

# FY 2008 WPI Project Progress Report

## World Premier International Research Center (WPI) Initiative

Host Institution	National Institute for Materials Science	Host Institution Head	Teruo Kishi
Research Center	International Center for Materials Nanoarchitectonics Project	Center Director	Masakazu Aono

### Summary of center project progress

#### 1. Research Objectives

The purposed center aims to develop and offer new materials that contribute to a sustainable development. Research systems were revised on October 1st. We had grouped PIs into 5 key technologies of nanoarchitectonics, but we have since realigned these into 4 fields, Nano-materials, Nano-system, Nano-green and Nano-bio, and have clarified the Center's policy direction for each in light of comments from the Follow-Up Committee. The 30 PIs have been assigned as follows. Nano-materials:11; Nano-system:12; Nano-green:5 ; Nano-bio:2.

The management system was revised on October 1st. The 3 Deputy Director-General positions were abolished and replaced with a Chief Operating Officer position under the Director-General. The objective of this is twofold: to reduce the management burden on the PI cum Director-General and to streamline and speed up management operations under the Director-General's assistant, the Chief Operating Officer.

8 new Principal Investigators were added for a total of 30 (19 from NIMS and 11 at satellites and partner institutions). In order to hire more top-class PIs, we recruited internationally, and have succeeded in appointing Professor of Materials Science and Technology at the University of Rome, Enrico Traversa. His appointment commenced in January 2009.

#### 2. Management

The Center was intended to carry on the international management know-how from the ICYS Project that was subsidized for 5 years with Special Coordination Funds for Promoting Science and Technology starting in FY2003. The MANA administrative arm was strengthened by inheriting ICYS personnel and knowledge.

After the 6month transition period, the administrative arm described in the application has been detailed, and 3 teams—Planning, General Affairs and Technical Support—were launched on October 1st.

#### 3. Infrastructure

All administrative Japanese staff are fluent in English and 2 foreign staff (1 Swiss, 1 Polish) has been hired. As such, English is the official language of the Center, and a strong administration and research support system is in place to assist researchers with procedures and other clerical matters. International recruitments of new PIs and post-doctoral researchers have been intensively conducted. We have invited two full-time foreign PIs and 55 foreign post-doctoral researchers, making for an internationally diverse group of researchers.

#### 4. Indicators and Methods for Assessing MANA's Level in the World

As of the end of March, MANA boasts 192 members, of which 160 are researchers. 83 researchers (52%) are foreign, well above the final 30% target for the WPI Program.

According to the ESI Database (current as of the end of March, 2009), NIMS ranked 4th in the world and 2nd in Japan for the number of citations in the materials science field over the last 4 years and 10 months (January 2004 to October 2008). We have cleared one of our 5-year mid-term objectives of ranking within the top 5 in the world.

#### 5. Securing Competitive Research Funding

As of March 2009, Center researchers have secured about 1.58 billion yen in total. This included competitive external funds of about 550 million yen, private sector funds of about 150 million yen and research funds from NIMS of about 880 million yen. Of this figure, about 350 million yen has been newly secured in this fiscal year alone.

#### 6. Host Institution Commitment

Since October 1st, the entire 13,000 m<sup>2</sup> of the old Nanomaterials and Biomaterials Research Building was allocated to MANA, and we are in the process of stationing all of the main researchers there. As such, it was renamed the MANA Building.

## 1. Summary of center project

### <Initial plan>

The purposed center aims to develop and offer new materials that contribute to a sustainable development. For this purpose, excellent researchers, especially young researchers who will create a future, will join the center from across the world and perform intensive research under an internationally-open environment, based on a new materials development system "nanoarchitectonics".

"Nanoarchitectonics" is a technology system for arranging nanoscale structural units-- in other words, a nanostructure unit as a group of atoms and molecules-- in an intended configuration. Nanoarchitectonics is an exceedingly dominant method for realizing innovative functions and performance that keep up with complex requirements for materials. The center will make the best use of this technology with the aim of developing new materials that contribute to sustainable development. Namely, the goal of research in the center is the "development of innovative materials that enable new technologies required for the realization of a sustainable society in the 21st century", with a new paradigm of materials development based on nanoarchitectonics.

To achieve the objectives of research, we will start the project, selecting from NIMS and other domestic and overseas institutes 22 principal investigators who have the most excellent abilities and careers. During the project, we will find additional principal investigators, including Asian (non Japanese) researchers, resulting in a final total of about 27. Under the principal investigators, the center will arrange the lineup consisting of about 200 staff in total including technical staff, and select and organize excellent young researchers.

The center will establish a "melting pot" research environment, gathering excellent young researchers from various countries. The center will respect the novel and freewheeling ideas of young researchers as much as possible and the "melting pot" research environment will be an ideal incubation apparatus for such ideas. The center also utilizes this "melting pot" environment to foster young researchers, contributing to the main body of NIMS by providing young staff researchers. Finally, the center will adopt unique systems to thoroughly promote the integration of different fields and to foster young researchers.

### <Results/progress/alternations from initial plan>

The Center was reformed in October 2008, one year after its inception. Research fields were reorganized into 4 fields, Nano-materials, Nano-system, Nano-green and Nano-bio, and a new COO position was established in order to strengthen administrative systems.

8 new Principle Investigators were appointed to bring the total to 30. Of these 8, 2 were transferred from NIMS, 3 were new full-time hires, and 3 were invited from outside of the Center.

As of the end of March, 2009, the Center has 192 employees, of which 160 are researchers and 83 researchers (52%) are foreign. With a solid system for foreign researcher intake, the Center is gradually becoming a global research hub.

## 2. Research fields

### <Initial plan>

The 21st century is, without doubt, the century where humanity, for the first time in its experience, recognizes the enormity and limits of the earth. The future of humanity depends on whether or not we can find a way to sustain development, under severe restrictions of energy, environment, resources and food. To solve this common issue for all humanity, the most dominant field of research that Japan can contribute will be in materials science. Materials form the basic foundation that supports all technologies, and is the area where Japan can best show its abilities. In fact, the many successes of Japan in key industries such as automotive, electrical machinery, and electronics have been realized by the development of materials. It is self-evident that industries and society of Japan will be depending on materials in the 21st century, and it is also true that “sustainable development” is not possible without an innovation in materials. Materials science is actually the lifeblood for human beings.

For the development of new materials that will be required in the 21st century, the center is working to realize a paradigm shift in materials research through a new materials development system named “nanoarchitectonics”. “Nanoarchitectonics” is a technology system to arrange nanoscale structural units -- in other words, a nanostructure unit as a group of atoms and molecules-- in an intended configuration. This technology is critical for development of nanotechnology, beyond the stage of nanoscience. “Nanoarchitectonics” is also a typical interdisciplinary field that relates widely to such fields as material science, physics, and chemistry.

### <Results/progress/alternations from initial plan>

With the focus on nanotechnology and materials, there has been no change here since the time of application. However, at the time of application, MANA projects were defined according to 5 technical aspects of nanoarchitectonics, but based on the feedback from the Follow-Up Committee, research fields were adjusted with a focus on the “Output Image”. Namely, research fields were reorganized into the 4 fields of Nano-materials, Nano-system, Nano-green and Nano-bio. In addition, MANA’s policy direction was more clearly defined as striving for the innovation of materials to contribute to “sustainable development” through nanoarchitectonics.

### 3. Research objectives

<Initial plan>

The research objective to be achieved is  
**“Development of innovative materials required for the realization of a sustainable society in the 21<sup>st</sup> century”.**

To be more specific, we set the following three objectives (issues to be studied intensively are shown as examples).

**1) Development of innovative materials related to environment, energy and resource**      Examples:

Examples:

Superconducting materials (superconducting diamond thin film, etc.)  
Battery materials (materials for solid state rechargeable batteries, etc.)  
Catalysts (visible light active photocatalyst, etc.)

**2) Development of innovative materials for nanoelectronics that lead to innovations in information and communication technology**

Examples:

Quantum information device materials (novel quantum-bit materials, etc.)  
Atomic electronics materials (materials for novel atomic switches, etc.)  
Photonic device materials (quasi phase matching element material, etc.)

**3) Development of innovative materials that enable the development of new technologies for diagnosis, treatment and renaturation.**

Examples:

DNT chip materials (nanopillar array, etc.)  
Biomaterials (regenerative materials, etc.)

Technologies used in nanoarchitectonics can be roughly classified into 4 techniques: (1) atom/molecule novel manipulation; (2) chemical nanomanipulation, (3) field-induced material control; and (4) “artificial” self-assembly and organization (“artificial” means “controlled” or “guided”); see Figure 1. In addition, theoretical and computational approach is quite important for conducting research effectively.

<Results/progress/alternations from initial plan>

As of October 1st, we realigned research into 4 fields, Nano-materials, Nano-system, Nano-green and Nano-bio, and have clarified the Center’s research targets.

**1) Nano-materials Field:** to utilize new synthetic methods to explore novel nanoscale materials, such as nanotubes, nanowires, nanosheets, nanoparticles and supramolecules in organic/inorganic/metal systems and to artificially assemble these materials to produce new innovative functions for energy and environment applications.

**2) Nano-system Field:** to create novel functionality as a system through systematic organization of nanostructures by various novel methods for fabrication/organization, property measurement, and theoretical modeling.

**3) Nano-green Field:** to develop highly-efficient energy conversion systems for solar energy, fuels and biomass, which are essential for sustainable society, by controlled arrangement of atom and molecules based on rational design, i.e., nanoarchitectonics.

**4) Nano-bio Field:** to develop innovative biocompatible materials and functional biodevices for regenerative medicine, cell therapy, minimum-invasive surgery and clinical diagnostics by integrating materials science and biological science.

The changes were based on the Follow-Up Committee’s comments that “In advancing nanoarchitectonics, the establishment and operation of the four technical groups is desirable. However, if each group conducts investigations in only its own field, it will be difficult to make breakthroughs in nanotechnology.” After several months of discussion, changes were executed.

Figure 1 shows the relationship between nanoarchitectonics and the 4 new fields.

