- Reconstruction after the Great East Japan Earthquake -
Details about the Great East Japan Earthquake –Earthquake–

• Main earthquake M9.0 (14:46)
  – 500km x 200km. Largest ever recorded.

• Immediately following the quake (multiple stages)
  – Off the coast of Sanriku M7.5 (15:08)
  – Off the coast of Ibaraki Prefecture M7.3 (15:15)
  – Along ocean trench M7.4 (15:25)

• Transition in aftershocks
  – Off the coast of Fukushima/Ibaraki/Boso
  – Prolonged aftershock activity
  – Linked to north / south / offshore?

Tohoku University Research Center for Prediction of Earthquakes and Volcanic Eruptions, Assistant Prof. Uchida
http://www.aob.geophys.tohoku.ac.jp/info/topics/20110311_news/index_html
Details about the Great East Japan Earthquake –Tsunami–

■ Tsunami warning: 14:49, March 11, 2011
   *Estimated height of Tsunami at Sendai Port: 7.2m
   (Tsunami advisory was canceled at 17:58, March 13)

■ Tsunami Damage Statistics (for Sendai City only)
   • Human loss (704 people dead, 26 still missing)
   • Flooded homes
     (8,110 homes, including 1,160 rural homes flooded)
   • Damaged agricultural land (Approx. 1,800ha flooded)
   • Damaged industrial facilities (Ex. Factories around Sendai Port)
   • Damaged lifeline utilities
     (Ex. Minami-Gamo Purification Center,
      Gas Bureau City of Sendai LNG Terminal)
   • Damaged transportation facilities
     (Ex. Sendai Port, Sendai Airport)

Sendai City Website
(as of 13:00, September 16, 2011)
Area Flooded by Tsunami (Sendai)
Details about the Great East Japan Earthquake – Radiation –

Radiation levels following the Great East Japan Earthquake

Location: Tohoku University Cyclotron and Radioisotope Center (μSv/h)

- Annual background radiation in Guarapari, Brazil (10mSv)
- World average annual background radiation (2.4mSv)
- Average annual background radiation in Japan (1.5mSv)
- Exposure from flying round-trip between Tokyo and New York (0.2mV)
- Annual outdoor radiation at Tohoku University Hospital, assuming current levels continue (1mSv)
Overview of Tohoku University at time of disaster

Campuses

- **Katahira** (Headquarters, Research Institutes (4), Graduate School of Life Sciences, Professional Graduate Schools)
- **Aobayama** (Graduate Schools of Engineering/Science/Pharmaceutical Sciences/Information Sciences/Biomedical Engineering, etc.)
- **Kawauchi** (Graduate Schools of Art and Letters/Education/Law/Economics and Management/International Cultural Studies, etc.)
- **Amamiya** (Graduate School of Agricultural Science)
- **Seiryo** (Tohoku University Hospital, Graduate Schools of Medicine/Dentistry, Institute of Development, Aging and Cancer)

Students 18,572 (17,073 Japanese students, 1,499 international students)

Faculty and Staff 11,590 (includes part-time employees)
Damage Situation

Students and staff safety confirmation (as of March 30, 2011)

Students: 3 dead
(2 undergraduates, 1 new student)
14 injured

Staff: no deaths or injuries.
* Family members of 7 of the staff died or are missing.

The situation of student homes (as of March 30, 2011)

Homes of 526 students (5.2%) were
fully or partially destroyed

331 students (3.2%) are considering moving

Provided dormitory rooms
Post-earthquake Trends among International Students / Staff

Number of foreign students at time of the earthquake: 1,499
(132 undergraduate, 1,043 graduate, 324 research students etc.)

- Post-quake trends: 790 students left Japan
  (759 returned to home countries, 31 evacuated to different countries)
  ※ Based on the response rate, it is estimated that approx. 1,200 students left Japan

- Students returned after new semester commenced: 92.2%
  (enrolled students/new students)
  - Undergraduate students: 97.8% (135/138)
  - Graduate students: 99.0% (1,117/1,128)
  - Non-regular students: 70.9% (280/395)

Number of foreign staff at time of the earthquake: 348
(169 full-time, 179 part-time)

- Post-quake trends: 144 (41.4%) employees left Japan
  - 66 full-time (39.1%), 78 part-time (43.6%)

- Returned staff (as of July 1): Almost all staff have returned
  ※ 2 people resigned
The situation of facilities

