



Institute for Multidisciplinary Sciences

Yokohama National University



FACULTY
PROFILE

YNU

YOKOHAMA National University

SCIENCE and VISION

ABOUT IMS

The Positioning of the Institute for Multidisciplinary Sciences (IMS)

By comparison with the Institute of Advanced Sciences (IAS), which undertakes outstanding, world-class research in cutting-edge technology research spheres, the Institute for Multidisciplinary Sciences (IMS) is a vision-driven research institute seeking to help build an ideal society through interdisciplinary collaboration across diverse research fields that aims to realize a vision for the society of the future.

The IMS's Principal Investigators (PIs) include many up-and-coming younger researchers who will be playing an important role in the society of the future, and the IMS is aiming to accelerate the strengthening of diversity and interdisciplinary collaboration. The IMS is boldly undertaking work on current research topics which have been selected through back-casting from the vision of where we want to be in the future, and is realizing research activities that will lead to the generation of new academic fields and of new value for society.

Framework for Collaboration with External Partners

In recent years, the competition in the university sector to secure high-level international research talent has become increasingly intense, and the movement of research talent between countries has accelerated. As with the IAS, which has made the recruitment and securing of first-rate foreign researchers a priority, and has been proceeding with the putting in place of the necessary systems, the IMS has also been forging an international collaboration network with overseas companies, overseas universities, and other international partner organizations, aimed at realizing the YNU's vision, and has been strengthening measures to build itself into an International Network Hub that will be at the center of innovative, high-level research activities. In addition, by implementing initiatives for ongoing strengthening of collaboration with non-academic bodies, including the local community and industry, the IMS is aiming both to enhance international research capabilities and promote the social implementation of research results.

Research Organization

The Institute for Multidisciplinary Sciences (IMS) has six academic centers of practice: the Typhoon Science and Technology Research Center, the Research Center for Next-Generation Health Technology, the Semiconductor and Quantum Integrated Electronics Research Center, the Shipbuilding & Ocean Renaissance International Center, the Center for Urban Disaster Resilience and Safety Science and the Center for Security Practice, Intelligence, Research, and Advanced Learning as well as six units: the Co-Innovation Dynamics Research Unit, the Biosphere Research Unit, the Artificial Intelligence for Innovation and Co-Creation Research Unit, Global Cultural Heritage Research Unit, the Research Unit of Aeronautics and Astronautics and Age-Friendly Space Research Unit. These research centers and research units, which take on the challenges of global social issues, aim to realize their respective visions for the future and contribute to solving global issues facing humanity and co-creating innovation through dialogue with society, based on the synergy of the outstanding new technologies of the Institute of Advanced Science (IAS).