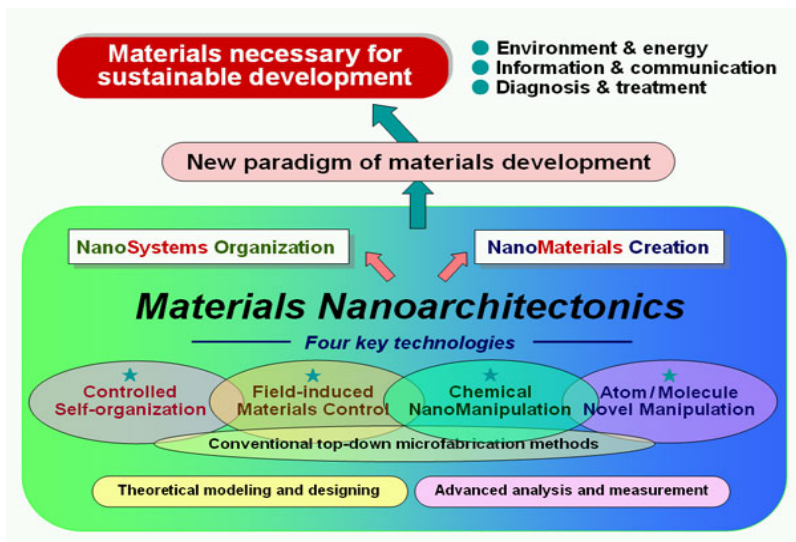


Figure 1: New paradigm in material development through materials “nanoarchitectonics”

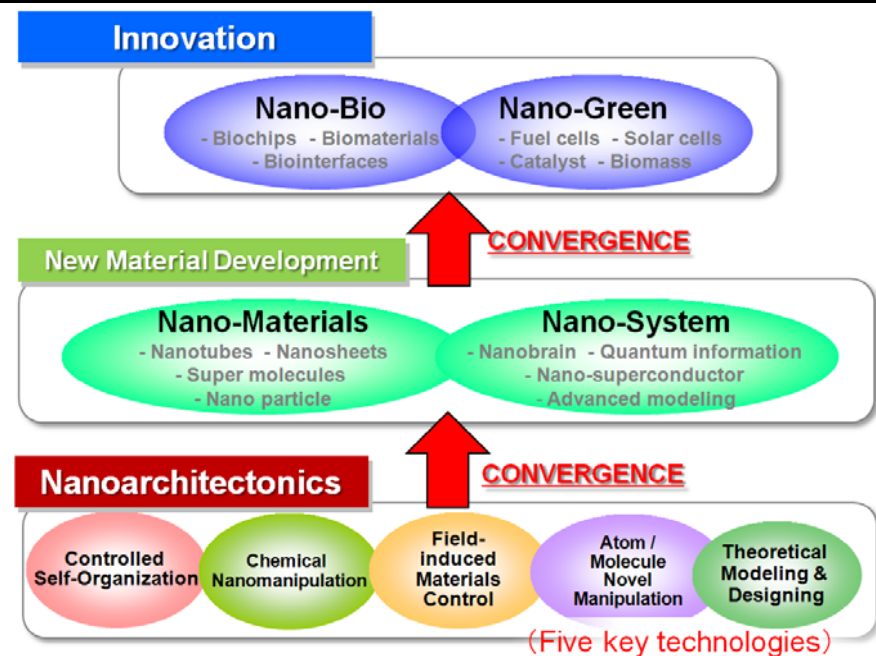


Figure 1. New research system of MANA

8PIs were added in FY2008 for a total of 30 (19 from NIMS and 11 at satellites and partner institutions). New MANA PIs for FY 2008 are as follows: Prof. Christoph Gerber (U. Basel), Prof. Kohei Uosaki (Hokkaido U.), Associate Prof. Keiichi Tomishige (U. Tsukuba), Biomaterials Center Director Dr. Yuji Miyahara (NIMS), Nano Systems Functionality Center Director Dr. Nakayama Tomonobu, Dr. Liyuan Han (NEC), Prof. Enrico Traversa (U. Rome) and Kazuhito Tsukagoshi (AIST). The 30 PIs have been reassigned as follows. Nano-materials: 11; Nano-system: 12; Nano-green: 5; Nano-bio: 2.

When revisions were implemented on October 1st, Chief Scientists and Engineers were removed from the Center organization. Their mission was to support MANA’s research startup by arranging the sharing of NIMS large-scale facilities, and after 1 year, this obligation has been all but met.

ICYS-MANA Researchers were also added to the team on April 1st. ICYS-MANA has inherited the spirit and the systems of ICYS which finished in FY2007. As of October 1st, there are 10 post-doctoral researchers from around the world conducting research at MANA.

Figure 2 illustrates MANA’s new research organization.

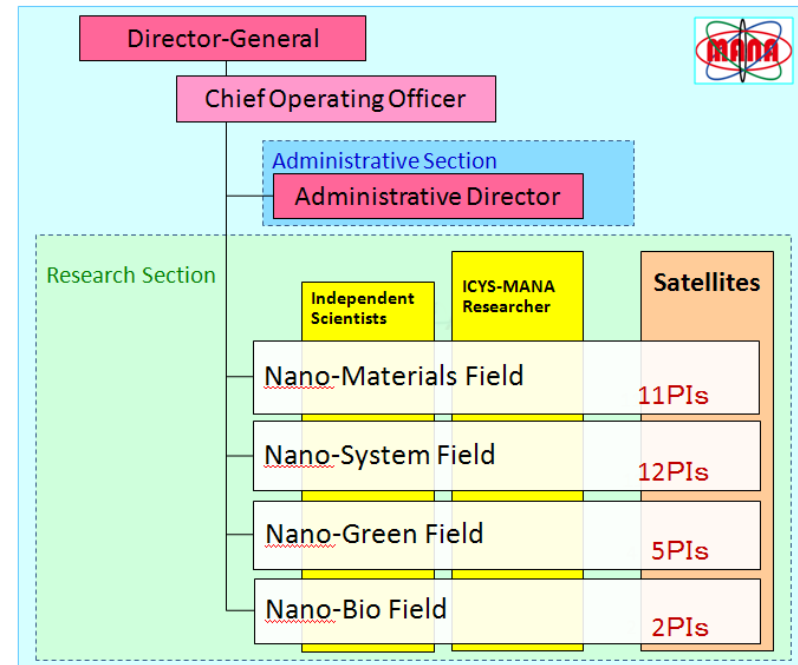


Figure 2: MANA organizational chart

#### 4. Management

<Initial plan>

##### 1) Composition of administrative staff

Starting in 2003, NIMS has about five years experience in research, using English as the official language of ICYS activities. Therefore, it has the advantage of being able to perform both efficient and international administrative operation by making the best use of its experience and know-how acquired in ICYS. All the documents regarding, for example, office routine regulations, purchase of items, and official trips are today already available both in Japanese and English. As a result, an environment of supporting documentation is close to perfection so that foreigner researchers can devote themselves to their study without a language barrier.

<Results/progress/alternations from initial plan>

##### 1) Composition of administrative staff

The Center, at the time of application, was intended to carry on the international management know-how from the ICYS Project that was subsidized with Special Coordination Funds for Promoting Science and Technology starting in FY2003. The ICYS Project was completed in FY2007, and the MANA administrative arm was strengthened by undertaking the ICYS assets (i.e., personnel and knowledge) almost as is.

After the transition period from April to June 2008, the administrative arm described in the application has been detailed and 3 teams—Planning, General

Based on the experience in ICYS, we will establish 3 groups including planning, general affairs, and technical assistance for efficient operation of the administrative division with the use of English as the official language. Further segmentation of the administrative division into planning group, personnel group, general affairs group, accounting group, supplies group, etc. would adversely affect improvements in efficiency and would impose inconvenience especially to foreigners. It is important to establish an administrative system where each person can handle clerical work as widely as possible.

- **Planning Group:** Responsible for operations regarding employment and planning, such as recruiting, as well as employment of young researchers such as postdoctoral researchers, regular performance evaluation of researchers, holding of symposiums, and public relations as well as publication. Run by about five staff members under the supervision of the planning group leader (a middle-ranking researcher of NIMS).
- **General Affairs Group:** Responsible for general affairs, accounting, and clerical work regarding researchers' attendance record, payroll, official trips, and purchase of supplies. Run by about 15 staff members under the supervision of the general affairs group leader (assign a NIMS employee who has good experience with ICYS). Especially, with the aim of reducing clerical work for researchers, we will hire about 10 secretaries, who will carry out all the clerical work for researchers. The secretaries hired as staff members of the general affairs group must have English language skills equivalent to a TOEIC score of 850 points or more. In addition, five administrative staff will join to the center from NIMS.
- **Technical Assistance Group:** Responsible for technical assistance work such as maintenance and control of shared devices used in the center, services in response to requests from researchers, and research assistance. A system will be established so that routine experiments can be conducted by technicians as much as possible. For this purpose, approximately 15 persons who are former NIMS's researchers (retirement people with a Ph.D degree) with good research backgrounds and English speaking proficiency are employed at the final stage for establishment of a system capable of high-level technical assistance. In addition, five technical assistants will join to the center from NIMS.

## 2) Decision-making system

The center, as its basic principle, intends to establish a decision-making system that can support strong leadership of the center director. In addition, the center intends to minimize the number of meetings in its operation so that the researchers can devote themselves to their studies.

Affairs and Technical Support—were launched on October 1st. All Japanese staff are fluent in English and 2 foreign staff (1 Swiss, 1 Polish) has been hired. As such, English is the official language of the Center, and a strong administrative support system is in place to assist researchers with procedures and other clerical matters.

- **Planning Team:** This team handles international relations, liaising with satellites, holding symposia and planning public information and publications. The team also works on Principle Investigator and Independent Scientist recruitment tasks. The team of 5 staff operates under the leadership of the Planning Team Leader, a Swiss national.
- **General Affairs Team:** This team handles budget management, workplace operations, salaries, official trips and accounting for materials purchases. To provide support without a language barrier, all staff members have either graduated from foreign universities or have TOEIC scores of 800+. A team of 6 staff work in tandem to cover duties such as interpreting, securing and managing external funding, and report writing assistance in order to provide English-language support to the foreign researchers.
- **Technical Support Team:** This team handles research equipment maintenance, analysis, measurements, common technical support for the management of labs, toxins and waste materials, advice on equipment and experiments required for research and patenting. 4 staff members work under the guidance of the Team Leader (former NIMS Scientist).

The MANA Support Committee was established in NIMS. This committee cooperates with MANA researchers and administrators. It provides support for recruitment and international relations in an effort to energize MANA, and it also serves to facilitate enhanced communication with the offices of the NIMS Planning Division. The Vice President in charge of MANA is the committee Chairman with the heads of the 9 offices of the NIMS Planning Division serving as members. The committee does not meet regularly, but when requested to deliberate matters, the Chairman and the members visit MANA to discuss detailed support measures with MANA officials.

