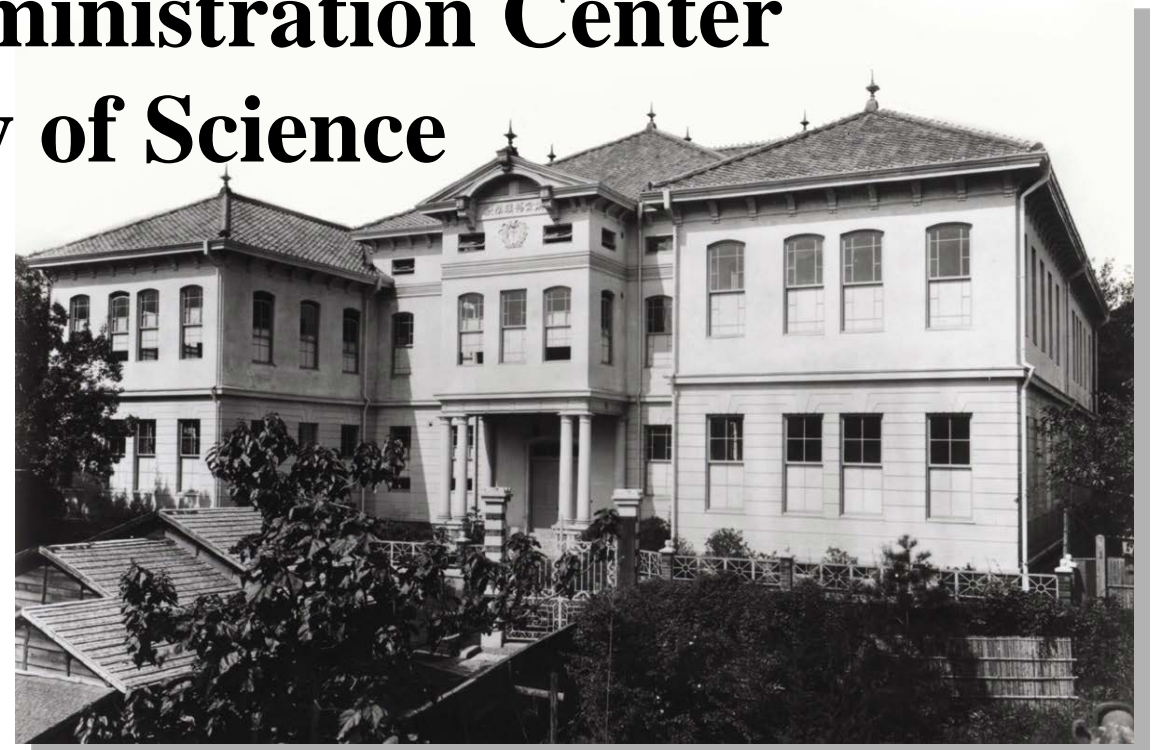


# **Industry-Academia Cooperation Activities at Tokyo University of Science**

**March 10, 2015**

**Yoshito Koga**

**University Research Administration Center  
Tokyo University of Science**



東京物理学校(1906年)



# Innovative Tokyo





# Building a Better Future with Science

## Mission

### Building a Better Future with Science

Since the founding of Tokyo University of Science in 1881, science and technology have advanced at a dizzying pace. Global issues such as environment and energy challenges have emerged as crucial issues.

Today our founding principle of advancing science and technology in harmony with nature is more relevant than ever.

Rooted in a strong sense of ethics, scientists and engineers at TUS strive to solve global challenges and make the world a better place through science.

**Akira Fujishima, Ph.D.**  
**President, Tokyo University of Science**



**President Fujishima is known for discovering the photocatalytic and superhydrophilic properties of titanium dioxide (TiO<sub>2</sub>)**

# TUS at a Glance 1

# 1881

21 young physicists establish  
**Tokyo Academy of Physics,**  
the forerunner of  
Tokyo University of Science.



TUS has graduated  
more Masters of Science than any other  
private university in Japan.

The founders championed  
the founding principle of  
“**Building a Better Future  
with Science**”  
and promoted science.

TUS is  
**the oldest**  
private university of  
science and technology  
in Japan.





