

FY 2008 WPI Project Progress Report

World Premier International Research Center (WPI) Initiative

Host Institution	Tohoku University	Host Institution Head	Akihisa Inoue
Research Center	Advanced Institute for Materials Research	Center Director	Yoshinori Yamamoto

Summary of center project progress

The Institute is based on the following three principles: (1) To carry out innovative studies in materials science and establish a world-class research center at Tohoku University; (2) To establish the best system for a world-class research center at the Institute by reviewing traditional Japanese research and management systems; (3) To promote international cooperation and establish a "visible center" through joint research with networks and satellites in and outside Japan. We hope that as a result of implementing plans based on these principles, excellent researchers will come together and world-class research projects will be carried out at the Institute

To be more specific:

(1) We will merge the five existing fields of physics, chemistry, materials science, electronic engineering/informatics, and precision/mechanical engineering, and create new fields in materials science. To that end, 29 Principal Investigators (PI) have been divided into four groups: (i) bulk metallic glasses (BMG); (ii) nanophysics; (iii) nanochemistry; and (iv) device/system construction. Thus, we aim to promote not only cooperation among groups, but also collaborative studies. With the bulk metallic glasses group, researchers around the world are now interested in our Institute because of the discovery/creation of the pioneering and original BMG by PI Inoue. Thus, the Institute is growing into a truly worldwide research center. In addition, PI Inoue and Prof. Johnson of the California Institute of Technology, a leader in metallic glasses studies in America, received the James C. McGroddy Prize for New Materials from the American Physical Society. This means that the importance of this area and studies at the Institute are being widely acknowledged.

(2) The Advanced Institute for Materials Research at the WPI Research Center is regarded as a unit of Tohoku University and PIs are full-time researchers at this Institute. The proposals made as part of our application are being steadily carried out for system reform.

Posts for associate professors, assistant professors, and postdoctoral researchers were offered widely all over the world, and people with excellent talents have been employed. PIs are supposed to use English for communication, while all administrative staff also have a good command of English. As for the environment for research, particularly in terms of space, the first stage of construction work for the new buildings was completed and the second stage has been also completed. The remodeling of existing buildings has been completed and all PIs invited from other institutions inside Japan have moved in and started their studies without any problems.

(3) With regard to international cooperation and construction of an overseas network, we have established our first satellite in England. Since research related to BMG is one of the most important research themes for the Institute, the European satellite was set up at the University of Cambridge, which will function as an overseas base for BMG-related research. The creation of a network for nanophysics and nanochemistry (or nanoscience including both) is being promoted mainly by respective PIs' universities and research institutions. Researchers engaged in the establishment of devices/systems are connected with our partners or satellites in Europe and America, and it will be possible for them to cooperate with each other. The second workshop was held in March 2009, with the participation of many overseas researchers, including as PIs and their co-researchers. They discussed and sought themes for cooperative research/interdisciplinary research, not only among WPI researchers, but also non-WPI researchers. In addition, we have assigned researchers who are closely related with the Institute through joint research projects with PIs as WPI adjunct professors or WPI adjunct associate professors. Thus we are expanding our network to establish a WPI research network that widely covers the world.

In light of the above, we believe that progress at our Institute has been favorable.

1. Summary of center project

<Initial plan>

The main objective of the Center is to promote the development of new materials under a world-leading organization for interdisciplinary research in functional materials, by use of an innovative method of atomic and molecular control, departing from the typical approaches and moving towards the next generation. In addition to basic research, the Center will pursue (1) the creation of new compounds and materials with innovative functions which exceed existing ones, (2) the construction of devices based upon a new fundamental paradigm, and (3) the promotion of applied research projects on materials and systems architecture that will generate direct societal impacts. In addition, the Center will establish innovations in understanding diverse material functions through the creation of new basic materials and compounds which brings significant benefits for the future of humanity.

A wide range of materials including metals, semiconductors, superconductors, ceramics, and organic and biological compounds will be the subjects of our investigation, aiming at the creation of innovative functions: (1) the creation of new structural materials, electronic materials, nanomolecular materials, materials for surface and interface systems, and materials having molecular assembling properties; (2) the development and elaboration of these materials leading into devices and systems; and (3) the construction of new architectures, using these devices and materials leading to the betterment of society. Synergy between the above three stepwise strategies is anticipated, and the merging of the five research fields (physics, chemistry, materials science, electrical engineering, and mechanical engineering) is strongly thrust to the forefront, and thereby we are convinced that the WPI Research Center for Atom-Molecule-Materials must be established at Tohoku University. "From atom and molecule to social welfare through materials" is the guiding principle for the center as outlined in the detailed items on the research theme and the organization of the center.

<Results/progress/alternations from initial plan>

In compliance with our three basic principles shown in (1) to (3), basic and applied research is being promoted smoothly.

The research items are shown on the left, and we have built up a research organization so that not only research in each of these areas can be deepened but also synergy effects can be produced by interdisciplinary/cooperative research.

Also, we have established an institute management system where the Institute Director is responsible for decision making.

We have established a satellite at the University of Cambridge and created some overseas tie-up centers in Europe, America and Asia. In the meantime, we have assigned outside researchers who are closely related with the Institute through joint research projects with PIs as WPI adjunct professors or WPI adjunct associate professors. Thus we have strengthened international and domestic cooperation.

2. Research fields

<Initial plan>

(Research fields) "From Atom and Molecule to Materials," means the merging of physics, chemistry, materials science, and engineering to generate functional materials.

(Relevant fields) Chemistry, materials sciences, electronics engineering and information sciences, Precision and mechanical engineering, physics.

Our project addresses the inter-disciplinary fields consisting of the above five disciplines.

(Importance) Materials science is one of the most important fields for the future of science and technology in Japan as well as in the world. Materials science is the most important basis for all materials in our present society and should be continued as a core technology in future in order to maintain the current high technology endeavors in our country.

The research activities of materials science at Tohoku University have been world class. Our present research activities and their excellence over those of European and American countries in material science should be maintained and, in the next 10 years, extended to the discovery of new materials and compounds with innovative functions by the combination of the above five disciplines to produce devices and systems applicable and useful to the benefit of society. Furthermore, it is expected that an entirely new paradigm will be born through the fusion approach.

<Results/progress/alternations from initial plan>

To fuse the five academic fields, we selected and assigned researchers from respective fields to PIs and started interdisciplinary research with a total of 29 members; 19 from Japan and 10 from European countries and America. Four interdisciplinary research groups, namely those for bulk metallic glasses, nanophysics, nanochemistry, and device/system construction, were organized for interdisciplinary research covering the existing five science fields and efforts are being made to promote such research. Furthermore, as explained in "1. Summary of center project," we have introduced the adjunct professor system and are expanding international and domestic cooperative networks aiming to create a huge network of materials science.

3. Research objectives

<Initial plan>

The main objective of the Center is to promote the development of new materials under a world-leading organization for interdisciplinary research in functional materials, by the use of an innovative method of atomic and molecular control, departing from the typical approaches and moving towards the next generation. In addition to basic research, the Center will pursue (1) creation of new compounds and materials with innovative functions which exceed existing ones, (2) construction of devices based upon a new fundamental paradigm, and (3) promotion of applied research projects on materials and systems architecture that will generate direct societal impacts. In addition, the Center will establish innovations in understanding diverse materials functions through the creation of new basic materials and compounds which brings significant benefits for the future of humanity.

<Results/progress/alternations from initial plan>

For bulk metallic glasses, studies on the production of larger-sized BMG are showing satisfactory progress. A research project to apply smaller-sized BMG to magnetic materials is also progressing. In nanophysics, PI Kawasaki succeeded in observing the quantum hall effect in an oxide compound for the first time. The development by PI Takahashi of a photoemission spectroscopy device for measuring the physical properties of superconducting matter leads the world. In nanochemistry, the development of pentacene single crystals on the interface between solid and liquid by PI Itaya and the development of soft materials by PI Nishi are worth attention. In the device/system construction field, it is expected that PI Omi will achieve super high-performance ULSI using new silicon technology. Similarly favorable results have been achieved in other fields, as well.

