functional Films Saxony, NanoMat, and CC-NanoBioTech, were specified. He explained the structure, collaboration and results of CC-NanoChem as an examples.

WORKING GROUP DISCUSSIONS-I

Chair: R.P.H. Chang (Northwestern University, US)

Theme: Establishing the Global Nanotechnology Network.

Group Leaders: Dr. J. Baglin (IBM, USA), Prof. R. Nemanich (North Carolina State University, USA) and Dr. E. Kaufmann (Argonne National Laboratory, USA)

Participants separated into three groups and discussed desirable features of the Global Nanotechnology Network. Participants stressed the importance of user-oriented GNN and user-controlled development of a GNN structure. They discussed issues of education, collaboration, global roadmapping in nanotechnology, data evaluation, standard development, accessibility, etc. A Wish List of activities and capabilities for a Global Nanotechnology Network was created. For each item of List, the feasibility and cost were roughly assessed. Then, the relative requirements for Central Staff vs. contributions from the Independent Nodes were estimated.

October 12, 2003

KEYNOTE LECTURE-I

Chair: T. Kishi (NRNSJ; NIMS, Japan)

Dr. M. Roco (Senior Adviser at the National Science Foundation, USA)

"Nanotechnology Research and Collaboration in the USA"

Dr. Roco overviewed nanotechnology initiatives and investment strategy for most countries of the world. The worldwide nanotechnology R&D investment reported by government organizations has increased approximately seven-fold in the last six years, from \$432 million in 1997 to about \$3 billion in 2003. Priority nanoscale science and technology goals may be envisioned for international collaboration.

SPEAKER PANEL-III: Government Funding in Other Regions

Chair: R.P.H. Chang (Northwestern University, US)

Two reports from Nanotechnology leaders:

Prof. M.K. Wu (Academia Sinica, Taiwan)

"The National Science and Technology Program on Nanoscience and Nanotechnology in Taiwan" Prof. Wu presented a talk on Taiwan funding for Nanotechnology Networking and research collaborations. He discussed current Taiwan government initiatives to support the development of nanotechnology networks and research collaborations. He stressed the importance of education programs in interdisciplinary fields, and of international exchange and international collaborations.

Prof. S. Xie (Chinese Academy of Science, China)

"Funding and Networks for Nanotechnology in China"

Prof. Xie explained the current strategy and funding initiatives of the Chinese government to encourage the development of nanotechnology networks and to support national and international collaborations in nanotechnology research and education. He reported on the current Chinese programs and initiatives in nanotechnology research collaboration, and surveyed existing Chinese nanotechnology networks, their function and interaction with other nanotechnology networks inside and outside China.

SPEAKER PANEL-IV: Networking with Industry Partners

Chair: A. Nishijima (AIST, Japan)

Five reports from Nanotechnology leaders:

Dr. H. Yokoyama (AIST, Japan)

"Strategic Nanotechnolgy Global Networking: Current Status and Proposal of AIST"

Dr. Yokoyama devoted his report to strategic nanotechnology global networking, its current status and the proposals of AIST. Since speedy realization of groundbreaking ideas without delay is important in nanotechnology R&D, AIST has been making efforts to establish bilateral relationships with major organizations in North America, Europe and Asia. He also made a proposal to call for future partners both in academia and industry.

Prof. K.J. Snowdon (University of Newcastle, UK)

"U.K. Nanotechnology Networks: Industry"

Prof. Snowdon spoke about industrial aspects for Nanotechnology Networks of the UK. He described the evolving UK Micro- and Nano-Technology Network, which will provide a marketoriented focus for the facilities, people and organizations engaged in micro and nanotechnologies in the UK. He explained the INEX model of parallel R&D development, which promotes entrepreneurship and commercialization by managing collaborations between industry and academic researchers.

Prof. J.C. Yang (ITRI, Taiwan)

"Nanotechnology Networking: ITRI's Approaches"

Prof. Yang discussed the Taiwan approach to Industrializing Nanotechnology. In Taiwan, over 60 percent of the six-year \$615 million National Nanotechnology Program has been targeted at the "industrialization" of nanotechnology, and much of this industrialization R&D work will be conducted at ITRI. He stated that R&D activities would be focused on a mission to establish Taiwan as a front-runner in the industrialization of nanotechnology, and to build technical competencies that would ensure nanotechnology excellence for Taiwan's industry well into the long term.