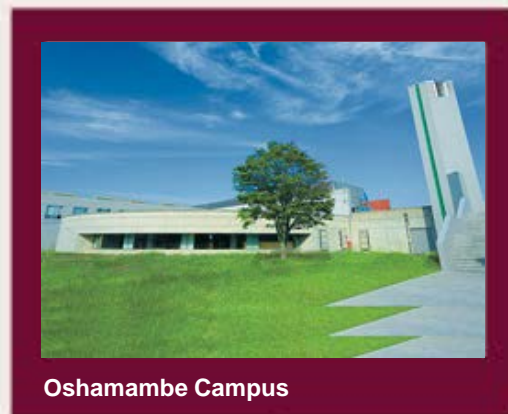
# TUS Campuses

5 Campuses

19,766 Students

1,100,220 Square meters

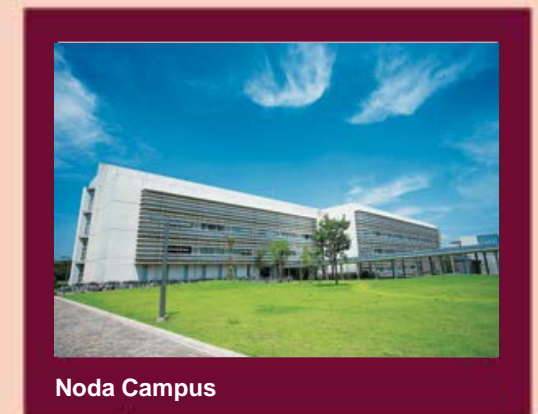
2 Affiliated universities



Oshamambe Campus

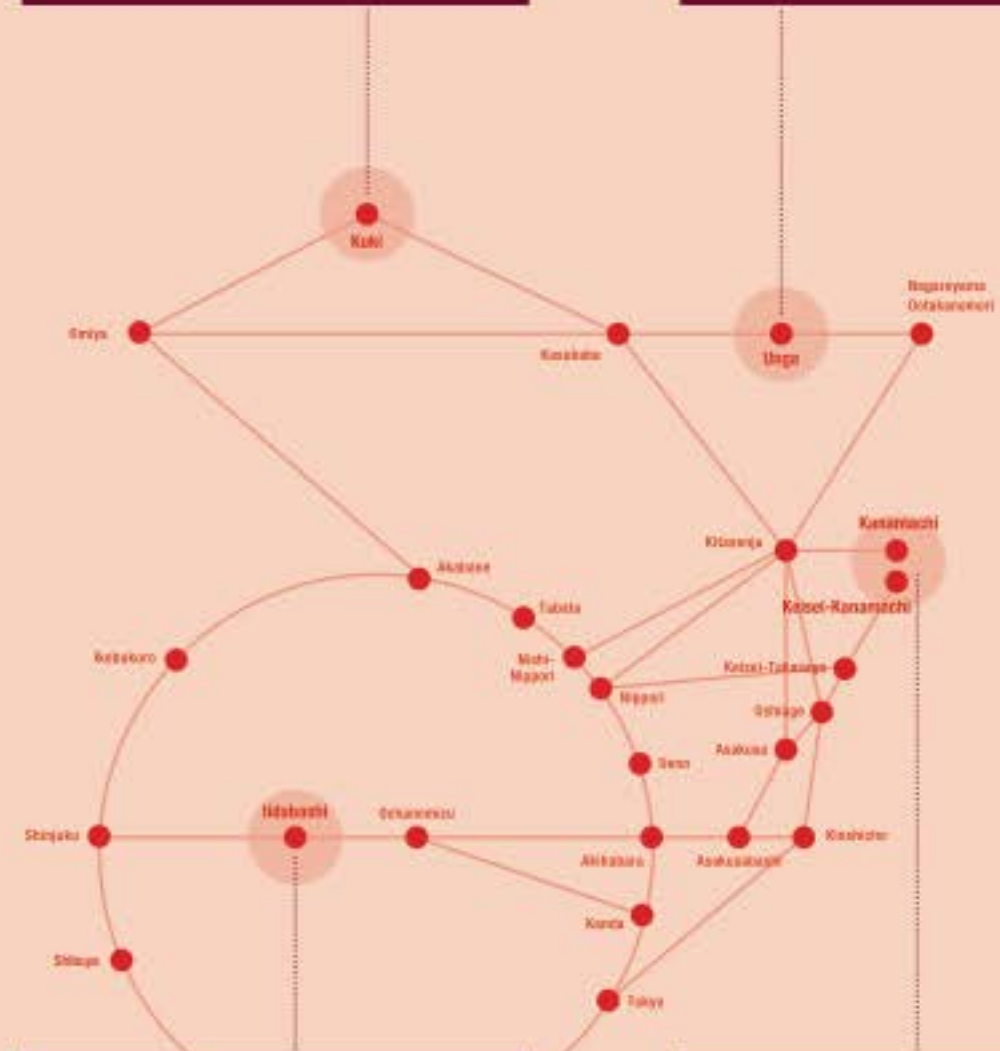


Kuki Campus



Noda Campus

Tokyo Metropolitan Area



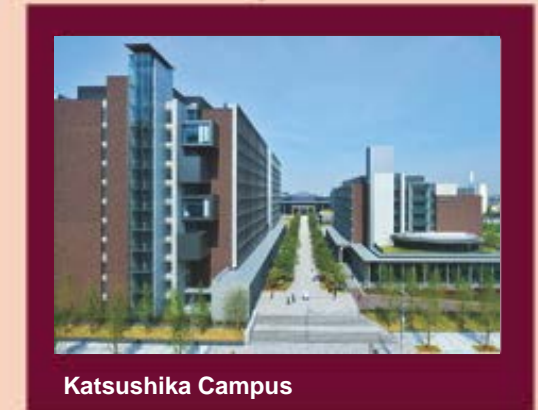
Tokyo University of Science, Yamaguchi



Tokyo University of Science, Suwa



Kagurazaka Campus



Katsushika Campus

# TUS at a Glance 2

students

19,766

Undergraduate

16,430

Master course

2,776

Doctoral course

264

Specialist course

296

Faculty members

841

Undergraduate

8

Faculties

33

Departments

Graduate

11

Graduate schools

31

Departments

Total TUS graduates

Approx. 190,000

10

Research centers



19

Research divisions



More than

350

laboratories

Library collection



1,036,124

items



6,261

Electronic journals



14,668

E-books





# TUS in



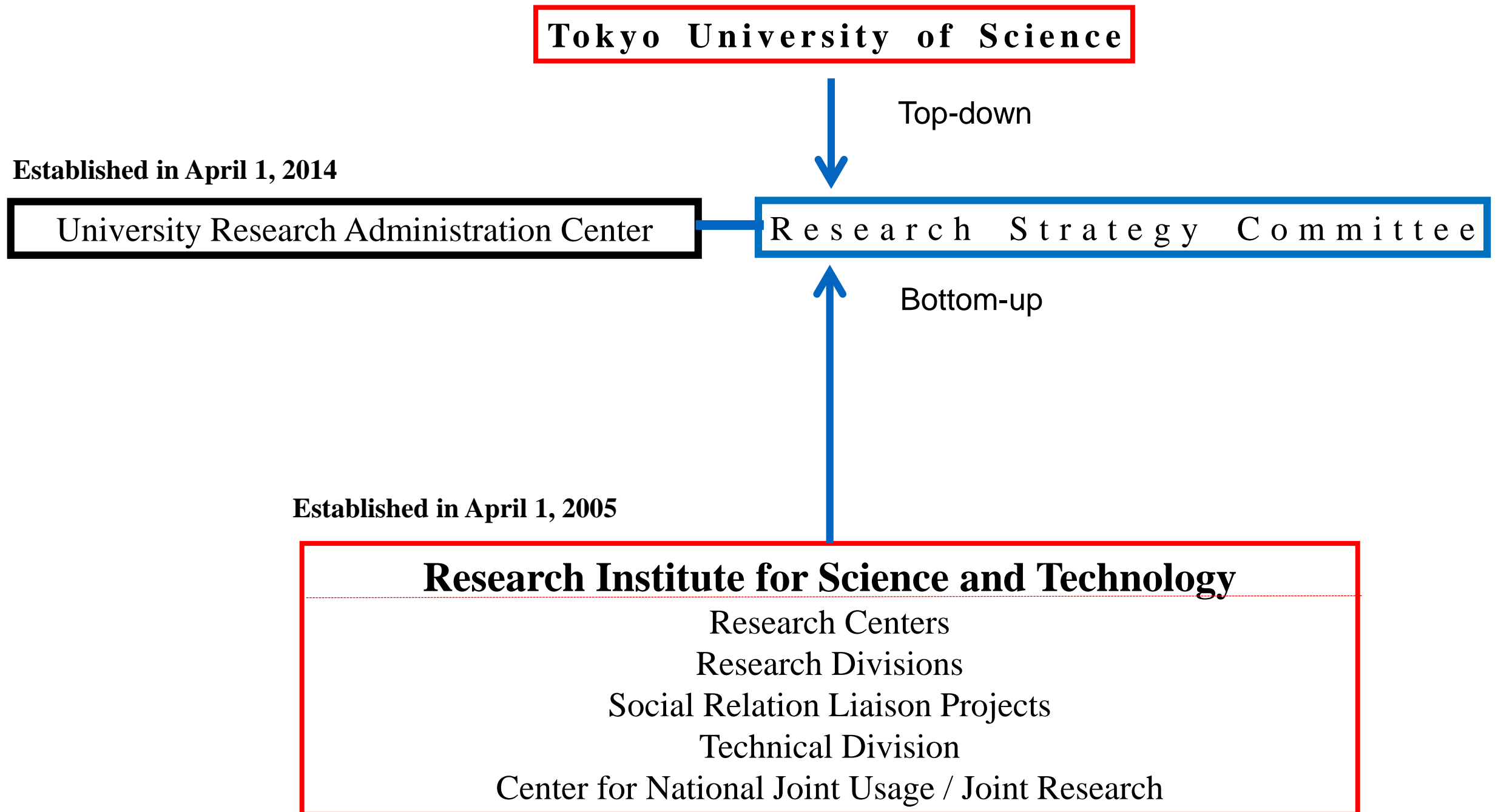
# Pictures



TOKYO UNIVERSITY OF SCIENCE



# Organizational Chart for Research Strategy at Tokyo University of Science (TUS)





# Research Institute for Science & Technology

## Bio • Pharmacy

- Center for Physical Pharmaceutics
- Research Center for RNA Science
- Center for Environmental Health Science for the Next Generation
- Research of for Chirality
- Translational Research Center
- Division of Pharmaco-creation frontier
- Division of Bio-organometallics
- Academic Detailing Database Division
- Division of Medical-Science-Engineering Cooperation

## Fundamentals

- IR FEL Research Center
- Leading-Edge Holography Technologies Research and Development Center
- Quantum Bio-Informatics Research Division
- Imaging Frontier Research Division

