FY 2009 WPI Project Progress Report
World Premier International Research Center (WPI) Initiative

Host Institution	National Institute for Materials Science	Host Institution Head	Sukekatsu Ushioda
Research Center	International Center for Materials Nanoarchitectonics	Center Director	Masakazu Aono

Summary of center project progress

1. Workforce

As of March 2010, MANA now employs 214 staff. Of this number, 181 are researchers. There are 94 foreign researchers, or 52% of the total, and the 22 female researchers constitute 12% of the total. The total number of Principle Investigators stands at 30 (21 from NIMS and 9 at the Satellites) with 10 in Nano-Materials, 11 in Nano-System, 7 in Nano-Green and 2 in Nano-Bio. In order to strengthen Nano-Green field, two PIs were added and the Nano-Interface Group was established as part of Nano-Green and a faculty member from Hokkaido University was hired as a MANA Scientist.

2. Research

Among MANA's research topics, research on nano-sheets and atom switches has especially gained prominence. MANA anticipates practical applications for this output in the near future, and MANA will further promote cooperation in this field of research. Additionally, MANA feels it is crucial for young researchers from various disciplines to conduct joint research in order to create new research seeds via fusion research. Starting this fiscal year MANA adopted a fusion research subsidy system and launched 6 projects.

3. Management

MANA Administrative Section has provided all researchers with quick-acting, far-reaching, Japanese-style service regardless of nationality and thus realized its mission of "providing an environment in which researchers can devote themselves to their research by reducing non-research work".

4. Satellites

MANA has actively engaged in research exchange with satellites, holding joint workshops with Cambridge and CNRS. Prof. Gimzewski, satellite PI at UCLA, was featured in the NHK's satellite TV program "the Proposal for the Future" and research at MANA was introduced in the program. The satellites also play important roles in cultivating young researchers. MANA holds summer school programs annually with Cambridge and UCLA, and the PI at Georgia Tech is serving as a mentor for an Independent Scientist at MANA. Said Independent Scientist has visited Atlanta 4 times to conduct research.

5. Collaboration with Universities

To strengthen ties with universities, MANA held workshops with 6 oversea and domestic universities. Furthermore, 17 researchers at MANA hold teaching positions and are supervising the research of 22 PhD students in the NIMS Graduate Schools that includes the University of Tsukuba, Hokkaido University, and Waseda University. In addition, MANA has accepted 14 students from 7 foreign universities with which NIMS has concluded International Joint Graduate School Agreements. MANA has also accepted 33 interns of which 31 have been foreigners.

6. Scientists Exchange

Since the 3D System is extremely effective for cultivating a wide array of young researchers with global perspectives, MANA decided to expand the system to also cover some post-doc researchers starting this fiscal year. In FY2009 there were 8 researchers on this system. On the other hand, using both NIMS and MANA systems, MANA invited a total of 115 senior researchers and young researchers from around the globe.

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

According to the ESI Database as of March 1st, 2010, NIMS ranked 3rd in the world for the number of citations in the materials science field over the last 5 years (January 2005 to December 2009). MANA has cleared one of its 5-year mid-term objectives of ranking within the top 5 in the world. 47% of the NIMS citations are from articles written by researchers affiliated to MANA. Given the ratio of MANA-affiliated researchers in NIMS (18%), one can see that MANA's contribution is great.

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 form 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>

MANA’s research objective remains unchanged: “to develop innovative materials that enable new technologies required for the realization of a sustainable society in the 21st century” by using a new paradigm for materials development based on nanoarchitectonics. To achieve this, we reorganized research into 4 fields in October 2008: Nano-Materials, Nano-System, Nano-Green, and Nano-Bio.

With the departure of Professor Gerber (University of Basel, Switzerland) from the Nano-System field in March 2009, the participation of Dr. Takada (NIMS) in the Nano-Green field and the transfer of Professor Yaghi (UCLA) from the Nano-Materials to Nano-Green field both in January 2010, the total number of Principle Investigators now stands at 30 (21 from NIMS and 9 at the Satellites) with 10 in Nano-Materials, 11 in Nano-System, 7 in Nano-Green and 2 in Nano-Bio.

As of March 2010, MANA now employs 214 staff. Of this number, 181 are researchers. There are 94 foreign researchers, or 52% of the total, and the 22 female researchers constitute 12% of the total. Foreign and female researcher numbers have increased steadily, but given the size of the Center, we feel these are appropriate levels and will continue to maintain them going forward.

While we added a new Principle Investigators in Nano-Green Field in FY2009, we also employed some outstanding young researchers in the fields of Nano-Green, Nano-Bio and Theoretical Computation—areas which needed additional personnel. In November 2009, the Nano-Interface Group was established in the Nano-Green Field, and we brought in Dr. Hidenori Noguchi from Hokkaido University. In the Nano-Bio Field we hired Eriko Watanabe (Japan Women’s University) in November 2009, and in Theoretical Computation we hired Katsunori Wakabayashi (Hiroshima University) in June 2009. Both were hired as MANA Independent Scientists.

Since the 3D System we have been using for MANA Independent Scientists has proven to be extremely effective for cultivating young researchers, we have expanded it to encompass post-doctoral researchers, allowing them to spend up to 3 months engaged in joint research overseas. Meanwhile, we established the Fusion Research Funding and selected 6 topics from among 18 applications which we will fund for 2 years with 10 million yen (0.1M dollars) (Exchange Rate: JPY/USD=100) in research subsidies in an effort to promote interdisciplinary research.

