2.Summary of Proposal

(Compile in English within 3 pages.)

Host institution	National Institute for Materials Science
Head of host institution	Sukekatsu Ushioda, President
Research center	International Center for Materials Nanoarchitectonics (MANA)
Center director	Masakazu Aono
Chief center-project officer (in October 2007)	Masakazu Aono
Project summary	"Sustainable development" is the biggest issue for the 21st century of humanity. The most probable field of research that Japan can make significant contributions regarding this issue will be materials science. The center project is designed from the viewpoints of the essential importance of materials science and the necessity for an international cooperation in effectively promoting materials science. The purpose of the center is to gather excellent domestic and international scientists under an internationally-open environment, develop innovative materials that contribute to sustainable development, based on a new technology system for materials development called "nanoarchitectonics", and offer them to the world. For this purpose the center selects 24 principal investigators (9 foreigners) who have excellent abilities and careers and gathers excellent young researchers under them, forming the workforce consisting of about 230 staff in total.
Mission statement and/or center's identity	1. Promote interdisciplinary research by materials nanoarchitectonics 2. Serve as a "melting pot" where top-level researchers gather from around the world 3. Secure and cultivate outstanding, innovative young scientists 4. Construct a network of nanotechnology centers throughout the world
Research fields	**Main research field: Materials science** **Fused other research fields: Chemistry, Physics** Material is a base that supports the foundation of all fields of science and technology and is the area where Japan can best show its abilities. It is self-evident that industries and society of Japan will depend on materials in the 21st century, and it is also obvious 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 required in the 21st century, the center will work to realize a paradigm shift in materials development through a new technology system for materials development that we call "nanoarchitectonics". Nanoarchitectonics is a technology system to arrange nanoscale functional structural units as a group of atoms or molecules in an intended configuration. The technology system is critical for practical applications of nanotechnology, beyond the stage of nanoscience. Nanoarchitectonics is also a typical interdisciplinary field that relates widely to such fields as materials science, physics, and chemistry.
Research objectives	The research objective to be achieved by materials development based on nanoarchitectonics 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. **1) Development of innovative materials related to environment, energy and resource** - Superconducting materials (superconducting device, 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** - Quantum information device (quantum dot, etc.) - Atomic electronics (atomic switch, etc.) - Photonic device (quasi phase matching element, etc.) **3) Development of innovative materials that enable the development of new technologies for diagnosis, treatment and renaturation.** - Drug delivery system (stimuli-responsive polymers, etc.) - Biomaterials (biocompatible tissue engineering materials, etc.)
Outline of management	The center, as a basic principle, intends to establish the decision-making system that can support strong leadership of the center director, and therefore, it will give him the substantial authority of the center's operation in general. In other words, the center director is given the authority regarding employment, renewal of contracts, payroll, research expenses, and space allocation 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. On the other hand, it is an important characteristic concerning managerial operation in the center that the center succeeds and develops the concepts through the International Center for Young Scientists (ICYS) program, which was operated by NIMS. Utilizing the experience gained from ICYS, the center will establish a research environment which is likened to a "melting pot", gathering excellent young researchers from various countries. The center aims to bring an innovation to the fundamental and basic field of materials science, respecting as much as possible the free thinking of young researchers, generated by the stimulation in the melting pot environment. The center also utilizes this melting pot environment to foster young researchers, positioning the center as a place to foster young researchers with tenure who will create the future for NIMS.
Researchers and other center staffs, satellites, partner institutions	Principal Investigators: 25 (foreigners: 10) Total Researchers: 200 (foreigners: 120) Total Staff at the Center: 230 Highlighted PIs: M. Aono, Y. Bando, H. Takayanagi, M. Welland, J. Gimzewski, Z.-L. Wang, C. Joachim, Y. Nagasaki, K. Kadowaki, F. Winnik Satellites: Univ. Tsukuba, Tokyo Univ. Science, Univ. Cambridge, Univ. California (UCLA), Georgia Inst. Tech., CNRS, Univ. Montreal Collaborations: Inst. Physics, CAS (China), KAIST (Korea), Max Planck Inst., Charles Univ. (Czech), Univ. California (UCSB) etc.
Administrative director	Takahiro Fujita
Outline of research environment	We will take the following measures to arrange a research environment in the center: (1) establish an environment where researchers can devote themselves to research, enriching assistance related to various clerical procedures and assistance in experiments. Particularly at the center where half of the researchers come from abroad, we will develop a perfect 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; (2) provide start-up research funds to researchers invited from external organizations so that they can launch their own laboratories immediately; (3) secure capable young researchers from all over the world by utilizing ICYS' accumulated recruiting know-how. We also secure researchers including graduate students through relationships with the University of Tsukuba,