## Functional Materials

- Research Center for Green and Safety Sciences
- Photocatalysis International Research Center
- Photovoltaic Science and Technology Research Division
- Division of Ecosystem Research
- Division of Nanocarbon Research
- Division of Thermoelectrics for Waste Heat Recovery
- Division of Colloid and Interface Science
- Division of Synergetic Supramolecular Coordination Systems in Multiphase
- Na-ion batteries project

## Structural Materials

- International Research Division of Interfacial Thermo-fluid Dynamics

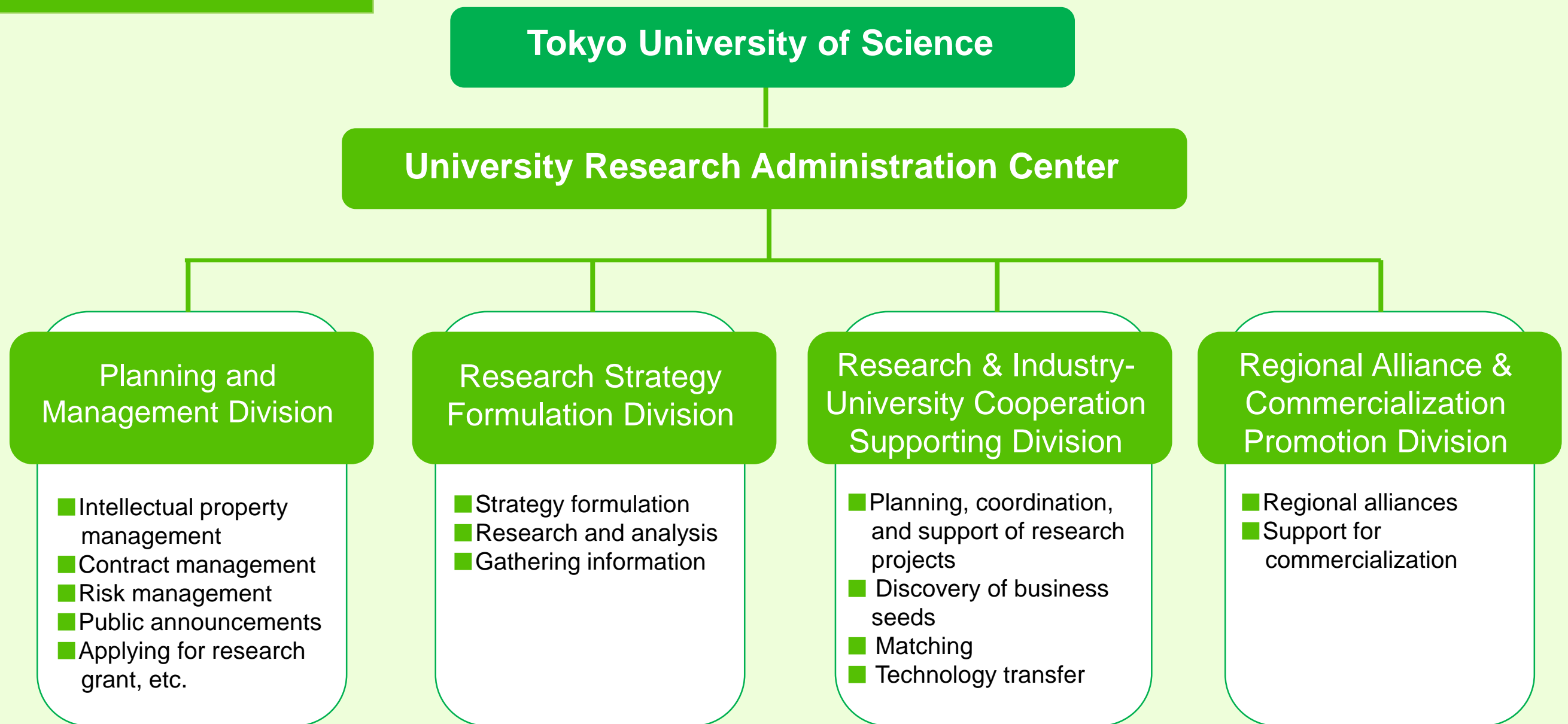
## Information and Social

- Center for Fire Science and Technology
- Division of Next Generation Data Mining Technology
- Mountain Atmosphere Research Devision
- Division of Intelligent System Engineering
- Division of Integrated Science of Oshamambe town
- Division of Advanced Communication Researches
- Division of Advanced Urbanism and Architecture

**RIST TUS**

# Organizational Chart of University Research Administration Center

## Organizational Chart





# URA Center's Major Activities

**1. Joint Research**

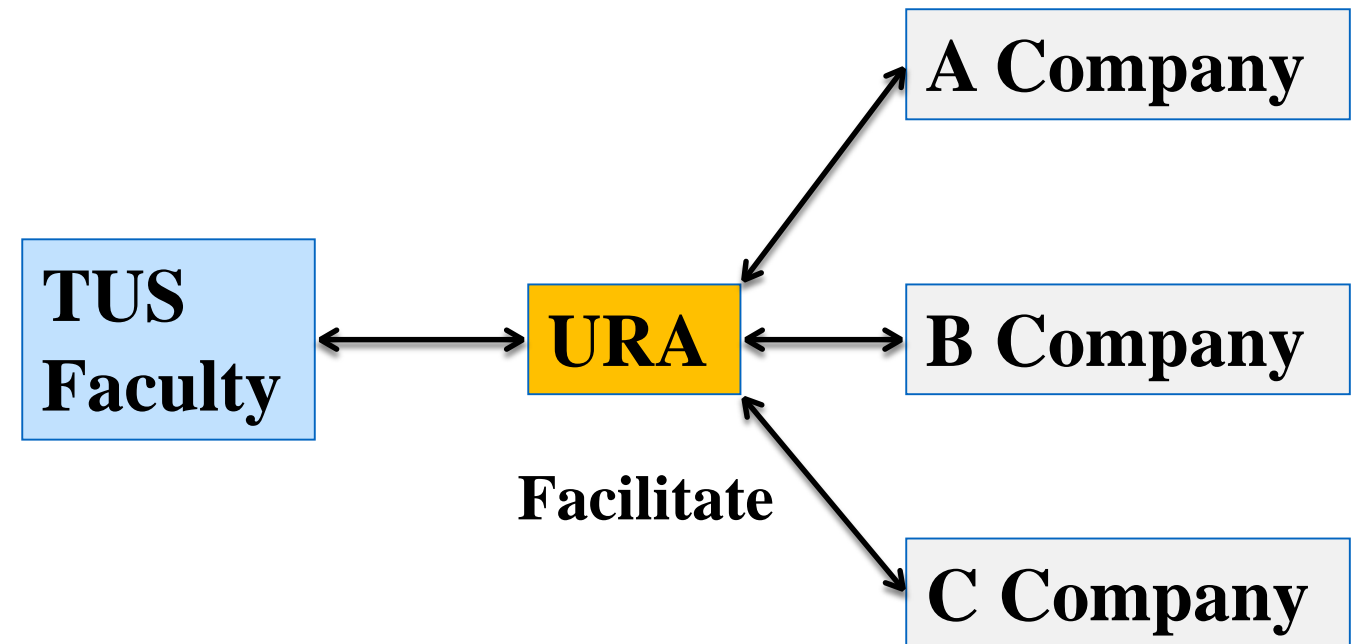
**2. Entrusted Research**

**3. Technical Guidance**

**4. Material Transfer**

**5. Establishment of Joint Venture/Venture Companies**

**6. Collaboration with Government, Local Government, Universities and Companies**



A petri dish with a blue agar surface and a central bacterial colony.