Prof. G. Crean (NMRC, Ireland)

"Nanotechnology in Ireland"

Prof. Crean presented nanotechnology networking and research collaborations in Ireland. He explained how Irish networks are funded and how they interact with one another, with Europe and with the rest of the world. He also described internationally competitive regional clusters in Cork and Dublin, and the National Nanofabrication Facility in Cork. Approaches to networking with industry were discussed.

Dr. M. Ishikawa (Mitsubishi Res. Inst. Japan)

"Nanotechnology Networking in Japanese Industry"

Dr. Ishikawa overviewed the strategy and current initiatives at Mitsubishi Research Institute, Inc. (MRI) to promote nanotechnology networking and research collaborations. From a detailed analysis of nanotechnology trends, he pointed out the importance of making nanotechnology roadmaps, and of building bridges between academic and industrial researchers. He considered that bottom-up nanotechnology is a key for industrial technology breakthrough and that Japanese industry is very interested in bio-mimetic nanotechnology.

KEYNOTE LECTURE-II

Dr. T. Noda (NRNSJ, Japan)

"Activities in Nanotechnology Researchers Network"

Dr. Noda presented the Nanotechnology Supporting Project and the Nanotechnology Researchers Network Center of Japan (NRNSJ). The objectives of the NRNSJ are to construct networks serving researchers and facilities through sharing of up-to-date information on research output and sharing of advanced facilities for common use. The NRNSJ is making databases on national research programs, researchers and laboratory activities, and patents on nanotechnology.

FOCUS TALK-III

Chair: N. Kishimoto (NML-NIMS, Japan)

Prof. R.P.H. Chang (Northwestern University, USA)

"An International Virtual Institute: Cyber-Infrastructure for the Global Nanotechnology Network" Prof. Chang discussed how the prototype cyber-infrastructure of the International Virtual Institute (IVI) currently under development at Northwestern University can be used to enhance the real space activities and facilities of the Global Nanotechnology Network (GNN) and facilitate collaborations among its members. Examples of functions under development include: Virtual Offices for collaborative research programs; a Global Research Gallery for displaying the latest research findings; Information Resource Center; Science and Engineering Technology Learning Center; etc.

WORKING GROUP DISCUSSIONS-II

Chair: R.P.H. Chang (Northwestern University, USA)

Theme: Establishing the Global Nanotechnology Network.

Group Leaders: Dr. J. Baglin (IBM, USA) and Prof. R. Nemanich (North Carolina State University, USA)

Participants separated into two groups and discussed structure and possible ways of implementation of the Global Nanotechnology Network. Participants discussed the administrative structure of the GNN. They elaborated a basic minimum structure of organization and responsibility needed to initiate and sustain the GNN and to coordinate the functions listed in the Wish List. They decided that the GNN should operate explicitly as a Not-for-Profit enterprise. A list of critically important features of performance and philosophy for the new GNN was compiled. A new aspect, how to motivate users to participate in development of the GNN, was discussed. Principles of implementation of a user-friendly and user-controlled GNN were discussed.

SUMMARY SESSION

Chair: N. Kishimoto (NML-NIMS, Japan)

Dr. J. Baglin (IBM, USA) summarized the group findings for the desirable features, structure and ways of implementing of the Global Nanotechnology Network. The next GNN workshop is planned for Europe.

Appendix 1. WORKING GROUP DISCUSSION REPORTS

Attachment A.

Working Report, Group A.

Discussion Leader: Dr. John Baglin, IBM Almaden Research Center, San Jose, CA, USA. Secretary: Prof. David Officer, Massey University, New Zealand,

GNN Mission and Capabilities: Wish List

The Group was asked to create a Wish List of activities and capabilities for a Global Nanotechnology Network.

Question:

What would be the most valuable things that a GNN might be created to accomplish??

Criteria:

- (a) Must represent *value added*; things that are not available to you at your desk today.
- (b) Should relate to international linkages.
- (c) Time to full implementation of these activities may be several years.

<u>Plan</u>:

- 1. Create the Wish List assuming that nothing is physically impossible or too expensive.
- 2. Then, for each item, make rough assessments of feasibility and cost.
- 3. Then, estimate the relative requirements for Central Staff vs. contributions from the Independent Nodes.