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 Program Committee's Comment in FY2007 that MAMA should make breakthroughs in nanotechnology by the integration of both researchers and research contents, 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 21st 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**

<Results/progress/alternations from initial plan>

As of October 2008, MANA 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

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

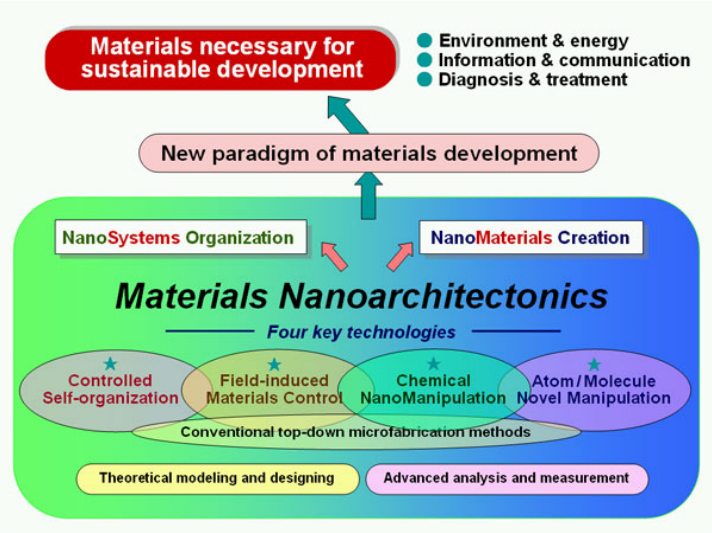
2) **Development of innovative materials for nanoelectronics that lead to innovations in information and communication technology**

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 (nanopiller 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.

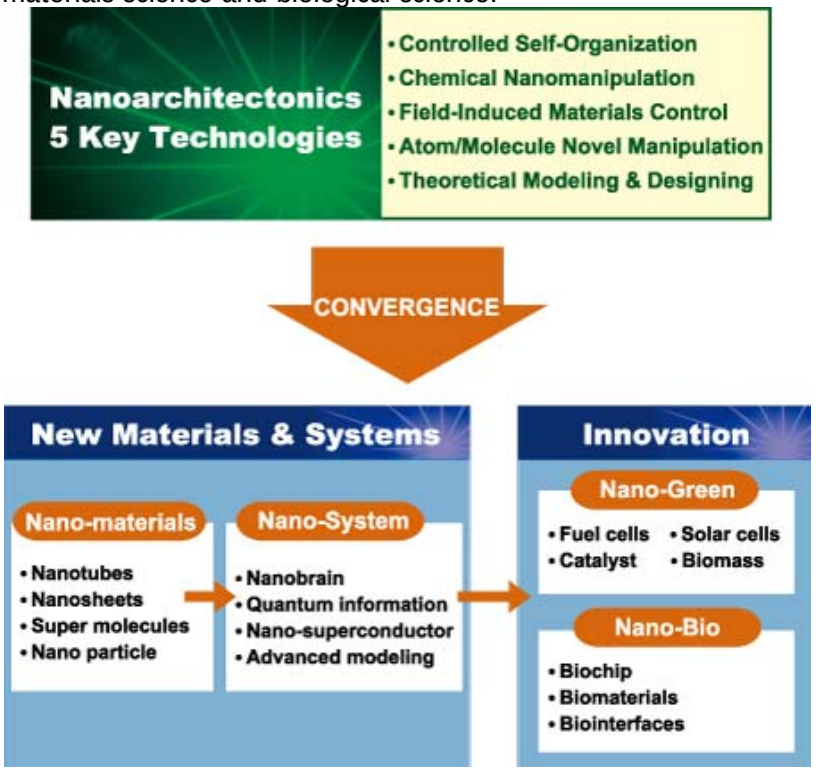


materials to produce new innovative functions for energy and environment applications.

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.



Research system of MANA

In FY2009 many outstanding research results were obtained in 4 research

Figure 1: New paradigm in material development through materials "nanoarchitectonics"

fields such as Nano-Materials, Nano-System, Nano-Green and Nano-Bio. Featured research results are shown below.

Nano-Materials Field:

Dr.Sasaki, PI has successfully assembled oversized titania nanosheets layer-by-layer into highly ordered lamellar nanostuctures. The colloidal nanosheets were found to spontaneously float at the air-liquid interface, which can be transferred onto a substrate surface. The nanosheet films obtained are expected to have promising applications as high-k nanofilms and seed layer films for growth of various functional crystals.

Nano-System Field:

Dr.Hasegawa, PI has realized an operation of neuroplasticity using an electrochemical atomic switch based on an ionic conductive material, by controlling grain size of the ionic conductive material and operating conditions. This first demonstration of the neuroplasticity by a solid-state device is expected to contribute a development of all hardware neural computing systems.

Nano-Green Field:

Dr.Ye, PI has developed a facile and effective approach for preparing core–shell Ag/AgCl hetero-nanowires with uniform structures by an in-situ oxidation reaction between pentagonal Ag nanowires and $FeCl_3$ solution at room temperature. These novel hetero-nanowires exhibit excellent photocatalytic performance for decomposition of methylic orange under visible-light irradiation.

Nano-Bio Filed:

Dr.Miyahara, PI has demonstrated an FET-based and yet "Debye length-free" molecular detection scheme by using a glucose-responsive polymer gel (NB10), serving as a chemical-electrical signal transducer. Detected FET signals during the polymer gel transition are attributable to the change in the apparent permittivity of the gel presumably due to the change in the swelling degree or the water content. It must be emphasized that many other types of stimulus-responsive gels have been reported to which the present detection scheme should be readily and universally applicable.

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.

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

<Results/progress/alternations from initial plan>

1) Composition of administrative staff

While we have added 28 new researchers since last fiscal year, the Administrative Section continues to run full-tilt with approximately the same number of staff as last fiscal year.

Planning Team: This team of 4 holds symposia and workshops, liaises with foreign satellites and other overseas research institutions, recruits foreign researchers, sends young scientists abroad, engages in public relations and oversees publications. In light of the Program Committee's comment, the team has hired 1 web expert to improve the homepage. The COVERGENCE newsletter, which is published 3 times per year, is on track with issues 2, 3 and 4 released in June, October and February, respectively.