**YNU President,
Director of
IAS and IMS**

**UMEHARA
Izuru**



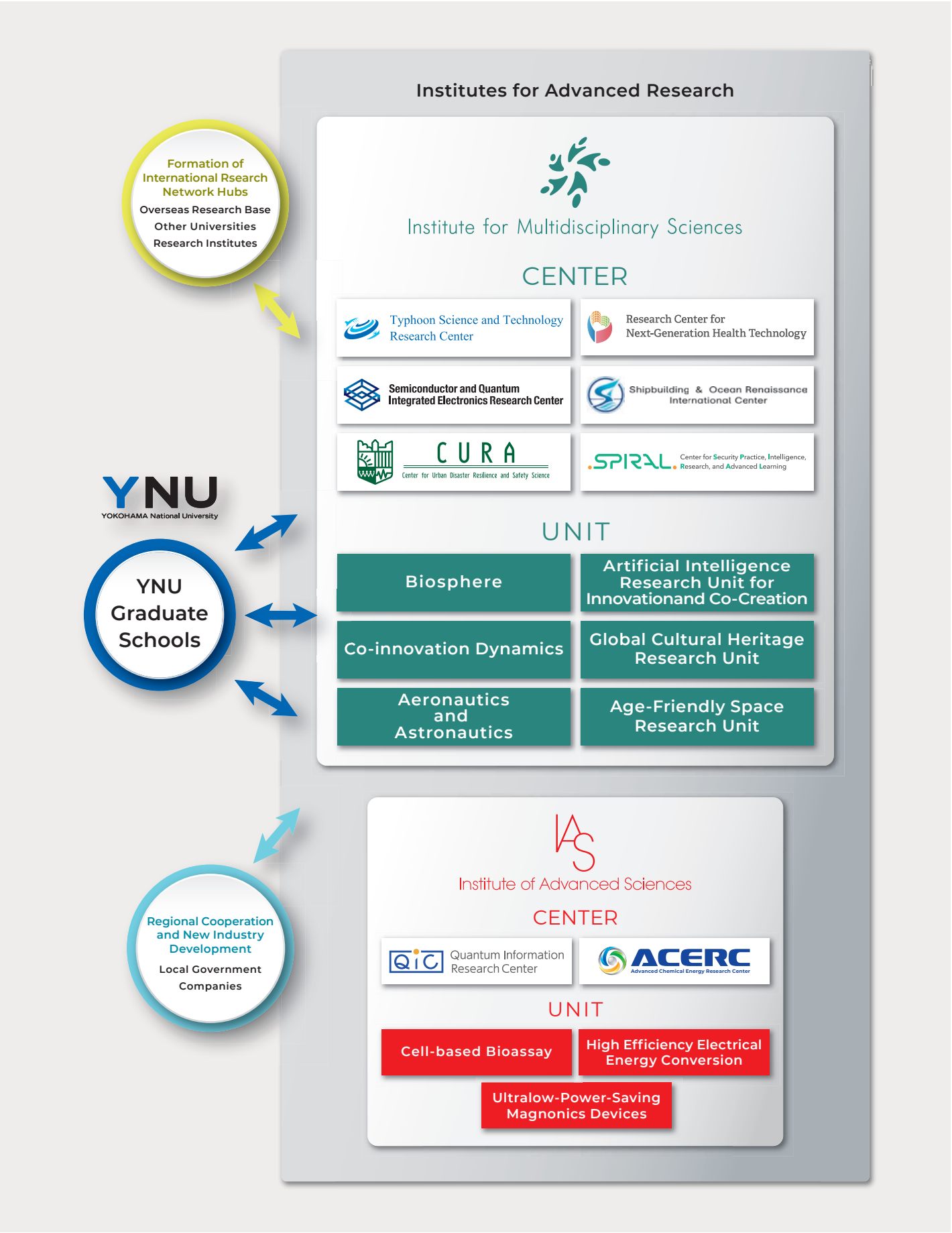
**Vice Director of
IAS and IMS**

**YOSHIKAWA
Nobuyuki**

Research Support System

The IAS and the IMS bring together international researchers in a wide range of fields from both within and outside Japan to undertake high-level research projects. Dedicated research strategy planning managers and industry-university-government collaboration coordinator have been assigned to realize focused support not only for the putting in place of a leading-edge research environment, external funding management, and research outreach activities (including research PR and science communication), but also for the building of a researcher network that links together the researchers at the IAS and the IMS across the boundaries of their respective research fields.

IMS Organizational Structure



Institute for Multidisciplinary Sciences

INTRODUCTION OF THE CENTER

CENTER 1



TRC
Typhoon Science and Technology Research Center

VISION

As Japan's first dedicated typhoon research facility, the Typhoon Science and Technology Research Center aims to contribute to the formation of a safe, active and sustainable society, by reducing typhoon disaster risk. The Center also aims to contribute to a carbon-free society by harnessing typhoon energy.



Center Director
FUDEYASU
Hironori

ABOUT

As Japan's first dedicated typhoon research institute, the Typhoon Science and Technology Research Center aims to contribute to the formation of a safe, active and sustainable society, by reducing typhoon disaster risk. The Center also aims to contribute to a carbon-free society by harnessing typhoon energy.