Introduction of :

Patent Applications Activities

Technology Transfer Activities

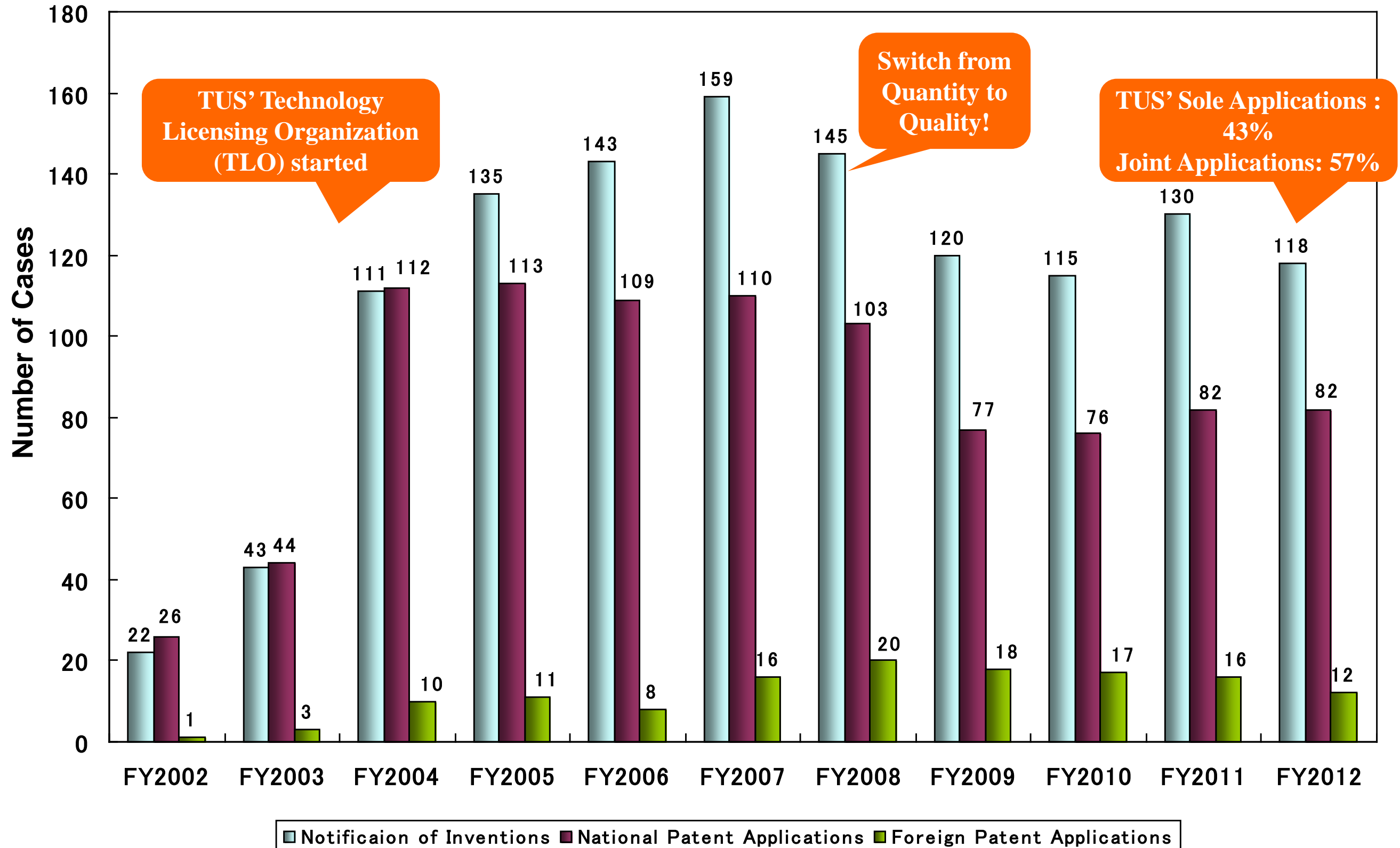
Joint Research & Entrusted Research Activities