In Sendai city
- Katahira Campus (Headquarters, Research Institutes)
  - Entry Restricted: 7
- Kawauchi Campus (General Studies, Liberal Arts)
  - Unsafe: 2
  - Entry Restricted: 3
- Seiryo Campus (Medicine, Dentistry)
  - Entry Restricted: 3
- Amamiya Campus (Agriculture)
  - Unsafe: 3
  - Entry Restricted: 3
- Aobayama Campus (Science, Engineering)
  - Unsafe: 8
  - Entry Restricted: 24

Natori City (Near Sendai Airport)
- Boat House and Boarding House

Onagawa Town
- Field Science Center, Graduate School of Agricultural Science

Shichigahama Town
- Yacht House

Kesennuma City
- 5+

Osaki City
- 6+

Sendai City
- 6+

Kurihara City
- 7

Tome City
- 6+

Kesennuma

Shiroishi City
- 6–

Kakuda City
- 6–

Natori City
- 6–

Destroyed and swept away by the tsunami

Swept away by the tsunami

Damaged by the earthquake
Kawauchi Campus

Lecture Hall Corridor

University Library
Aobayama Campus

School of Engineering - Civil Engineering and Architecture Research Building

Research Center for Electron Photon Science (Tomizawa) - Particle accelerator equipment

Micro/Nano-Machining Research and Education Center, School of Engineering
Educational Affairs

- 2010 degree conferment ceremony cancelled (degree certificates/President’s message mailed to graduating students in late April)

- Separate late stage entrance examinations cancelled

- Undergraduate / Graduate entrance ceremonies & Orientation for newly enrolled students rescheduled from April 6 to May 6 (conducted by individual departments)

- Commencement of lectures
  Common Education Lectures (undergraduate 1st and 2nd year) - May 9
  Specialized undergraduate / graduate lectures - April 25
Entrance Ceremony
(conducted individually by each department)

University-wide Orientation
The Status of Restoration and Reconstruction

We are not only recovering our education and research environments, but also taking the disaster as an opportunity to improve them more than ever.
Financial Support for Afflicted Students

- Exemption of entrance fees and tuition

- Scholarships
  - Payment of Emergency Scholarships
  - Utilization of other scholarships

- Dormitories for students
  - Construction of emergency dormitories
  - Expansion of University Houses, etc.

- Consideration of long-term support
Promotion of understanding and dissemination of information overseas

- Communicate **accurate information** on damage and status of recovery at Tohoku University
- Promote Tohoku University’s vision for reconstruction

- Disseminate accurate information promptly via university website
- Closely exchange information with foreign embassies and organizations in Japan
- Welcome visiting dignitaries from foreign embassies/institutions from countries including Australia, Germany, Sweden, Switzerland, Slovakia, Canada, China, Korea (※Slovakian, Canadian and Swedish Ambassadors visited)
- Participated in international conferences with major overseas institutions
  - Second International Exhibition and Conference on Higher Education (2011.4.19-22; Riyadh)
  - NAFSA Annual Conference (2011.5.29-6.3; Vancouver)

(NAFSA: Association of International Educators)
Regional Contribution 1. Tohoku University Hospital

- Accepting patients from hospitals in the disaster area, transporting patients to hospitals outside the prefecture
- Providing medical supplies in and outside of Miyagi Prefecture
- Securing medicine, medical materials etc.
Regional Contribution 2. Radiation Monitoring

- Providing information on radiation levels in the atmosphere to local residents → 4 on-campus monitoring posts, 7 monitoring posts in Miyagi

- Monitoring radiation levels in vegetables, milk, tap water, the atmosphere, the soil and sea water in response to requests from Miyagi Prefecture, Fukushima Prefecture and local governments

- Removing contaminated soil from the playgrounds of nursery schools in Fukushima City
Regional Contribution

3. Surveys using robots

Conducting surveys inside nuclear reactor building (End of June 2011)

Using the robots to
- measure outside radiation levels,
- conduct surveys inside the nuclear reactor building and conduct light work
  - Take video
  - Measure temperature / humidity
  - Measure dose-rate
  - Create 2-D / 3-D maps
Regional Contribution

4. Disaster waste

- Survey of damaged vehicles
- Proper treatment and recycling of waste

Survey at Tagajo City

Measuring radiation dose: Yamamoto Town

Survey at a dismantling plant: Kurihara City
Regional Contribution  5. Student volunteers

- Conducting various activities in areas which suffered enormous damage ex. Working in Yamamoto Town at the request of Miyagi Prefecture
- Established a support office for student volunteer activities on campus