## 2) Decision-making system

As of October 1st, Chief Operating Officer position was newly created under the Director-General to reduce the management burden on the PI cum Director-General and to streamline and speed up management operations.

The Administrative Director receives orders from the Director-General to

**Principal investigators meeting:** The principal investigators meeting will be held on a regular basis (about once every month) and will be led by the center director. Matters concerning center operation in general will be discussed and reported under the full leadership of the center director. Also, the principal investigators must clearly communicate the intentions of the center director to all the young researchers and graduate students.

**Advisors:** The center will take advice on the management and other issues from knowledgeable outsiders.

### 3) Allocation of authority between center director and host institution

**Director of the center:** The director of the center will be given authority over the center's operation in general. In other words, the center director will have authority in employment, renewal of contracts, payroll, research expenses, and space allocation for researchers including senior and young researchers of the center, etc. who are invited to the center, except for those who are enrolled in the main body NIMS. His authority also includes employment and renewal of contracts administrative staff members of the center, except for those who are enrolled in the main body NIMS.

**President:** The president, as the responsible person of the host institute, supports the center operation to the fullest extent, while respecting the authority of the director over the operation of the center. However, upon some situations such as receipt of any advice from the Steering Committee and NIMS Executive Board, the president can make personnel changes to the center director, principal investigators invited from external organizations, etc. Further, according to need, he must take various additional measures necessary for the center operation including, for example, improvement of the experimental space and additional assignment of NIMS researchers.

manage administrative duties, while the Chief Operating Officer will assist the Director-General in research management. The Director-General, Chief Operating Officer and Administrative Director occupy offices next to each other so they may confer at any time to make snap decisions on Center management issues.

The Administrative Director was also appointed as Chief of the Planning Division of NIMS and takes part in the Board Meeting of NIMS which is held every week in order to smooth the relationship between NIMS and MANA.

As for the advisors of MANA, Prof. Kroto, a winner of the Nobel Prize in Chemistry, visited MANA on 19th July, 2008 and made one-on-one discussion with 7 young researchers and gave advices to them. Moreover, professor of University of California, Santa Barbara, Galen Stucky joined MANA as 4th advisor.

### 3) Allocation of authority between center director and host institution

This part remains the same as initial plan.

As for the revision of MANA organization at October 1st, 2008, Host Institution Head and Director-General took counsel together and made decision of new MANA's framework. Host Institution Head revised the whole organization and the personnel, and provided a research building as hub for illicit activity of MANA. Director General concurrently took necessary budgetary steps and strengthened MANA administrative arm.



## 5. Researchers and center staffs

i) "Core" to be established within host institution

### Principal investigators

	At beginning	Planned for end of FY 2007	Final goal (Date: month, year)	Results at end of FY 2007	Results at end of FY 2008
Researchers from within host institution	14	14	16 (October, 2011)	14	16
Foreign researchers invited from abroad	4	4	7 (October, 2011)	5	7
Researchers invited from other Japanese institutions	3	3	4 (October, 2011)	3	7
<b>Total principal investigators</b>	<b>21</b>	<b>21</b>	<b>27</b> (October, 2011)	<b>22</b>	<b>30</b>

### All members

	At beginning	Planned for end of FY 2007	Final goal (Date: month, year)	Results at end of FY 2007	Results at end of FY 2008
<b>Researchers</b> <Number of foreign researchers among them and their percentage> [Number of female researchers among them and their percentage]	140 <56, 40%>	140 <56, 40%>	167 <84, 50%> (October, 2011)	121 <53, 44%> [13,11%]	160 <83, 52%> [15, 9%]
<b>Principal investigators</b> <Number of foreign researchers among them and their percentage> [Number of female researchers among them and their percentage]	21 <7, 33%>	21 <7, 33%>	27 <10, 37%> (October, 2011)	22 <7, 32%> [1, 5%]	30 <10, 33%> [1, 3%]
<b>Other researchers</b> <Number of foreign researchers among them and their percentage> [Number of female researchers among them and their percentage]	119 <49, 41%>	119 <49, 41%>	140 <74, 53%> (October, 2011)	99 <46, 46%> [12,12%]	130 <73,56%> [14,11%]
<b>Research support staffs</b>	17	17	20 (October, 2011)	25	13
<b>Administrative staffs</b>	20	20	22 (October, 2011)	24	19
<b>Total</b>	<b>177</b>	<b>177</b>	<b>209</b> (October, 2011)	<b>170</b>	<b>192</b>

## ii) Satellites

### <Initial plan>

The center intends to promote effectively top world-level research that is appropriate to the world's center of substance and material research. At the same time, with the aim of fostering young researchers on the international level, it will collaborate actively with domestic and foreign research institutes. The center establishes two kinds of affiliates which are satellite institutes and collaborative institutes. The satellite institutes will serve as center's branches. On the other hand, based on the MOU agreement, the collaborative institutes carry out collaborative research and personnel exchange with the center.

Recently, NIMS has successfully organized the World Materials Research Institute Forum for global networking of materials institutions. Learning from this, the center will organize a World Nanotechnology Research Institute Forum and make efforts in global networking and global research collaboration in the field of nanotechnology and nanomaterials. Moreover, by participating in "Nanotechnology Network Japan Program (MEXT Innovation Support Program)" in which NIMS is deeply involved, the center will strengthen domestic network with Japan's nanotechnology related institutes.

**Satellite Institutes:** Research institutes to which principal investigators invited from external organizations belong are referred to as the satellite institutes. By December, 2007, the center plans to set up satellite institutes at the University of Tsukuba, University of Cambridge, UCLA, Georgia Institute of Technology and CNRS. The satellite institutes will play an important role in conducting research and are expected to be bridgeheads of the center.

- **University of Tsukuba:** Professor K. Kadowaki and Professor Y. Nagasaki are world leading researchers on superconductivity and organic chemistry, respectively. Their two satellite laboratories are set up in the University of Tsukuba with the intention of complementing the center's research activity and they will be bridgeheads of the center for the University of Tsukuba. Each of the laboratories will have stationed a few young researchers who are hired by the center to conduct research.

For the purpose of human resources cultivation, NIMS has already set up a Doctoral Program in Materials Science and Engineering at the Graduate School of Pure and Applied Sciences, University of Tsukuba. The center will accept many graduate students who can contribute to the research of the center as the junior researchers, utilizing this collaboration system with the University of Tsukuba.

### <Results/progress/alternations from initial plan>

MANA proposed establishing satellites in the research institutes to which its external Principal Investigators were affiliated. All required MOUs (or agreements) to establish the satellites scheduled at the time of application were concluded by July 2008.

In addition, an agreement and research contract were signed in October 2008 with Hokkaido University for a new satellite to be headed by PI Professor Kohei Uosaki. An agreement for the satellite was signed with the University of Tsukuba in June 2008. Associate Professor Keiichi Tomishige joined as an additional PI of the satellite.

As mentioned above, research and young researcher development is at each satellite proceeding accordingly.

### University of Tsukuba

An agreement concerning the establishment of the satellite was concluded with the University of Tsukuba in June 2008. The following research and supervision of MANA Independent Scientists are progressing accordingly.

- Professor Kazuo Kadowaki, Graduate School of Pure and Applied Sciences  
Research topics (Nano-system field): Nanoscience research on the use of high temperature superconductivity. Creation of nanostructures by microscopically sculpting high quality single crystal superconductors while controlling the operation of quantum coherences through the use of Josephson junctures.
- Professor Yasuo Nagasaki, Graduate School of Pure and Applied Sciences  
Research topics (Nano-bio field): Research on new nanobioimaging and materials design for nanodiagnoses and treatment and the evaluation of the attributes of these materials with the aim of creating novel biotools.
- Associate Professor Keiichi Tomishige, Graduate School of Pure and Applied Sciences  
Research topics (Nano-green field): Development of catalysts for efficient biomass conversion. Research on creating high value-added fuels to make biomass easier to use and technologies to convert biomass into chemical

- **Tokyo University of Science:** Professor Takayanagi, who is a world distinguished researcher of superconducting devices, will join the center, conducting the superconducting-device related research. NIMS is not very strong in this field. This satellite will be a bridgehead of the center to conduct joint research with the Tokyo University of Science.

- **University of Cambridge:** Professor Mark Welland, as Director of Interdisciplinary Research Center in Nanotechnology (IRC) of UK, is a world leader in nanoscience as well as in nanotechnology, especially with a focus on superfine processing by using an electron beam and creation of nanostructures. He has also served as a scientific adviser to the UK Prime Minister. He will join the research activities at this center with regard to the study of nanostructure fabrication. This satellite will play an important part in conducting the research of the center and will be a bridgehead of the center for the University of Cambridge.

- **UCLA:** Professor James Gimzewski is very well known as the researcher who has established the foundation of today's nanoscience and nanotechnology at the IBM Zurich Research Laboratory immediately after the invention of the scanning tunneling microscope. After moving to UCLA several years ago, he launched a study concerning fusion of nanotechnology and biotechnology and has performed ingenious research including his recent invention of a desktop size fusion device. He participates in the center's research concerning manifestation of new functions of nanostructures and their measurement, playing an important role in the project. This satellite will be a bridgehead of the center for UCLA.

products.

#### Tokyo University of Science

- Professor Hideaki Takayanagi, Department of Applied Physics

NIMS has signed a contract with the Tokyo University of Science for Professor Takayanagi's dispatch. Research space at NIMS has been secured for him so that he can conduct both his TUS research and his NIMS research in the same place.

Research topics (Nano-system field): Research into nanotechnology for new superconducting devices.

#### Hokkaido University

- Professor Kohei Uosaki, Graduate School of Science, Division of Chemistry

An agreement to establish a satellite and a research contract has been signed with Hokkaido University in October 2008. The following research and supervision of MANA Young Scientists are progressing accordingly.

Research topics (Nano-green field): Research on establishing methods to align highly controlled atoms and molecules on solid surface aiming to realize energy and highly-efficient conversion processes for materials in interfaces, especially solid-liquid interfaces.

#### University of Cambridge

- Prof. Mark E. Welland, Director, Cambridge Nanoscience Centre

An MOU and a research contract has been signed in July 2008. Actual research activities have started.

Research topics (Nano-system field): Creation of materials that use functions of biosystems to exceed those functions (bio-inspired energy efficient materials).

#### UCLA

- Prof. James K. Gimzewski, Director, Nano/Pico Characterization Lab. , UCLA

An MOU and a research contract were signed in March 2008. Research activities are progressing as follows. Professor Gimzewski and his colleagues spent time at MANA in August 2008 and September to discuss how to conduct an integrated research project. A MANA research associate has stayed at the UCLA satellite to conduct collaborative research.