	International Joint Graduate Schools and other institutions as well as enrich the content of research education; (4) evaluate personal performances of researchers and reflect evaluation results in their salaries, with high-performance researchers receiving higher monetary awards; (5) provide total space of approximately 10,000㎡ for the research activities at the center; (6) hold an international research conference once a year to show that the center is one of the world's top-level centers in the material science field.
Outline of indicators for evaluating a center's global standing	We can cite such indicators as impactful achievements (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 amount of external funds 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 lectures, and conditions relating the number of academic society awards received. The institutional 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 it is not absolute. NIMS, host institution of the center, ranked 12th in the world for the number of citations of papers over the past 10 years in the materials science field in 2007; however, if taken statistics for the past 5 years, NIMS ranked 6th in the world, which obviously shows that the research activities in NIMS became remarkably active after it changed its organizational system to that of an independent administrative institution. We set the final goal to be the top-three of the world ranking (No. 1 in Japan) at the time of the ex-post evaluation, to get higher than the current rank, by leading the main body of NIMS, carrying out research activities at the center in a radically accelerated manner. The rank order can be deemed sufficient to position NIMS as the world's top independent materials research institute.
Securing research funding	It would be of particular note that in 2007 principal investigators of the center acquired an average of one billion yen every year for the past 3 years as the total amount of external funds. It is also worth of mentioning that NIMS allocated a total average of approximately 800 million yen per year to those principal investigators from operational subsidies. Both of these facts verify that we have reasonable direct costs to conduct world's top-level research. In 2007, we also succeeded in obtaining external funds from other MEXT projects, and therefore we believe we can keep the current level of average funds obtained, or it may exceed the current level.
Appropriations plan (Exchange Rate: JPY/USD=80)	FY 2012 2013 2014 2015 2016 Total Cost ($ millions) 16.68 16.68 16.68 16.68 16.68 83.4
Summary of host institution's commitment	The center in this concept has two aspects: (1) an advanced research implementation agency to conduct fundamental and basic research for materials, fusing fields with chemistry and physics, (2) an institution to foster researchers who create the future for material research, in an international and interdisciplinary atmosphere. Looking from the viewpoint of NIMS's main body, the center is expected to play two roles: to strongly lead NIMS in research and to provide NIMS with young researchers. Therefore, the center is definitely incorporated into the long-term strategies of NIMS's main body, and the activities are extremely effective for stimulating the whole of NIMS. For these reasons, NIMS is willing to make efforts for the center's smooth operation to the fullest, including, for example, offering of human resources, allocation of research funds, supply of research space and transfer of administration authority to the center director.

3．Research Center Project (in English)

Host institution	National Institute for Materials Science
Head of host institution	・Name, position title Sukekastu Ushioda, President
Research center	International Center for Materials Nanoarchitectonics (MANA)
Center director	Masakazu Aono
Chief center-project officer(in October 2007)	・Name, affiliation, position title (in October 2007) Masakazu Aono, National Institute for Materials Science, Fellow (Coordinating Director of Key Nanotechnologies Field)
Project summary	・Briefly describe the general plan of the project. The center develops and offers 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, research fields of the center are organized into four fields, Nano-materials, Nano-system, Nano-green and Nano-bio. We started the project with 22 principal investigators, selecting from NIMS and other domestic and overseas institutes, who have the most excellent abilities and careers. During the project, we will find additional principal investigators, resulting in a final total of about 25. Under the principal investigators, the center will arrange the lineup consisting of about 230 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 aims to stimulate research activities and bring an innovation to the fundamental and basic field of materials science, respecting as much as possible the novel and freewheeling ideas of young researchers, generated by the stimulation in the melting pot environment. The center also utilizes this “melting pot” environment to foster young researchers, contributing to the main body of NIMS by providing young staff researchers. The center will adopt unique systems to thoroughly promote the integration of different fields and to foster young researchers.
	Major changes from initial project plan: Based on the following comment from the FY2007 follow-up committee, the research organization was reorganized so that MANA’s

	policy direction was more clearly defined as striving for the innovation of materials to contribute to "sustainable development" through nanoarchitectonics: "In advancing nanoarchitectonics, the establishment and operation of the five technical groups is desirable. However, if each group conducts investigations in only its own field, it will be difficult to make breakthroughs in nanotechnology. The integration of both researchers and research contents will be essential."
Mission statement and/or center's identity	・ Briefly and clearly describe the mission statement and/or the project's identity as WPI center. 1. Promote interdisciplinary research by materials nanoarchitectonics 2. Serve as a "melting pot" where top-level researchers gather from around the world 3. Secure and cultivate outstanding, innovative young scientists 4. Construct a network of nanotechnology centers throughout the world

(1) Research fields

・ Describe in simple words and phrases within one line the research field of the project.
・ Choose relevant fields from among ①－⑦ below, specifying the interdisciplinary field(s) that the project addresses.
①Biosciences, ②Chemistry, ③Material sciences, ④Electronics engineering and information sciences, ⑤Precision and mechanical engineering, ⑥Physics, ⑦Mathematics
・ Describe the importance of the proposed research, including domestic and international R&D trends in the field and Japan's advantages.
・ If centers in similar fields already exist in Japan or overseas, please list them.