Venture Companies

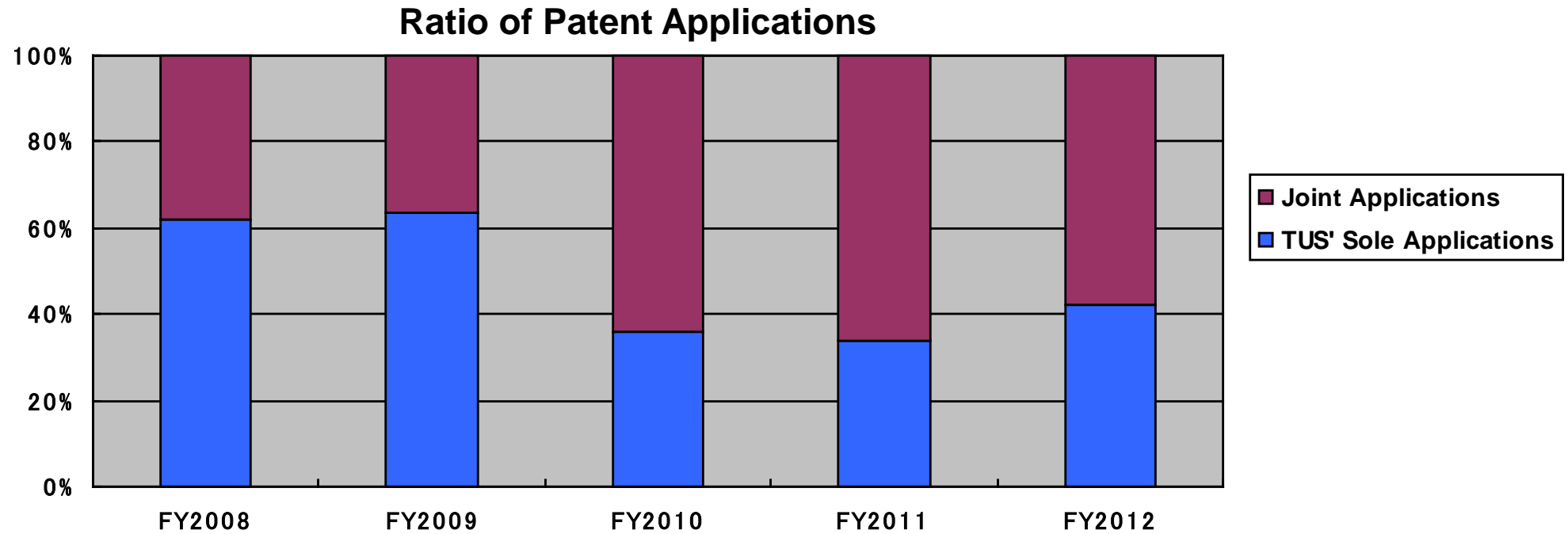
Tribology Center



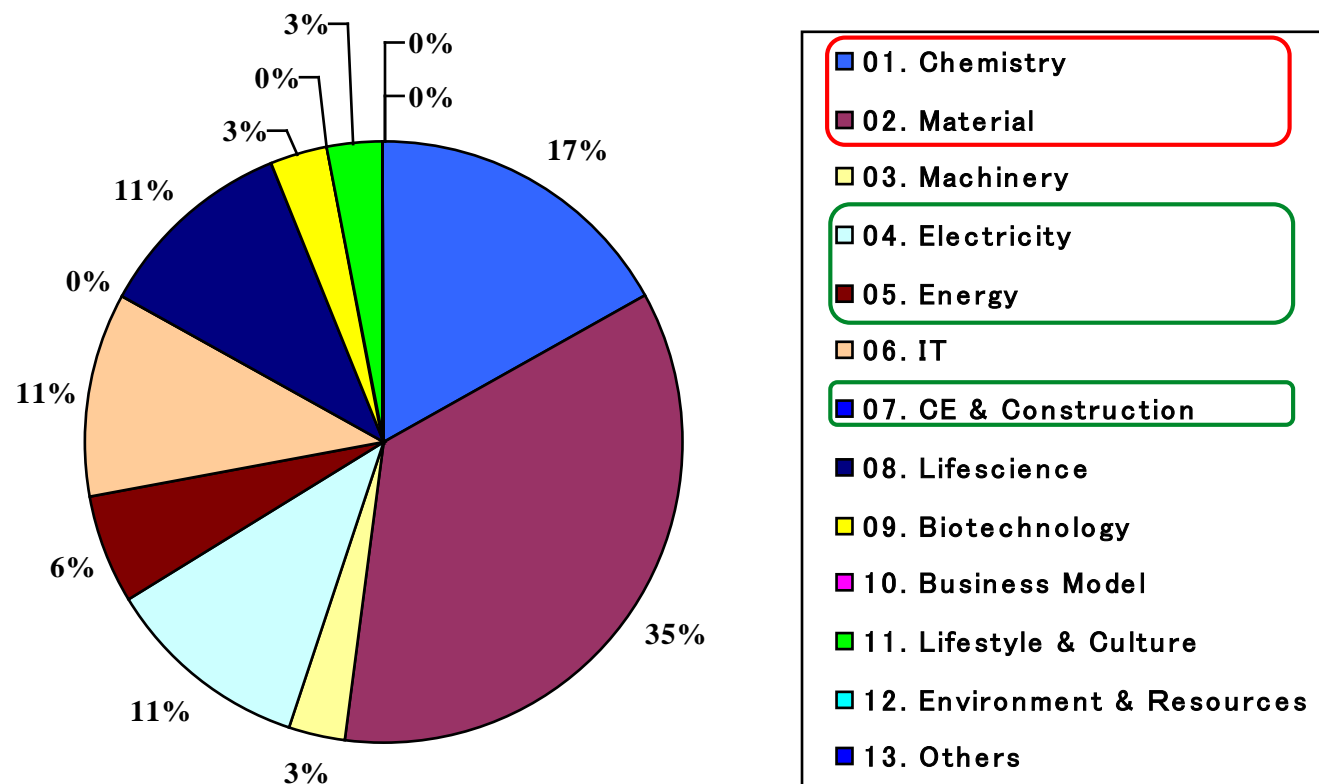
# Number of Patent Applications



# Patent Applications by Field of Technology

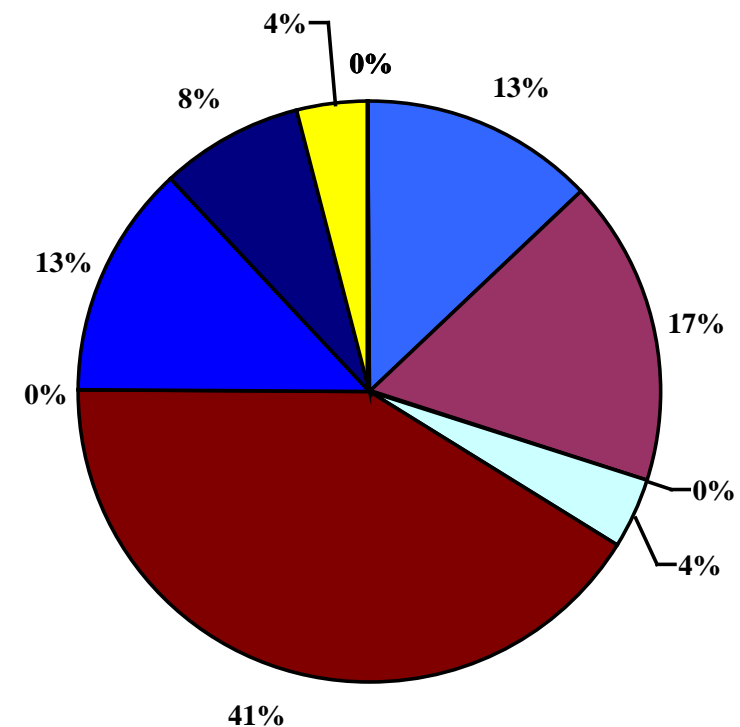


**TUS' Sole Applications (FY 2012)**



★Growing Fields: 01. Chemistry & 02. Material

**Joint Applications (FY 2012)**



★Growing Fields: 04. Electricity & 05. Energy  
(Remarkable for Thermoelectricity and PV)