4. Management

<Initial plan>

1) Composition of administrative staff

Our administrative staff provide logistic support which allows researchers to conduct their studies flawlessly. We also intend to actively invite eligible experts who can handle proactive research development, and together with the researchers, aid in the expansion of research results. Consequently, this formation can significantly contribute to the Center's research goal activities.

Specifically, daily routines such as in accounting, human resources and research support are managed by highly experienced staff who can accomplish their duties without difficulty. They will be selected mainly from intramural administrative staff. To satisfy the requirements for the Center's official language, which is English, staff who have supportive abilities in English language will be preferentially assigned, and external staff with a good command of English are also planned to be recruited. Besides the duties above, a Program Officer, Project Manager, and other senior positions will be occupied by excellent and experienced personnel from various fields including researcher evaluation, international research coordination, activating expansion of and public relations for research results, and planning and support of research workshops. We will proactively hire diverse professionals; not only experienced at the University, but also from the private sector and non-Japanese with international experience, former researchers etc., utilizing an annual salary system.

2) Decision-making system

In the bid for a rapid and flexible decision making process, we will not specifically launch a decision making organization, but set up a top-down command system governed by our Center Director.

Aimed at support for a Center Director's top-down decision making system, an International Advisory Board, which includes Nobel Laureate board members, is to be established directly under the Center Director position. We will also develop a proper environment utilizing Internet technology, so that the Center Director and board members can effectively exchange and share their views together on implementation of system reform and other issues for creation of a world premier international research center.

<Results/progress/alternations from initial plan>

1) Composition of administrative staff

As a result of the reorganization, the administrative work system consists of four sections; General Affairs, International Academic/Research Cooperation, Accounting, and Property Management Sections. As of April 1, four people were employed as full-time administrative staff at the Institute, selected from staff members who had been engaged in highly specialized duties in accounting and personnel affairs at the University. Additionally, as in fiscal 2007, experts on laws/regulations, personnel/salaries, financial affairs, research support, international exchange, etc. who are working for the administration department at head office of host institution were assigned as concurrent staff at the Institute, as a means for the administration department to support the Institute by assisting the Institute's full-time administrative staff. Some additional associate staff were also employed to help with the execution of tasks in English and ensure smooth operation of the laboratories. A deputy director of the administration department has been appointed to support the administrative director. In fiscal 2007, the deputy director had a concurrent post in the administration department at head office. However, a full-time deputy director was assigned as an assistant to supervise the administration department as of April 1.

As mentioned above, additional full-time administrative staff were employed while the building exclusively for the administration department was prepared, resulting in the establishment of a research support system. In the meantime, because research and administration buildings were interspersed, branch of the administration department has been set up in that research building that is far from the administration building for the convenience of researchers.

In addition to administrative staff, technical staff were employed as research support staff on an annual salary system from people in and outside the University who are engaged in facility maintenance, network systems and safety management.

2) Decision-making system

We still do not have a decision-making scheme under the council system. Decisions are made using a top-down method by the Institute Director, in a flexible and prompt manner.

In addition, PI liaison meetings are held when necessary, where PIs share information and exchange opinions about the operation of the Institute with the Institute Director, so that the Institute can operate smoothly.

Also, the university will implement a taskforce team in the Administration Bureau, led by the Office of the President, which will activate environmental improvements for Center Director top-down management to bring flexible approaches, and revisions and betterment of the university's system at the Center Director's request.

3) Allocation of authority between center director and host institution

To secure the independence of the center administration, the host institution will limit its authority to extremely important items such as the appointment and dismissal of the Center Director, and leave all other personnel, budget execution and other items effectively under the discretion of the Center Director.

For personnel matters, the host institution will only retain authority over the appointment and dismissal of the Center Director, and have all other personnel items within the center including the employment of lead researchers determined by the Center Director.

The budget allotted to the center (personnel expenses and non-personnel expenses) will be turned over in its entirety for free execution at the judgment of the Center Director, and it will be possible to carry over funds allocated for budget items that are not implemented by the end of the fiscal year to the subsequent fiscal year.

3) Allocation of authority between center director and host institution

The Institute Director continues to make all judgments related to the operation of the Institute as stated in the initial plan so that the Institute can be managed independently. On the other hand, the host institution has authority only over very limited important matters such as decisions on the assignment or dismissal of the Institute Director.

The Institute Director also makes final decisions on the appointment of researchers and implements the budget at his discretion.

5. Researchers and center staffs

i) "Core" to be established within host institution

Principal investigators

	At beginning	Planned for end of FY 2007	Final goal (Date: month, year)	Results at end of FY 2007	Results at end of FY 2008
Researchers from within host institution	15	15	15	15	15
Foreign researchers invited from abroad	11	11	11	11	10
Researchers invited from other Japanese institutions	4	4	4	4	4
Total principal investigators	30	30	30	30	29

All members

	At beginning	Planned for end of FY 2007	Final goal (Date: month, year)	Results at end of FY 2007	Results at end of FY 2008
Researchers <Number of foreign researchers among them and their percentage> [Number of female researchers among them and their percentage]	60 < 19, 31%>	90 < 28, 31%>	120 < 38, 31%>	42 < 16, 38%> [2, 5%]	83 < 33, 40%> [5, 6%]
Principal investigators <Number of foreign researchers among them and their percentage> [Number of female researchers among them and their percentage]	30 < 12, 40%>	30 < 12, 40%>	30 < 12, 40%>	30 < 12, 40%> [0, 0%]	29 < 11, 38%> [0, 0%]
Other researchers <Number of foreign researchers among them and their percentage> [Number of female researchers among them and their percentage]	30 < 7, 23%>	60 < 16, 26%>	90 < 26, 27%>	12 < 4, 33%> [2, 17%]	54 < 22, 41%> [5, 9%]
Research support staffs	44	44	53	1	13
Administrative staffs	35	35	40	16	26
Total	139	169	213	59	122

<p>ii) Satellites <Initial plan> <u>Institution (1)</u> -Role -Personnel composition and structure -Collaborative framework <u>Institution (2)</u></p>	<p><Results/progress/alternations from initial plan> In fiscal 2007, we considered setting up a satellite at the IBM Thomas J. Watson Research Center as an American base for nanophysics. It was agreed, however, that overseas satellites should specialize in bulk metallic glasses for the time being, which is the top priority subject of the Institute, and joint research with European BMG groups should be promoted preponderantly. Accordingly, a satellite was established at the University of Cambridge. In addition, discussions are under way for cooperation with the Osaka Center for Industrial Materials Research at the Institute for Materials Research, Tohoku University, which will work as a domestic satellite. The realization of this plan is expected to lead to further progress in practical studies in the development of industrial infrastructure materials. <u>Institution (1)</u> The University of Cambridge -Role Joint research that is both wide and deep into the creation, characterization, functional evaluation, and theory establishment, etc. of bulk metallic glasses -Personnel composition and structure Alan Lindsay Greer, Shantanu Madge (Postdoc) -Collaborative framework Expands the network based on the University of Cambridge in cooperation with the other European BMG group (Alain Reza Yavari).</p>
<p>iii) Partner institutions <Initial plan> <u>Institution (1)</u> University of Wisconsin-Madison -Role Joint research in nanophysics -Personnel composition and structure Max G. Lagally (PI) -Collaborative framework Promotes joint research in nanophysics. Arranges postdoctoral researcher and assistant professors, etc. <u>Institution (2)</u> Grenoble Institute of Technology -Role Joint research into bulk metallic glasses -Personnel composition and structure Alain Reza Yavari (PI) -Collaborative framework</p>	<p><Results/progress/alternations from initial plan> <u>Institution (1)</u> University of Wisconsin-Madison -Role Joint research in nanophysics -Personnel composition and structure Max G. Lagally (PI), Shelley Ann Scott (Assist. Prof.) -Collaborative framework Promotes joint research in nanophysics. Scott has been appointed as an assistant professor at UWM while the joint research system is being developed. <u>Institution (2)</u> -Role Joint research into bulk metallic glasses -Personnel composition and structure Alain Reza Yavari (PI), Konstantinos Geogarakis (Postdoc), Kateryna Chrnokhvostenko (Technical staff)</p>

Promotes joint research into bulk metallic glasses. Arranges postdoctoral researchers and assistant professors, etc.