Nanotechnology and Materials Science

Main research field: ③ Materials Science
Relevant fields: ② Chemistry and ⑥ Physics

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.

(2) Research objectives

・ Describe in a clear and easy-to-understand manner the research objectives that the project seeks to achieve by the end of the grant period. In describing the objectives, the following should be articulated in an easily understandable manner: What new domains are expected to be pioneered by fusing the target fields. In the process, what world-level scientific issues are sought to be resolved. What is the expected impact of the scientific advances to be achieved on society in the future.

a) Research Objectives

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.

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

Examples:

Superconducting materials (superconducting device, 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 (quantum dot, etc.)
Atomic electronics (atomic switch, etc.)
Photonic device (quasi phase matching element, etc.)

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

Examples:

Drug delivery system (stimuli-responsive polymers, etc.)
Smart biomaterials (biocompatible tissue engineering materials, etc.)

・ Describe concretely the research plan to achieve these objectives.

b) Research plan

It was hoped that that dreamlike development would be awaiting us in the future of remarkable developments in nanotechnology. However, recently a question has arisen relating to whether nanotechnology is really developing as expected. The question arose coincidentally by the recent recognition that a sort of breakthrough is inevitable for the practical use of nanotechnology, beyond the nanoscience level. Such a breakthrough will be made by pioneering a new technology system for creation of a new function of the whole unit, by arranging individual nanostructual units that have useful functions in an intended configuration. Such a technological system is called "***Nanoarchitectonics***".

"Nanoarchitectonics" is a technological system to arrange nanoscale functional structural units as a group of atoms and molecules in an intended configuration. The purpose is to produce a new function of the whole unit through concerted interaction between nanostructures, so it is needless to say that fundamental research in the related materials science field is included. Nanoarchitectonics can be roughly classified into two fields, "NanoSystem Organization" and "NanoMaterials Creation". A typical example of the "NanoSystem Organization" is the development of a nanoelectronics circuit. Challenging electronic devices are produced experimentally, using carbon nanotubes, functional molecules, etc., but the practical use is impossible without a technology to integrate and link these devices into a system. A typical example of the "NanoMaterials Creation" is synthesis of a new material that does not exist in nature by combining and laminating heterogeneous substances with "nanosheets" that were obtained by chemical exfoliation from a layered material. With the enhancement of this technique, it will be possible to synthesize various new materials that show interesting functions.

Technologies used in nanoarchitectonics can be roughly classified into 5 techniques: (1) atom/molecule novel manipulation; (2) chemical nanomanipulation, (3) field-induced materials control; (4) controlled self-organization; and (5) theoretical modeling and designing.

Atom/molecule novel manipulation is a method to control the configuration or the coupling state of individual atoms and molecules using proximity probes including scanning tunneling microscope (STM) and atomic force microscope (AFM). Chemical nanomanipulation is a method to control nanoscale substances by skillfully utilizing chemical equilibrium states and non-equilibrium states in a liquid or solid phase, temporally and spatially. This method enables nanomanipulation of various substances. Field-induced materials control is a method which uses

changes in physical states dexterously through the intervention of electric fields, magnetic fields, electromagnetic fields (light, X-ray), and stress fields. Controlled self-organization is at the opposite end of the above atom/molecule novel manipulation. The latter is an artificial method to forcibly manipulate individual atoms and molecules, but this method relies on interactive forces specific to atoms and molecules. Hence, diverse effective nanoarchitectonics may be realized by the successful combination of both methods. Theoretical modeling and designing, or theoretical and computational approach, is quite important for conducting research effectively. More theoreticians will be integrated into the projects in order to guide and support the research.

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 this goal, the center is engaged in the development of innovative new materials in the four research fields of Nano-materials, Nano-system, Nano-green and Nano-bio by making full use of nanoarchitectonics (Figure 1).

1) **Nano-materials field**: we create inorganic and organic nanoscaled materials, seeking new or enhanced physical and chemical properties.
2) **Nano-system field**: we pay special attention to novel functionalities created by mutual interactions among individual nanostructures and construct nano-systems that utilize the created functionalities effectively.
3) **Nano-green field**: we construct highly efficient interfacial energy/materials conversion systems by arranging metal, semiconductor and organic molecules with atomic/molecular resolution.
4) **Nano-bio field**: we develop new functional biomaterials and medical devices through an active fusion of biotechnology with a wealth of knowledge in the field of materials science.