General Affairs Team: This team of 11 handles budget management, workplace operations, salaries, official trips, scientist invitations, and accounting for materials purchases. In addition, staff provide thorough support to foreign researchers in the form of translation, interpreting and advice on daily living. We have reinforced staff and made some personnel transfers to further strengthen this team.

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.

Technical Support Team: This team of 5 handles research equipment maintenance, analyses and measurements, common technical supports for the management of labs, toxins and waste materials, advice on equipment and experiments required for research, applications for external funding and patenting of research outcomes.

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.

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.

2) Decision-making system

On October 1st, 2008 a Chief Operating Officer (COO) position was created under the Director-General, and management operations have functioned as intended under the direction of 3 executives: the Director-General, the COO and the Administrative Director. By reducing the management burden on the Director-General who is also a PI, the time he has been able to devote to research has significantly increased. Since a system is in place in which the 3 executives confer as needed to make snap decisions on issues, MANA has been able to streamline and speed-up center management.

The Administrative Director serves concurrently as the Head of the Planning Division at NIMS and attends the weekly NIMS Board Meeting thus promoting communication between NIMS and MANA and maintaining NIMS' commitment as the host institution.

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

3) Allocation of authority between center director and host institution

Regarding MANA personnel appointments, NIMS and MANA confer on tenured staff while MANA has sole discretion over fixed-term staff. Since April 2009, MANA has hired 7 tenured staff and 26 fixed-term staff. Until recently Independent Researchers were only hired as tenured staff, but with the establishment of a new fixed-term position, MANA hired 1 fixed-term Independent Researcher on its own accord.

On July 1st, 2009 the presidency of the host institution NIMS changed

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.	hands from Dr. Teruo Kishi to Dr. Sukekatsu Ushioda.

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 (1/10/2011)	Results at end of FY 2008	Results at end of FY 2009
Researchers from within host institution	14	14	16	19	20
Foreign researchers invited from abroad	4	4	7	6	5
Researchers invited from other Japanese institutions	3	3	4	5	5
Total principal investigators	21	21	27	30	30

All members

	At beginning	Planned for end of FY 2007	Final goal (1/10/2011)	Results at end of FY 2008	Results at end of FY 2009
Researchers <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%>	165 < 86,52 %> [13, 7.9%]	181 < 94,51.9 %> [22,12.2 %]
Principal investigators <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%>	30 < 10, 33.3%> [1 , 3.3%]	30 <9, 30%> [1 , 3.3%]
Other researchers <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%>	135 <76, 56.3%> [12, 8.9 %]	151 <85, 56.3%> [21, 13.9%]
Research support staffs	17	17	20	13	16
Administrative staffs	20	20	22	19	17
Total	177	177	209	197	214

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

<Results/progress/alternations from initial plan>

MANA has established satellite institutes in research centers to which external Principal Investigators are affiliated. There are currently 7 MANA satellites at the following domestic and foreign institutions: University of Tsukuba, Hokkaido University, Tokyo University of Science, University of California Los Angeles, Georgia Institute of Technology, University of Cambridge, and the Centre National de la Recherché Scientifique (CNRS; French National Center for Scientific Research) Center for Material Elaboration & Structural Studies. These satellites are involved in research in each of the fields at MANA and serve as venues for training MANA's young researchers.

University of Tsukuba

Located adjacent to NIMS, this satellite engages in frequent mutual exchange with MANA in conducting research, joint intake of American students and joint seminars and workshops. In October 2009, a symposium on advanced materials science and technology was held jointly with Taiwan's National Tsing Hua University. The details of the 3 PIs' research are as follows.

Professor Kazuo Kadowaki: Graduate School of Pure and Applied Sciences

In the Nano-System Field, Professor Kadowaki conducts cutting-edge research on quantum nanoscience that uses high temperature superconductivity.

the research of the center as the junior researchers, utilizing this collaboration system with the University of Tsukuba.	**Professor Yasuo Nagasaki**: Graduate School of Pure and Applied Sciences In the Nano-Bio Field, Professor Nagasaki researches new nanobioimaging and materials design for nanodiagnoses and treatment and evaluates of the attributes of these materials with the aim of creating novel biotools. **Associate Professor Keiichi Tomishige**: Graduate School of Pure and Applied Sciences In the Nano-Green Field, Associate Professor Tomishige conducts research on renewable, carbon-neutral biomass fuels and catalysts for converting biomass into chemical products.
・**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.	**Tokyo University of Science** **Professor Hideaki Takayanagi**: Department of Applied Physics In the Nano-System Field, Professor Takayanagi developed the nano-SQUID, or nano superconducting quantum interferometer, and conducts research on new superconducting devices. With a room and research space at MANA, PI Takayanagi works with 3 MANA Research Associates (post-doc) and 2 Assistant Professors from Tokyo University of Science to create nano-devices and elucidate their properties in super-low temperatures. **Hokkaido University** **Professor Kohei Uosaki**: Graduate School of Science, Division of Chemistry In the Nano-Green Field, Professor Uosaki conducts research on establishing methods to align highly controlled atoms and molecules on solid surfaces aiming to realize energy and highly-efficient conversion processes for materials in interfaces, especially solid-liquid interfaces. To further strengthen effective cooperation with MANA, MANA established the Nano-Interface Group at MANA in November 2009 together with PI Uosaki's lab. Hokkaido University Assistant Professor Hidenori Noguchi was appointed to MANA for this reason.
・**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	**University of Cambridge** **Professor Mark E. Welland**: Director, Cambridge Nanoscience Centre (UK) In the Nano-System Field, Professor Welland conducts research on the creation of materials triggered by the functions of biosystems (bio-inspired energy efficient materials). His research is divided into lab work and

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.