RESEARCH CONTENTS

The Typhoon Science and Technology Research Center contributes in four ways:

- 1 **Contribution to the formation of a safe, active and sustainable society, by reducing typhoon disaster risk**
- 2 **Contributing to a carbon-free society by creating a new source of renewable energy**
- 3 **Contributing to the recovery of Japan as a technology superpower through typhoon innovation**
- 4 **Contribution to cultivation of personnel who can succeed on the world stage through seamless research partnership between industry and academia**

CENTER 3



Semiconductor and Quantum Integrated Electronics Research Center

VISION

The Centre will contribute to solving issues and improving the convenience of our increasingly diverse societies by promoting the realisation of smart cities, for example, through the research and development, and diffusion of cutting-edge electronics technologies.



Center Director
MANABE
Seiji

ABOUT

As a specialized organization for semiconductor and quantum technology located in Yokohama, we will foster innovation by connecting research institutions and companies worldwide and by connecting university and society.

RESEARCH CONTENTS

Establishment of five laboratories

- 1 **Semiconducting heterogeneous integration laboratory**
Focuses on the true value, deepening, and evolution of chiplet technology, and promote research on "heterogeneous integration" that can "connect" various devices in an "energy-saving" and high-speed manner with enabling parallel operation.
- 2 **Advanced integrated device laboratory**
Promotes researches on new devices that transcend the limitations of conventional semiconductor devices, as well as on their integration technologies.
- 3 **Quantum Internet laboratory**
Promote research and development for the realization of the quantum Internet as the foundation for global connectivity of quantum devices.
- 4 **Photonics laboratory**
Contribute to the pioneering of next-generation optical communication technologies and non-destructive and accurate diagnostic technologies for social infrastructure.
- 5 **Social value innovation laboratory**
Practical and theoretical research on methods of innovation (especially social implementation) is conducted to realize value by disseminating SQIE research results to society.

CENTER 2



Research Center for Next-Generation Health Technology

VISION

The Center builds health innovation ecosystems based on research evidence from general knowledge, linking development of medical and healthcare technology to technology development and practical research. In this way the Center creates innovative spaces where people can enjoy health and happiness through movement, work and residential living.



Center Director
SHIMONO
Tomoyuki

ABOUT

By gathering the Center's "seeds" related to general health technology, including health, medicine and social services, the Center becomes a hub that links industry, academia and citizens, advancing world-leading academic research. We aim to be an organization that shoulders the responsibility of organically and effectively advancing regional liaison, industry-academic-public liaison and medical-industrial liaison.

RESEARCH CONTENTS

Establishment of five laboratories

- 1 **Revolutionary Medical Device Creation Laboratory**
Conducts R&D in medical devices to support new medical technologies
- 2 **Healthcare MaaS Laboratory**
Development of high-value-added service technologies linking movement with medicine, such as transport for hospital admissions, emergency care and critical care.
- 3 **Medical Data Science Laboratory**
Research on use of Big Data linked to early diagnosis of presymptomatic and latent disease in the healthcare and medical fields
- 4 **Femtech/Assistive Tech Research Laboratory**
Research on femtech to achieve divergence and inclusion and support technologies considering disabilities and other differences in abilities
- 5 **Health Innovation Ecosystem Co-creation Laboratory**
Advancement of research fusing social science and urban science as needed to form ecosystems centered on health technologies

CENTER 4



SORIC
Shipbuilding & Ocean Renaissance International Center

VISION

To address the two major challenges of shipbuilding revitalization and advancing ocean development, we integrate diverse and cutting-edge knowledge through industry-government-academia and international collaboration. Through this approach, we seek to drive structural transformation and new value creation in the maritime and ocean industries, while advancing next-generation maritime and ocean systems and industrial foundations for a sustainable future.



Center Director
MITSUYUKI
Taiga

ABOUT

We integrate research on shipbuilding DX systems based on robotics, AI, and digital twins; design and operational optimization of maritime and ocean systems; ocean energy utilization; ocean observation and exploration systems; maritime cybersecurity; and maritime industrial strategy and global partnerships, to advance sustainable and globally competitive next-generation maritime and ocean industrial systems.