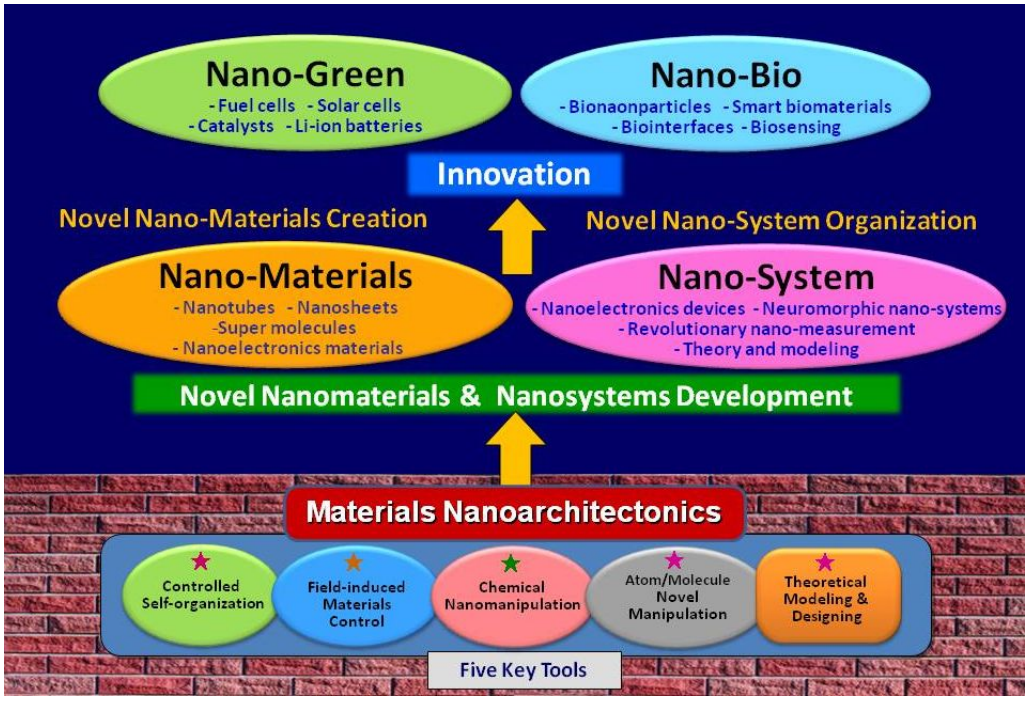

Figure 1. Four research fields of MANA

One of the aims of the WPI Program is to create new academic fields by integrating different disciplines. Together with the four research fields outlined above, we will establish a research system that encourages researchers to tackle risky yet highly rewarding research in an effort to generate novel ideas and approaches that lie beyond the purvey of existing endeavors.

(3) Management

i) Center director

・ Provide the name of the center director, his/her age (as of 1 April 2012), , specialties, and brief career profile(within 5 lines).

・ If there is a plan to change the center director, how does the new center director intend to construct the center and what is his/her vision of objectives to be achieved? Provide a synopsis written by the new center director (free format).

Name: Masakazu Aono (67 years old as of 1 April 2012)
Specialties: Nanoscience, nanotechnology, nanoelectronics, surface physics and chemistry
Biography:
1972 Doctoral degree, University of Tokyo in 1972
1972 to 1986 National Institute for Research in Inorganic Materials
1978 to 1980 Visiting professor, University of Wisconsin
1982 to 2002 Institute for Physical and Chemical Research (RIKEN)
1996 to 2005 Professor, Osaka University
2002 to present National Institute for Materials Science

ii) Administrative director

・ Provide the name of the administrative director, his/her age (as of 1 April 2012), and his/her brief career profile(within 5 lines).

Name: Takahiro Fujita (59 years old as of 1 April 2012)
Biography:
1977 Master of Engineering, University of Tokyo
1977 to 2002 NKK Corporation
1987 Master of Science, Virginia Tech
2001 to present National Institute for Materials Science

iii) Composition of administrative staff

・ Concretely describe how the administrative staff is organized.

Starting in 2003, NIMS had about five years experience in research, using English as the official language of ICYS (International Center for Young Scientists) 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 four groups including planning, general affairs, technical assistance, and outreach 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.

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- **Planning Team:** Responsible for operations regarding administration of research plans and achievements, liaison with overseas satellites, building networks, planning and holding symposiums, etc. Run by about three staff members under the supervision of the planning group leader (an internationally experienced researcher of NIMS).

- **General Affairs Team:** Responsible for general affairs, accounting, and clerical work regarding researchers' attendance record, payroll, official trips, and purchase of supplies. Run by about 12 staff members under the supervision of the general affairs group leader (a former NIMS employee who has good experience with ICYS). Especially, with the aim of reducing clerical work for researchers, we will hire about 10 secretaries, who will carry out all

the clerical work for researchers. The secretaries hired as staff members of the general affairs group must have English language skills equivalent to a TOEIC score of 800 points or more.