Institution (3) IBM Thomas J. Watson Research Center

-Role

Joint research in nanophysics

-Personnel composition and structure

Rudolf M. Tromp (PI)

-Collaborative framework

Promotes joint research in nanophysics. Specifically, arranges postdoctoral researchers and assistant professors, etc., whose main work centers on research into surface physics and surface chemistry.

Institution (4) University of Massachusetts Amherst

-Role

Joint research into high polymer chemistry and soft materials

-Personnel composition and structure

Thomas P. Russell (PI)

-Collaborative framework

Promotes joint research into high polymer chemistry and soft materials. The partners in Japan should be PIs Nishi and Shimomura. Arranges postdoctoral researchers and assistant professors, etc.

Institution (5) Chemnitz University of Technology

-Role

Joint research into MEMS

-Personnel composition and structure

Thomas Gessner (PI)

-Collaborative framework

Promotes joint research into MEMS. The main partner in Japan is PI Esashi, and other engineering system researchers will participate. Arranges postdoctoral researchers and assistant professors, etc.

-Collaborative framework

Promotes joint research into bulk metallic glasses. Yavari has visited WPI several times, making active efforts to promote joint research with the BMG group. Also, as a member of a partner organization of the European satellite (The University of Cambridge), he made particular efforts for stationing personnel.

Institution (3) IBM Thomas J. Watson Research Center

-Role

Joint research in nanophysics.

-Personnel composition and structure

Rudolf M. Tromp (PI), Abdullah Al-Mahboob (Assist. Prof.) –transferred to PI Hashizume group as of October 2008

-Collaborative framework

Promotes joint research in nanophysics. Al-Mahboob has been appointed as an assistant professor at Sendai while the joint research system is being developed.

However, Tromp resigned PI on October 1, 2008 owing to unavoidable engagement that he must concentrate and focus his own research at IBM Center. Accordingly, IBM Center is apart from our partner institution.

Institution (4) University of Massachusetts Amherst

-Role

Joint research into high polymer chemistry and soft materials

-Personnel composition and structure

Thomas P. Russell (PI)

-Collaborative framework

Promotes joint research into high polymer chemistry and soft materials. Within the framework of joint research, we accepted a student on doctoral course from Russell's laboratory at UMA as a visiting scientists.

Institution (5) Chemnitz University of Technology

-Role

Joint research into MEMS

-Personnel composition and structure

Thomas Gessner (PI), Yu-Ching Lin (Assist. Prof.)

-Collaborative framework

Promotes joint research into MEMS. Lin has been appointed as an assistant professor at Sendai while the joint research system is being developed.

Institution (6) University College London

-Role

Joint research into surface physics and theoretical research

-Personnel composition and structure

Alexander Shluger (PI)

-Collaborative framework

Promotes joint research into surface physics and theoretical research. The main partner in Japan is the theory group (PIs Tsukada and Tokuyama), and an experiment system group will be added. Arranges postdoctoral researchers and assistant professors, etc.

Institution (7) The University of Cambridge

-Role

Joint research into bulk metallic glasses

-Personnel composition and structure

Alan Lindsay Greer (PI)

-Collaborative framework

Promotes joint research into bulk metallic glass. Arranges postdoctoral researchers and assistant professors, etc.

Institution (8) Institute of Chemistry, Chinese Academy of Science

-Role

Joint research in nanochemistry and surface chemistry

-Personnel composition and structure

Li-Jun Wan (PI)

-Collaborative framework

Promotes joint research in nanochemistry and surface chemistry. Arranges postdoctoral researchers and assistant professors, etc.

Institution (9) The Pennsylvania State University

-Role

Joint research in nanophysics

-Personnel composition and structure

Paul S. Weiss (PI)

-Collaborative framework

Promotes joint research in nanophysics. Arranges postdoctoral researchers and assistant professors, etc.

Institution (6) University College London

-Role

Joint research into surface physics and theoretical research

-Personnel composition and structure

Alexander Shluger (PI), Peter Sushko (Assoc. Prof.-from Apr to Dec 2008, Adj. Assoc. Prof.-from Jan 2009), Thomas Treventon (Assist. Prof.)

-Collaborative framework

Promotes joint research into surface physics and theoretical research. The joint research system is being reorganized by allocating Sushko as an associate professor and Treventon as an assistant professor at Sendai. In the meantime, Shluger and researchers in Shluger's laboratory at UCL have visited WPI several times, promoting the establishment of a system for joint research within the physics group.

Institution (7) The University of Cambridge

-Role

Joint research into bulk metallic glasses

-Personnel composition and structure

Alan Lindsay Greer (PI), Shantanu Madge (Postdoc)

-Collaborative framework

Promotes joint research into bulk metallic glasses. As the European satellite, joint research will progress significantly. Madge has been appointed as a postdoc at Sendai while the joint research system is being developed.

Institution (8) Institute of Chemistry, Chinese Academy of Science

-Role

Joint research in nanochemistry and surface chemistry

-Personnel composition and structure

Li-Jun Wan (PI), Rui Wen (Postdoc)

-Collaborative framework

Promotes joint research in nanochemistry and surface chemistry. Wen has been appointed as a postdoc at Sendai while the joint research system is being developed.

Institution (9) The Pennsylvania State University

-Role

Joint research in nanophysics

-Personnel composition and structure

Paul S. Weiss (PI)

-Collaborative framework

Promotes joint research in nanophysics.

Institution (10) Johns Hopkins University

-Role

Joint research into bulk metallic glasses

-Personnel composition and structure

Kevin J. Hemker (PI)

-Collaborative framework

Promotes joint research into bulk metallic glasses. Arranges postdoctoral researchers and assistant professors, etc.

Institution (11) Tsinghua University

-Role

Joint research in nanophysics

-Personnel composition and structure

Qi Kun Xue (PI)

-Collaborative framework

Promotes joint research in nanophysics. Arranges postdoctoral researchers and assistant professors, etc.

Institution (12) Tokyo Institute of Technology

-Role

Joint research into high polymer chemistry, soft materials, and the properties of high-polymer solid state materials

-Personnel composition and structure

Toshio Nishi (PI)

-Collaborative framework

Promotes joint research into high polymer chemistry, soft materials, and the properties of high-polymer solid state materials. Arranges postdoctoral researchers and assistant professors, etc.

Institution (13) Waseda University

-Role

Joint research into solid-state properties theory

-Personnel composition and structure

Masaru Tsukada (PI)

Institution (10) Johns Hopkins University

-Role

Joint research into bulk metallic glass

-Personnel composition and structure

Kevin J. Hemker (PI)

-Collaborative framework

Promotes joint research into bulk metallic glasses.

Institution (11) Tsinghua University

-Role

Joint research in nanophysics

-Personnel composition and structure

Qi Kun Xue (PI), Hongwen Liu (Assist. Prof.)

-Collaborative framework

Promotes joint research in nanophysics. The joint research system is being reorganized, allocating Liu as an assistant professor at Sendai.

Institution (12) Tokyo Institute of Technology (PI Nishi was transferred to the Center at Tohoku University from April 2008.)

-Role

Joint research into high polymer chemistry, soft materials, and the properties of high-polymer solid state materials

-Personnel composition and structure

Toshio Nishi (PI), Ken Nakajima (Assoc. Prof.), Sou Fujinami (Postdoc), Dong Wang (Postdoc)

-Collaborative framework

Promotes joint research into high polymer chemistry, soft materials, and the properties of high-polymer solid state materials. The joint research system is being reorganized, allocating Nakajima as an associate professor and Fujinami and Wang as postdoctoral researchers. In the meantime, PI Hashizume is promoting joint research as an adjunct professor of TIT.

Institution (13) Waseda University (PI Tsukada will be transferred to the Center at Tohoku University from April 2009.)

-Role

Joint research into solid-state properties theory

-Personnel composition and structure

-Collaborative framework
Promotes joint research into solid-state properties theory. Arranges postdoctoral researchers and assistant professors, etc.

Institution (14) Advanced Research Laboratory, Hitachi Ltd.

-Role
Joint research into the properties of solid-state surfaces and nanophysics
-Personnel composition and structure
Tomihiko Hashizume (PI)
-Collaborative framework
Promotes joint research into the properties of solid-state surfaces and nanophysics. Arranges postdoctoral researchers and assistant professors, etc.