The Wish List is shown in Table 1, with added columns indicating feasibility, likely cost, and a scale of reliance on an active central staff vs. input from regional nodes. All were considered to have high priority.

Each item on the List is the result of substantive discussion and thoughtful description, and all items shown were shaped and strongly supported by everyone in the Group. Many other proposals were considered and rejected.

WISH LIST for GNN Activity and Capabilities	Feasibility	Cost	Reliance on Central Staff	Reliance on Regional Nodes
Nanotech Industry Roadmaps – facilitate and publish	**	\$	****	****
Global databases of human resources and facilities	**	\$	***	****
Provide avenue for specific studies, reports, white papers	***	\$	**	**
Global Nanotech University: Generate interdisciplinary modular education materials and for-credit programs.	***	\$\$\$	****	****
Promote student and faculty exchange programs and facility access (including funding).	* * *		***	***
Catalyst for partnerships. Active match-making for resources (company-to-company, company-to-university, etc., and academia-to-commercialization partners)	**	\$\$	**	***
Standards development	*	\$	*	*
Provide info. about global policies and practice (especially funding)	**		**	***
Evaluation and publication of databases (on-going)	*	\$\$\$	**	**
Stimulate research and info. on impacts of nanotechnology	*	\$	*	*
Gather, edit, display hot new data and news	*		*	**
Enhanced nanotech patent search engine	***	\$	**	
Effective public outreach program	***	\$	****	****
Operate / support online topical Meetings, Workshops, Classes	***	\$	***	***
Calendar / coordination of Meetings and Conferences	***		*	*

Table 1. Wish List for Activities, Programs and Capabilities of a Global Nanotechnology Network.

GNN Performance and Usage: - Important Criteria - How should it look?

Question:

List critically important features of performance and philosophy for the new GNN.

Access Issues:

- The GNN should operate explicitly as a Not-for-Profit enterprise.
- Access to much of the content should be free. Possibly subsidized by sponsors.
- "Members" should get general access, and pay a nominal membership fee.
- Cost-intensive services may be priced "at cost".

User Interface:

- The GNN portal must be user-friendly.
- Portal should present a consistent, intuitive navigation path in all its functions.
- This single "face" should assist the user through as many levels of search / access as practicable, probably fading as the user approaches a remote node that already has its own style.
- Multilingual portal / user interface on GNN to assist initial access as much as possible.
- Language: Provide translated directories. Provide Google-like translation software to assist when needed.
- Incorporate a Google network search engine.

Bandwidth / speed problems:

- Must provide "text-only" option wherever possible.

Input:

- Must be easy to input new material.
- Credit / citation for input must be maintained as an option.
- Input submission should be screened for appropriateness, by a site "Manager".
- Input will generally be a privilege for members only.

Organization of the GNN as an entity

Question:

Describe the basic minimum structure of organization and responsibility needed to initiate and sustain the GNN and to coordinate the functions listed above.

- GNN requires both real and perceived system of responsibility and coordination.
- GNN must, in perception and in reality, be USER-CONTROLLED.

Physical center:

Needs a set of dedicated servers, not necessarily co-located.

Structure:

- 1. Board of Directors (probably including Directors of regional nodes)
- 2. Advisory Board (Users, and people with related experience, etc.)
- 3. Manager
- 4. Secretariat
- 5. Scientific / technical liaison. To interact with technical responders, get material required, negotiate with contributors and contractors and resource people, etc. A mover and shaker who has rapport with the technical community.
- 6. "Product" Department, e.g. Virtual Conference Center; Educational Materials; (see Wish List)
- 7. Marketing: including market evaluation, and market development
- 8. Business Plan: Essential to operate in a businesslike way. Responsible management of big bucks.
- 9. IT Update and Maintenance person. Essential that GNN software and systems be constantly state-of-the-art.

Strategy:

Group A strongly urges further planning by international consensus to: (1) build a robust GNN infrastructure; (2) encourage strong member participation; (3) engage and maintain user interest; and (4) ensure the viability of GNN partnerships and services.

Attachment B.

Working Report, Group B

Discussion Leader: Prof. Yuri Gogotsi, Drexel University. Secretary: Prof. Robert Nemanich, North Carolina State University.