- **Technical Assistance Team:** 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 5 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.

- **Outreach Team:** Responsible for outreach activities such as wide-ranging publicity for WPI/MANA activities to garner public support for science and technology. Run by about three staff members under the supervision of the leader who possesses excellent outreach skills.

iv) Decision-making system

・ Concretely describe the center's 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 concerned.

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

v) Allocation of authority between the center director and the host institution's side

・ Concretely describe how authority is allocated between the center director and the host institution's side.

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

- **President:** The president, as the responsible person of the host institute, supports the center operation to the fullest extent, while respecting the authority of the director over the operation of the center. However, upon some situations such as receipt of any advice from 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.

(4) Researchers and other center staffs, satellites, partner institutions

i) The "core" to be established within the host institution

a) Principal Investigators (full professors, associate professors or other researchers of comparable

standing)

	numbers		
	At beginning	At end of FY 2011	Final goal (October, 2014)
Researchers from within the host institution	14	17	17
Foreign researchers invited from abroad	4	5	5
Researchers invited from other Japanese institutions	3	3	3
Total principal investigators	21	25	25

・ Describe the concrete plan to achieve final staffing goal, including steps and timetables.
・ Attach a list of principal investigators using the Appendix. Place an asterisk (*) by names of the investigators considered to be ranked among the world's top researchers. Describe the policy and strategy for inviting the PIs who are to be included after 1 April 2012.

b) Total members

	Numbers		
	At beginning	At end of FY 2011	Final goal (October, 2014)
Researchers	90 <56, 40%>	206 <116, 56%> [45, 22%]	200 <120, 60%> [50, 25%]
Principal investigators	21 <7, 32%>	25 <10, 40%> [2, 8%]	25 <10, 40%> [3, 12%]
Other researchers	69 <24, 40%>	181 <106, 59 %> [43, 24 %]	175 <110, 63%> [47, 27%]
Research support staffs	17	8	12
Administrative staffs	20	18	18
Total number of people who form the "core" of the research center	127	232	230

・ Enter the total number of people in the columns above. In the "Researchers" column, put the number and percentage of overseas researchers in the < > brackets and the number and percentage of female researchers in the [ ] brackets.
・ Enter matters warranting special mention, such as concrete plans for achieving the Center's goals, established schedules for employing the main researchers, particularly principal investigators.

ii) Collaboration with other institutions

・ If the "core" forms linkages with other institutions, domestic and/or foreign, by establishing satellite functions, Provide the name of the partner institution(s), and describe the role of the satellite functions, personnel composition and structure, and collaborative framework between the host institution and the said partner institutions (e.g., contracts to be concluded, scheme for resource transfer).
・ If some of the principal investigators will be stationed at satellites, attach a list of these principal investigators and the name of their satellite organizations using the Appendix.
・ If the "core" forms organic linkages with other institutions, domestic and/or foreign, without establishing satellite functions, provide the names of the partner institutions and describe their roles and linkages within the center project.

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. NIMS has successfully organized the World Materials Research Institute Forum for global networking of materials institutions. Learning from this, the center will make

efforts in global networking and global research collaboration in the field of nanotechnology and nanomaterials.

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.

Satellite Institutes: Research institutes to which principal investigators invited from external organizations belong are referred to as the satellite institutes. So far, the center set up satellite institutes at the University of Tsukuba, Tokyo University of Science, University of Cambridge, UCLA, Georgia Institute of Technology, CNRS and University of Montreal. The satellite institutes will play an important role in conducting research and are expected to be bridgeheads of the center. These satellites also serve as venues for training MANA's young researchers.

- **University of Tsukuba:** Professor K. Kadowaki and Professor Y. Nagasaki are world leading researchers on superconductivity and organic chemistry, respectively, which NIMS is not very strong. 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 strengthen and enhance the program by appointing many principal investigators who join the center from NIMS as professors of the program and accepting many capable graduate students who can contribute to the research of the center as the junior researchers.

- **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, which NIMS is not very strong. This satellite will be a bridgehead of the center to conduct joint research with the Tokyo University of Science.

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

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

- **Georgia Institute of Technology:** Professor Z. Wang is an outstanding researcher in the field of materials science, who is ranked 6th in the world, by having a total number of article citations of over 40,000. 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: over 3,000). 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.

- **University of Montreal:** Professor Francoise Winnik is a leading expert on polymer chemistry-based nano-bio research. In addition to conducting research at the University of Montreal, she is the Executive Editor of *Langmuir*. She has a lab at MANA where she spends five months out of the year conducting joint research with MANA and the University of Tsukuba satellite. While helping to bolster MANA's Nano-bio field, she has also contributed to internationalizing MANA by promoting human exchange between the two institutions.

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 200 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.