Institution (15) The University of Tokyo

-Role
Joint research into crystal interfaces and theory
-Personnel composition and structure
Yuichi Ikuhara (PI)
-Collaborative framework
Promotes joint research into crystal interfaces and theory. Arranges postdoctoral researchers and assistant professors, etc.

Masaru Tsukada (PI), Kazuto Akagi (Assoc. Prof.), Akira Masago (Postdoc), Hiroyuki Tamura (Assist. Prof.)

-Collaborative framework
Promotes joint research into solid-state properties theory. The joint research system is being reorganized, allocating Akagi as an associate professor, Tamura as an assistant professor, and Masago as a postdoctoral researchers.

Institution (14) Advanced Research Laboratory, Hitachi Ltd.

-Role
Joint research into surface physics and nanophysics
-Personnel composition and structure
Tomihiko Hashizume (PI), Taro Hitosugi (Assoc. Prof.), Katsuya Iwaya (Assist. Prof.), Nobuyuki Fukui (Postdoc)
-Collaborative framework
Promotes joint research into surface physics and nanophysics. The joint research system is being reorganized, allocating Hitosugi as an associate professor, Iwaya as an assistant professor, and Fukui as a postdoctoral researcher.

Institution (15) The University of Tokyo

-Role
Joint research into crystal interfaces and theory
-Personnel composition and structure
Yuichi Ikuhara (PI), Susumu Tsukimoto (Lecturer), Mitsuhiro Saito (Assist. Prof.), Zhongchang Wang (Postdoc)
-Collaborative framework
Promotes joint research into crystal interfaces and theory. The joint research system is being reorganized, allocating Tsukimoto as a lecturer, Saito as an assistant professor, and Wang as a postdoctoral researcher.

6. Summary of center's research environment

<Initial plan>

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

We will arrange the environment so that the researchers participating at this Center can devote themselves exclusively to research to the greatest possible extent. The environment the Center provides for PIs is similar as that provided for Distinguished Professors in the US.

We will make arrangements so that the researchers themselves will not be involved in the managerial work of the host institution, provide detailed time management (effort management) for the researchers, and otherwise secure ample time for the researchers to engage in research at this Center as much as possible.

We will also prepare strong staff backup for accounting, personnel, research support, liaison and public relations work so that the researchers can devote themselves to research. The function of staff will be to implement various procedures and management tasks on behalf of the researchers. In addition to individuals who will perform day-to-day accounting and other administrative tasks, we will assign as program officers other individuals with outstanding experience in fields such as researcher evaluation, international research coordination, the ordered development of research findings, the publication of research findings, and the planning and support of research conferences. To these ends, in addition to utilizing university staff, we will make use of the annual salary system to actively employ individuals with experience in the private sector, foreigners (individuals with international experience), distinguished researchers, and other diverse personnel. We will also assign the technical staff required for the smooth progress of the research.

Besides the scientific and research issues, it is necessary to provide PIs not only with sufficient facilities and space in laboratories, but also with an enjoyable living environment at home, especially for people from abroad. We will do our best to arrange a comfortable environment.

2) Startup research funding

At the discretion of the Center Director, the necessary start-up funds will be provided in cases when the invited researchers require funds to continue their own research vigorously when they are initially transferred to the center.

We will also promptly provide the invited researchers with opportunities for brainstorming and research and information exchange with Tohoku University researchers and for examining the potential for joint research at the university, support their access to common university experimental and other facilities, and otherwise support the vertical advance of their research.

<Results/progress/alternations from initial plan>

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

At the time of application, we proposed offering an environment equivalent to that offered to Distinguished Professors in the United States, and as the first step, we have paid each full-time PI at the Institute an extra allowance of 100,000 yen a month since the foundation of the Institute. The Institute introduced this system independently before any other organization at the host institution. The host institution later introduced the same system as well. Furthermore, the Institute Director has requested the departments involved not to let researchers who belonged to the host institution before the Institution was founded involve themselves in administrative tasks for the host institution or in educational activities in principle, unless the researchers themselves want to, so that the researchers can have sufficient time for their research activities.

We have agreed that additional research support staff would be employed in step with the future development of the facility environment. This fiscal year, full-time technical staff were employed to be in charge of safety management, facility maintenance, and network systems. With administrative staff, additional full-time employees were employed to be stationed in the administration building which is used exclusively for the administrative tasks of the Institute. Also, administration branch was set up in research building which is far from the administration building for the convenience of researchers. In the meantime, most of the documents have been replaced with English versions for the convenience of researchers from other countries.

For accommodation, we have preferentially offered intramural staff apartments to Japanese researchers for the time being. For researchers invited from abroad, we are currently establishing a system in cooperation with an estate agent to offer apartments on a monthly basis, etc.

2) Startup research funding

The research system of the Institute consists of four research groups: bulk metallic glasses, nanophysics, nanochemistry, and device/system groups. In fiscal 2007, the costs paid by each group to purchase research equipment which is indispensable, fundamental, and used in common to promote research were covered by the start-up fund. This fiscal year, the fund continued to be used for groups which needed to introduce additional research equipment to improve the research infrastructure.

3) Postdoctoral positions through open international solicitations (Recruitment Method)

In the recruitment of post-doctoral researchers, we will secure superior international personnel via international recruitment using Tohoku University's website (English and Japanese), international scientific journals, and Tohoku University's overseas bases, specifically as follows:

- 1) International recruitment via Tohoku University's website (English and Japanese)
- 2) International recruitment through recruitment advertisements in *Nature*, *Science* and other international scientific journals, and in the publications of academic societies in which the lead researchers are members
- 3) International recruitment via the website of the JREC-IN (Japan Research Career Information Network) personnel database (English and Japanese) administered by the Japan Science and Technology Agency
- 4) International recruitment using Tohoku University's US office, China office, and other overseas offices and bases, and by asking renowned universities worldwide to post the recruitment information on their websites, including global universities which have academic exchange agreements with Tohoku University (119 institutions), and members of university consortia (The Association of East Asian Research Universities [AEARU], etc.)
- 5) Other international recruitment utilizing the international networks that the lead researchers have developed in each academic field.

(Employment Screening Method)

Post-doctoral researcher employment screening committees comprised of several members will be organized for each lead researcher, with the lead researcher serving as the committee chairperson. The post-doctoral candidates will be determined through an initial selection by examination of documents and a secondary selection by interviews. The final employment decisions will be made by the Center Director. This process will positively employ post-doctoral researchers with superior results in interdisciplinary research as well as in their field of specialization, in order to promote comprehensive interdisciplinary research efforts.. The Center Director will directly make the employment decisions to secure promising post-doctoral researchers in accordance with the center concept.

(Employment of Female Researchers)

We have an employment plan that the percentage of female researchers including postdoctoral fellows among all the researchers of WPI reaches at least

We held workshops, inviting domestic and overseas researchers, and research meetings for respective groups, to offer opportunities for cooperation regardless of research themes as well as for active exchanges of opinion and information, which are expected to lead to better research results in the future.

3) Postdoctoral positions through open international solicitations

We continued to invited researchers publicly and internationally through our website, major international magazines, etc. aiming to secure excellent talent continuously, and received more than one hundred applications from inside and outside Japan.

For fields directly related to PIs, the relevant PIs examined the documents (and interviewed applicants when necessary) as in the previous fiscal year and selected appropriate candidates. Final decisions to employ them as basic researchers were made by the Institute Director.

The Institute Director also employed interdisciplinary researchers at his own discretion, giving priority to interdisciplinary research areas involving PIs engaged in different fields, and employed female researchers.

10%, hopefully, in between 10 and 20%.

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

We will prepare an environment which permits researchers to carry out their work duties in English.

We will prepare an environment whereby the exchanges between researchers and administrative staff can always be conducted in English right from the launch of the center by assigning multiple staff members to each section who can perform their work duties in English.

To these ends, we will assign university staff with superior English skills, in addition to expertise in such fields as accounting, personnel and research assistance, as administrative staff on a priority basis. Additionally, to supplement the English abilities of those staff, we will also secure administrative staff who are proficient in English by utilizing dispatched workers and the annual salary system to employ outside personnel, to assign to the center administrative staff who can execute work duties in English.