- **Georgia Institute of Technology:** 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.

- **CNRS:** 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.

computation with each section handled respectively by the University of Cambridge and the University of London. In July 2009 the University of Cambridge and MANA held a joint workshop, and 3 graduate students from this satellite came to MANA in November and December 2009 to conduct research under the supervision of MANA scientists.

UCLA

Professor James K. Gimzewski: Director, Nano/Pico Characterization Lab., UCLA (USA)

In the Nano-System Field, Professor Gimzewski conducts research on the design and creation of neural networks that simulate brain function and on X-rays. In July 2009 the Japan-UK-US Nanotechnology Summer School was held at UCLA and 29 students, including students from UCLA, MANA and the University of Cambridge satellite, conducted 5 days of research presentations and discussions. PI Gimzewski spent January through March 2010 conducting joint research at MANA. This joint research pertains to new neurocomputation circuits that use the learning functions of atomic switches. Prof. Gimzewski was featured in the NHK's satellite TV program "the Proposal for the Future" and research at MANA was introduced in the program.

Georgia Institute of Technology

Professor Zhong Lin Wang: Director, Center for Nanostructure Characterization (CNC), Georgia Tech (USA)

In the Nano-Materials Field, Professor Wang conducts research on crating and evaluating the qualities of one-dimensional nano-scale materials which are expected to increase solar cell efficiency. PI Wang also serves as mentor to a MANA Independent Researcher who frequently visits the satellite to conduct joint research on nano-devices.

CNRS

Professor Christian Joachim: Center for Material Elaboration & Structural Studies (CEMES), CNRS, Toulouse (France)

In the Nano-System Field, Professor Joachim conducts research on developing materials for next generation nano-electronics, spintronics devices and brain-like computers. In October 2009 CEMES and MANA held a joint workshop at CEMES and successfully brought together theoretical and experimental scientists. One graduate student from this satellite came to MANA between August and October 2009 to conduct research under the supervision of MANA scientists.

iii) Partner institutions

<Initial plan>

Collaborative Institutes: 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.

Overseas Offices: 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.

<Results/progress/alternations from initial plan>

In addition to the 4 overseas satellites, MANA has concluded MOUs with 15 research institutes (7 in Europe, 5 in Asia and 3 in the United States) and is engaged in joint research and personnel exchange. This fiscal year MANA concluded new MOUs with the following 7 institutes:

1) Indian Institute of Technology Madras
2) University of Cologne (Germany)
3) Swiss Federal Institute of Technology (EPFL) Lausanne
4) University of Rome Tor Vergata (Italy)
5) Heidelberg University (Germany)
6) Loughborough University (UK)
7) Lawrence Berkeley National Laboratory (USA)

In April 2009 MANA concluded a joint research agreement with the Indian Institute of Chemical Technology (IICT) to conduct research on nano-porous catalyst materials. MANA will provide 5 million yen (50,000 dollars) (Exchange Rate: JPY/USD=100) to IICT over 2 years and collaborate with IICT's outstanding researchers with the aim of speeding up this research.

In addition, NIMS opened up an overseas office at the University of Washington in Seattle, USA in April 2008, and has since conducted joint research to match the needs of US counterparts while promoting exchange among researchers, students and clerical staff. MANA PI Kenji Kitamura has made this office the base for his activities, and setup the venture company NIMBUS Technologies LLC (NIMBUS) in June 2009. The aim is to turn PI Kitamura's research output, i.e., his medical infrared light source and terahertz light source, into a business in the United States.

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

<Results/progress/alternations from initial plan>

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

Clerical work support system in English: There are 22 staff in the Administrative Section and all of them, foreign and Japanese, are fluent in English. Since more than half of MANA's researchers are foreign nationals, the 3 teams cooperate—using English as the language—to provide all researchers with quick-acting, far-reaching, Japanese-style service regardless of nationality. The WPI Administrative Section has nearly realized its mission of "providing an environment in which researchers can devote themselves to their research by reducing non-research work".

Making paper work bilingual: All major guidebooks, documents and the homepage are almost entirely bilingual, and there is a strict policy of conducting meetings and email communication in English. To encourage foreign researchers to apply for Grant-in-Aid and other external competitive funding, we provide instructions and support for completing applications in English.

Assistance for daily life: MANA subcontracts settling-in support for foreign researchers to the Japan International Science and Technology Exchange Center (JISTEC), and expenses for this are borne in full by NIMS. MANA also runs its own Japanese language and Japanese culture

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.

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).

classes for foreign researchers. Thus far we have held 3 series of Japanese language classes in which a total of 120 researchers participated and 11 courses of Japanese culture training in which 158 researchers participated.

Patent specialist: MANA employs a part-time patent specialist who is fluent in English, and he is working to turn MANA research output into protected intellectual property. This fiscal year we filed 41 patent applications.

Providing sufficient technical staff and facilitating access to equipment: The Technical Support Team of the Administrative Section currently employs 4 staff to provide assistance with experiments and device maintenance. Three of the 4 staff are retired NIMS researchers who are extremely well-versed and fluent in English. They serve as excellent advisors to all the young foreign and Japanese researchers. In addition, we added 12 shared facilities this fiscal year to bolster the research infrastructure.

2) Startup research funding

In FY2009, 2 of the external PIs conducting research at MANA were granted 20 million yen (0.2M dollars) each and 1 PI appointed last fiscal year was granted 95 million yen (0.95 M dollars) in startup research funding.

As for satellites, the 4 domestic PIs and 4 overseas PIs that are working on projects continuing from last fiscal year were allocated research funding ranging from 10 to 20 million yen each. The 14 Independent Scientists were each granted 3 million yen (30,000 dollars) and the 14 ICYS-MANA Researchers were each granted 2 million yen (20,000 dollars) in startup research funding.