(5) Research Environment

・ Concretely describe measures to be taken to satisfy each of the requirements outlined below, including steps and timetables.

○ Provide an environment in which researchers can devote themselves exclusively to their research, by exempting them from other duties and providing them with adequate staff support to handle paperwork and other administrative functions.

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.

- **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.

- **Assistance for daily life**: We will improve the support system for foreign researchers and their families to set themselves up for living in Japan, such as housing search, medical care, education and job search for the spouse to eliminate various barriers that foreigners encounter when they come to Japan. We subcontract this settling-in support for foreign researchers to a specialized agency.

- **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 5 people including researchers retired from NIMS.

○ Provide startup research funding as necessary to ensure that top-caliber researchers invited to the center do not upon arrival lose momentum in vigorously pursuing their work out of concern over the need to apply immediately for competitive grants.

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 20 million yen 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 about 10 million yen. Young researchers such as post-doctorates will be allocated a start-up research fund as necessary to an amount of up to 10 million yen. On average, one principal investigator will conduct research with a group of 6 young researchers including 2 NIMS researchers, 2 post-doctorates and 2 junior researchers (graduate students).

○ As a rule, fill 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. In addition, we will make our best effort to employ female young researchers and students.

Securing young researchers including post-doctorates

- **International open recruiting:** We will conduct international open recruiting through international publications such as "Nature" and by the recommendation from the executives of more than 200 research institutes which NIMS is affiliated with. Young researchers refer to those who obtained their Ph.D within the last 10 years.

- **Multi-national young researcher group**: Through ICYS activities, we have proven that the stimulative, 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.

- **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. 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 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 to other universities, 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 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.

- **Internships:** NIMS established an internship system to proactively accept students from universities throughout Japan and the world which have not concluded agreements with NIMS and provide them with opportunities to partake in materials and nanotechnology research.

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

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

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

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

○ Establish English as the primary language for work-related communication, and appoint 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:

- **Orientation:** We hold regular English orientations and lab tours for newly appointed NIMS researchers to ensure that new researchers can begin their research at NIMS immediately. We provide information required for research, such as work regulations, benefits, research administration (equipment purchasing, official trips etc.), intellectual property, research ethics, applications for external funding, safety, etc., and tours of the primary research facilities.

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

- **NIMS Research Guide**: We will make a booklet about information on NIMS research activities. 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. 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.

○ Adopt a rigorous system for evaluating research and a system of merit-based compensation. (For example, institute a merit-based annual salary system primarily for researchers from outside the host institution. As a basic rule, the salaries of researchers who were already employed at the host institution prior to the centers' establishment are to be paid by the host institution.)

At the center, we will establish a flexible result-reward system 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 10 to 20 million yen, depending on their performance. Salaries of the fixed-term young researchers such as post-doctorates will be more than about 5 million yen, and will be assessed by their performance.

- **Individual performance evaluation and reward system:** Permanent NIMS researchers are subject to a personal performance evaluation that takes into account papers, patents and other research output. Performance evaluation results are reflected in the following year's bonus, with high scoring researchers receiving higher monetary awards based on the number of points received.

- **The center evaluation committee:** We will set up a center evaluation committee which consists of external experts (about 50% are foreigners. An external expert will be appointed to act as chair) to evaluate the management of the center and research activities every two years.

- **Term of a principal investigator:** The term of a principal investigator shall be 5 years. 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.

○ Provide equipment and facilities, including laboratory space, appropriate to a top world-level research center.

- **Space of the center:** For the research activities at the center, NIMS will provide total space of approximately 10,000 m^2.

- **Space for experimentation:** We will provide office space and laboratory rooms in MANA Building only for young researchers, including post-doctorates, who conduct their research independently (about 4,000 m^2 in total). We will provide approximately half a room as experimental space. We will provide necessary and sufficient space to principal investigators invited from external organizations.

- **Single-occupied office and cafeteria:** We will provide young researchers with a single-occupied office 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 discussions, including a cafeteria.

- **Research equipment:** We will secure world's top-level advanced facilities with high commonality, in cooperation with NIMS in a well-planned manner.

○ Hold international research conferences or symposiums regularly (at least once a year) to bring the world's leading researchers together at the center.

To show that the center is one of the top world-level centers in the materials 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.

○ Other measures to ensure that top-caliber researchers from around the world can comfortably devote themselves to their research in a competitive international environment, if any.

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

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

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

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

- **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.

- **Invitation program:** We will invite faculty members from foreign research institutes who can conduct joint research with MANA researchers for 1 to 3 months.

- **Sabbatical leave program:** We will send principal investigators and young scientists to foreign research institutes to conduct joint research for 1 month to 1 year.

- **Collaboration with Universities:** We will actively convene joint workshops with universities from around the globe. Many MANA researchers will also hold teaching positions at universities and put a great deal of effort into student education.