Research topics (Nano-system field): Fusion of nanotechnology and biotechnology, nano X-ray systems.

<ul style="list-style-type: none"> <li>▪ <b>Georgia Institute of Technology:</b> Professor Z. Wang is an outstanding researcher in the field of nanotechnology, who is ranked among the world's top 25 by having a total number of article citation of over 15,000. In particular, his discovery of the ZnO nanobelt has drawn attention as a new material applicable in piezoelectric elements and in biosensors (total cited numbers: 1,519 times). This satellite will contribute to the project mainly in the electronic materials field and will be a bridgehead of the center for the Georgia Institute of Technology.</li>   <li>▪ <b>CNRS:</b> Professor Christian Joachim is the leading authority who has clarified the electronic states of nanostructures, especially the electronic state of functional molecules, by means of first-principle calculations. On the other hand, by organizing a group consisting of experimentalists and theorists, he is now devoted to the realization of single-molecule devices. He is expected to join this research center for theoretical study of new nanostructure functions, leading the theoretical research. This satellite will be a bridgehead of the center for CNRS.</li> </ul>	<p><u>Georgia Institute of Technology</u></p> <ul style="list-style-type: none"> <li>•Prof. Zhong Lin Wang, Director, Center for Nanostructure Characterization (CNC), Georgia Tech</li> </ul> <p>An MOU and a research contract were signed in July 2008. Research activities are progressing as follows. Professor Wang spent time at MANA in October to discuss research plans in depth.</p> <p>Research topics (Nano-materials field): Fundamental research on the observation and characterization of crystal growth in one-dimensional nanoscale materials to develop nanomaterials with energy applications. A MANA Independent Scientist has stayed at the GIT satellite to conduct collaborative research.</p> <p><u>CNRS</u></p> <ul style="list-style-type: none"> <li>•Prof. Christian Joachim, Center for Material Elaboration &amp; Structural Studies (CEMES) -CNRS, Toulouse</li> </ul> <p>An MOU and a research contract were signed in July 2008. Actual research activities have started.</p> <p>Research topics (Nano-system field): Fundamental research focusing on molecular logic gates and molecular magnetism to develop materials for emerging nanoelectronics, spintronics devices and brain-like computers.</p>
<p>iii) Partner institutions &lt;Initial plan&gt;</p> <p><b>Collaborative Institutes:</b> These institutes are expected to serve as sites for collaborative research with the center as well as exchange and training of young researchers. Among about 130 institutes in Asia, Europe, North America, East Europe, etc. with which NIMS already has MOU agreements, approximately 30 major institutes including, for example, Institute of Physics, Chinese Academy of Science (China), KAIST (Korea), Max Planck Institute (Germany), Charles University (Czech), and UCSB (U.S.) are serving as the collaborative institutes. It is further planned that MOU agreements will be signed with an additional 10 institutes by December, 2007 and with a further additional 20 institutes by December, 2008.</p> <p><b>Overseas Offices:</b> With the aim of strengthening overseas collaborations of the center and NIMS, overseas offices will be set up in UCSB, University of Washington and others. They are expected to conduct recruiting and investigation into the current research trend overseas. In particular, they will play roles in obtaining US-governmental funds from organizations such as DARPA and NSF and will also serve as liaisons for foreign personnel, for foreign enterprises, and for collaboration with overseas universities.</p>	<p>&lt;Results/progress/alternations from initial plan&gt;</p> <p>We are planning and deliberating the establishment of the World Nanotechnology Research Institute Forum (WNRIF) in order to strengthen ties with external organizations. We intend to conclude MOUs with other institutions as we progress with organizing WNRIF.</p> <p>In March 2008, we concluded a contract to establish a NIMS Office at the University of Washington, and we have been promoting cooperative activities, including initiatives to strengthen MANA's overseas presence, since June.</p>

## 6. Summary of center's research environment

### <Initial plan>

#### 1) Environment in which researchers can devote themselves to their research

The following factors are required to establish an environment where researchers can devote themselves to their research: 1) to develop a clerical work support system, so that paperwork for business trips or the purchase of supplies can be promptly processed in support of the researchers' work; 2) to provide researchers with sufficient technical staff for the maintenance of equipment, services in response to requests from researchers or assistance in experiments; 3) to minimize the frequency of conferences for the improvement of communication; 4) to provide assistance to researchers and their family for their life in Japan when necessary. Since half of the researchers at the center will come from abroad, we will develop a system to manage the use of English as the official language so that foreign researchers can devote themselves to research without having to deal with a language barrier.

**Clerical work support system in English:** Through five years' experience at ICYS, a clerical work support system using English as the official language has been implemented, so we will allocate those experienced people to the center as clerical staff, and we will hire new non-permanent staff under the experienced clerical staff. English proficient secretaries will be hired under principal investigators to handle clerical services in response to requests from researchers (10 secretaries by the end of December 2007, and 20 in total by the end of March, 2008).

**Make paper work bilingual:** All documents such as forms will be in Japanese and in English, so that the burden of paperwork on researchers will be reduced. Further, translators and/or interpreters will be on the staff to support foreign researchers. In addition, English education will be given to both young researchers and senior Japanese researchers and to clerical staff to improve their English capabilities (operation to make all documents bilingual will be completed by March 2008).

**Assistance for daily life:** We will improve the support system for foreign researchers and their families to set themselves up for living in Japan, such as housing search, medical care, education and job search for the spouse to eliminate various barriers that foreigners encounter when they come to Japan. Full-time staff will be hired (October 2007).

**Patent specialist:** For the convenience of foreign researchers to make patent applications in Japanese, we will hire English proficient patent specialists.

### <Results/progress/alternations from initial plan>

#### 1) Environment in which researchers can devote themselves to their research

**Clerical work support system in English:** English-language support systems, including personnel, developed in ICYS have been almost entirely carried over into MANA. As such, we have, for the most part, created an environment in which researchers, Japanese as well as foreigners alike, can devote themselves to research. Two new foreign staff has been assigned to the Planning Team, and a fully-prepared international administrative system is, for the most part, in place. We have secured 19 administrative staff, including foreigners, who are fluent in English.

**Making paper work bilingual:** We have made strides in this area thanks to previous experience with ICYS. This year we commenced an instructional service in English so that foreign researchers can apply for external funding. English is the official language for MANA's internal email communication, and we have started to hold some meetings in English. We have continued to provide administrative staff with English language training, and we have initiated short-term study abroad programs for young Japanese scientists.

**Assistance for daily life:** NIMS has contracted daily life support for foreign researchers to a specialist company while MANA operates its own Japanese language and culture classes for foreign researchers.

**Patent specialists:** We have rehired the patent specialist fluent in English that we hired for ICYS, and he is working to turn MANA output into protected intellectual property.

**Providing sufficient technical staff and facilitating access to equipment:** We will establish a system where researchers can use freely the latest large-scale international level research equipment owned by NIMS (High Voltage Electron Microscopy, High Magnetic Field Magnet, Spring-8 dedicated beam line and Nano Foundry) for their research, by provision of sufficient technical staff. Further, we will promote shared use of other advanced equipment. We will also provide researchers with sufficient assistance, such as research assistants, who will undertake routine experimental procedures. For those technical staff and others, we are going to hire about 15 people including researchers retired from NIMS (total 15; 5 by the end of December 2007, another 5 by March 2008 and 5 by the end of December 2008). In addition, five technical staff will join the center from NIMS.

## 2) Startup research funding

We will provide start-up research funds to researchers invited from external organizations so that they can launch their own laboratories immediately. We will grant a start-up fund of about 200,000 dollars to principal investigators invited from external organizations who conduct their research at NIMS. Those principal investigators who work in satellite research institutes will be allocated an annual research fund of 100,000 dollars. Young researchers such as post-doctorates will be allocated a start-up research fund as necessary to an amount of up to 100,000 dollars. On average, one principal investigator will conduct research with a group of 6 young researchers including 2 post-doctorates, 2 NIMS researchers and 2 junior researchers (graduate students).

## 3) Postdoctoral positions through open international solicitations

Securing highly capable young researchers including post-doctorates is vital to the operation of the center in view of human resource development. Fortunately, we have been able to, in the ICYS project, select about 50 highly capable young researchers from about 25 countries, out of 1000 applicants from about 70 countries. By utilizing ICYS' recruiting know-how accumulated to date, we will secure capable young researchers. Further, we will promote securing graduate students and provide them with sufficient research guidance.

## Securing young researchers including post-doctorates

**International open recruiting:** We will conduct international open recruiting through international publications such as "Nature" and by the

**Providing sufficient technical staff and facilitating access to equipment:** We carried over the technical support team from ICYS to MANA. There are currently 4 staff that handle experiment support and device maintenance. MANA researchers are taking advantage of the latest large-scale international level research equipment owned by NIMS. We are also promoting the shared use of other cutting-edge NIMS facilities, including those items slated for purchase in the future.

## 2) Startup research funding

In FY2008, 2 of the external PIs conducting research at NIMS were granted 20 million yen each and 1 newly-appointed PI was granted 17 million yen in startup research funding. As for satellites and PIs at partner institutions, the 2 Professors at the University of Tsukuba that are working on projects continuing from last fiscal year were granted 20 million yen each, and PIs at satellites beginning research this fiscal year, namely 2 domestic PIs and 6 PIs overseas, were allocated research funding ranging from 4 to 20 million yen each. The 12 Independent Scientists were each granted 3 million yen and the 12 ICYS-MANA Researchers were granted 2 million yen each in startup research funding. MANA Research Associates (51 postdoctoral researchers), Junior Researchers (12 graduate students involved in research projects), administrative staff (8 secretaries etc.) and 13 research assistants (technicians etc.) have been assigned to work under the PIs in a fortified research organization.

## 3) Postdoctoral positions through open international solicitations

## Securing young researchers including post-doctorates

**International open recruiting:** We have already begun international open recruitment of ICYS-MANA Researchers and MANA Research Associates in

recommendation from the principals of more than 130 research institutes which NIMS is affiliated with. Young researchers refer to those who obtained their Ph.D within the last 10 years. Asian countries such as China, India, etc. will be promising countries from which to recruit excellent young researchers and students. In addition, we will make our best effort to employ female young researchers and students.

**Multi-national young researcher group:** Through ICYS activities, we have proven that the international environment created by young multi-national researchers from different fields, cultures and races (at ICYS, this kind of international environment is referred to as a “Melting Pot”) is vital to both the research activities and human resource development of young researchers. Therefore, the center will also establish young multi-national researcher groups in different fields. We will hire about 60 post-doctorates from more than 20 different nations (total of about 60: 30 by March 2008 and another 30 by March 2009).