Furthermore, we will arrange systematic opportunities for administrative staff to participate in English training and constantly improve their English ability (including English in areas of expertise).

Documents for internal use that must be filled out personally by the researchers will be prepared in English, so that the foreign researchers will be able to submit all relevant documents.

We will also incrementally boost the ability to use English in the performance of duties at the center, and progressively shift to a system whereby English will become the official language for all meetings inside the center and English will be used whenever possible for all documents drafted inside the center.

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

As for the evaluation of researchers, Tohoku University has already stipulated a university-wide method for the assessment of individual faculty, with a researcher evaluation scheme at each department. The performance of center researchers will be strictly evaluated in accordance with this system, and the researchers' salary assessments (pay-raise system and diligence allowance) and incentives such as priority allocation of research funds will be determined based on the evaluation results. For salaries in particular, in addition to the active adoption of the annual salary system, special allowances will be granted to researchers who make outstanding contributions.

We will establish an international advisory board, including Nobel Prize recipients as members, and an external evaluation board. They help to evaluate not

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

We have full-time administrative staff with good English skills, who were selected from University employees specializing in accounting, personnel affairs, research support, etc. To add to this, we have employed associate staff with a good command of English as assistants to support them, and thus established an administrative structure that will enable them to carry out their tasks in English.

Following the previous fiscal year, we offered language training courses, which were carried out by an external organization on consignment, in order to improve the English ability of the administrative staff. We will continue offering such courses in the following fiscal years to further improve their language ability. Such efforts are expected to result in the upgrading of the administrative structure.

English versions of most of the application forms for internal use that must be filled out personally by researchers have already been prepared. Thus efforts are being made to allow overseas researchers to prepare their applications and associated documents entirely in English.

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

For evaluating individual researchers, we have set evaluation criteria based on the ideal way of evaluating individual teachers that has been adopted by our host institution, and use them to evaluate the research results every year. We use the results of the evaluation when making an assessment for pay raises and promotion, while also using them to decide on whether to renew the appointment of researchers when their term of office expires. For new researchers who are employed from outside the host institution, we have introduced an annual salary system, and introduced a system in which pay increments can be set freely by the Institute Director according to our evaluation of the researcher's ability. We have been providing full-time PIs with an extra allowance (100,000 yen a month) since the foundation of the Institute. This allowance can also be increased, depending on the

only the research of individual PI but also the system and organization of the WPI center.

Additionally, “invitation allowances” (maximum period of 5 years) will be granted to prominent invited researchers from outside the host institution in accordance with their research accomplishments and most recent salaries.

Moreover, new systems will be introduced including a “Fellow Professor” (tentative name) system for professors playing leading roles in the research, as well as a system for preparations payments or contract conclusion payments to provide additional incentives when trying to attract Nobel Prize–class researchers, etc.

Tohoku University’s “University Professor System” will also be actively used for the invitation of prominent researchers.

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

To prepare a facilities environment suitable for a global top-level center, the host institution will operate a new core facility (building) for the center’s activities so it can be used from around April 2008 as a target date. This facility will be equipped with flexible water supply and drainage equipment, air conditioning equipment, and power sources so that it can be a research space that meets the respective room arrangement, equipment, apparatus and other usage demands of the individual researchers. Considering the great importance of information exchange and brainstorming among the researchers, the researchers’ office wing will be arranged with a library section, discussion corners and other spaces where the researchers can gather in a central zone, with the individual offices located on the outskirts of this common area. The security arrangements will ensure safety by zone, covering each research room or each department and the entire building. Energy conservation equipment will be adopted to mitigate pressure on research funds.

In addition to this new building, research space in existing buildings will also be used to conduct the business of center research. In those cases as well, while there will be some limitations on the room arrangements, the research rooms and offices will be upgraded as deemed suitable for a global top-level center with improvements based on the above approach, starting with reinforcement of the structures’ earthquake resistance.

Private-sector facilities will also be actively utilized to flexibly secure sufficient research space in accordance with the progress of the research.

Arrangements will be made to provide the researchers with priority access to high-performance electron microscopes and other state-of-the-art research equipment through close coordination with the Technology Center for Research and Education Activities and other related Tohoku University organizations.

evaluation.

It has been agreed that when inviting renowned researchers from outside the host institution, we should adopt a flexible pay system to provide them with an invitation allowance, preparation allowance, contract conclusion allowance, etc.

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

The first stage (3,650 m²) of the integration laboratory building exclusively for Institute use was completed at the end of fiscal 2007, while part (2,500 m²) of the strategic common-use space held by the host institution was offered to the Institute following the renovating of existing buildings. The existing space (4,500 m²) will continue to be used by PIs who belonged to the host institution before the foundation of the Institute so that their successors can be fostered (for the education of students). In addition, the administrative building (300 m²) was prepared available to the Institute, making a total Institute space 10,950 m² by the end of fiscal 2007. The second stage of construction of the integration laboratory building (5,350 m²) was completed at the end of 2008. It is designed as an open laboratory with a mechanical space that can be flexibly used for various research projects and equipped with a full-scale security system that covers the entire building while monitoring individual laboratories independently. In addition to the individual laboratories, the second stage of the laboratory building will have an "Innovation Space" for researchers for information exchange and brainstorming among researchers to create new ideas. To add to this, the new building which is to be completed by the host institution at the end of fiscal 2009 is expected to have a dedicated space for the Institute to hold international conferences etc. (about 1,000 m²).

For the research facilities, we will consider measures to organically coordinate the start-up facilities installed for the Institute with the state-of-the-art facilities offered by the Technology Center for Research and Education Activities of the host institution.

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

We will advance international development via researcher and other personnel exchanges and institutional relations for international joint research by positively utilizing Tohoku University's US office, China office, 11 liaison offices and other overseas offices and bases, and via liaison with global universities which have academic exchange agreements with Tohoku University (119 institutions), and members of university consortia (The Association of East Asian Research Universities [AEARU], and Top Industrial Managers for Europe [TIME]).

Specifically we will first organize an international materials cooperation support committee among leading global universities to advance research on the topic "new substances and materials from atomic and molecular control, and functional innovation" and establish a structure to advance research and development under international institutional cooperation.

Then, using this international consortium along with Tohoku University's existing global network described above, we will arrange periodic opportunities for mutual exchange including the short-term overseas dispatch of center researchers and the invitation of global researchers to Japan, hold pacesetting cutting-edge international research conferences assembling top-level global researchers on a regular basis, and otherwise prepare an environment in which the center's researchers can engage in international research exchange, information exchange and brainstorming with the world's leading researchers.

8) Other measures, if any

We will advance the following approaches to build a center that compiles and advances the latest global information and research, and attracts the top minds initiating dramatic scientific developments.

1) We will establish an international advisory board, including Nobel Prize recipients as members. The names of the members are following; Dr. Hans H. Rohrer (Switzerland, 1986 Physics Nobel Laureate), Prof. Herbert Gleiter (Director, Institute for Nanotechnology Research, Karlsruhe), Prof. Robert J. Silbey (Dean, College of Science, MIT), Prof. Robert J. Birgeneau (Chancellor, Univ. California, Berkeley), Prof. Bing-Lin Gu (President, Tsinghua Univ. Beijing), Prof. K. Osterwalder (President, The UN University and President, ETH Zurich), Mr. Tadashi Onodera (President, KDDI Corp). They will report directly to the Center Director to support top-down type decision making by the Center Director. The Center Director and the international advisory board will organically cooperate and exchange opinions, and positively implement reforms to promote a global top-level research center. Further, the evaluation of accomplishments of researchers, which will be carried out every year, and the other evaluation events such as the recruitment of postdoctoral fellows will be performed based on advice of peer

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

To support the existing representative offices in the United States and China, liaison offices, etc. of Tohoku University, the Institute has incorporated into itself and developed the organization and the function of an International Frontier Center for Advanced Materials (IFCAM), which was an organization affiliated to the Institute for Materials Research and functions as an international think tank and as a recruitment center in the field of advanced substances/materials science. Thus we are ready to establish an international consortium.

A workshop was held on March 1-6 this year. PIs of the Institute including foreign researchers, joint researchers, domestic/foreign materials researcher communities, and members of the International Advisory Board, Nobel laureates in physics, Dr. Rohrer and Dr. Bednorz, were invited to the workshop. Each PI did not only report on their research activities to date, but also announced achievements and policies in the future research activities of the Institute, especially focusing on interdisciplinary research fields.

