



# Enhancement of Societal Resiliency against Natural Disasters

## A Brighter Future for a Nation Prone to Natural Disasters, Leveraging Industry-Academia-Government Cooperation to Create a Disaster Information System

The March 11 earthquake in northeastern Japan, volcanic eruptions, super typhoons, sudden downpours, and other disasters and extreme weather events have been a hallmark of Japanese life in recent years. Scientists and citizens are apprehensive about predictions of a colossal earthquake in the Nankai Trough at some time in the mid-2000s. And all the while, voices call urgently for the construction of social infrastructure that can withstand such large-scale natural disasters. Our nation needs stronger, more resilient disaster prevention and mitigation functions that provide actionable real-time disaster information. This program is a vital component for ensuring the safety and confidence of both today's and future generations.



Program Director

**Masayoshi Nakashima**

Kyoto University

Professor

Disaster Prevention Research Institute

### Profile

Professor Nakashima graduated with a degree in architectural engineering from Kyoto University in 1975. In 1977, he earned a Master of Architectural Engineering degree from the same university. Nakashima was awarded a Ph.D. in Civil Engineering from Lehigh University in 1981, after which he joined the Building Research Institute of the Ministry of Construction as chief researcher. In 1988, Nakashima was named associate professor in the Kobe University Department of Environmental Planning, where he served until 1992, when he joined the Kyoto University Disaster Prevention Research Institute as an associate professor, a position he holds presently. From 2011 to 2013, Prof. Nakashima served as Director of Disaster Prevention Research Institute, Kyoto University. In 2015, he also began serving as President of the Architectural Institute of Japan.

## Research and Development Topics

### 1. Prediction: Use the latest prediction analysis technologies to predict the scope and nature of disasters

Develop advanced observation and prediction technologies to quickly determine the scope and nature of disasters. Provide a public-private platform for sharing disaster-related data.

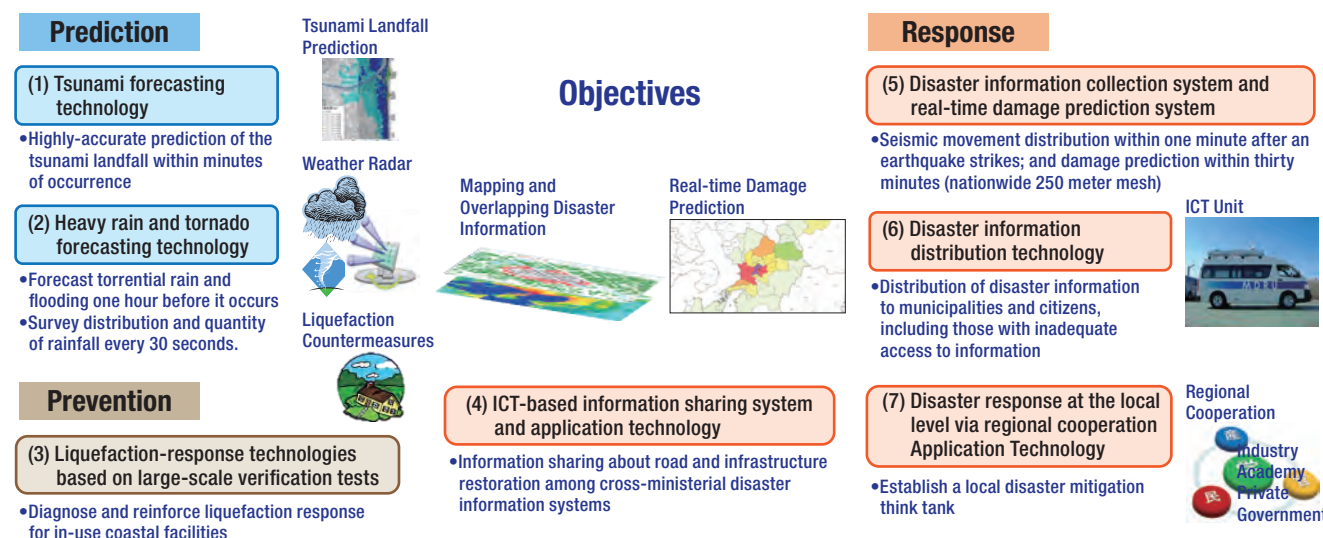
### 2. Prevention: Improve seismic resistance technologies based on large-scale verification tests

Develop technologies to deal with wide-scale liquefaction; conduct large-scale verification tests and analyses for verification; secure technology and share information to help improve and harden urban infrastructure to resist disasters.