**Application method and recruitment:**

Applicants will propose a three year research plan in the application form. We will conduct the selection by weighing originality of the research plan and potential of the candidate as a researcher through two steps; screening of the application documents and interviewing (about 5% is assumed as the ratio of successful applicants). Applicants will be invited to the center for an interview, and have a one hour interview from which we will decide if the applicant will be accepted (the recruitment committee will consist of about 6 principal investigators headed by the center director as the committee chair). The employment period shall be two years, but renewal of the contract for another year may be granted after appraisal of the results. The reason we limit the employment period to 3 years at maximum is because we give priority to career improvement of post-doctorates and alike so that we can promote recruitment to NIMS’ research staff.

**Securing the junior researchers (graduate students)**

**Graduate School of University of Tsukuba:** At the Doctoral Program in Materials Science and Engineering, Graduate School of Pure and Applied Sciences, University of Tsukuba, which is jointly managed by NIMS and University of Tsukuba, we have made extensive efforts towards internationalization such as the implementation of an entrance examination in English since April 2004, the year we accepted the first students. As a result, the majority of doctoral course students at present come from abroad. By extending this system, we will secure capable graduate

FY 2008. We advertised in Nature and other renowned journals and on the MANA homepage. By the deadline at the end of August, we had received 58 applications from around the globe. We have narrowed the ICYS-MANA Researcher applicants to 7 with a document screening and are currently conducting interviews. At this point in time, 3 applicants have passed (1 each from Japan, China and India). 1 MANA Research Associate was appointed from a field of 34 applicants. We intend to continue hiring top notch postdoctoral research associates.

**Multi-national young researcher group:** As of the end of March, 2009, we have 12 ICYS-MANA Researcher of which 9 are foreigners. There are 51 MANA Research Associates assigned to the PIs and Independent Scientists, of which 44 are foreigners. There are 63 postdoctoral researchers, of which 53 (84%) are foreigners. We have achieved a truly multinational group of young researchers.

**Securing Junior Researchers (graduate students)**

**University of Tsukuba Graduate School:** As of the end of March, we have 12 Junior Researchers, of which 6 are foreigners. We are currently negotiating with the University of Tsukuba to establish a Master’s curriculum in which students can take all of their required credits in English starting in FY2009.

students from foreign countries such as China and India and make them conduct research as the junior researchers. Upon creation of the center, instructors at University of Tsukuba and instructors at the Doctoral Program in Materials Science and Engineering will take charge of the master's course program by supplementing each other, and an English curriculum will be prepared in a manner that allows students to take all the requisite courses in English. Further, we will provide a world-class research assistantship to all the graduate students as NIMS junior researchers, so that we can provide an environment in which students can concentrate on their studies and research without worrying about their tuition or the cost of living.

**International Joint Graduate School:** By expanding the International Joint Graduate School Program which NIMS already has with Charles University in Czech and Warsaw University of Technology in Poland, we will allow capable graduate students to participate in research under the supervision of principal investigators at the center.

**Human resource development of young researchers:** Fostering capable young researchers under the world's top class principal investigators is one of the remarkable features of the center. For that purpose, at the center, we will further expand the activities at ICYS.

**Fostering in the Melting Pot:** We will develop an international environment where capable multi-national youths gather at one center from around the world, and develop their talents by receiving stimulation there. For that purpose, we will assemble about 60 post-docs of different nationalities from more than 20 countries in one place.

**Mentor system:** In order to enhance independence of young researchers who obtained their Ph.D within the last 10 years, top world-class principal investigators will become their mentors and give advice regarding their research while respecting the researchers' own initiatives. Through the five year experience in ICYS, this mentor system proved to be quite effective for young researchers to enhance their independence, widen their research scope and show creativity.

**Foster human resources by 3D system:** A human resource development called 3D system will be established to enhance independence of young researchers and develop extensive interdisciplinary knowledge and experience. The 3D system stands for Double-mentor, Double-discipline and Double-affiliation; meaning: Research guidance by more than one mentor to enhance independence, having more than one discipline to strengthen interdisciplinary background knowledge, and multiple affiliations

**International Joint Graduate School:** We concluded five agreements with University of Washington (USA), Stony Brook University (USA), Nanjing University (China), Budapest University of Technology (Hungary) and Moscow State University (Russia) in FY 2008. We expect to have graduate students from FY 2009 if all goes well.

**Fostering in the Melting Pot:** As of the end of March, 2009, the total number of young scientists at MANA is 128 from 15 countries (MANA Scientists: 41, Independent Scientists: 12, ICYS-MANA Researchers:12, MANA Research Associates:51, Junior Researchers: 12).

**Mentor system :** Independent Scientists may propose which mentor that they wish to work with. One scientist is currently conducting a 6-month research project at Harvard University in the United States. The other 5 scientists are contemplating trips within the fiscal year. ICYS-MANA Researchers have been provided with the conditions to conduct independent research and have been assigned mentors. We have systems in place to respect the young researchers' autonomy while providing research advice.

**Foster human resources by 3D system:** We have decided to apply this system to MANA Scientists as well as Independent Scientists. We are now screening candidates.



to strengthen an independent spirit. We will carry out fostering of young researchers by utilizing satellite institutes as well as with the cooperation of overseas' cooperating organizations because the 3D system cannot be achieved by NIMS alone. We will also use the 3D system to promote human resource development of the junior researchers (graduate students) who belong to the center.

**Career development:** As a result of the abovementioned human resource development at the center, we will not only hire young researchers as permanent staff researchers at NIMS, but we will provide also them an associate professor's position or alike in research institutes either in Japan or abroad, to further their career development.

4) Administrative personnel who can facilitate the use of English in the work process

As mentioned previously, through the ICYS project NIMS has experienced research work using English as the official language, and therefore we have already trained clerical staff and have accumulated know-how. In using English as the official language, the keys for success lies in the improvement of the clerical staff's English proficiency, rather than of researchers' English proficiency, and the preparation of paper work materials in English. In Japan, bilingual documentation and communication in English and Japanese are effective. At the center, about 5 clerical staff members who have experience in ICYS will participate in the plan. To make English the official language, we will prepare the following items:

**Life in NIMS:** We will make a booklet "*Life in NIMS*" (approx. 30 pages) with full information on procedures for coming to Japan as well as on life in Japan. We will partially revise a booklet made for ICYS.

**NIMS Research Guide:** We will make a booklet about information on NIMS research activities (approx. 50 pages). We will partially revise a booklet made for ICYS.

**Bilingual documentation of various paper works:** We will make bilingual documentation of paper work for business trips, purchase of supplies, salary, regulations and others (approx. 100 pages). ICYS has already prepared such documentation, so we will revise those.

**Principal investigators meeting:** The meeting will be held once a month in English.

**Intranet:** The office communication through the Internet in the center will be done bilingually in English and in Japanese.

**Career development:** 9 ICYS-MANA Researchers have been employed as NIMS permanent researchers. Furthermore, 12 young MANA scientists and Independent scientists have been appointed as associate professors at domestic universities.

4) Administrative personnel who can facilitate the use of English in the work process

MANA has inherited ICYS know-how on conducting research operations with English as the official language and cultivating administrative staff. Namely, 5 experienced ICYS staff has been employed by MANA.

**Bilingual** documentation includes **Life in NIMS, NIMS Research Guide** and other documentation developed for ICYS. These are also used for MANA. Documentation will be revised as needed and any new documentation deemed mandatory will be made bilingual.

Thorough use of English in meetings and emails etc. has been enforced.

5) Rigorous system for evaluating research and system of merit-based compensation

At the center, we will develop a different salary scale from that of NIMS's main body, and will establish a flexible compensation package to secure excellent researchers and to provide them appropriate treatment. We will expand the system, which we have implemented in ICYS, including an annual salary system.

**Annual salary system:** Salary system for fixed-term principal investigators invited from external organizations or fixed-term young researchers such as post-doctorates will be an annual salary system. Because an annual salary system has already been introduced in ICYS, we will make full use of the experience. Annual salaries of the fixed-term principal investigators invited from external organizations will be in a range of 80,000 to 180,000 dollars, depending on their performance. Salaries of the fixed-term young researchers such as post-doctorates will be more than ca. 40,000 dollars, and will be assessed by their performance.

**Assessment of the salary and renewal of contract:** The center director shall evaluate research performance of young researchers to determine their salary for the next year. Salary shall not be based on seniority but on research performance, so as to be able to generate differences of more than about 50% in bonus among researcher of the same age group based on their performance.

**Performance evaluation committee:** The committee evaluates the research performance of young researchers once each year (the center director chairs the committee, and several principal investigators are included). They will assess the renewal of contract, salary and research budget for the next fiscal year.

**The center evaluation committee:** We will set up a center evaluation committee which consists of external experts (about 8 people, about 50% of whom are foreigners. An external expert will be appointed to act as chair) to evaluate the management of the center and research activities. At the same time, they will conduct performance assessments of the center director and principal investigators. The NIMS president will determine the annual salary of the center director after receiving a report from the center evaluation committee. The term of a principal investigator shall be 5 years, with a mid-term assessment in the 3rd year. Moreover, those who have shown excellent performance at the 5-year assessment will be allowed an extra five year of affiliation. For purposes of rejuvenation, about 1/4 of the principal investigators in total shall be replaced 5 years after the

5) Rigorous system for evaluating research and system of merit-based compensation

The Center employs different salary systems than NIMS in order to award outstanding researchers in accordance with their ability.

**Annual salary system:** Individual performance assessments consisting of research achievement scores (articles, patents, etc.) and peer assessment scores are conducted on all permanent researchers except for MANA Independent Scientists. The results of these assessments will be reflected as additional performance scores in the FY2009 bonus. To allow MANA Independent Scientists sufficient time to undertake original research, performance assessments were not conducted on them for this fiscal year.

**Assessment of the salaries and contract renewals:** Since the initial fiscal year after the Center's launch lasted only 6 months, we decided not to reflect achievements in salaries for FY2008. In FY2008, however, we will evaluate research performances of all MANA researchers by means of MANA's own evaluation method in addition to the NIMS evaluation system and will reflect the results in their salary or research grant.

**Performance evaluation committee:** The committee is scheduled to meet at the end of fiscal 2008.

**The center evaluation committee:** The committee consists of 10 external stakeholders (6 from foreign institutions and 4 from Japanese institutions). The first meeting was held on March 12th, 2008 with 6 members in attendance. Since this was held 5 months after MANA's establishment, MANA's objectives, plans and operating policies were commended. We will assess our researchers' output at the next meeting.

establishment of the center, to introduce new research fields, and to prevent the center from becoming inflexible.