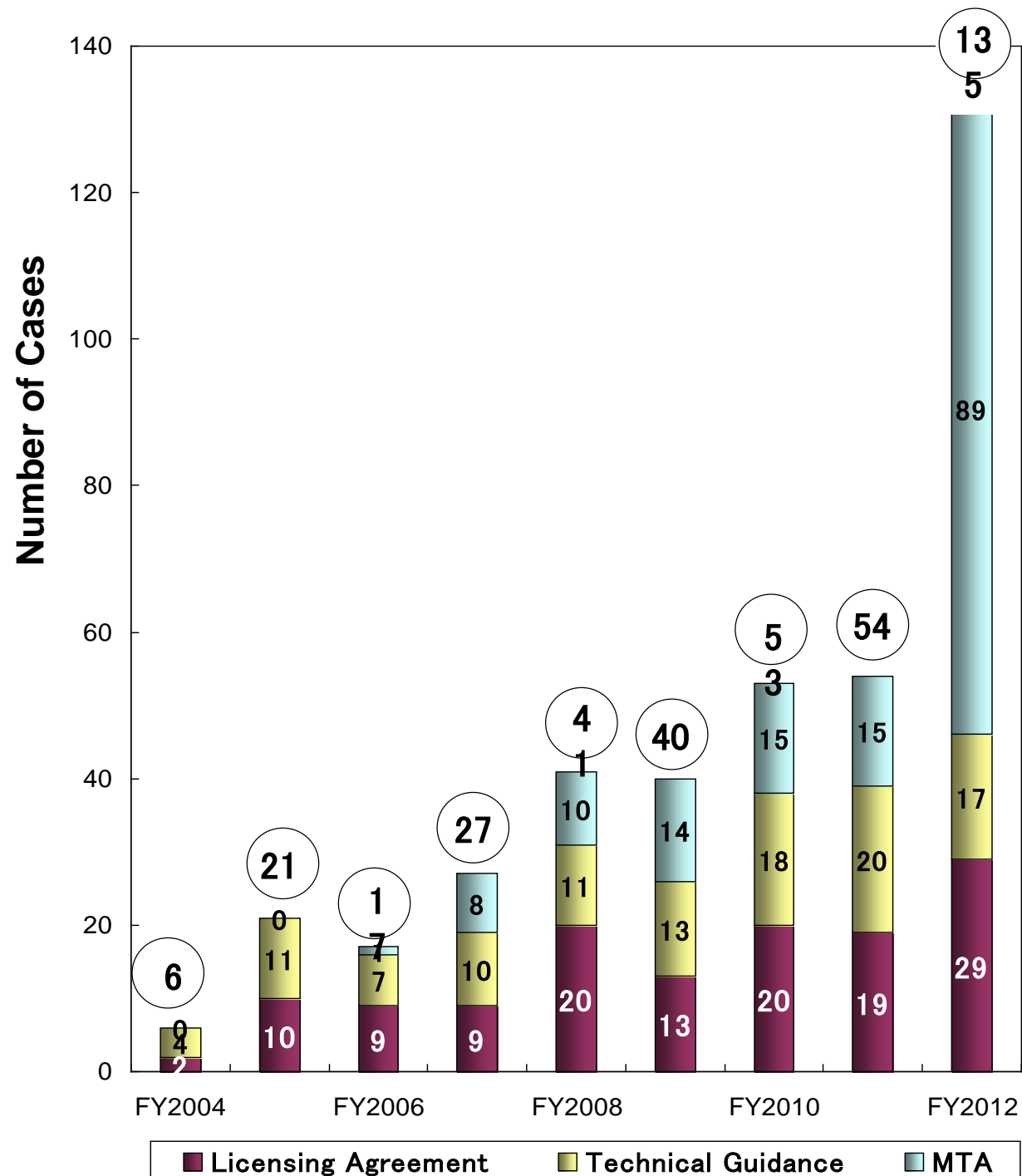




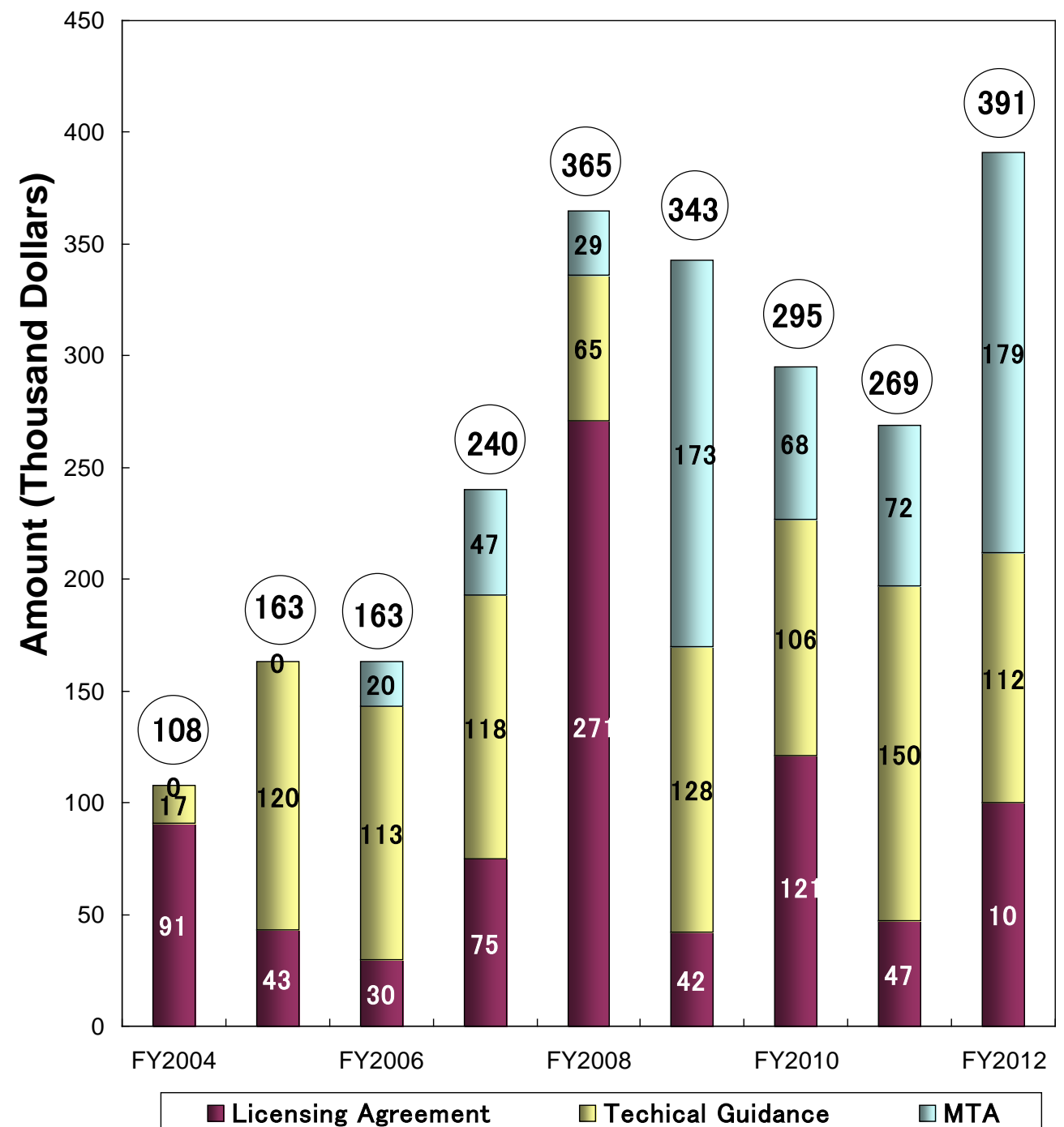
# Implementation of Technology Transfer

★Calculated at a Rate of 100 Yen to the Dollar

## Number of Cases

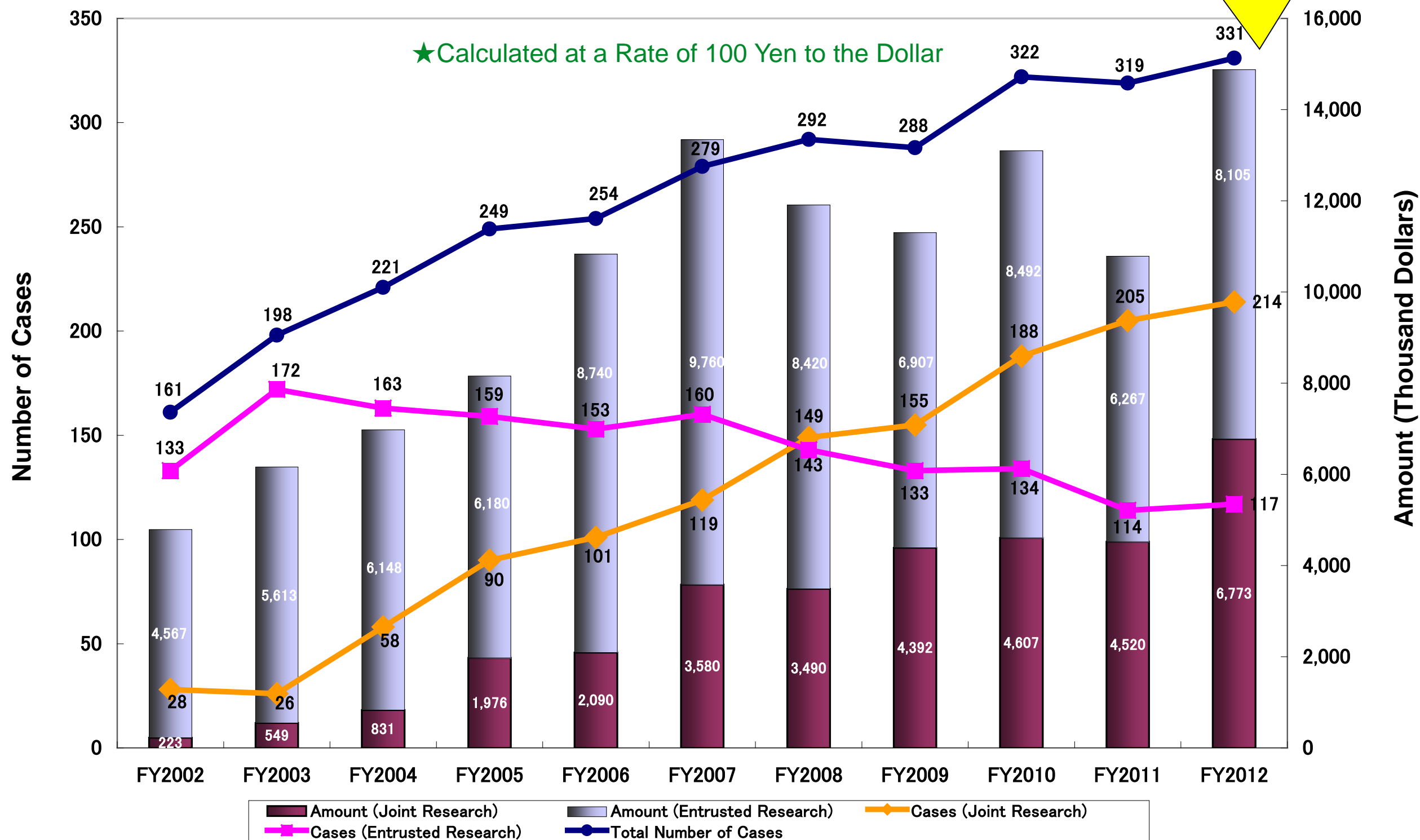


## Amount



# Joint Research & Entrusted Research (New Contract Base)

About 15 Million Dollars  
Best Performance to Date





# **Venture Companies**

## **originated from Tokyo University of Science**

### **L.V.M.C. INC.**

*Providing Materials for Cosmetics*

*PhamaLiposomal Vesicle Formulation*

### **ACTEiiVE CORPORATION**

*Providing CO<sub>2</sub> Reduction Materials (CO<sub>2</sub> Absorber)*

*Resin-Property Remover*

### **INNOPHYS**

*Providing and Developing Wearable Power-Assist Device*



# INNOPHYS CO.

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- **A Robotics Venture**
- **Established in December, 2013**
- **by Kikuch Seisakusho Co., Ltd.**  
**Prof. Hiroshi Kobayashi**
- **Location: Katsushika Campus,**  
**Tokyo University of Science**
- **Products:**  
**Power Assists Suits**  
**“MUSCLE SUIT”**





# MUSCLE SUIT<sup>®</sup>

## Wearable Power-assist Suit

- ▶ A Partial Exoskeleton Structure; can be worn “knapsack-style”, Ten Second to put it on
- ▶ Uses a mouthpiece as its control
- ▶ Uses specially designed rubber tubes (McKibben-type) & compressed air as the source of its power, unlike other similar suits that rely on electric motors
- ▶ Water-proof & Dust-proof
- ▶ **Desperately Needs Compressed Air**



### Waist Assist

Weight: 4kg  
Assist Power: 40kg  
Picking up everyday loads  
with about a third of the  
usual effort