RESEARCH CONTENTS

Establishment of four laboratories

- 1 **Advanced Shipbuilding Technology & Talent Development Lab**
Advances cutting-edge shipbuilding technologies and talent development through industry-academia collaboration, grounded in the fundamentals of naval architecture and ocean engineering.
- 2 **Next-Generation Shipbuilding Systems Lab**
Enhances and automates shipbuilding systems through robotics, AI, digital transformation (DX), cybersecurity, and digital twin technologies.
- 3 **Maritime Strategy & Global Partnerships Lab**
Leads international maritime collaboration and supports the development of regulatory frameworks, standards, and industrial policies.
- 4 **Blue Economy & Ocean Innovation Lab**
Promotes the design and demonstration of innovative ocean-use solutions, including offshore wind and marine energy technologies.

Institute for Multidisciplinary Sciences

INTRODUCTION OF THE CENTER



VISION

The Center seeks to pioneer a new academic framework for urban disaster resilience by advancing interdisciplinary research based on urban science and industrial safety engineering, and fostering co-creation among governments, industry, academia, and citizens. These efforts aim to transform urban density and diversity from sources of vulnerability into drivers of resilience and societal strength.



Center Director
**SHIBUTANI
Tadahiro**

ABOUT

Viewing cities as dynamic systems to clarify the interdependencies among human behavior, infrastructure, logistics, and industrial activities, the center aims to develop a theoretical framework for urban disaster resilience, digital twins, and functional continuity indicators, thereby supporting more effective urban planning and evidence-based decision-making by local governments.

RESEARCH CONTENTS

Establishment of three laboratories

- 1 Urban Disaster Management Lab.**
Investigates disaster management strategies to enhance societal resilience and minimize risks to communities and livelihoods.
- 2 NUrban Infrastructure Lab.**
Examines the design and operation of resilient infrastructure essential for mitigating disaster impacts on society and daily life.
- 3 Industrial Safety Lab.**
Promotes research on industrial safety to reduce the impacts of industrial disaster on urban resilience.

Institute for Multidisciplinary Sciences

INTRODUCTION OF THE UNIT

UNIT 1 Biosphere

VISION

To address various problems such as climate change and biodiversity loss, we will provide scientific evidence to leverage the value of nature to maximum effect and present new ways of interacting with nature and society that consider humans as a part of the biosphere.



Principal Investigator
**KAGAMI
Maiko**

RESEARCH CONTENTS

This research unit will provide the scientific evidence needed to utilize the boundless value of nature, in applications such as climate stabilization, disaster risk reduction, pandemic control, food and water security, and cultural diversity. Through collaboration among science, society, and policy, this research unit aims to build sustainable development for the biosphere, including humanity.



VISION

Through the spiral advancement of research, education, and practice, we elevate Japan's cybersecurity technologies and talent to global excellence and help shape a trusted digital society.



Center Director
**YOSHIOKA
Katsunari**

ABOUT

Through the spiral advancement of research, education, and practice, we foster an ecosystem that integrates cutting-edge cybersecurity research, research-driven advanced education, cyber threat intelligence, and real-world security operations, enabling innovative technologies to address evolving threats in the AI era, cultivating globally active cybersecurity professionals, and advancing a trusted digital society.

RESEARCH CONTENTS

Establishment of four laboratories

- 1 Cybersecurity Research and Practice Lab.**
Conducts research and development of cybersecurity technologies and provides support for security operations.
- 2 Next-Generation Cryptography Lab.**
Advances the mathematical foundations required for post-quantum cryptography (PQC) and advanced cryptographic technologies, and conducts research and development of next-generation cryptographic solutions.
- 3 Cybersecurity Advanced Practical Education and eXpertise Lab.**
Promotes and develops practical cybersecurity education, incorporating knowledge and expertise gained from real-world operational environments.
- 4 Cybersecurity Linkage, Innovation, Networking and Knowledge-Sharing Lab**
Serves as the interface between the laboratories and society by promoting the social implementation of research outcomes through technology transfer and standardization, while supporting collaborative research and conducting outreach activities.