8) Other measures, if any

1) The International Advisory Board is to be established as originally scheduled and Dr. Georg J. Bednorz, a Nobel laureate in physics in 1987, was newly added as a member of the Board. And we are studying introduction of a "Network Discussion System" to contribute to efficient coordination between the Institute Director and the Advisory Board. This system will enable us to give guidance/advice, evaluate the activities of each PI, and carry out a review of the employment of post-doctoral researchers, etc.

2) In the research system at the Institute, researcher groups are classified into four: bulk metallic glasses, nanophysics, nanochemistry, and device/system construction. One feature of the Institute is that a PIs term of office is five years. International open recruitment will be held for all positions including those currently occupied and support for young researcher's blue-sky research (research that does not need the permission of a professor). To meet these appointment conditions and produce research results based on a fusion between the research fields at the Institute, not only young researchers but also PIs are encouraged to join two or more groups (with each choice being related to the researcher's major and minor subjects). In addition, a non-hierarchical research structure has been created.

<p>reviewers consisted of top class researchers from abroad and from domestic institutes.</p> <p>2) We will arrange a flat research organizational structure with as few hierarchical relations as possible to create an environment where even young researchers can develop their own ideas.</p> <p>3) We will provide young researchers with research support from senior mentors and otherwise promote the organic development of research.</p> <p>4) We will assign the necessary technical staff to ensure the smooth development of research apparatus to support superior state-of-the-art research and creative research.</p> <p>5) We will prepare a system to provide highly detailed lifestyle and education advice to support the daily life in Japan of foreign researchers at the center and the education of their children. For example, concerning schooling and education of researchers' children, Tohoku International School (having kindergarten, elemental school, junior high school, and high school) accepts children from abroad, so researchers can focus their research without being bothered by educational problem. Further we consider about possibility for supporting the expenses for children's education. Not only Tohoku International School, but also the ordinary schools nearby Tohoku University are used to accepting children from abroad. We contact the regional public organizations, which founded such schools, and intend to ask them cooperation on the acceptance and education of children from abroad.</p>	<p>3)/4) It is assumed that the development of staff as senior mentors and technical staff should be improved in conjunction with the future development of facilities.</p> <p>5) For overseas researchers' living in Japan, we are establishing a system in cooperation with an estate agent who can offer monthly apartments at short notice to resolve the residence issue, and to arrange education for their children, Tohoku International School that offers education from kindergarten to high school levels is available in the city. In the future, to improve the educational environment for the children of overseas researchers, we hope to request the cooperation of the host institution in constructing a system that can accept children through the coordinated efforts of, for example, Tohoku University and regional schools (from elementary school to high school).</p>
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7. Criteria and methods used to evaluate center's global standing

<p><Initial plan></p> <p>i) Criteria and methods to be used for evaluating the center's global standing in the subject field</p> <p>We evaluate each PI and researcher by the following indicators; publication in internationally well-recognized top-class journals, citation number of those papers, invited and plenary lectures at the well-recognized international symposiums, receiving international awards, and acquisition of research funds. As possible as we can, we want to use numerical and objective factors for evaluation. The center's global standing is primarily evaluated by the ranking of institutions of each discipline, based on citation analysis made by ISI. Besides, other factors, such as visible contribution to society by providing really useful materials, are used for evaluation.</p> <p>ii) Results of current assessment made using said criteria and methods</p> <p>Evaluation of the PIs based on the above criteria is attached to their CVs. The institution ranking of material science in TU is the number 3 among 536 institutes in the world. According to the citation analysis, Max-Planck is the number 1 and Chinese Academy is the number 3 in materials science, but they are large</p>	<p><Current assessment></p> <p>There have been no modifications to the index or evaluation techniques. Good news is shown below.</p> <p>(1) PI Inoue and PI Russell were elected as a member at the National Academy of Engineering (NAE).</p> <p>(2) PI Inoue received the James C. McGroddy Prize for New Materials from the American Physical Society.</p> <p>(3) PI Miyazaki received the Oliver E. Buckley Condensed Matter Prize from the American Physical Society.</p> <p>(4) Not having been received specific prizes yet, however, research achievements of PI Takahashi, PI Shimomura and PI Kawasaki were reported in some medias.</p>
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organizations including several independent institutions in different cities. The ranking of physics in TU is the number 9 among 592 institutes, and that of chemistry is the number 18 among 774 institutes in the world.

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

As one of the outcomes, in the basic research fields, we strongly expect the world premier award in science will be given to a researcher (or hopefully researchers) in our institute, at the very least a world top-class international award will go to researchers. Also, it is expected that the ISI citation ranking of Tohoku University will be elevated dramatically. In the applied research fields, we are sure that many new systems will be developed on the basis of the newly created materials with their innovative functions will become commercially realizable and contribute very much to society's wellbeing. We think that the second issue (contribution to social welfare) is more and more important than the first one for evaluating accomplishments in our WPI center. In the interim, the relative indicators similar as above mentioned will be employed.

8. Securing competitive research funding

<Initial plan>

i) Past record (dollars)

FY2007 6,914,000

ii) Prospects after establishment of the center

The host institution constructs a new building for the WPI research center until April, 2008. The salary for PIs, who have been researchers at each institute or Faculty in TU, is essentially paid by TU, even after they join the WPI center. Further, the fund for research, setting up instruments and equipments necessary for research at the Center, renovation of research space and laboratory, and smooth management of the Center will be supported by TU. For this purpose, TU will prepare approximately 1700000 US \$ annually.

Besides the supports from TU mentioned above, the PIs joining from TU have obtained the research funds of approximately 11000000 US \$ from outside in 2006 fiscal year, so we expect that similar amounts of research funds (or even greater amounts) will be obtained by them in future.

<Results/progress/alternations from initial plan>

FY2008 12,831,000 USD (exchange rate: JPY/USD=120)
(1,539,695,000 JPY)

PIs joining from Tohoku University obtained the research funds from of over 11,000,000 USD from outside in 2008 fiscal year.

In the meantime, the second stage of construction of the integration laboratory building (5,350 m² / 770,000,000JPY) will be completed by the end of fiscal 2008 by the host institution.

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

<Initial plan>

After the implementation term of this program is completed, the center will continue with its activities in order to enhance the potential for research at this center.

Also, within this program, we will actively introduce new research methods incorporating new concepts into the existing graduate course and research center at our university.

Noteworthy of Tohoku University, is its offering of the Institute for International Advanced Research and Education Organization (established in April, 2007) on basis of the 21st Century COE Program achievements. Incorporating the Institute for International Advanced Research and Education (initiated in April, 2006), it supports the graduate students who pursue integrated research; and the Institute for International Advanced Interdisciplinary Research (introduced in April, 2007) which promotes research in the many areas. We will initiate and develop a method reform and human resources cultivated in this center for enhancing the level of the fusional areas, fostered into the organization's activities, to rank as one of the best centers in the world. In order to insure that the research institutes collaborate intimately and to increase its research abilities of emerging or fusional areas, we contemplate about the reorganization and integration of existing graduate course and research center in our university as well.

<Results/progress/alternations from initial plan>

(i) Extensive introduction of system reform technique developed at the Institute into the host institution

At the time of application, we proposed offering an environment equivalent to that offered to Distinguished Professors in the United States, and as the first step, we have paid each full-time PI of the Institute an extra allowance of 100,000 yen a month since the foundation of the Institute, October 2007. In line with this, the "Tohoku University Distinguished Professor System" was introduced in December 2007 for the host institution too, in accordance with the decision by the President and a mechanism to provide University personnel playing leading roles in education, research, social contributions, etc. with an extra allowance has been introduced.

(ii) Pursuing the potentials of reorganization and integration of the existing research courses and laboratories

Our future vision for the Institute is to form a unique and incomparable international materials science research center, based on the results of past research on materials science at Tohoku University as well as international exchanges resulting from those activities. As the International Frontier Center for Advanced Materials (IFCAM), an organization affiliated to the Institute for Materials Research, already functions as an international think tank as well as a recruitment center in the field of advanced substances/materials science, the host institution has positively incorporated its function into the Institute and we are making good use of it.