44 MANA Scientists have been assigned to work under the NIMS PIs and are each granted 1 million yen (10,000 dollars) in startup research funding. Furthermore, 60 Research Associates (postdoctoral researchers), 21Junior Researchers (graduate students involved in research projects), and 9 research assistants (technicians) have been assigned to work under the PIs in a fortified research organization. (Exchange Rate: JPY/USD=100)

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.	3) Postdoctoral positions through open international solicitations
Securing young researchers including post-doctorates	**Securing young researchers including post-doctorates:** There are 2 postdoctoral researcher positions at MANA: ICYS-MANA Researcher and MANA Research Associate. The former are unsupervised, independent postdoctoral researchers who conduct research on their own accord as well as NIMS tenure-track researchers, while the latter are normal postdoctoral researchers.
International open recruiting: We will conduct international open recruiting through international publications such as "Nature" and by the 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 counties from which to recruit excellent young researchers and students. In addition, we will make our best effort to employ female young researchers and students.	**International open recruiting**: MANA conducted 1 round of international open recruiting at the beginning of FY2009 for ICYS-MANA Researchers and selected 6 from 47 applicants. One have been appointed as ICYS-MANA Researchers and 5 more are slated for appointment by the end of this fiscal year. We also appointed 23 new MANA Research Associates. Since several of the ICYS-MANA Researchers' terms will expire partway through next fiscal year, MANA held another round of international open recruiting in the latter half of this fiscal year.
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).	**Multi-national young researcher group:** As of March 2010, MANA has 12 ICYS-MANA Researchers of which 8 are foreigners. There are 60 MANA Research Associates assigned to the PIs, of which 49 are foreigners. There are 72 postdoctoral researchers, of which 57 (80%) are foreigners. MANA has achieved a truly multinational group of young postdoctoral researchers.
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 doctorial course students at present come from abroad. By extending this system, we will secure capable graduate 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

Securing Junior Researchers (graduate students)

NIMS operates the "NIMS Graduate Schools" having concluded agreements with the University of Tsukuba, Hokkaido University, Waseda University and Kyushu University, and graduate students are taught advanced research by NIMS researchers on the frontlines of their fields. As of March 2010, 17 scientists at MANA are teaching in the NIMS Graduate Schools. Students in the NIMS Graduate Schools who possess especially outstanding skills are appointed as Junior Researchers and are paid a salary for their contribution to NIMS research. As of March 2010, there are 21 Junior Researchers working at MANA, of which 17 are foreigners.

Number of MANA members at the NIMS Graduate Schools

School	No. of Faculty	No. of Students
University of Tsukuba	9	9
Hokkaido University	4	10
Waseda University	4	2

University of Tsukuba Graduate School: In September 2009, the school established a Master's curriculum in which students can take all of their required credits in English. The objective is to attract outstanding foreign students from the Master's program to the NIMS Graduate Schools.

International Joint Graduate School: The International Joint

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.	Graduate School is a program in which PhD students from renowned universities around the globe spend several months to one year researching under the supervision of NIMS researchers. As of March 2010, MANA has brought in 14 students from Moscow State University (Russia), Charles University and the University of Pardubice (Czech Republic), Xian Jiaotong University (China), Yonsei University (Korea) and Anna University (India). **Internships:** NIMS established an internship system to proactively accept students from universities throughout Japan and the world which have not concluded agreements (such as the NIMS Graduate Schools) with NIMS and provide them with opportunities to partake in materials and nanotechnology research. In FY2009 MANA has accepted 33 interns, of which 31 have been foreigners. MANA has accepted 4 interns from the NSF Summer Institute, 1 from DAAD (German Academic Exchange Service), and 1 from the Winter Institute Program of the Japan-Korea Industrial Technology Co-Operation Foundation. MANA has also welcomed 4 US students for 11 weeks from the NSF's National Nanotechnology Infrastructure Network (NNIN) Research Experience for Undergraduates (REU) Program which is in its second year.
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.	**Human resource development of young researchers**
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.	**Melting pot cultivation:** As of March 2010 MANA has 151 young researchers* from 14 countries. MANA has achieved an environment where capable multi-national youths gather at one center from around the world, and develop their talents through friendly competition. *Young researchers: MANA Scientists, Independent Scientists, ICYS-MANA Researchers, MANA Research Associates, graduate students.
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	**Mentor system:** MANA Scientists and Independent Scientists can propose which mentors they would like to work with. ICYS-MANA Researchers are first provided with an environment in which they can conduct self-motivated research, after which mentors are assigned. In this manner we have created a system in which we maintain respect for

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 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.

young researchers' autonomy while providing them with research advice.

Human resource development with the 3D system: Since the 3D System is extremely effective for cultivating a wide array of young researchers with global perspectives, MANA decided to expand the system beyond MANA Scientists and Independent Scientists to also cover ICYS-MANA Researchers starting this fiscal year. Thus far in FY2009 there are 8 researchers on this system.

Career development: Two foreign scientists have been appointed as associate professors at Nanyang Technological University (Singapore) and Uppsala University (Sweden), which indicates MANA has steadily played an integral part in the development of young researchers' career.

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

MANA is almost the perfect environment for providing swift administrative services to all researchers, be they Japanese or foreign. Staff in the Administrative Section possess the experience and know-how to handle any situation. One researcher even remarked, "I have conducted research at several institutes in the United States and Europe, but MANA has the best research environment."

In addition, there is a strict policy of conducting meetings and email communication in English, and all major guidebooks, documents and the homepage are almost entirely bilingual.

To improve the English proficiency of administrative staff in order to make management systems fully bilingual, the host institution, NIMS, has decided to initiate full-fledged correspondence education with schooling (which MANA had already established) and overseas language training for all young tenured administrative staff starting in FY2010.

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.