Departing for the disaster area  Sorting relief supplies for Kesennuma City  Students cleaning out a house in Yamamoto Town
Regional Contribution

6. Disseminating / Archiving Information on the Disaster

Tohoku University’s specialists from a variety of fields are reporting on the disaster situation; sharing information and developing a database

Utilizing Tohoku University’s academic potential in the arts and sciences

The Great East Japan Earthquake debriefing session

• 1st meeting 2011.4.13  One month post-disaster emergency report meeting chaired by Tohoku University (Conference Sendai, Sendai Trust City)
• 2nd meeting 2011.6.10  Three month post-disaster report meeting chaired by Tohoku University (Sendai International Center)
• 3rd meeting 2011.9.13  Six month post-disaster report meeting chaired by Tohoku University (Conference Sendai, Sendai Trust City)
New Challenges for Tohoku University
Establishment of Institute for Disaster Reconstruction and Regeneration Research

As a core university based in the disaster area of the Great East Japan Earthquake, we will engage systematically and strategically in research, education and societal contribution for the reconstruction / regeneration of the region, and transmit and put research results into practice.

Scheme that can respond flexibly to various needs (possibilities)

Institute for Disaster Reconstruction and Regeneration Research

Center for gathering the collective wisdom of foreign/Japanese institutions

Government
“Reconstruction Design Council”

Cooperation with national and local government (contribution to reconstruction vision / plan)
One-stop Service

Local Government
“Reconstruction Plan”
Purpose and Mission

Mission 1  **Contribute to the reconstruction / regeneration of the region**
As a center of knowledge in the disaster area, contribute to the reconstruction / regeneration of the region from the unprecedented disaster.

Mission 2  **Create a comprehensive center of excellence for disaster reconstruction**
Create a worldwide COE of comprehensive R&D for disaster reconstruction not only in northeast Japan but also throughout the World.

In order to contribute to disaster recovery, it is necessary to develop problem-solving projects through a cross-disciplinary research organization that goes beyond existing department frameworks, and to strategically and methodically tackle problems.
Priority Projects of the Institute

Research for reconstruction / regeneration of the region

Creation of comprehensive COE

International Research Projects on Disaster Science
(International Research Institute of Disaster Science)

Project for the Reconstruction of Community Health Care

Project for environmental energy

ICT Reconstruction Project

Tohoku marine science project

Regional Industries Restoration Support Project

Industry-University Collaboration Development Project for Reconstruction

Regeneration of community-based society and life

World-leading advanced science and technology

Though projects will basically be run independently, the institute will fully cooperate with reconstruction projects through project leader meetings etc.
A Public Exhibition Space has been opened on the first floor of the Extended Education & Research Building. It will be used as a space for exhibiting the latest research activities by Tohoku University.

Now we are exhibiting some panels about status of the damage caused by the Great East Japan Earthquake, as well as research on the earthquake, tsunami and radiation, and support activities for afflicted areas.

- Days open: Weekdays (Monday to Friday)
  *Closed on Saturdays, Sundays, and national holidays
- Hours: 9:30-17:00
  Exhibition Space may be closed temporarily on weekdays as instructed by the university.
We will bring together our wisdom and support the restoration and revitalization of the region by conducting strategic and systematic research, education and social contribution, and we will transmit and put research results into practice.

We will contribute to the regeneration of the region, Japan and human society by working vigorously to create a safe and secure society for the next generation in which humans can coexist with nature.

Tohoku University is implementing a public relations campaign for reconstruction.
Powerful Positive Tohoku University
You can use the following slides if necessary.
Please do not edit any sourced charts and pictures in the slides.
Details about the Great East Japan Earthquake -Radiation-

* From National Institute of Radiological Sciences Website

* From Miyagi Prefectural Government Website
4 shelters placed on campuses

Students, staff, examinees, their parents, and neighborhoods residents stayed in shelters on our campuses.  
* Approx. 2,000 people stayed from March 11-16.  
  Relief supplies were provided to them.  
  (Ex. emergency food, meals, drinking water and bedding etc.)  
  - Sakura Hall (in Katahira Campus)  
  - Kawauchi Gymnasium (in Kawauchi Campus)  
  - Engineering Laboratory Complex Buiding (in Aobayama Campus)  
  - Seiryo Gymnasium (in Seiryo Campus)
Support from other universities and corporations

- [Relief supplies and donations]
  - From national universities, companies, organizations, and individuals