(6) Indicators for evaluating a center's global standing

・ Describe concretely the following points.

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 institutional 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

Based on the facts listed below, we believe our undertakings are making excelling progress toward achieving our goal of "becoming a top-echelon research base to which researchers from around the world wish to be associated."

- NIMS ranked 5th in the world for the number of institutional citations in the materials science field over the last 5 years (January 2006 to December 2010).
- NIMS is the No.1 institute in the materials science field in the institutional citation ranking in Japan.
- The amount of external funding acquired has increased by 1.63 times compared to FY2008.
- As of March 31, 2012, 206 researchers are affiliated with MANA. Of these, 116 researchers, or 57%, are foreign nationals. In addition, many researchers from Japan and abroad visit MANA. In this way, MANA is becoming an international research center that attracts researchers from around the world.

iii) Goals to be achieved through the project (at time of final evaluation)

- 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 field of materials science 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 Society, Germany because of the size difference. Therefore, NIMS set its goal to be in the world's No.3 (which corresponds to No.1 among single institutions).
- NIMS will be the No.1 institute in the materials science field in the institutional 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 FY2007.
- 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 25 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-doctorates.

- Of young researchers at NIMS, 20% will be non-Japanese.

(7) Securing research funding

Future prospects

・ Describe the concrete prospects for securing resources that match or exceed the project grant.
・ Calculate the total amount of research funding (e.g., competitive funding) based on the percentage of time the researchers devote to research activities at the center vis-à-vis the total time they spend conducting research activities. Be sure the prospects are realistically based on the past record.

・ Based on the past record, describe the concrete prospects for securing resources that match or exceed the project grant.
・ Calculate the total amount of research funding (e.g., competitive funding) based on the percentage of time the researchers devote to research activities at the center vis-à-vis the total time they spend conducting research activities ("Effort ②" in Appendix 2). Be sure the prospects are realistically based on the past record.

As for projects with operational subsidies that are handled by researchers who join the center from NIMS as principal investigators, NIMS will allocate the research expenditure for those projects to the center to implement the project at the center. In addition, part of operating expenses necessary for center's activities such as purchasing of new equipments, exploratory research funding, operation of common facilities, satellite institutions funding, scientist exchanges, holding symposia and outreach activities will be allocated from NIMS operational subsidies.

Also, among competitive grants obtained by researchers who join the center from NIMS, NIMS will allocate an amount equivalent to the direct costs to the center, if the research plan is consistent with that of the center. MANA's researchers continue to capture large-scale competitive funding, and the amount of external funds they acquire is growing steadily.

Others

・ Describe activities and initiatives to be taken after project funding ends.
・ Describe expected ripple effects (e.g., how the research center project will have trailblazing components that can be referred to by other departments in the host institution and/or other research institutions when attempting to build their own top world-level research centers).
・ Describe other important measures to be taken in creating a world premier international research center, if any.

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.

5. Host Institution's Commitment (in English)

February 9, 2012

To MEXT

National Institute for Materials Science (NIMS)

Sukekatsu Ushioda, President

I confirm that the measures listed below will be taken faithfully regarding "**International Center for Materials Nanoarchitectonics**" adopted under the World Premier International Research Center Initiative.

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

・ Describe clearly the host institution's mid-to-long-term strategy plan and how the center is positioned within that strategy.

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 materials research in an international and interdisciplinary atmosphere.

The objective related to (1) is the "development of innovative materials to realize a sustainable society", and this is consistent with the midterm objectives and midterm plan of NIMS. Accordingly, the center can be positioned as an organization which will play a principal role to lead the main body of NIMS by carrying out 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. The center is also positioned as a place to foster world-class young scientists and to supply tenured researchers to NIMS.

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>

・ Describe the concrete measures that the host institution will take to satisfy the following requirements.

(1) How it will support the center's need to secure resources that match or exceed the project grant through such means as competitive grants obtained by researchers participating in the project, in-kind contributions and other forms of assistance by the host institution (including partial payment of salaries, provision of research space), and/or external donations.

NIMS will support the center in the following manner.

i) Personnel expenses of some NIMS permanent staff (such as researchers with tenure and clerical staff) and some non-permanent staff who join the center will be allocated from operational subsidies and other funds of NIMS.

ii) As for projects with operational subsidies that are handled by researchers who join the center from NIMS as principal investigators, we will allocate the research funds for those projects to the center to implement the project at the center. Among competitive grants obtained by researchers who join the center 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) Part of operating expenses necessary for center's activities such as purchasing of new equipment, exploratory research funding, operation of common facilities, funding satellite institutions, scientist exchanges, holding symposia and outreach activities will be allocated from NIMS operational subsidies.

iv) We will secure sufficient space mainly at the MANA Building in the Namiki Site.

v) Other than the above, we will give additional assistance for budgeting and space as needs arise.