### 3. Response: Improve response capabilities by sharing and applying information related to disasters

Collect information related to disasters and disaster prevention/mitigation; develop technologies for a public-private information sharing system for real-time information allowing informed decision making by national institutions for disaster response, local governments, businesses, organizations, and individuals during times of crisis.

• Conceptual diagram of research and development on the enhancement of societal resiliency against natural disasters



## Exit Strategies

### ✓ Contribute to disaster prevention measures

Provide technologies for seamless communications of disaster information collected through public and private sources; this disaster prevention system will allow for officials determining disaster responses to have access to useful information.

### ✓ Provide continuity

Create a system of consistent disaster prevention training and education to train citizens in immediate safety response during disasters. Share useful disaster information throughout rural communities; foster and utilize regional disaster research centers throughout Japan to ensure continued disaster prevention response improvement at the local level.

### ✓ Ensure Japanese industrial competitiveness

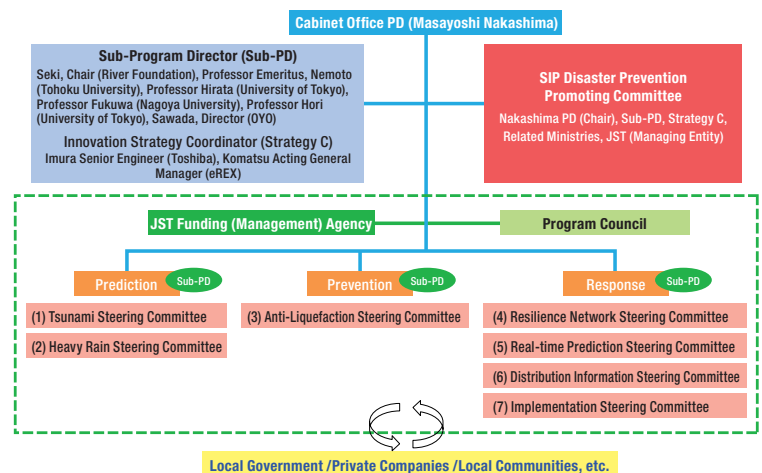
Provide a system for real-time information sharing using the latest scientific technologies to facilitate industrial and community continuity in the aftermath of large-scale natural disasters.

### ✓ Create industries based on disaster prevention/mitigation

Transfer technology to the private sector (businesses) and local governments related to real-time disaster information and immediate disaster response; transfer technologies to Asia and other nations.

## Implementation Structure

The SIP Disaster Prevention Promoting Committee has been established under the Cabinet Office, consisting of a Program Director (PD), Sub-PD, relevant government ministries and agencies, and the Japan Science and Technology Agency (JST). A steering committee is set up for the program conference and also for each research area on prediction, prevention and response. Under this structure, we run research and development projects aimed at creating mechanisms for the “cross-ministerial communication and sharing of information” and “practical and direct application of the latest scientific technology on predicting and surveying to assist in disaster response.”

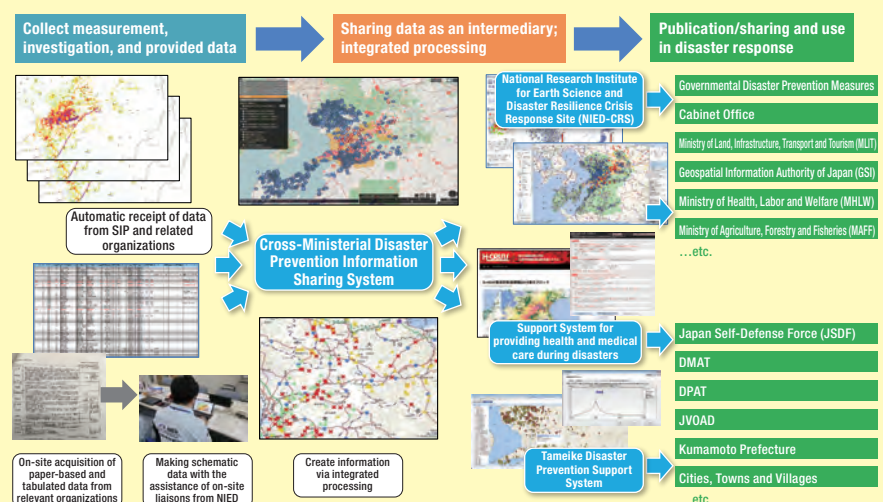


## Progress to Date

### Advancements in building a resilient disaster information system

We are making progress in building a resilient disaster information system to ensure effective disaster prevention and mitigation. We will accomplish this by fostering cooperation among disaster prevention organizations to collect and consolidate their disaster information and provide it to users in the most optimal way. During the September 2015 floods that occurred in Joso City, Ibaraki Prefecture, we integrated information held by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Geospatial Information Authority of Japan (GSI) into a prototype for this system. We have already achieved notable results. This includes being able to provide information on passable roads not affected by floods which could be used to send medical teams to disaster-affected areas.