- [Support for education and research activities]
  - Temporary research and course accommodations from domestic and foreign universities
  - Physical supports for recovery work from organizations
Tohoku University Centennial Hall (Kawauchi Hagi Hall)

Risk of collapse due to broken blocks

Boarding and lighting equipment fell from the ceiling (also occurred during aftershocks)

Damage to the ceiling

Fallen Lighting
Cyclotron and Radioisotope Center

Damage to support section of accelerator component

Support pillar of accelerator collapsed

Damage to beam supply vacuum duct
Facilities swept away by tsunami

Houses swept on top of our facilities

Onagawa Town

Field Science Center, Graduate School of Agricultural Science
Shichigahama Yacht House

After tsunami – completely destroyed and swept away

Before tsunami
Natori City

Natori Boat House and Boarding House

The tsunami flooded the building and swept huge amounts of debris inside.
Flexible operation and active participation by all departments

◆ Promotion of institute planning project (top down)
  ➢ Planning, design and management of projects on important research issues

◆ Promotion and support of member proposal project “Reconstruction Action”
  ➢ Gather information and provide support for projects tackled voluntarily by members of Tohoku University
Planning Office

Director
Akihisa Inoue (President)

Steering Committee

Board of Governors

① International Research Projects on Disaster Science
② Project for restructuring of local medical care
③ Project for environmental energy
④ ICT Reconstruction Project
⑤ Tohoku marine science project
⑥ Regional Industries Restoration Support Project
⑦ Industry-academic project for reconstruction

【Duties of Planning Office】
① Lead the planning and design of projects related to important issues
② Plan and design joint (large scale) projects focusing on industry-academic collaboration
③ Coordinate reconstruction action based on previously collected information on societal contribution
④ Coordinate on-campus funding (including distribution of President’s discretionary spending)
⑤ Gather and disseminate diverse information
⑥ Progress management of projects
⑦ General coordination

TOHOKU UNIVERSITY
International Research Institute of Disaster Science (IRIDeS)

[Summary]

IRIDeS will renovate disaster mitigation and crisis management system based on the lessons learned from the Great East Japan Earthquake Disaster not only in Japan but also overseas, and will advance following research projects to promote disaster prevention and reduction a next Catastrophic Disaster (LHPC: Low Probability High Consequences). Our institute's missions are 1) Reconstruction of disaster prevention and reduction technologies based on reality of the 2011 off the Pacific coast of Tohoku earthquake and tsunami disaster, 2) Construction of “Disaster area supportology” in the event of a disaster, 3) Advancement of anti-hazard performance and upgrading for multiple-fail-safe in urban areas as disaster reconstruction projects, 4) Research on mechanism of mega earthquake and tsunami generation and developing of next-generation of early detection technology of tsunamis, 5) Establishment of disaster medicine and medical service system in wide area massive disaster, and 6) Rehabilitation region and urban and creating disaster digital archive pass for the next generation. IRIDeS will take the leading role for causing paradigm shift on catastrophic disaster countermeasures and responses by accomplishing 6 missions.
### Center for the Comprehensive Education of Community Health Care (2011)

**Principal Missions**

- Employing affected medical staff (doctors, nurses, technologists etc)
- Providing cutting-edge knowledge & training for affected staff
- Providing opportunities for education experience (community health care courses for medical & paramedical students by affected staff)
- Dispatching junior medical staff and revitalization of staff exchange
- Construction of stable community health care systems

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**Local governments • Flagship hospitals**

**Tohoku University School of Medicine & Hospital**

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**Coalition/collaboration**

**Project for the Reconstruction of Community Health Care**

**Launching the Center for the Comprehensive Education of Community Health Care**

**Toward stable and sustainable community health care**

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**Along with reconstruction of affected hospitals**

**Tohoku Medical Bank**

**Geome cohort study**
1. Research into smart energy systems
   - Resilient power systems
   - Town planning project for low carbon, disaster resistant towns

2. Research into fuel cell technology to support the power network
   - Research into storage technology to support the use of natural energy
   - Fundamental research into solid oxide fuel cells to support self-sufficient power
   - Fundamental research into developing cheap and highly efficient photovoltaic cells

3. Research into energy production technologies that are in harmony with the environment
   - Production of biomass energy for restoration of the environment in the disaster area and disaster response
   - Geothermal energy in harmony with the environment

Under the Institute for Disaster Reconstruction and Regeneration Research

① Formulation of scenarios and thorough consideration of policies that match Tohoku: Establishment of target and time line for each technological development with a view to minimizing cost and maximizing efficiency (areas that will speed up the reconstruction process, mid to long-term areas)