(2) How it will institute a system under which the center's director is able to make substantive personnel and budget allocation decisions necessary to implementing the center project—a system, which in practice, allows the center director autonomy in making decisions regarding the center's operation.

The center director is given the authority for the center's general operation by the president of NIMS. In other words, the center director has the authority to recommend employment, renewal of contracts, determination of research expenses, and allocation of 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.

(3) The support it will provide to the center director in coordinating with other departments within the host institution when recruiting researchers for the center, 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 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, necessary human resources can be supplied to the center from the main body of NIMS. We believe such mobility of human resources between the center and the main body of NIMS will stimulate both organizations.

(4) Its flexibility in applying, revising, or supplementing the host institution's internal systems as needed for the center to effectively implement 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). Such a flexible and distinctive management style can be adopted to the center as an extension of the above operations experienced. Furthermore, we are planning to actively adopt the center's successful management systems to the main body of NIMS.

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

For the research activities at the center, we will provide a space, approximately 10,000 m^2 for research, mainly at the MANA Building in the Namiki Site. The space will be used to secure the following:

Space for experimentation:

We will provide offices and laboratories at the MANA Building for young researchers such as post-doctoral fellows who will proceed with their research independently (about 4,000 m^2 in total). We will provide approximately 1/2 span as their laboratories. We will provide necessary and sufficient space to principal investigators invited from external organizations.

Single-occupied office and cafeteria:

We will provide young researchers with a single-occupied office (approx. 12 m^2) 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 offices together in one place, and secure enough space for discussions, including a cafeteria. At the center, we will utilize single-occupied offices which are currently used by ICYS.

We will allow researchers at the center to freely use research equipment and facilities such as Nano Foundry that NIMS possesses, and will make an effort to accommodate their needs for the use

as a priority. Furthermore, we will secure world's top-level advanced facilities with high commonality, in cooperation with the center in a well-planned manner.

(6) Other types of assistance it will provide to give maximum support to the center in achieving its concepts and objectives and becoming a world premier international research center in both name and deed.

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

（Appendix）

(in English)

List of Principal Investigators

・If the number of principal investigators exceeds 10, add columns as appropriate.
・Place an asterisk(*) by the name of the investigators who are considered to be ranked among the world's top researchers.
・Give age as of 1 April 2012.
・For investigators who cannot participate in the center project from 1 April 2012, indicate the time that their participation will start in the "Notes" column.

Name	Age	Current affiliation (organization, department) and specialties	Academic degree	Notes
① AONO, Masakazu*	67	Nano-System Organization Unit, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Specialty on NanoSciene and Nanotechnology	Ph.D., The University of Tokyo(1972)	
② BANDO, Yoshio*	64	Inorganic Nanostructures Unit, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Specialty on Nanomaterials and Transmission electron microscope	Ph.D., Osaka University(1975)	

（Host institution：National Institute for Materials Science　Abbreviation of the Center：MANA）

（Appendix）

③	SASAKI, Takayoshi*	56	Soft Chemistry Unit, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Specialty on Nanosheet and Softchemistry	Ph.D.(Science), The University of Tokyo, (1986)	
④	GOLBERG, Dmitri*	51	Nanotubes Unit, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Specialty on nanotubes and nanowires	Ph.D., Moscow Institute for Ferrous Metallurgy (1990)	
⑤	ARIGA, Katsuhiko*	49	Supermolecules Unit, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Specialty on Supramolecular Chemistry and Surface Science	Ph.D., (Engeering), Tokyo Institute of Technology(1990)	

（Host institution：National Institute for Materials Science　Abbreviation of the Center：MANA）

（Appendix）

⑥	CHIKYOW, Toyohiro	52	Nano-Electronics Materials Unit, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Specialty on Semiconductor and electric materials	Ph.D., Waseda University (1989)	
⑦	NAKAYAMA, Tomonobu	50	Nano Functionality Integration Unit, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Specialty on Scanning Probe Microscopy and Surface Physics	Ph.D., The University of Tokyo(1999)	
⑧	HASEGAWA, Tsuyoshi	49	Atomic Electronics Unit, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Specialty on Nano-devices	Ph.D. (science), Tokyo University of Science(1996)	

（Host institution：National Institute for Materials Science Abbreviation of the Center：MANA）

（Appendix）

⑨	HU, Xiao	50	Nano-System Theoretical Physics Unit, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Specialty on condensed-matter-physics	Ph.D., (Physics), The University of Tokyo(1990)	
⑩	TSUKAGOSHI, Kazuhito	44	π-Electron Electronics Unit, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Specialty on Nano electronics	Ph.D., Osaka University(1995)	
⑪	UOSAKI, Kohei*	65	Nano Interface Unit, International Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS), Specialty on Surface Physical Chemistry	Ph.D., The Flinders University of South Australia(1977)	

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