#### • Concept of providing disaster information



# Building a Ministerial-Based Foundation for Sharing Disaster Prevention Information with Municipalities and Industry during a Disaster

Japan continues to experience frequent natural disasters, including landslides and floods caused by sudden downpours, earthquakes, and volcanic eruptions. Consequently, work is continuing at fever pitch to strengthen society's resiliency against natural disasters, and to minimize and stem such threats.

## Natural Disasters are Still Frequent, Cause Major Damage

Strengthening society's resiliency against natural disasters through the sharing and use of real-time disaster information is a matter of urgency for a nation such as Japan, which is subject to frequent natural disasters. As this program enters its third year, Masayoshi Nakashima looks back on the last two years as Program Director.

"The past two years have been a forceful reminder of the perpetual need for disaster prevention and mitigation initiatives. This is particularly so given the frequent occurrence of natural disasters in Japan, including the torrential rain that caused landslides in Hiroshima City and the eruption of Mt. Ontake in 2014, the floods that occurred in Joso City, Ibaraki Prefecture in September 2015, and the Kumamoto earthquake in April 2016. This program is the largest cross-ministerial project in the SIP, involving 10 participating ministries. Even here, we are working to form closer ties with relevant organizations, while integrating our research findings, policies, and information. All this is to achieve the common goal of ensuring more effective disaster prevention activities. I believe this program is the only path to realizing this vision."

## Developing High-Speed, High-Precision Technology to Predict Natural Disasters

Let's take a close look at each focus area of this program, now in its third year.

The program has made advancements in developing technology to predict tsunamis, heavy rain, and tornadoes. This technology will help us estimate the scope and nature of natural disasters. Nakashima elaborates, "As far as forecasting torrential rain and tornadoes, we are developing a multi-parameter phased array radar (MP-PAR) that can measure the distribution and quantity of rainfall every 30 seconds. We are also working on a high-speed and high-precision system to survey and estimate the formation of cumulonimbus clouds that cause heavy

rain. Our aim is to use these tools to improve the accuracy of forecasting information on floods and landslides caused by sudden downpours and similar weather."

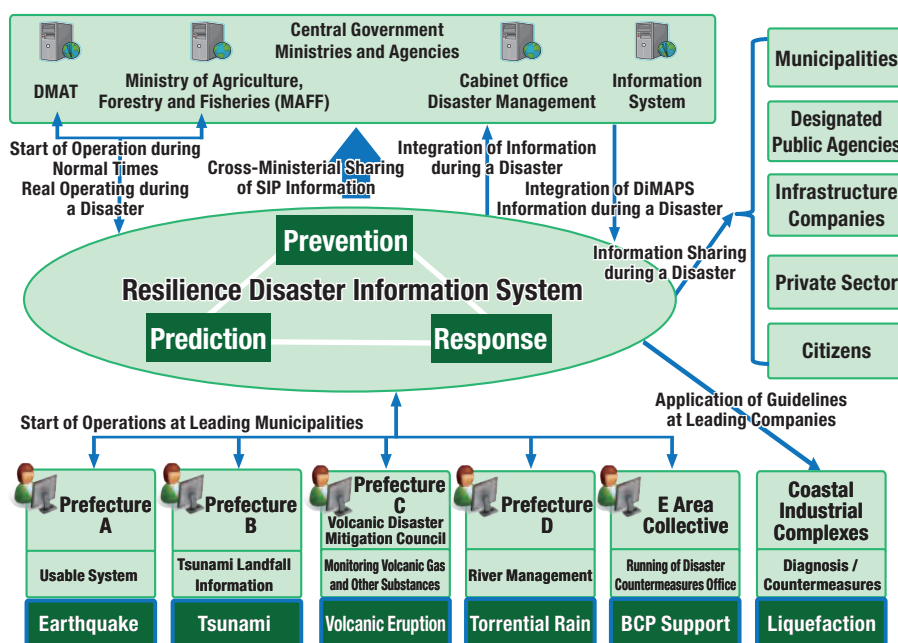
In terms of prevention, the program is developing and verifying technologies to deal with liquefaction caused by earthquakes.