I. <u>Topics considered (in order of importance)</u>

A) Highest Priority:

- 1. Global map oriented web access to Nanotechnology researchers (i.e. a directory: include links to individual sites).
- 2. Global map oriented web access to Nanotechnology research projects (who is doing what: include links to individual sites).
- 3. Global map oriented web access to Nanotechnology facilities (include links to individual sites).
- 4. Links to other funded Nano Portals and Web based information sources such as the NSF funded nanoportal at UCLA (I could not find this page).
- 5. Societal impact and ecological concerns.

B) Other Possibilities:

- 1. Education information (including workshop summaries, virtual workshops, education information, curriculum development discussion groups, 3-D and 'living' text).
- 2. Summaries of National Nanotechnology efforts (including links to lists of funded projects).
- 3. Networking for young investigators (discussion groups, employment opportunities, funding opportunities).
- 4. Evaluation data base of nanotechnology standards.
- 5. Nano research gallery student competition with comments posting and discussion groups.
- 6. Preprint posting with comments posting and discussion groups.
- 7. Board for review of scientific and technical content available through web access.
- 8. Nanotechnology Dictionary.
- 9. Smart search engine (may be beyond current technology).
- 10. Annual Business competition for new nanotech advances (like the R&D awards).
- 11. Track publications and patents on Nanotechnology.

II. Anticipated Membership:

- 1. Researchers
- 2. Nano materials and equipment suppliers
- 3. Nanotechnology focused corporations
- 4. Educators and Workforce training groups

III. Discussion Points:

- 1. Information should be filtered to provide added value. The content needs to be intellectually stimulating.
- 2. Global map access with some measure of information (such as Dictionary topics) on the front page such as using intensity or color as a measure of the level of the effort.
- 3. Consider organizing the information on three planes Research, Education, and Industry.
- 4. Needs to link effectively to existing and developing nano nets and avoid duplication.
- 5. As technology develops, industry will write a nanotechnology roadmap.
- 6. Education may become a major focus of the Global Nano Net.
- 7. Keeping content current is critical. Approaches were discussed for allowing users/members to update their information.
- 8. Develop content that members will use for their profession requires real content and careful control of content.

Attachment C.

Working Report, Group C

Discussion Leader: Dr. Elton Kaufmann, Argonne National Laboratory.

Participants: Dr. Yong LIU, Nanyang Technological University, Sinagapore

Dr. Gilbert L. Rochon, Purdue University, USA

Dr. Helmut Schmidt, Institut für Neue Materialien & University of Saarland, Germany

Dr. K. L. CHOY, University of Nottingham, UK

Dr. XIE Sishen, Inststitute of Physics, Chinese Academy of Sciences, China

Dr. Han-Jo LIM, Ajou University, Korea

Dr. Akira KAMIYA, NEDO, Japan

Dr. Elton Kaufmann, Argonne N. L., USA (Discussion Leader)

Content: (GOAL: "Better than Google")

Information on GNN is: classified (categorized), triaged, organized, intermediated (refereed) delivered to individual researchers includes: licensing opportunities technology evaluation experts at nodes (research &) development experiences communications news, reports, etc. queries calls for advice calls for resources links to existing networks service locations tools experiences best practices strategies policies

Customers of GNN are: education developing countries collaborations/exchanges/visits international interdisciplinary broader introduction to new counterparts searches/literature nodes (e.g., publishers) government sponsors of technology development large companies' technical officers venture capital firms researchers in need of tools telerobotics network developers foundations and NGOs (altruistic) GNN public relations dangers of nano (WND=weapons of nanodestruction) **Issues** with respect to GNN are: comprehensive membership criteria network definition (information, coordination, local vs. global) "let function define meaning" language (especially vis a vis Asia) subnets intellectual property English OK for science but questionable for policy, technology, education GNN newsletter search algorithms down to lowest level standardization network structure what content is on GNN per se and what is linked from external sources? On GNN: central resources, repositories public/publications/info portal curricula, syllabi, modules software databases preprints/generic abstracts patents member profiles job/employment center topical chat groups (monitored) e-conferences/workshops e-directory e-publication/journal facility guide glossary, collaboratories

vertical "tree"-like not acceptable (implies hierarchy, priorities, for some over others) prefer nested layers/shells (like "peeling onion") see diagram