10. Host institution's commitment

<Initial plan>

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

Tohoku University will clearly stipulate the advance of research and organizational development based on this program as a priority in its interim plan.

Specifically, the relevant section of Tohoku University's interim plan – 2 Measures to Achieve Research Goals (1) Measures to Achieve Goals Concerning Research Levels and Research Results, Fields to be Addressed by the University on a Priority Basis – presently reads "Advance organizational development and promote research in basic research fields for which we have been recognized by the 21st Century COE Program and others on the basis of our performance and proposals for organizational restructuring." If the university is selected for this program, this passage will be amended to read "Advance organizational

<Results/progress/alternations from initial plan>

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

When the decision to establish the Institute was made in fiscal 2007, the host institution presented a new independent mid-term plan in the "Areas Where Tohoku University Should Make Particular Efforts" and clarified that the University would preponderantly support research at, and establishment of an organization at the WPI Research Center for Atom/Molecule/Materials, Advanced Institute for Materials Research (WPI-AIMR), a center for international advanced atom/molecule/materials research. As the host institution, the University has continuously offered support.

development and promote research in basic research fields for which we have been recognized by the World Premier International Research Center (WPI) Initiative, the 21st Century COE Program and others on the basis of our performance and proposals for organizational restructuring.” and the university will give priority support to advancing research and organizational development based on this program.

-Concrete Measures

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

The host institution will provide the necessary space in accordance with the advance of the research and the expansion of the center’s research organization by operating a new core facility for the center’s activities so it can be used from around April 2008 as a target date, and research space will also be secured within the host institution’s existing facilities. Additionally, the host institution will basically pay the personnel expenses of all researchers who were affiliated with the host institution prior to the formation of the center. Beyond that, the host institution will expend enough money each year on such items as research expenses and other researcher support, the installation of apparatus required for research at the center, the refurbishing of research space, and management, administration and other items required for the smooth execution of the center’s research. Aside from that, the host institution will provide the researchers with priority access to the Technology Center for Research and Education Activities’ high-performance electron microscopes and other research equipment and assistance so that the center can implement global top-level research.

In addition to this support from the host institution, the researchers who will participate in the center obtained approximately 11000000 US \$ in outside funds in FY 2006, and they are projected to obtain an equal or greater amount of research funds once they are at the center. Thus overall the host institution fully expects to secure an amount of resources for the center that is equal or greater than the amount of support provided by this program.

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

To secure the independence of the center administration, the host institution will limit its authority to extremely important items such as the appointment and dismissal of the Center Director, and leave all other personnel, budget execution and other items effectively under the discretion of the Center Director.

For personnel matters, the host institution will only retain authority over the appointment and dismissal of the Center Director, and have all other personnel items within the center including the employment of lead researchers determined by

-Concrete Measures

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

The building for general research on materials and properties in the Katahira district was renovated while a new integration laboratory building was constructed so that researchers invited to WPI could proceed with research activities smoothly after employment. As a result, additional research space which PIs who had belonged to the host institution before the foundation of the Institute needed has been secured and they can cope with the development of their research. Moreover, a sufficient amount (money and in kind) has been secured for funds to cover the salaries of PIs and administrative staff, aids to cover some research costs, the costs of installing the facilities necessary for research at the Institute, the cost of renovating research space, and expenses for general Institute operations. Thus an environment for smooth research activities has been secured.

Besides the financial support from the host institution, researchers participating in the Institute’s activities acquired external funds amounting to US\$12,831,000 (¥ 1,539,695,000) in fiscal 2008. This amount equals, or is even greater than, the amount offered to the Institute under this program.

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

It has been agreed that in the operation of the Institute, the host institution has authority only over very limited important matters such as the decision on the appointment or dismissal of the Institute Director. When the application was made, the head of the host institution promised to leave authority over all personnel matters including the approval of PI employment, as well as flexible execution of the budget allocated from the host institution, to the Institute Director. This promise has been fulfilled since the founding of the Institute.

the Center Director.

The budget allotted to the center (personnel expenses and non-personnel expenses) will be turned over in its entirety for free execution at the judgment of the Center Director, and it will be possible to carry over funds allocated for budget items that are not implemented by the end of the fiscal year to the subsequent fiscal year.

(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

After Tohoku University is selected for this program, the Council of Department Heads Concerned with the World Premier International Research Center (WPI) Initiative will continue to actively support the Center Director, meeting at his request and as otherwise needed to secure the cooperation of the related departments for the greater vitality of the center research activities.

(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 plan to establish an international advisory board, including Nobel Prize recipients as members, which will report directly to the Center Director to support top-down type decision making by the Center Director. To these ends, the president of the host institution will make the necessary requests for cooperation from Nobel laureates. In addition, an environment will be established, including the use of Internet technologies, to facilitate swift consensus building and organic linkages between the Center Director and the international advisory board, and . Also, so that work at the center can be conducted smoothly in English, we will assign staff with superior English skills, in addition to expertise in such fields as accounting, personnel and research assistance, as administrative staff on a priority basis.

To introduce a compensation system that reflects researchers' abilities, we will urgently examine the introduction of new systems including a "Fellow Professor" (tentative name) system aiming at balance with the salaries paid by universities in the Tokyo area for professors playing leading roles in the research, as well as a system for preparations payments or contract conclusion payments when

It has been agreed that in the future, the preparation of all documents in English will be approved as a model case for the host institution, which will be linked to the enhancement of the support staff. This is in consideration of a workplace environment where English is used as the common language, which is a characteristic of the Institute.

(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

When applying for this program, the host institution organized a "Council of Department Heads Concerned with the World Premier International Research Center (WPI) Initiative" as a coordinating committee within the university to assemble researchers from within the host institution. The council consists of the heads of the eight departments concerned and is chaired by the head of the host institution. Accordingly, this council has been engaged in coordination within the host institution. It continued to be under the management of the head of the host institution even after the program was adopted. A meeting of the council is held when necessary at the request of the Institute Director. Thus, we have a system to positively support the Institute Director with the cooperation of the related departments.

(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

The international advisory board consists of the members named in the original plan and an additional member. We are considering the introduction of a network discussion system to contribute to efficient cooperation between the Institute Director and the advisory board.

When the Institute was founded, we preferentially employed administrative staff capable of carrying out tasks in English and familiar with accounting, personnel management, and research support in the University. To further improve their English ability, we have offered language training courses which are carried out by an external organization on consignment.

At the time of application, we proposed offering an environment equivalent to that offered to Distinguished Professors in the United States, and as the first step, we have paid each full-time PI of the Institute an extra allowance of 100,000 yen a month since the foundation of the Institute. In line with this, the "Tohoku University Distinguished Professor System" was introduced after that for the

absolutely necessary for the invitation of Nobel Prize class researchers, etc.

Tohoku University's "University Professor System" will also be actively used to invite the world's cutting-edge researchers to the center.

A standing task team will also be established with the office of the President taking the lead of it for rapid examinations and responses in cases when the Center Director requests the flexible administration, revision, improvement or adjustment of the host institution's systems, and the host institution will otherwise prepare an environment for the smooth conduct of top management by the Center Director.

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

The host institution will operate a new core facility (building) for the center's activities so it can be used from around April 2008 as a target date. Research space will also be secured within the host institution's existing facilities. To secure research space in accordance with the advance of the research and the expansion of the center's research organization, the center will be given priority use of joint-use space at the university or campus level, and the Facilities Preparation and Administration Committee will deliberate all items of concern regarding the use of research space and other facilities and accommodate the center's needs.

(6) Support for other types of assistance

The Tohoku University action plan "Inoue Plan 2007 (Toward Becoming a World Leading University)" released in April 2007 already clearly stipulates that the university will apply for the World Premier International Research Center (WPI) Initiative as a measure for strengthening Tohoku University's research foundations as a research-centered university.

Moreover, based on the results of the 21st Century COE Program, Tohoku University established the International Advanced Research and Education Organization (completed April 2007) comprising the Institute for International Advanced Research and Education (established April 2006), which supports graduate students pursuing interdisciplinary fields, and the Institute for International Advanced Interdisciplinary Research (established April 2007), which promotes interdisciplinary research by young researchers. The global COE Program at the University is advancing its activities in coordination with this Organization, and those activities will be smoothly transferred to this Organization when the COE Program is finished.