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

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

All tenured NIMS researchers excluding Independent Scientists are subject to an individual achievement assessment consisting of an evaluation of research achievement points (articles published, patent applications etc.) and an evaluation by their superiors. The results of the evaluation are reflected in the next fiscal year's bonus to reward researcher performance. MANA did not conduct evaluations of Independent Scientists to encourage them to steadily undertake original research, but since some Independent Scientists have started producing outstanding output, MANA has allowed these researchers the option of undergoing the FY2009 performance evaluation, giving due consideration to their motivation.

The 2nd MANA Evaluation Committee was held on March 5th, 2010. This evaluation covered research achievements released at the 3rd MANA symposium.

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 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 ㎡.

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 ㎡ 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

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

Since October 1st, 2008 the entire 13,000 m^2 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; however, with the increase in researcher numbers, office and lab space became limited, and in FY2009 we secured office and lab space for the new Nano-Interface Group outside of the MANA Building.

MANA renovated the cafeteria, presentation corner and discussion corner in the corridor on the 5th floor of the MANA Building to enhance the melting pot atmosphere.

In addition, NIMS delinked the nano-patterning line in the MANA Building which was part of our partner organization, the NIMS Nanotechnology

external organizations.

Single-occupied office and cafeteria: We will provide young researchers with a single-occupied office (approx. 12 ㎡) 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.

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.

Innovation Center, in order to establish the directly-operated MANA Foundry in April 2009. The MANA Foundry has 13 staff, and its objective is to further promote the creation of new materials and systems using nanoarchitectonics. MANA Foundry operating expenses are covered entirety by the MANA's host institution, NIMS.

Furthermore, funds for the construction of a new MANA Building were approved in the first supplementary budget for FY2009. At 6,000 m^2, the new MANA Building will be located directly to the south of the existing MANA Building, and is slated for completion by the beginning of 2012. The building will have a "Melting Pot Zone" with a cafeteria, and promote further interaction among the 4 Fields of Nano-Materials, Nano-System, Nano-Green and Nano-Bio. MANA expects this will invigorate center activities.

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

The 3rd MANA International Symposium was held from March 3rd to March 5th, 2010. Renowned researchers from around Japan and the world was invited to participate in lectures and discussions with MANA PIs and other researchers.

8) Other measures, if any

Invitation of foreign researchers: MANA has 3 researcher invitation programs to ensure that MANA is a research center that attracts all levels of researchers from around the world.

NIMS Open Research Institute Program: This program is run by NIMS and brings together all levels of researchers from young researchers to highly regarded scientists. In FY2009, 53 researchers were invited to MANA by this program.

MANA Short-Term Research Program: This is an original MANA program that invites faculty members from foreign research institutes who can conduct joint research with MANA researchers. Invitees stay at MANA for 1 to 3 months. In FY2009, 13 researchers were invited by this

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.

program.

JSPS Invitation Program: This program was funded by the first supplementary budgets for FY2009 and was held this fiscal year only. Pairs of globally-active scientists and young researchers were invited with the aim of cultivating young researchers and internationalizing the research environment. By adding NIMS subsidies MANA invited 7 renowned researchers and 11 young researchers from the West from the beginning of 2010. MANA also held a stay-over workshop in late March 2010 when more researchers gathered.

Collaboration with Universities: The FY2008 Program Committee remarked, "Since MANA is not a university, MANA should place special effort into bringing in (graduate) students in various ways" to which MANA has responded by actively convening joint workshops with universities from around the globe. Many MANA researchers also hold teaching positions at universities and they put a great deal of effort into student education.

Joint Workshops: As seen below, MANA held workshops with 6 oversea and domestic universities in FY2009. MANA aims to promote research exchange and boost MANA's name recognition in order to scout for talent.

Dates	University	Workshop Location
9/20 - 9/22	Xian Jiaotong University	Xian, China
10/10 – 10/12	National Tsinghua University	Univ. Tsukuba
10/13	University of Rome	Rome, Italy
11/12 – 11/13	Warsaw University of Technology	MANA
12/10 – 12/11	Osaka University	Osaka University
1/14	Waseda University	Waseda University

Participation in University Education: As mentioned above, 17 scientists at MANA are teaching in the NIMS Graduate Schools that includes the University of Tsukuba, Hokkaido University, and Waseda University. MANA also has 8 scientists who are supervising students from other universities as Visiting Professors.

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 31st 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 facts, MANA's self-assessment is that the Center is on course to meet the goals set for 7 years in the future.

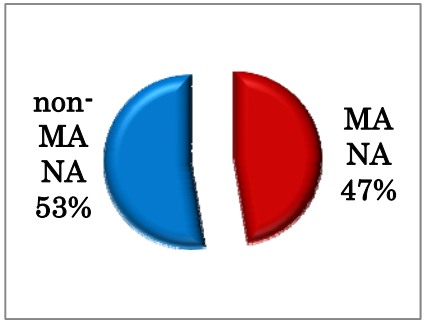
- ✓ As of March 2010, MANA boasts 214 total members, of which 181 are researchers. 94 researchers (52%) are foreign, which is well above the final 30% target for the WPI Program.
- ✓ According to the Thomson Reuters' ESI Database as of March 1st, 2010, NIMS ranked 3rd in the world for the number of citations in the materials science field over the last 5 years (January 2005 to December 2009). MANA has cleared one of 5-year mid-term objectives of ranking within the top 5 in the world.

Institutional Citation Ranking (materials science)

Rank	Institution	Citations
1	Chinese Academy of Sciences	35,377
2	Max Planck Society	15,473
3	NIMS	10,237
4	National University of Singapore	10,174
5	Tohoku University	9,984
6	MIT	8,917
7	Tsing Hua University	8,728
8	AIST	8,150
9	CNRS	7,511
10	Georgia Institute of Technology	7,339

(January 2005 to December 2009)

- ✓ 47% of the aforementioned citations are from articles written by researchers affiliated to MANA. Given the ratio of MANA-affiliated researchers in NIMS (18%), one can see that MANA's contribution is great.