However, salaries for researchers who belong to the center and are affiliated to NIMS shall be borne by NIMS, according to the results of the assessment from the center.

6) Equipment and facilities, including laboratory space, appropriate to a top world-level research center

**Space of the center:** For the research activities at the center, NIMS will provide total space of approximately 10,000 m<sup>2</sup>.

**Space for experimentation:** We will provide office space and laboratory rooms in the Nano Biomaterial Research Building only for young researchers, including post-doctorates, who conduct their research independently (about 4,000 m<sup>2</sup> in total). We will provide approximately 1/2 of that as experimental space. We will provide necessary and sufficient space to principal investigators invited from external organizations.

**Single-occupied office and cafeteria:** We will provide young researchers with a single-occupied office (approx. 12 m<sup>2</sup>) where they can devote themselves to research and to have a comfortable living environment. Also, to realize an ideal Melting Pot environment, we will put all the office rooms together in one place, and secure enough space for casual talks, including a cafeteria. At the center, we will utilize single occupied offices which are currently used by ICYS, and additionally will prepare approximately 10 rooms to cover shortfalls.

**Research equipment:** We will secure world's top-level advanced facilities with high commonality (for example, next-generation ultra high resolution electron microscope), in cooperation with NIMS in a well-planned manner.

7) International research conferences or symposiums held regularly to bring world's leading researchers together

To show that the center is one of the top world-level centers in the material science field, we will hold an international research conference once a year (a conference with 300 attendants). Furthermore, we will hold workshops as needed to provide leading world researchers in this field with opportunities to exchange information. Also, every summer we will open a summer school to foster young researchers.

6) Equipment and facilities, including laboratory space, appropriate to a top world-level research center

**Space of the center:** Since October 1st, the entire 13,000 m<sup>2</sup> of the old Nanomaterials and Biomaterials Research Building was allocated to MANA, and the main researchers are all stationed there. As such, it was renamed the MANA Building. Office and lab space has been secured for PIs, Independent Scientists, ICYS-MANA Researchers, postdoctoral researchers and students.

**Space for experimentation:** Space was located for non-MANA labs on the 4th and 5th floors of the MANA Building which have since been transferred to a different place. We were able to devote this lab space entirely to MANA within FY2008.

**Single-occupied office and cafeteria:** The 5th floor cafeteria in the MANA Building serves as the Center's "Melting Pot." We have provided Independent Scientists and ICYS-MANA Researchers with a single-occupied office as well as PIs.

**Research equipment:** 1.3 billion yen was invested in nanofoundries in FY2007. In FY2008 we installed solar-powered facilities and equipment for superconductive materials.

7) International research conferences or symposiums held regularly to bring world's leading researchers together

The 2nd International Symposium of the fiscal year will be held from February 25th - 27th, 2009. We will invite renowned researchers from around the globe, and MANA PIs and Independent Scientist will introduce their annual results. We also held the Cambridge-UCLA-NIMS Summer School at the end of July. In addition, we welcomed 5 American graduate students for 11 weeks on a cooperative program with the NSF in the United States. The program was a big success, and we have decided to accept 6 additional participants next fiscal year.

8) Other measures, if any

The most remarkable feature of the center will be not only that the center sends excellent leading world research results generated by top world-level principal investigators and subordinate young researchers, but that the center is a human resource development center where young researchers will be fostered and improve their careers to become future leaders. It is also a feature of the center that it respects young researchers' fresh and innovative ideas, as well as those of principal investigators. To realize these features, the proportion of foreigners among young researchers shall be more than 50%. Our strength lies in the 5-year experience of the ICYS project, which we can improve and extend for further development, for example, research management using English as its official language and know-how in human resource development for young researchers.

We have to keep the following points in mind to create an internationally attractive research environment:

**Use English as the official language:** By eliminating the language barrier, we need to establish a system where foreign researchers can do all their works without the need for understanding Japanese.

**Ensure independent research activities:** We will provide young researchers an environment where they can carry out their research independently. For that purpose, we will appoint world-leading principal investigators to be their mentors, to encourage young researchers to become independent. Further, we will provide young researchers with sufficient assistants such as technical staff so that they can proceed with their research independently, by receiving help to use common equipment and to get assistant services for work.

**High salary standard:** We will provide higher salaries than in NIMS to motivate young researchers.

**Utilization of world-leading equipment in NIMS:** We will establish a system where researchers can use the world's most advanced leading large-scale equipment such as High Magnetic Field, Nano Foundry, SPring-8 dedicated beam line, High Voltage Electron Microscopy, which are available at NIMS.

8) Other measures, if any

As of the end of March, 2009 there are 128 young Scientists at MANA, of whom 71, or 55%, are foreigners.

Type	Number	Number of Foreigners
MANA Scientists	41	9
Independent Scientists	12	3
ICYS-MANA Researchers	12	9
Research Associates	51	44
NIMS Junior Researchers	12	6
Total	128	71

To inherit the intellectual know-how from ICYS and create an attractive, international research operation we continue to make efforts such as the following:

**Use English as the official language:** Some of the ICYS support staff for foreign researchers were hired again for MANA from April. We have created a solid organization.

**Ensure independent research activities:** Mentors and support systems have been put in place to assist young Scientists in earnest.

**High salary standard:** We have guaranteed a level of monthly salaries and bonuses for Independent Scientists that is higher than that of NIMS researchers. ICYS-MANA Researchers also get a higher salary than usual.

**Utilization of world-leading equipment in NIMS:** We have enhanced the Technical Support Team so that all MANA researchers, Japanese and foreign alike, have unfettered access for cutting-edge large-scale facilities.

## 7. Criteria and methods used to evaluate center's global standing

### <Initial plan>

#### i) Criteria and methods to be used for evaluating the center's global standing in the subject field

To evaluate the center's global standing in the materials science area, we can use indicators such as number of papers accepted by renowned journals, ratio of researchers that are considered worthy of being named the world's top level researchers, the number of foreign researchers employed, the total external grants obtained, the number of cooperative research projects with private sector corporations, the number of patents applied and granted, the conditions of patents exploited, the number of invited talks at major international conferences, and the number of academic society awards received. The ranking of the number of citations of papers in the field of materials science presented by ISI can be a strong indicator to evaluate research institutions, although its effectiveness is debatable in the academic community.

#### ii) Results of current assessment made using said criteria and methods

- According to the ISI's ranking of research organizations based on the total number of citations in the field of materials science over the past 10 years, NIMS, which is the host institution of the center, was ranked the 12th in the world as of May 2007, while it was ranked 31<sup>st</sup> in 2003 when NIMS first appeared in the ranking. This is a clear indicator of how NIMS has improved its standing in the last four years. When comparing paper citations over the five years before becoming an independent administrative institution (1996-2000) and the five years after becoming an independent administrative institution (2002-2006), NIMS ranked 6th, up from the 31st in the world. This means that the recent organizational reforms after becoming an independent administrative institution six years ago drastically increased its research achievements. NIMS publishes about 1,300 papers a year, only one third of which is in materials science and the rest of which is in the fields of physics, chemistry or biotechnology. Nevertheless, NIMS gained a high standing in the materials science discipline.
- The principal investigators from NIMS gained external grants of 1,358 MJPY in FY2006 alone. In terms of the amount of the external funds gained, the center is equivalent to the world's top level.

### <Current assessment>

Judging from the following progress, MANA has a fairly good start toward the goal of the next decade.

- As of the end of March, MANA boasts 192 members, of which 160 are researchers. 83 researchers (52%) are foreign, well above the final 30% target for the WPI Program.
- According to the ESI Database (current as of January 1st, 2009), NIMS ranked 4th in the world and 2nd in Japan for the number of citations in the materials science field over the last 4 years and 10 months (January 2004 to October 2008). We have cleared one of our 5-year mid-term objectives of ranking within the top 5 in the world.
- As of the end of March, 63 post-doctoral researchers and 12 Graduate students are involved in MANA.
- As of the end of March, there are 42 foreign permanent researchers in NIMS and it represents 7.5% of the total number of permanent employees. We had a fairly solid start to fulfill the after five-year goal: about 10% of the permanent employees will be foreigners in NIMS.

- The number of the external grants gained by NIMS, which will be the host institution of the center, is growing every year. Particularly, the growth of the grants from private sector corporations is noticeable with a total amount of more than 500 MJPY in FY2006.
- In the last several years, the number of foreign researchers employed by NIMS has increased dramatically. Around 200 foreigners join NIMS as post-docs or graduate students every year. This indicates that NIMS is an open and attractive international institute for foreign researchers.

iii) Goals to be achieved through the project (at time of interim and final evaluations )

At the point of Mid-term evaluation (5 years later):

- NIMS, the host institution of the center, will rank within top-5 in the materials science field according to the world's institute ranking of ISI based on the number of citations in the past five years.
- The center will have secured 100 young researchers and 50 graduate students from all over the world.
- About 10% of the permanent employees will be foreigners in NIMS.

At Ex-post evaluation (10 years later) :

- The center will be a high status research center for materials science, which many researchers all over the world aspire to join.
- NIMS will rank within the top-3 in the ISI ranking based on citations in the last five years. Since the citation ranking is advantageous for large institutions, it is impossible to exceed in numbers giant institutes such as Chinese Academy of Sciences or Max-Planck Institute, Germany because of the size difference. Therefore, NIMS set its goal to be in the world's No.3 (which corresponds to No.1 among single institutions).
- NIMS will be the No.1 institute in the materials science discipline in the institute citation ranking in Japan.
- The numbers of total external grants obtained, cooperative research projects, and of collaborative research grants by private businesses will be 1.5 times greater than at present.

- For the ten-year period, the center has secured about 200 young researchers and 100 graduate students from all over the world.
- This center will function as a research center for growing “Emerging Leaders” in materials science. Researchers in this center will promote their careers and about 50 of them will get permanent positions in NIMS, and another 50 at overseas and domestic universities or research institutes after staying for some time in this center as graduate students or post docs.
- About 20% of the permanent employees will be foreign researchers in NIMS.

### 8. Securing competitive research funding

#### <Initial plan>

##### i) Past record

We have been steadily obtaining an average of about 1.4 billion yen of external funds in recent years. In addition, the total amount of operational subsidies allocated is remaining at the level from 0.8 to 1.4 billion yen. The averaged effort (b/a ratio in Appendix II) of the prospective principal investigators is about 80 %. Therefore, the expected amount of the fund that the prospective principal researcher get for the activity of this center is 1.7-2.2 billion yen every year. This value is nearly equivalent to the amount of requested funding shown in the form of "3. Appropriation Plans".