Tohoku University intends to provide the maximum support to the center as a special research zone within the host organization, arrange organic relations with the International Advanced Research and Education Organization, making them into vehicles for education and research and help us contribute, as one of the world's leading universities, to the development of our society.

host institution too, in accordance with the decision by the President and a mechanism to provide University personnel playing leading roles in education, research, social contributions, etc. with an extra allowance has been introduced. When inviting Nobel Prize-class researchers, it has been agreed that the "University Professor System" of the host institution will be applied. However, if the existing system turns out to be an obstacle, it would be flexibly revised in light of the then conditions by a task team headed by the manager of the President's office, at the request of the Institute Director.

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

The host institution had renovated the building for general research of materials and properties and built a new integration laboratory building as part of efforts to secure space for researchers who were invited to WPI in April 2008. For research space in existing facilities, we have established a system where researchers can preferentially use the open laboratory space shared by the entire University, in accordance with the progress and development of their research.

(6) Support for other types of assistance

Applying for the "World Premier International Research Center (WPI) Initiative" has been incorporated into Tohoku University Action Plan announced in April 2007, and we have fulfilled part of that commitment by establishing the Institute.

The host institution has organized the International Advanced Research and Education Organization (IAREO) as a research support organization for the "fusion" of different research fields. IAREO is an interdisciplinary research center whose members are mainly post-doctoral researchers intending to work on research to fuse different science fields, and it also comprises the Institute for International Advanced Research and Education, which aims to support graduate students who intend to work on interdisciplinary research. In the meantime, the activities of IAREO are not limited to materials science. IAREO is an interdisciplinary research support organization with an incubation function, aiming to contribute to the successive creation of research and educational organizations in interdisciplinary areas in the host institution; e.g., between medicine and engineering, and physics and mathematics. As a result of establishing the Institute, educational research support for postgraduates etc. who are engaged in interdisciplinary fields based upon materials science will be offered by the Institute and IAREO in cooperation. This means that the host institution has established a career support system for graduate students as well as post-doctoral and tenure-track researchers.

11. FY 2008 funding

(Exchange Rate: JPY/USD=120)

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

Cost Items	Details	Costs (ten thousand dollars)
Personnel	Center director and Administrative director	16
	Principal investigators (no. of persons):29	147
	Other researchers (no. of persons):54	282
	Research support staffs (no. of persons):13	34
	Administrative staffs (no. of persons):26	24
	Total	503
Project activities	Gratuities and honoraria paid to invited principal investigators (no. of persons):66	15
	Cost of dispatching scientists (no. of persons):0	0
	Research startup cost (no. of persons):0	0
	Cost of satellite organizations (no. of satellite organizations):0	0
	Cost of international symposiums (no. of symposiums):1	2
	Rental fees for facilities	0
	Cost of consumables	30
	Cost of utilities	1
	Other costs	193
	Total	241
Travel	Domestic travel costs	7
	Overseas travel costs	19

WPI grant for FY 2008

1251

Costs of establishing and maintaining facilities in FY 2008 792

Integration-Lab Bldg. II

(Number of facilities:3,346m²)

Costs paid: 648

Repairing facilities

(Number of facilities: , m²)

Costs paid:

Others

144

Cost of equipment procured in FY 2008

919

Electron Microscope:

Number of units:1

Costs paid: 64

Analytical Transmission Electron Microscope:

Number of units:1

Costs paid: 183

MPMS:

Number of units:2

Costs paid: 58

Fs Laser Amplifier System:

Number of units:1

Costs paid: 52

Spectrophotometer:

Number of units:2

Costs paid: 21

Solid-Liquid Interface AFM:

Number of units:3

Costs paid: 37

Nano Indenter:

Number of units:1

Costs paid: 13

VLSI test System:

Number of units:2

Costs paid: 19

HPES System:

Number of units:1

Costs paid: 10

High-Resolution AFM:

			Number of units:2	Costs paid: 10
	Travel and accommodations cost for invited scientists (no. of domestic scientists):30 (no. of overseas scientists):3	6	HPES System: Number of units:1	Costs paid: 18
	Travel cost for scientists on secondment (no. of domestic scientists):8 (no. of overseas scientists):2	5	Others	444
	Total	37		
Equipment	Depreciation of buildings	25		
	Depreciation of equipment	292		
	Total	317		
Other research projects	Projects supported by other government subsidies, etc.	68		
	Comissioned research projects, etc.	133		
	Grants-in-Aid for Scientific Research, etc.	408		
	Total	609		
Total		1707		

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

-Points specified as needing improvement

1) It is unclear how the fusion of the five sciences will be achieved. The director is recommended to state clearly the methodology to be used. Goals for innovation in material research have to be set at a high level.

-Efforts to improve them and results

1) WPI-AIMR consists of four thrusts, BMG (bulk metallic glasses), Nanophysics, Nanochemistry, and Device/system construction. The common basic concepts and researches of these four thrusts are interface, atom/molecule control, and M & N EMS (micro and nano-electro mechanical systems). For example, in the BMG research group, the interface between cluster structures and glue of BMG, and atom control of BMG structure arrangement become scientifically important issues, and application of BMG to M and N EMS becomes a key for contribution of this new material to society. Similarly, in the other three thrusts, the background common scientific issues and exit to society are interface, atom/molecule control, and M & N EMS. The four thrusts are doing fusion and cooperative researches based on these common concepts, and the WPI theory group is a great help for the fusion research. Some of the more concrete methodologies for enhancing the WPI-AIMR fusion research are presented below.

We have an organized WPI seminar every few months in which younger researchers, together with senior PIs, of all the four thrusts give progress reports on their researches, and the speakers are exposed to free discussion/advice/comments/criticisms. In the new WPI building, we set common

2) The newly built Integration Laboratory should serve as a “melting pot” to create interdisciplinary science. In this regard, a maximum number of researchers from the four groups should work together in this building.

3) AIMR needs to give further consideration to how it can develop a new management system and a non-traditional administrative system. A more clearly defined system of salary/wage payment needs to be established along with systems for enabling independent work by young researchers and for reducing clerical tasks. A good and innovative management system needs to be created.

4) Little concerted effort is being paid to making AIMR more visible. The director is recommended to create a concrete communication strategy for disseminating information both in and outside Japan on the center’s program, including newsletter, webpages and other media.

5) The organizational framework only allows decision-making by the highest level researchers. A channel needs to be put in place for young researchers to try new things. Similarly, platforms need to be created for young researchers to communicate with colleagues in the overseas satellites.

spaces in which researchers of different fields get together at coffee time, lunchtime, or any other occasion, making it more facile to discuss/talk/chat about their own researches, ideas, questions, and whatever else they want to. Every year, we request all the PIs to submit reports on how the fusion and cooperative researches are going and what is a positive (or negative) result on the fusion research.

I expect that this fusion research will produce a breakthrough in material sciences. Our PIs have achieved (or are achieving) excellent research in their own disciplines, but I strongly hope the breakthrough will come from WPI-AIMR.

2) I completely agree. It has been agreed that the BMG, nanophysics, and nanochemistry groups will move into the Integration Laboratory building. The device/system group is supposed to use the partly remodeled Materials and Physical Properties Laboratory (IMRAM) building.

3) We are collecting data on performances of individual PIs and other researchers so that we can assess their achievements based upon the collected data at the end of October 2008 and reflect these in their salaries for the following years. With young researchers, attention is paid to allowing them independence, while efforts are being made to reduce their duties so that they can concentrate on their studies.

4) The web pages, which were created in a short period of time when the Institute was founded, will be replaced with new ones by the end of this fiscal year. We have invested some money and invited some experts to make big improvements. As for newsletters, three volumes have been issued so far (issued quarterly). Their contents are fairly technical and intended for researchers. We would like to make simple brochures which can be read widely by the general public and distribute them widely.

5) Proposals and requests from young researchers are brought directly to the Institute Director, who gives them his full attention. Attention is being paid to the evenness of the organization. We believe that the channel to the Institute Director is always open. Some platforms for communication among young researchers and colleagues in overseas satellites have already been created, and we would like more of them.