Appendix 2. LIST OF PARTICIPANTS

Name		Affiliation/Institution	Country
Baglin	John	IBM Almaden Research Center	USA
Baraton	Marie- Isabelle	University of Limoges	France
Chakravory	Dipankar	Indian Association for the Cultivation of Science	India
Chang	R.P.H.	Northwestern University	USA
Chen	Nan	ATIP (Asian Technology Information Program)	Japan
Chowdari	B. V. R.	MRS- Singapore/National University of Singapore	Singapore
Choy	Kwang- Leong	University of Nottingham	UK
Crean	Gabriel M.	NMRC Ireland	Ireland
Fudamoto	Yasunori	National Institute for Materials Science (NIMS)	Japan
Fujita	Takahiro	National Institute for Materials Science (NIMS)	Japan
Glasow	Peter A.	E-MRS	Germany
Gogotsi	Yuri	Drexel University	USA
Goretta	Kenneth C.	Asian Office of Aerospace Research and Development (AOARD)	Japan
Hirahara	Keijiro	Nanotechnology Researchers Network Center of Japan (NRNCJ)	Japan
Huber	Carmen Huber	US National Science Foundation, Division of Materials Research, Office of Special Programs	USA
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Yokoyama	Hiroshi	National Institute of	Japan
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		Science and	
		Technology	
Ziegler	Christiane	University of	Germany
0	H.	Kaiserslautern:	,
		Nanotechnology	
		Competence Center	
		Competence Center	

Appendix 3. Presentations

Presentation List

October 11, 2003

1. Prof. R.P.H. Chang (Northwestern University, US) "Workshop's History and Current Goals"

SPEAKER PANEL-I: Reports on Nano Research and Networking

2. Dr. A. Kamiya (NEDO, Japan) "Japanese Nanotechnology Networks"

3. Prof. R.W. Siegel (Rensselaer Polytechnic Inst., USA) "U.S. Nanotechnology Networks"

SPEAKER PANEL-II: Reports on Nano Research and Networking

4. Prof. Z.G. Khim (Korean Nano Researchers Association, Korea) "Korean Nanotechnology Networks and Funding"

5. Prof. G.L. Rochon (Purdue University, USA) "Nanotechnology Research, Education, Infrastructure, and Collaboration at Purdue University"

6. Prof. J.M. Yacaman (University of Texas at Austin, USA) "U.S./Latin American Nanotechnology Networks"

FOCUS TALK-I

7. Prof. H. Tokumoto (Hokkaido University, Japan) "Toward International Collaborations in Nanotechnology Research"

FOCUS TALK-II

8. Prof. C. Ziegler (University of Kaiserslautern, Germany) "German Nanotechnology Networking Model"

9. Prof. H. Schmidt (Institute for New Materials, Germany) "German Nanotechnology Networking Model":

October 12, 2003

KEYNOTE LECTURE-I

10. Dr. M. Roco (Senior Adviser at the National Science Foundation, USA) "Nanotechnology Research and Collaboration in the USA"

SPEAKER PANEL-III: Government Funding in Other Regions

11. Prof. M.K. Wu (Academia Sinica, Taiwan) "The National Science and Technology Program on Nanoscience and Nanotechnology in Taiwan"

12. Prof. S. Xie (Chinese Academy of Science, China) "Funding and Networks for Nanotechnology in China"

SPEAKER PANEL-IV: Networking with Industry Partners

13. Dr. H. Yokoyama (AIST, Japan) "Strategic Nanotechnolgy Global Networking: Current Status and Proposal of AIST"

14. Prof. K.J. Snowdon (University of Newcastle, UK) "U.K. Nanotechnology Networks: Industry"

15. Prof. J.C. Yang (ITRI, Taiwan) "Nanotechnology Networking: ITRI's Approaches"

16. Prof. G. Crean (NMRC, Ireland) "Nanotechnology in Ireland"

17. Dr. M. Ishikawa (Mitsubishi Res. Inst. Japan) "Nanotechnology Networking in Japanese Industry"

KEYNOTE LECTURE-II

18. Dr. T. Noda (NRNSJ, Japan) "Activities in Nanotechnology Researchers Network"

FOCUS TALK-III

19. Prof. R.P.H. Chang (Northwestern University, USA) "An International Virtual Institute: Cyber-Infrastructure for the Global Nanotechnology Network"

Appendix 4. Workshop Scenes



Oct. 11, 2003



Oct. 12, 2003





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