##### ii) Prospects after establishment of the center

In FY 2007, the Nanotechnology Network Project by the Ministry of Education, Culture, Sports, Science and Technology starts, so that we can receive funds for maintenance and operation of advanced shared equipment. The shared equipment operated by the fund may be used for this center project, and therefore, the material amount of external funds obtained will be higher than now estimated.

Furthermore, the number of talented young researchers has increased recently with drastic increase of research achievements. The funds they obtain will continue to grow in the future.

As stated in the Commitment from the Host Institution attached separately, we assume the funds needed by those core principal investigators

#### <Results/progress/alternations from initial plan>

As of March, 2009, Center researchers have secured about 1.58 billion yen in total. This included the competitive external funds of about 550 million yen, private sector funds of about 150 million yen and research funds from NIMS of about 880 million yen. Of this figure, about 350 million yen has been newly secured alone in this fiscal year of 2008.

Type	Amount of Funds (Million yen)
1. Competitive external funds	550
2. Private sector funds	150
3. Funds from NIMS	880
total	1,580

can be sufficiently secured as before, by continuing to allocate research funds to principal investigators from the operational subsidies.

#### 9. Other important measures taken to create a world premier international research center

##### <Initial plan>

After project funding ends, NIMS will support the center financially so that the center can maintain its activities at least for 10 more years.

It is quite sure that the main body of NIMS will actively adopt center's successful management systems. The concept of the center is really unique and its experience will be very helpful not only for the main body of NIMS but for other institutions in Japan when they attempt to build their own research centers.

We would like to stress our valuable experiences obtained from the ICYS project. The center will succeed and develop the managerial operation in ICYS and this is our great advantage to realize the world premier research center in addition to our novel materials research technology of nanoarchitectonics.

##### <Results/progress/alternations from initial plan>

As MANA has overlapped with ICYS for 6 months, MANA Administrative Office had taken over the achievement and experience of ICYS in managing an international research center.

#### 10. Host institution's commitment

##### <Initial plan>

##### -Provision in host institution's mid-to-long-term plan

Looking from NIMS's point of view, the center is designed as an organization undertaking the two following roles, classified roughly: (1) an advanced research organization to conduct basic research for materials, fusing fields of materials science, chemistry and physics; (2) an organization to foster researchers who will create the future of material research in an international and interdisciplinary atmosphere. The objective related to (1) is the "development of innovative materials to realize a sustainable society", and this is perfectly consistent with the 2<sup>nd</sup> midterm objectives and midterm plan of NIMS. Accordingly, the center can be positioned as an organization which will play a principle role to lead the main body of NIMS by carrying out the research in a radically accelerated manner. On the other hand, to put (2), the fostering of researchers, as the other pillar of the concept is a very important point of the center, from the standpoint of NIMS. We have decided that, if this

##### <Results/progress/alternations from initial plan>

##### -Provision in host institution's mid-to-long-term plan



proposal is realized, NIMS's new staff researchers with tenure will be chosen, in principle, from young researchers of the center. Thus, the center is also positioned as a place to foster NIMS's future research staff with tenure. Therefore, the center is definitely incorporated into long-term strategies of the main body of NIMS in both aspects of research initiatives and supply of human resources.

#### -Concrete Measures

(1) Competitive grants obtained by researchers participating in the project and in-kind contributions, etc.

- i) Labor costs of permanent staff (such as researchers with tenure and clerical staff) and non-permanent staff that join the center from NIMS will be allocated from operational subsidies and other funds of NIMS except for those who are fully enrolled in the center.
- ii) As for projects with operational subsidies that are handled by researchers who join the center from NIMS as senior researchers, we will allocate an equivalent amount of the research funds to the center to implement the project at the center. Among competitive grants obtained by researchers who joined from NIMS, we will allocate an amount equivalent to the direct costs to the center, if the research plan is consistent with that of the center.
- iii) We will secure sufficient space mainly at the Nano/Biomaterial Research Building in the Namiki District.
- iv) Other than the above, we will give additional assistance for budgeting and space as the need arises.

(2) System under which the center's director is able to make substantive personnel and budget allocation decisions

The center director is given authority for the center's general operation by the president of NIMS. In other words, the center director has the authority to employ, renew contracts, make payroll decisions, determine research expenses, and allocate space for researchers who are invited to the center, except for NIMS permanent staff. His authority also includes employment and renewal of contracts of administrative staff members, except for NIMS permanent staff. If the center director makes the request and the NIMS president confirms its necessity, NIMS personnel are allowed to move to the center. If these are required to be secured, we will make the necessary rule in NIMS's internal regulations.

#### -Concrete Measures

(1) Competitive grants obtained by researchers participating in the project and in-kind contributions, etc.

- i) Personnel expenses for part of tenured staff involved in the MANA project (some Chief Scientists, Engineers and PIs) and part of fixed-term staff (MANA Research Associates, Junior Researchers and administrative staff) are covered by operating subsidies.
- ii) NIMS researchers involved as PIs in charge of subsidized projects receive research expenses to conduct projects in MANA. A portion of external funding secured by NIMS researchers participating in MANA and that complies with the Center's Research Plan is allocated to conduct projects in MANA. To support Principal Investigators and Chief Scientists ineffectively commencing research in MANA, start-up funds and research expenses were allocated from operations subsidies.
- iii) Since October 1st, the entire 13,000 m<sup>2</sup> of the old Nanomaterials and Biomaterials Research Building was allocated to MANA and the main researchers are all stationed there. As such, it was renamed the MANA Building. Office space has been secured for PIs, Independent Scientists, ICYS-MANA Researchers and other postdoctoral researchers and junior researchers.

(2) System under which the center's director is able to make substantive personnel and budget allocation decisions

The President of NIMS delegates oversight of Center operations to the Director-General of MANA. The Director-General possesses the authority to hire, renew contracts, determine salaries and research expenses and distribute space to Center researchers and staff, excluding tenured NIMS staff.

(3) Support for the center director in coordinating with other departments at host institution when recruiting researchers, while giving reasonable regard to the educational and research activities of those departments

NIMS personnel are allowed to move to the center if the center director requests it and he/she accepts the request and the NIMS president confirms its necessity. As stated above, the center will play a role to supply young staff researchers with tenure to the main body of NIMS. Conversely, it does not basically produce any problem that necessary human resources are supplied from the main body of NIMS to the center. We believe such mobility of human resource between the center and the main body of NIMS may stimulate both organizations.

(4) Revamping host institution's internal systems to allow introducing of new management methods (e.g., English-language environment, merit-based pay, top-down decision making) unfettered by conventional modes of operation

We have already experienced in pioneering operations of English use as the official language, clerical work support system in English, creation of bilingual clerical documents, annual salary system, researcher's performance evaluation, salary assessment, renewal of contracts, etc. at the International Center for Young Scientists (ICYS). There is no problem in adopting such a flexible and distinctive management style which can be seen as an extension of the above operations experienced. We are planning to actively adopt the center's successful management systems to the main body of NIMS.

(5) Accommodation of center's requirements for infrastructural support (facilities, e.g., laboratory space; equipment; land, etc.)

For the research activities at the center, we will provide a space, approximately 10,000 m<sup>2</sup> for study, mainly at the Nano/Biomaterial Research Building in the Namiki District. The space will be used to secure the following:

**Space for experimentation:**

We will provide laboratory space at the Nano Biomaterial Research Building for young researchers such as post-doctoral fellows who will proceed with their research independently (about 4,000 m<sup>2</sup> in total). We will provide approximately 1/2 span (20 m<sup>2</sup>) as their experimental space.

(3) Support for the center director in coordinating with other departments at host institution when recruiting researchers, while giving reasonable regard to the educational and research activities of those departments

If the Director-General desires and if the researcher agrees, NIMS staff may be transferred to MANA—or vice-versa—if deemed necessary by the President of NIMS. Several researchers were transferred into and out of the center with the systems revisions on October 1st.

(4) Revamping host institution's internal systems to allow introducing of new management methods (e.g., English-language environment, merit-based pay, top-down decision making) unfettered by conventional modes of operation

English-language support systems, including personnel, developed in ICYS have been almost entirely carried over into MANA. As such, we have, for the most part, created an environment in which researchers, Japanese and foreigners alike, can devote themselves to research. Two new foreign staff have been assigned to the Planning Team, and a fully-prepared international administrative system is, for the most part, in place. We have secure 5 administrative staff, including foreigners, that are fluent in English.

Salary systems have been revised so that ICYS-MANA Researchers (independent post-doctoral researchers) can be paid according to performance. Principal Investigators and other permanent NIMS researchers have their achievements reflected in their benefits under the existent NIMS evaluation system.

(5) Accommodation of center's requirements for infrastructural support (facilities, e.g., laboratory space; equipment; land, etc.)

On October 1st, the entire 13,000 m<sup>2</sup> of the old Nanomaterials and Biomaterials Research Building was allocated to MANA as its major research base, and the building was renamed to the MANA Building.

We have been able to provide all MANA researchers, including the external PIs, and visiting researchers with lab space, individual offices and a cafeteria. The old Administration Building was renovated into lab space for MANA researchers. Large-scale research facilities for battery materials and biomaterials on the campus have been installed and are shared by NIMS and MANA researchers.

We will provide necessary and sufficient space to principal investigators invited from external organizations.

**Single-occupied office and cafeteria:**

We will provide young researchers with a single-occupied office (approx. 12m<sup>2</sup>) where they can devote themselves to research and to live in a comfortable environment. Also, to realize an ideal Melting Pot environment, we will put all the living rooms together in one place, and secure enough space for casual talks, including a cafeteria. At the center, we will utilize single-occupied offices which are currently used by ICYS

We will allow researchers at the center to freely use research equipment and facilities such as Nano Foundry that NIMS possesses, and will make an effort to accommodate their needs for the use as a priority. Furthermore, we will secure world's top-level advanced facilities with high commonality, in cooperation with the center in a well-planned manner.

**(6) Support for other types of assistance**

We assume that the center project is extremely effective in activating the whole of NIMS, so we are willing to make efforts for the smooth implementation to the fullest. NIMS is expecting that the center will play a principle role in leading the main body of NIMS. However, this does not mean that NIMS intends to exploit the center to solve NIMS's specific issues such as the aging researcher population. Such problems should be, of course, solved through NIMS's own efforts. Actually, NIMS is expecting the center to play just two roles, i) leading of the main body of NIMS by carrying out research in a radically accelerated manner and ii) fostering of NIMS's future research leaders with establishment of NIMS's tenure-track system.