UNIT 2 Artificial Intelligence Research Unit for Innovation and Co-Creation

VISION

We contribute to a prosperous future society by pursuing original artificial intelligence (AI) technologies and promoting the beneficial application of AI in various fields.



Principal Investigator
**SHIRAKAWA
Shinichi**

RESEARCH CONTENTS

This research unit conducts innovative and co-creative research through the development of original techniques related to automated machine learning, evolutionary machine learning, and AI design with known unknowns. This research is based on AI, including machine learning, deep learning, and evolutionary computation. This research also promotes the application of AI technologies to other fields, such as bio technology, biomedical engineering, security, and industry academia-government collaborative research activities.

INTRODUCTION OF THE UNIT

UNIT 3

Co-innovation Dynamics

VISION

To achieve new social value by socially implementing advanced knowledge and technology, the Lab clarifies mechanisms for transfer and sharing of knowledge and technology both within and among organizations. The Lab also conducts practical research on the dynamics of strategy, management and innovation in partnership with industry, academia and government, to achieve co-innovation.

RESEARCH CONTENTS

We are asked to aim to promote innovation and achieve new social value by deploying advanced technologies and knowledge discovered by universities and the like in society (social implementation). This objective requires understanding the methods and dynamics of co-innovation among a variety of players in society. This Research Unit is primarily devoted to investigating the mechanisms and process of transfer / sharing of knowledge and technologies within and among organizations. This Unit also conducts practical research on the dynamics of innovation to realize social value, including the strategy and management of industry-academia-government collaboration for co-innovation.



Principal Investigator
MANABE
Seiji



Principal Investigator
YASUMOTO
Masanori

UNIT 4

Global Cultural Heritage

VISION

Aiming to realize a peaceful world free from war, by using the cultural assets that humanity has continued to create since prehistoric times, and which are shared across national and ethnic boundaries, to develop a bird's-eye view of human history across space and time.

RESEARCH CONTENTS

Both the fine arts and technology are 'art' that is continually being created by human beings. Our research includes the development of advanced measurement techniques that are useful in research on and conservation of works of art, and the application of informatics to accumulated cultural heritage data to discover new insights into the history of mankind.



Principal Investigator
FUKUNAGA
Kaori

UNIT 5

Aeronautics and Astronautics

VISION

We aim to realize a sustainable aerospace society in harmony with the global environment by integrating aerodynamic design technologies for high-speed flight, materials for extreme environments, optimal guidance and control, and innovative propulsion systems to advance eVTOL aircraft, reusable space transportation vehicles, and deep-space explorers.

RESEARCH CONTENTS

We integrate aerodynamic analysis of aircraft and spacecraft using CFD; materials design of superalloys and refractory high-entropy alloys (RHEA); rover design based on terramechanics; guidance, navigation, and control driven by trajectory optimization; and research on detonation and ion engines to develop next-generation aerospace systems, ranging from eVTOL aircraft to lunar and deep-space explorers.



Principal Investigator
ISHII
Kazuhiro

UNIT 6

Age-Friendly Space Research Unit

VISION

We aim to realize age-friendly spaces—encompassing homes, community hubs, and outdoor environments—where older adults understand their own physical condition and continue to live independently, thereby extending healthy life expectancy while reducing the societal burden of medical and long-term care.

RESEARCH CONTENTS

Integrating early detection of fall risk and functional decline through physical assessment, evidence-based spatial design of residential and outdoor environments, and community-based practice in the Yokohama area, we develop and implement a replicable age-friendly space model that sustains independent living in later life.



Principal Investigator
SHIMA
Keisuke



Institute for Multidisciplinary Sciences
Yokohama National University



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