② Based on this strategy, strongly promote and coordinate 3 areas of cutting edge research and development

Formulation of an inter-department research organization

Coordination with Japanese/foreign institutions and foreign researchers

A safe, secure and rich Tohoku

Clean energy - industrial cluster

Securing regional independence

Reconstruction of disaster areas

A society in harmony with the natural environment

- Government office
- Regional authorities
- Power companies
- Local businesses etc.
ICT Reconstruction Project

Center of Research and Demonstration of Disaster-Resistant ICT Infrastructure

- Transmission capacity handling rapid traffic growth
- Data disaster protection, Wide-area distributed cloud storage
- ICT medical support and agent system
- Ultra-low power consumption devices
- Adaptive and dependable communication link even in disasters
- Traffic congestion control Never-die network
- Network Layers

Transmission Media and Hardware

Services and Software

Collaboration with local governments and universities in Tohoku area

Creative reconstruction of disaster area using ICT
  - Construction of disaster-resistant safe and secure future city using ICT
  - Promotion of local industry through ICT R&D

Materials and Devices

All Japan network Industry-academy-government collaboration

Industry-academy and global center in ICT area
  - Launch and promotion of new industries in ICT field
  - World leading R&D of innovative ICT technologies

Global collaboration network
Tohoku University
Marine Science base

Government
“The Reconstruction Design Council”

Local authorities “reconstruction plan”

Miyagi

Prefecture

Sendai
City

Natori
City

Onagawa
Town

Fisheries Laboratory Committee

Japanese National Marine and Inland Water Biological Stations Committee

All Japanese universities, research institutes

I. Regeneration and preservation of natural environment
(1) Research into recovery and regeneration of marine environment G (water quality, sediment, plankton environment)
(2) Research into the regeneration of coastal organism ecosystems G (seaweed clusters, coastal biota)
(3) Research into the regeneration of coastal gene resource G (evaluation of genetic diversity)

II. Regeneration of marine production
(4) Research into regeneration of fisheries resources G (market surveys/catch surveys)
(5) Recovery of biological resources cultivation G (egg cultivation and release)
(6) Development of new cultivation technologies G (new on-shore cultivation innovation)

III. Recovery, regeneration and innovation in processing marine products
(7) Development of efficient processing technologies for marine products G
(8) Development of technologies for effective use of unused marine resources G
(9) Development of new energy production technologies which utilize organic marine products
(10) Development of highly efficient recycling methods that utilize marine products G
(11) Development of methods to ensure safe marine products G
Conducting research on the regional industries in Tohoku area after the disaster and fostering innovative abilities for the disaster restoration.

Graduate School of Economics and Management, Tohoku University
(Regional Innovation Research Center / Research Strategy Promotion Center)

Consortium for Restoration of the Regional Industry
<including local universities, local economic organizations,
local governments, etc...>

Regional industry restoration research groups

<Disaster Restoration>
Conducting research from a long-term perspective
Providing solutions for problems that Tohoku area is faced with
Crystallizing the wisdom of local universities

Regional innovative producer school

<Research Project>
Conducting individual research started with students’ own interests

<Basic Course>
Acquiring systematic and basic knowledge about region and management

Outreach

Expertise

Fund

Project making

commercialization

project

project

project

project

project

project

Regional Industries Restoration Support Project
This project will support the clustering of automobile related industries and advanced electronic machine industry for the reconstruction of the Tohoku Region. In addition, it will utilize the intellectual resources of universities to develop the following projects for the creation of a global industrial area.

- **Industry-University Project by Ordering Prototypes**: Order prototypes to Industry, test/evaluate them, and develop new products.
- **Open Use of Experimental Equipment**: Provide open use of University’s experimental equipment to local companies.
- **Technological Seeds & Needs Matching**: Facilitate new business creation by actively matching University’s technological seeds and Industry’s needs.
- **Reconstruction Fund Project Collaboration**
- **Open Innovation Center Project for Industry-University-Government Collaboration in Materials Field etc.**

**Creation of Globally Competitive Industrial Area**

[Diagram showing the flow of University → Order Prototypes → Test/Evaluate → Deliver Prototypes → Company (Disaster Area)]
We ask for the establishment of a Tohoku Reconstruction Science and Technology Fund (tentative name) which can be utilized over a long-term 10-year period in order to support Tohoku University reconstruction projects with the cooperation of Japanese and foreign universities / research institutions.