**(6) Support for other types of assistance**

NIMS expects MANA to (1) conduct and speed up cutting edge research on nanotechnology and nanomaterials in order to lead NIMS research and (2) cultivate the next generation of materials researchers in a global and interdisciplinary environment, i.e. provide NIMS with leading researchers and establish a NIMS tenure track system. We feel that the Center has made an excellent first step in this direction.

11. FY 2008 funding

(Exchange Rate: JPY/USD=120)

Ten thousand dollars (Exchange Rate: JPY/USD=120)

Cost Items	Details	Costs (ten thousand dollars)
Personnel	Center director and Administrative director	30
	Principal investigators (no. of persons):18	148
	Other researchers (no. of persons):140	495
	Research support staffs (no. of persons):20	49
	Administrative staffs (no. of persons):20	66
	Total	788
Project activities	Gratuities and honoraria paid to invited principal investigators (no. of persons):6	12
	Cost of dispatching scientists (no. of persons):1	2
	Research startup cost (no. of persons):29	12
	Cost of satellite organizations (no. of satellite organizations):10	99
	Cost of international symposiums (no. of symposiums):1	5
	Rental fees for facilities	0
	Cost of consumables	37
	Cost of utilities	134
	Other costs	42
	Total	343
Travel	Domestic travel costs	5
	Overseas travel costs	14
	Travel and accommodations cost for invited scientists (no. of domestic scientists):20 (no. of overseas scientists):65	36
	Travel cost for scientists on secondment (no. of domestic scientists):5 (no. of overseas scientists):30	9
	Total	64
Equipment	Depreciation of buildings	101
	Depreciation of equipment	515
	Total	616
Other research projects	Projects supported by other government subsidies, etc.	350
	Comissioned research projects, etc.	116
	Grants-in-Aid for Scientific Research, etc.	59
	Total	525
Total		2336

WPI grant for FY 2008	851
Costs of establishing and maintaining facilities in FY 2008	90
Repairing facilities :Installation of Additional Laboratory Costs paid:	90
(Number of facilities: 826m <sup>2</sup> )	
Cost of equipment procured in FY 2008	813
Atomic Layer Deposition Apparatus	
Number of units:1	Costs paid: 29
Time-lapse analysis system	
Number of units:1	Costs paid: 31
Catalyst characterization laboratory	
Number of units:1	Costs paid: 7
Super Solar Simulator	
Number of units:1	Costs paid: 13
Flat-type Vacuum Evaporator	
Number of units:1	Costs paid: 12
Impedance Meter	
Number of units:1	Costs paid: 5
Glove Box System	
Number of units:3	Costs paid: 26
In-Air Type Photoemission Spectroscope	
Number of units:1	Costs paid: 24
Spectrum Sensitivity Measuring Apparatus	
Number of units:1	Costs paid: 18
Muffle furnace	
Number of units:4	Costs paid: 9
Multi channel Potentio	
Number of units:1	Costs paid: 5
Hybrid Microscope	
Number of units:1	Costs paid: 10
Multi Spectro Plate Reader	
Number of units:1	Costs paid: 5
NanoViewer	
Number of units:1	Costs paid: 33
Millimeterwave Thermo Heater	
Number of units:1	Costs paid: 56
PLD	
Number of units:1	Costs paid: 24
XRD Systems	
Number of units:1	Costs paid: 23
Others	483

## 12. Efforts to improve points indicated as requiring improvement in follow-up review and results of such efforts

-Points specified as needing improvement

### 1) WPI Laboratory

MANA has modified its initial plan and made a decision to integrate the offices of its PIs into one building. This is a major step forward to realizing a "visible" research center, and MANA's decision to do is praiseworthy.

Therefore, when the facility will be completed should be clearly stated. It is desirable that it be introduced at an early stage as a place for continually renewing the WPI organization, generating new ideas on future innovation, integrating the five MANA research groups, and facilitating interaction and collaboration.

### 2) Research organization

In advancing nanoarchitectonics, the establishment and operation of the four technical groups is desirable. However, if each group conducts investigations in only its own field, it will be difficult to make breakthroughs in nanotechnology. The integration of both researchers and research contents will be essential. For MANA to become a world-leading nanoscience research center, each of its groups should recruit top world researchers, while considering the possibility of rotating members among the groups. In this respect, some fields should be strengthened, particularly the fields of *ab initio* and multi-scale computational simulations, computational nano-materials and device design, and mesoscopic theoretical chemistry, which complement the research in MANA's four technical groups. Unifying or integrating the key technologies should be aggressively challenged. Exchange of researchers also needs to be promoted between MANA and universities.

### 3) Research Satellites

Collaboration with satellites by merely providing research funding does not constitute an effective cooperative relationship. MANA should develop concrete joint projects or other mechanisms that involve the satellites in its activities. **1) Overseas:** The abilities of excellent foreign PIs should be effectively used by designing attractive programs for them. Since MANA is located in the Tsukuba area, which is not easily accessible for young students, it will be important to hold international workshops on nanoarchitectonics at universities and institutions in Japan, through which MANA can be advertised and excellent young researchers recruited. **2)**

**Domestic:** The Nano-Science and Technology Project is being carried out in the Nanotechnology Research Institute of the National Institute of

-Efforts to improve them and results

### 1) WPI Laboratory

Since October 1st, the entire 13,000 m<sup>2</sup> of the old Nanomaterials and Biomaterials Research Building was allocated to MANA, and we are in the process of stationing all the main researchers there. The building was renamed the MANA Building. Office space has been allocated to PIs, Independent Scientists, ICYS-MANA Researchers, other postdoctoral researchers and students.

### 2) Research organization

Research systems were revised on October 1st. We had grouped PIs into 5 technical aspects of nanoarchitectonics, but we have since realigned these into 4 fields, Nano-materials, Nano-system, Nano-green and Nano-bio, and have clarified the Center's policy direction for each in light of comments from the Follow-up Committee. The 30 PIs have been assigned as follows. Nano-materials: 11; Nano-systems: 12; Nano-green: 5; Nano-bio: 2. We recruited internationally for top-class PIs, and have succeeded in appointing Professor of Materials Science and Technology at the University of Rome, Enrico Traversa. His appointment as the PI for the Nano-green Field commenced in January 2009.

### 3) Research Satellites

**Overseas Satellites:** Joint research and personnel exchange with the satellites have begun. We have a plan to open labs at MANA for the PIs from University of Cambridge and UCLA. Interaction among young faculty postdoctoral researchers and students has begun. UCLA Professor and PI Gimzewski and his group of students spent 1 to 2 months conducting research at MANA in the summer of FY2008. Professor Wang from Georgia Tech has started similar activities, and mutual exchange between young researchers has started. In addition, several MANA researchers participated in conferences at Hokkaido University in June and Osaka University in November. They presented their research output and interacted with young researchers to promote MANA.

**Domestic Satellites:** Hokkaido University Professor Kohei Uosaki was

Advanced Industrial Science and Technology (AIST) in Tsukuba with a staffing scale comparable to MANA's. Though AIST has a competitive relationship with MANA, it will be important to build a cooperative partnership with it to advance R&D in this field. Both organizations are supported by the Japanese government, but have different missions within the nanotechnology domain. Nevertheless, greater prospects for future outcomes can be expected through collaboration, rather than competition. Interchange among researchers of the two organizations should be encouraged through joint seminars and other activities.

#### 4) Others

In addition, the following are some opinions expressed by the program committee members.

1. An aggressive challenge should be made to unify and integrate the key technologies with an eye to pioneering the next generation of innovative nano-materials and nano-sciences. To make the institute a globally attractive WPI center, it will be essential to set original research goals with impactful ripple effects and to seek highly creative research results, even if the number of researchers is limited. It would be desirable to have a committee to discuss the future prospects and directions of nanotech devices and systems.
2. For a research institute that is not a university, it is particularly important to develop channels through which to bring in new, fresh ideas and points of view. The existing young scientist program is good, but it is not clear whether it provides young scientists with sufficient freedom to try new things. The research agenda may be set too much from a top-down perspective.
3. The relationship between MANA and NIMS is a bit unclear. A clear differentiation should be made between the two organizations. If MANA does not maintain a distinct identity, it is feared that its project will be seen as buried among NIMS's other projects. It is not clear how MANA's approach to facilitate collaboration differs from what is already being used in NIMS. MANA needs to declare how it intends to deliver on its goals and ambitions with respect to management style, autonomy and freedom, and other operational aspects.
4. MANA people should be aware that they are paving a new way for other independent administration research institutions. They should take the lead in making changes and addressing challenges relative to other governmental research organizations as well.

appointed this fiscal year as a new PI in the Nano-green Field. Tokyo University of Science Professor and PI Takayanagi has established a research base at MANA, and he is working hand-in-hand with his group as a MANA member. Given MANA's proximity to the University of Tsukuba, 3 PIs from the university are participating in MANA together with the NIMS PIs. In-depth cooperation with the National Institute of Advanced Industrial Science and Technology (AIST) has just begun and five working groups have been launched regarding opt-devices and spintronics, etc. We also invited Dr. Kazuhito Tsukagoshi as a full-time PI from AIST as of January 2009 as a personnel exchange.

#### 4) Others

1. System revisions enacted on October 1st were undertaken in an aim to draw convergences in nanoarchitectonics through innovations in nanomaterials and nanosystems and a subsequent ripple effect into creative research output in the nano-green and nano-bio fields. We will also use the MANA Evaluation Committee to discuss future policies on nanotech devices and systems.
2. MANA Independent Scientists and ICYS-MANA Researchers will not only participate in PI-led research, but they will also conduct independent research projects on their own topics. PIs serve to only mentor young researchers, and sufficient time is secured for them to conduct independent and creative research projects.
3. In the system revisions enacted on October 1st, 2 NIMS research centers (Nanoscale Materials and Nanosystems Functionality) were merged, Biomaterials Center projects were implemented and fields handled by NIMS and MANA were clarified. However, since NIMS is still in the middle of its 2nd-phase mid-term plan, this division is still unclear in some areas, so we will further clarify both entities before the 3<sup>rd</sup> NIMS mid-term plan commences.
4. MANA researchers are very aware of both the honor and the responsibility of being the only independent administrative agency selected as a WPI Center. We would like to use this project to take the lead in "reforming a government research center and undertaking challenges."