MANA's contribution to NIMS citations

- 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-Plank 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).

- ✓ As of March 2010, 72 post-doctoral researchers and 21 graduate students are involved in MANA projects, and MANA is on course to achieving our goal of fostering 100 post-doctoral researchers and 50 graduate students in 5 years.
- ✓ As of March 2010, there are 41 foreign permanent researchers in NIMS, representing represents 9.6% of the total number of permanent employees. MANA is on course to achieving our goal of 10% foreigners in 5 years.

- 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.

<Results/progress/alternations from initial plan>

As of the end of FY2009, researchers participating in Center projects have secured 2.41 billion yen (24.1M dollars) in funding, of which 1,044 million yen (10.4M dollars) is external competitive funding, 233 million (2.3M dollars) is private funding and 1.14 billion (11.4M dollars) is research funding from NIMS. (Exchange Rate: JPY/USD=100)

Type	Amount of Funds	(Million yen) / (1,000 dollars)
External competitive funding		1,044
		10,444
Private funding		233
		2,329
Research funding from NIMS		1,141
		11,409
Total		2,418
		24,182

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 can be sufficiently secured as before, by continuing to allocate research funds to principal investigators from the operational subsidies.	The followings are main ptrojects of external competitive funding newly secured this fiscal year. ✓ Core Research for Evolutional Science and Technology (CREST) Liyuan Han: solar cells Katsuhiko Ariga: high-performance nano-structures Tsuyoshi Hasegawa: new axioms, new functions, new structures devices ✓ Grant-in-Aid for Scientific Research Kazuhito Tsukagoshi: Basic Research A for "Single-atom thin-film high speed transistor"

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> Since MANA was launched partway through NIMS' 2nd Mid-Term Plan (FY2006-FY2010), it was pointed out that the Center's autonomy and research project separation was not clear. In the 3rd Mid-Term Plan which is scheduled to commence from April 2011, we must clearly define the role of the MANA organization and its research within NIMS, and discussions about this are just getting underway.

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)	<Results/progress/alternations from initial plan> -Provision in host institution's mid-to-long-term plan

is the “development of innovative materials to realize a sustainable society”, and this is perfectly consistent with the 2nd 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 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.	-Concrete Measures (1) Competitive grants obtained by researchers participating in the project and in-kind contributions, etc. i) A portion of personnel costs for tenured staff engaged in the MANA project (i.e., engineers and MANA Scientists) and a portion of personnel costs for fixed-term staff (i.e., MANA research associates, Junior Researchers, administrative staff, technicians etc.) has been allocated from operational subsidies. ii) As for research projects with operational subsidies that are handled by researchers who join the center from NIMS as Principal Investigators, those research expenses have been allocated to MANA and research projects have been executed at MANA. Among competitive funding obtained by researchers who joined from NIMS, amounts equivalent to direct expenses have been allocated for projects consistent with the Center’s research plan. To support Principal Investigators, Independent Scientists and MANA Scientists in effectively commencing research in MANA, start-up funding and research expenses were allocated from operational subsidies.
(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	(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

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.	Director-General of MANA. The Director-General possesses the authority to hire, renew contracts, determine salaries and research expenses and distribute space to all 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.	(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 Thus far in FY2009 no major internal transfers have been conducted, but NIMS assigned priority positions for tenured staff in those fields required by MANA, and 7 tenured staff have been hired since April.
(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.	(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 NIMS has decided to improve the English proficiency of administrative staff with the aim of making all of the Institute's operational systems bilingual. Starting in FY2010, NIMS will primarily hire staff with advanced English fluency and has decided to initiate full-fledged correspondence education with schooling and overseas language training for all currently-employed young tenured administrative staff. NIMS plans to change its current researcher evaluation from an assessment of one fiscal year's worth of achievements to an assessment of an average of 3 years worth of achievements. By assessing a longer period of work, researchers will no longer have to struggle to produce achievements on a yearly basis, but will be able to conduct steady, well-grounded research projects. These reforms mean that the various system reforms and staff

	consciousness-raising efforts that MANA has undertaken within NIMS, i.e., administrative and technical support frameworks with English as the official language, offering Independent Scientists the option of performance-based salary weighting, and the issuing of moratoria upon these systems, etc., are increasingly permeating the host institution.
(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 ㎡ 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 ㎡ in total). We will provide approximately 1/2 span (20 ㎡) as their 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㎡) 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.	(5) Accommodation of center's requirements for infrastructural support (facilities, e.g., laboratory space; equipment; land, etc.) MANA added office and lab space for the Nano-Interface Group established in November 2009 within this fiscal year. In addition, NIMS delinked the nano-patterning line in the MANA Building which was part of our partner organization, the NIMS Nanotechnology Innovation Center, in order to establish the directly-operated MANA Foundry in April 2009. The MANA Foundry has 13 staff, and its objective is to further promote the creation of new materials and systems using nanoarchitectonics. MANA Foundry operating expenses are covered entirety by the Center's host institution, NIMS.
(6) Support for other types of assistance We assume that the center project is extremely effective in activating	(6) Support for other types of assistance NIMS expects MANA to (1) conduct and speed up cutting edge research

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.	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, in turn providing NIMS with leading researchers and establishing a NIMS tenure track system. MANA has improved NIMS' research performance and is making remarkable strides in cultivating young researchers.