"This year, we are using the E-Defense full-scale earthquake testing facility, building a simulation for reclaimed ground and port facilities that house petrochemical complexes and other equipment. We are also verifying the effectiveness of countermeasures against liquefaction using a seismic vibration table. We plan to draw up guidelines for creating even more effective countermeasures."

## The Resilient Disaster Information System Supports Society 5.0

Nakashima goes on to emphasize the key roles of minimizing and stemming disasters. This program is engaged in building an ICT-based Resilient Disaster Information System to share information. At the same time, we are creating prototypes

•Conceptual diagram of the Resilient Disaster Information System



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for technologies that make effective use of the system. This involves building an interface for real-time sharing of damage estimates and on-site damage information obtained by relevant organizations. This information must be seamlessly integrated with other disaster information systems, such as those managed by the Cabinet Office, by national organizations, and by local municipalities. Our aim here is to collect and provide information to carry out effective disaster prevention activities.

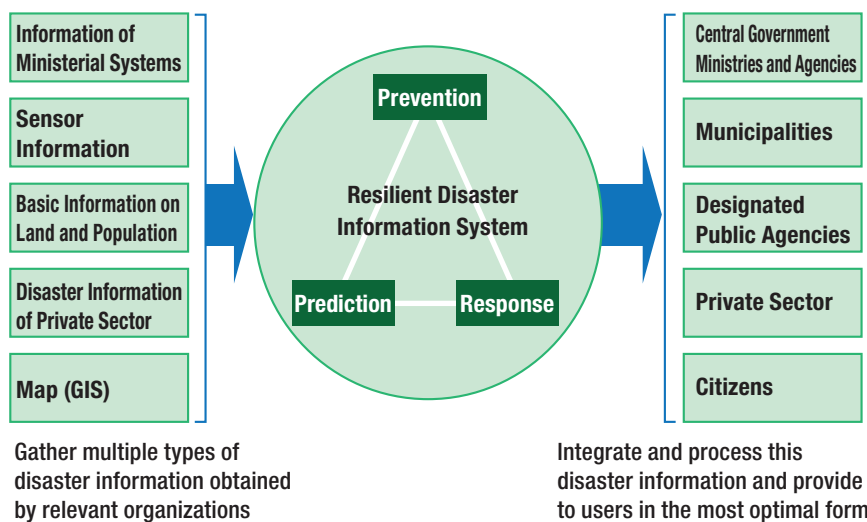
“During the September 2015 floods in Joso City, Ibaraki Prefecture, we integrated information held by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) and the Geospatial Information Authority of Japan (GSI). With this information, we were able to provide information to disaster medical assistance teams (DMAT) related to passable roads not affected by the floods. During the Kumamoto earthquakes, we were able to assess the concentration of areas where buildings had collapsed soon after the earthquake struck. We then collected the disaster information issued by numerous organizations, providing it to municipalities and institutions responding to the disaster.

The Resilience Disaster Information System will be one of the key platforms in Society 5.0,” states Nakashima. The program director stresses, “Although it is important to expedite the use of IoT and Big Data for disaster prevention and mitigation, we also need to develop ways to extract and provide essential information from a vast amount of data. At the same time, we must pay even more attention to the protection of personal information and other security-related issues.”

It is imperative that this program approaches disaster prevention and mitigation not from a short-term perspective, but as an ongoing initiative now and in the future. Nakashima states, “Thanks to even greater cross-ministerial cooperation than we initially envisioned, this program is advancing exceedingly well. In our third year, we are moving forward in laying the groundwork to ensure that the relevant organizations will continue their disaster prevention and mitigation initiatives even after the program ends. With our sights set firmly on the future, our first order of business is to hasten the development of technologies that will help us reach our ultimate goal.”

## Future Plans

This program continues to develop technologies to provide information to the Cabinet Office disaster prevention system and other related systems. This disaster information will enable federal and local governments, businesses, and organizations to make better decisions during disasters. This program will also develop technologies for sharing information immediately with individuals and groups, helping them to make their own informed decisions during disasters.



**We try our best to establish a solid foundation to prevent and mitigate natural disasters so that people of both today and future could exercise safe and happy lives.**