11. FY 2009 funding

i) Overall project funding

(Exchange Rate: JPY/USD=100)

Cost Items	Details	Costs (10,000 dollars)
Personnel	Center director and Administrative director	35
	Principal investigators (no. of persons):18	212
	Other researchers (no. of persons):147	804
	Research support staffs (no. of persons):10	48
	Administrative staffs (no. of persons):20	86
	Total	1,185
Project activities	Gratuities and honoraria paid to invited principal investigators (no. of persons):52	16
	Cost of dispatching scientists (no. of persons):2	4
	Research startup cost (no. of persons):34	214
	Cost of satellite organizations (no. of satellite organizations):8	156
	Cost of international symposiums (no. of symposiums):1	5
	Rental fees for facilities	0
	Cost of consumables	29
	Cost of utilities	173
	Other costs	58
	Total	655
Travel	Domestic travel costs	1
	Overseas travel costs	18
	Travel and accommodations cost for invited scientists (no. of domestic scientists):13 (no. of overseas scientists):101	64
	Travel cost for scientists on secondment (no. of domestic scientists):1 (no. of overseas scientists):17	4
	Total	87
Equipment	Depreciation of buildings	265
	Depreciation of equipment	811
	Total	1,076
Other research projects	Projects supported by other government subsidies, etc.	470
	Comissioned research projects, etc.	414
	Grants-in-Aid for Scientific Research, etc.	31
	Total	915
Total		3,918

Ten thousand dollars (Exchange Rate: JPY/USD=100)

WPI grant for FY 2009 1,475

Costs of establishing and maintaining facilities in FY 2009 40

Establishing new facilities
(Number of facilities: , m²) Costs paid:

Repairing facilities
(Number of facilities: , 84 m²) Costs paid: 40

Others

Cost of equipment procured in FY 2009 1132

High speed and High precision mapping photoluminescence system
Number of units: 1 Costs paid: 32

Absolute PL quantum yield measurement device
Number of units: 1 Costs paid: 9

Zeta-potential and particle size distribution measurement device
Number of units: 1 Costs paid: 11

Spectroscopic ellipsometer
Number of units: 1 Costs paid: 26

High resolution depth profile X-ray micro spot size photoelectron
Number of units: 1 Costs paid: 63

Electrochemical SPM Systems
Number of units: 1 Costs paid: 16

Color 3D Laser Scanning Microscope
Number of units: 1 Costs paid: 15

Preparative MPLC System
Number of units: 1 Costs paid: 5

Super centrifuge
Number of units: 1 Costs paid: 4

High-temperature attachment for X-ray diffraction machine
Number of units: 1 Costs paid: 4

Electron Spin Resonance Measurement System
Number of units: 1 Costs paid: 30

Pulse Laser Deposition System
Number of units: 1 Costs paid: 46

Lease of the supercomputer
Number of units: 1 Costs paid: 95

Others 775

ii) Costs of Satellites and Partner institutions

(Exchange Rate: JPY/USD=100)

Cost Items	Details	Costs (10,000 dollars)
Personnel	Principal investigators (no. of persons):1	
	Other researchers (no. of persons):19	
	Research support staffs (no. of persons):28	
	Administrative staffs (no. of persons):1	
	Total	81
Project activities		10
Travel		5
Equipment		18
Other research projects		43
Total		157

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

-Points specified as needing improvement	-Efforts to improve them and results
(1) Making clear distinctiveness of science being pursued in MANA, if any	(1) The concept of "materials nanoarchitectonics" has become a common understanding of researchers in all areas of MANA. Among MANA's research topics, research on nano-sheets and atom switches has especially gained prominence. We anticipate practical applications for this output in the near future, and we will further promote cooperation in this field of research. Additionally, we feel it is crucial for young researchers from various disciplines to conduct joint research in order to create new research seeds via fusion research. Starting this fiscal year we adopted a fusion research subsidy system and launched 6 projects. We plan on strengthening the frameworks for fusion research going forward.
(2) Reinforcement of nano-green and nano-bio fields	(2) In November 2009 we established the Nano-Interface Group as part of Nano-Green and hired a faculty member from Hokkaido University as a MANA Scientist. We aimed to be fully operational by April 2010 and worked on securing office and lab space. In addition, we transferred a PI Prof. Yaghi from Nano-Materials to Nano-Green and newly appointed Dr.

	Takada as a new PI in Nano-Green in January 2010. In Nano-Bio, we could not add a new PI so far but keep up a search for one, preferably female. At the same time, we successfully hired a female scientist, Dr. Eriko Watanabe from Japan Women's University, as an Independent Scientist.
(3) Collaboration with universities	(3) MANA held workshops with 6 oversea and domestic universities in FY2009. MANA aims to promote research exchange and boost MANA's name recognition in order to scout for talent. As for educational activities, 17 researchers at MANA hold teaching positions and are supervising the research of 21 PhD students in the NIMS Graduate Schools that includes the University of Tsukuba, Hokkaido University, and Waseda University. We also have 8 researchers who are supervising students from other universities as Visiting Professors. In addition, MANA has accepted 14 students from 6 foreign universities with which it has concluded International Joint Graduate School Agreements. We have also proactively brought in interns from around Japan and the world with the total now standing at 33.
(4) Strategy for collaboration with oversea satellite institutions	(4) MANA succeeds in eliciting firm commitments from oversea satellites by providing them with enough funds so that they can scout good talents and build research infrastructure to conduct top world-level research as part of MANA. The PIs at the 4 foreign satellites are all renowned researchers and they play important roles in conducting research in line with MANA objectives. We have actively engaged in research exchange, holding joint workshops with Cambridge and CNRS this fiscal year. Prof. Gimzewski, satellite PI at UCLA, was featured in the NHK's satellite TV program "the Proposal for the Future" and research at MANA was introduced in the program. The satellites also play important roles in cultivating young researchers. We hold summer school programs annually with the University of Cambridge and UCLA, and the PI at Georgia Tech is serving as a mentor for an Independent Scientist at MANA. Said Independent Scientist has visited Atlanta 4 times to conduct research.