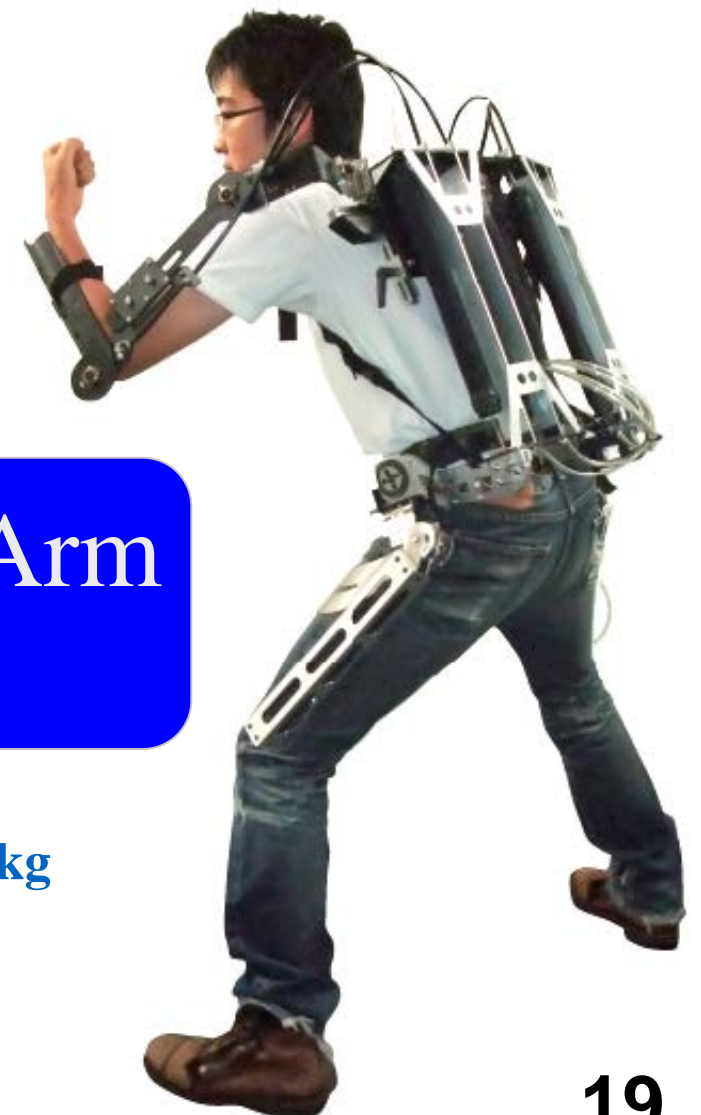
### Waist & Arm Assist

Weight: 8kg  
Assist Power: 30kg

### MuKibben-type

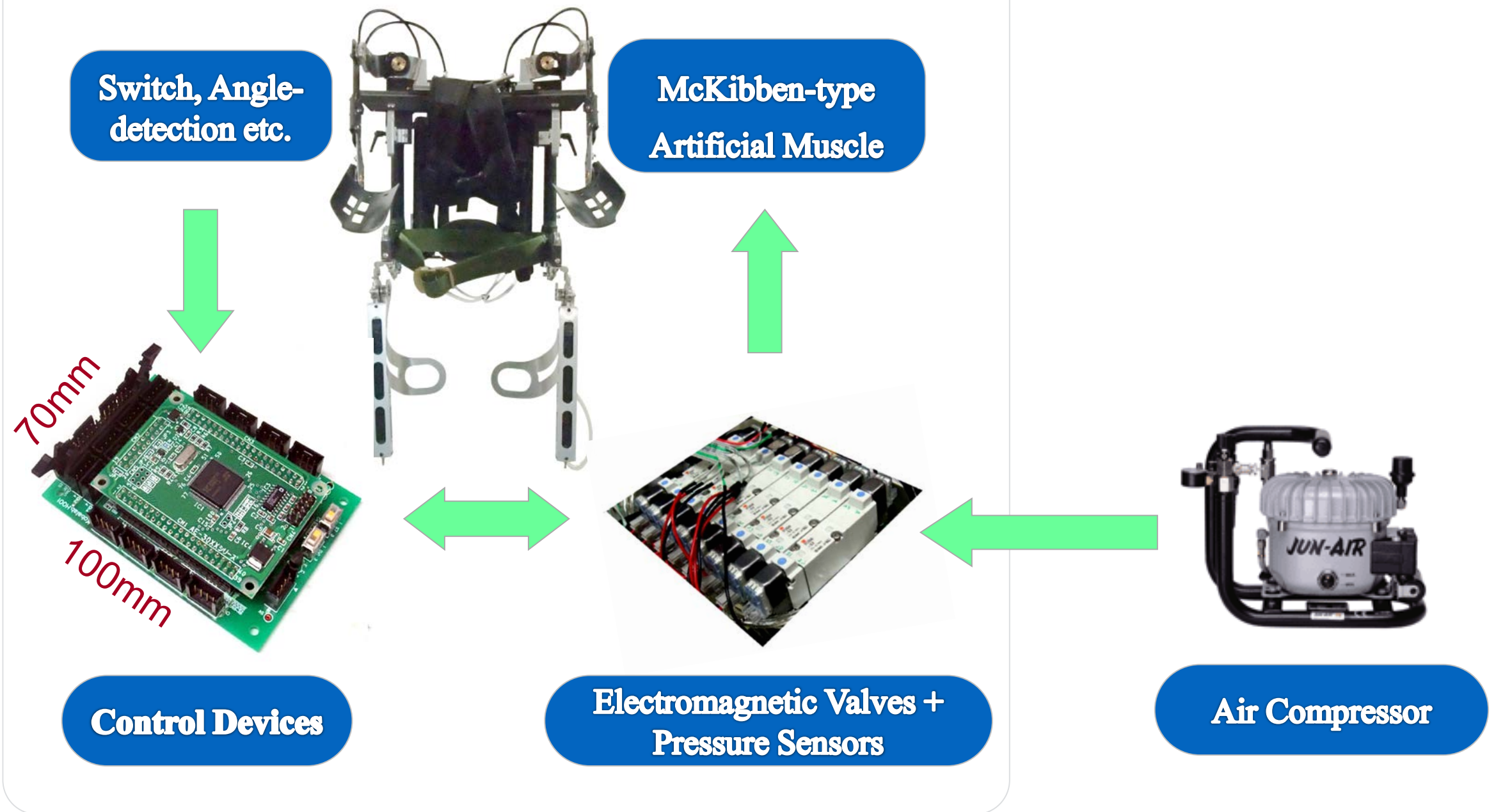


Contraction of  
Artificial Muscles



# System of MUSCLE SUIT<sup>®</sup>

## MUSCLE SUIT





# Potential Users of MUSCLE SUIT<sup>®</sup>

## Phase 1

### Logistics & Distribution

Workers



### Factory



Transport of Heavy Items

Factory Workers



Welding

Welders

### Construction & Building

Construction Workers



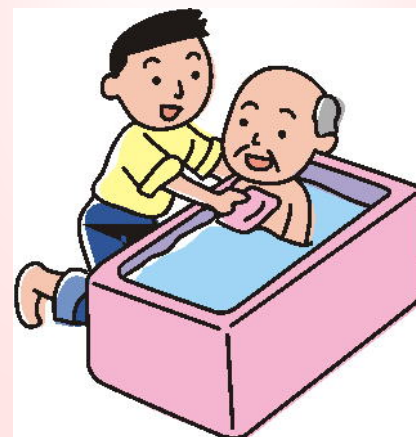
Construction of Reinforcing bar

## Phase 2

### Nursing Service



Helping to lift people into and out of chairs and baths



Home-helpers  
Caregivers  
Nursing Care Workers

## Phase 3

Old Persons  
Handicapped  
Persons



Daily Life Support

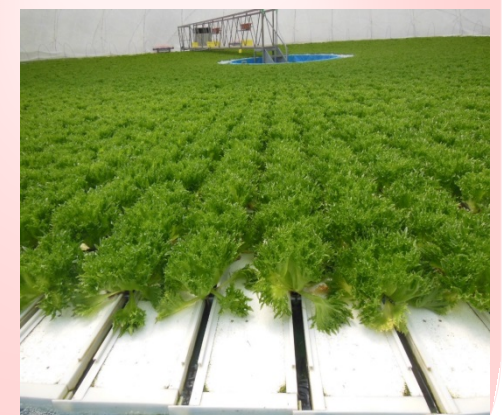


Rehabilitation



Walker

### Agriculture



Farmers

# Tribology Center

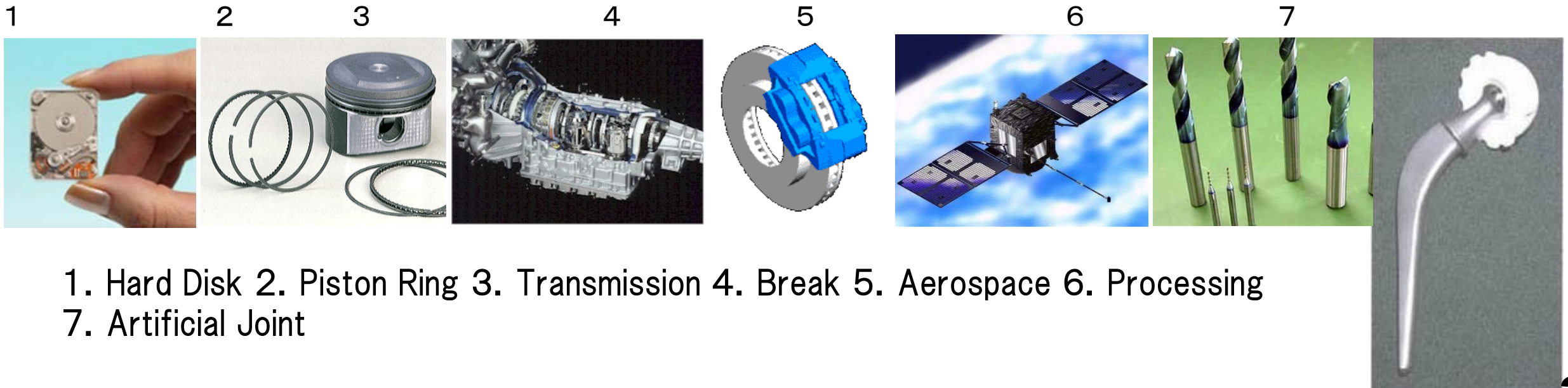
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- **A Regional Open Innovation Promotion Project supported by METI** (Ministry of Economy, Trade and Industry)
- **will be established in April, 2015**
- **Location: Katsushika Campus,  
Tokyo University of Science**
- **Goal:**  
**Further development of Japan's economy and industry through  
collaboration among industry, academia and government** (Tokyo metropolitan  
Industrial Technology Research Center)



# What is Tribology ?

- **“Tribology” is a coined word, derived from Greek word “Tribos”, meaning “friction”**
- **Fields of Tribology**  
Machine Design, Production and Assembly of Parts,  
Operation of Machine System, Maintenance, etc.
- **Importance of Tribology**  
Energy Conservation  
Reduction of Environmental Impact



1. Hard Disk 2. Piston Ring 3. Transmission 4. Break 5. Aerospace 6. Processing  
7. Artificial Joint

# Issue of Tribology

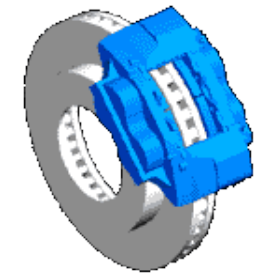
## 1. Friction Control

- **Decrease in Friction : Piston Cylinder, etc.**
- **Stabilization of Friction : Break System, etc.**



## 2. Wear Control

- **Improvement of Wear Resistance: for reliability, long life**
- **Acceleration of Wear: efficiency of facing**



## 3. Emission Control

- **Utilization of Emission : Friction Sound of Musical Instruments**  
**Recovery of Friction Heat, Earthquake**  
**Prediction by underground electric currents**
- **Control of Emission : Friction Noise, Vibration, Leakage of Lubricant,**  
**Dust caused by Friction, Electrified, etc.**

# Introduction of the latest Metal 3D Printer

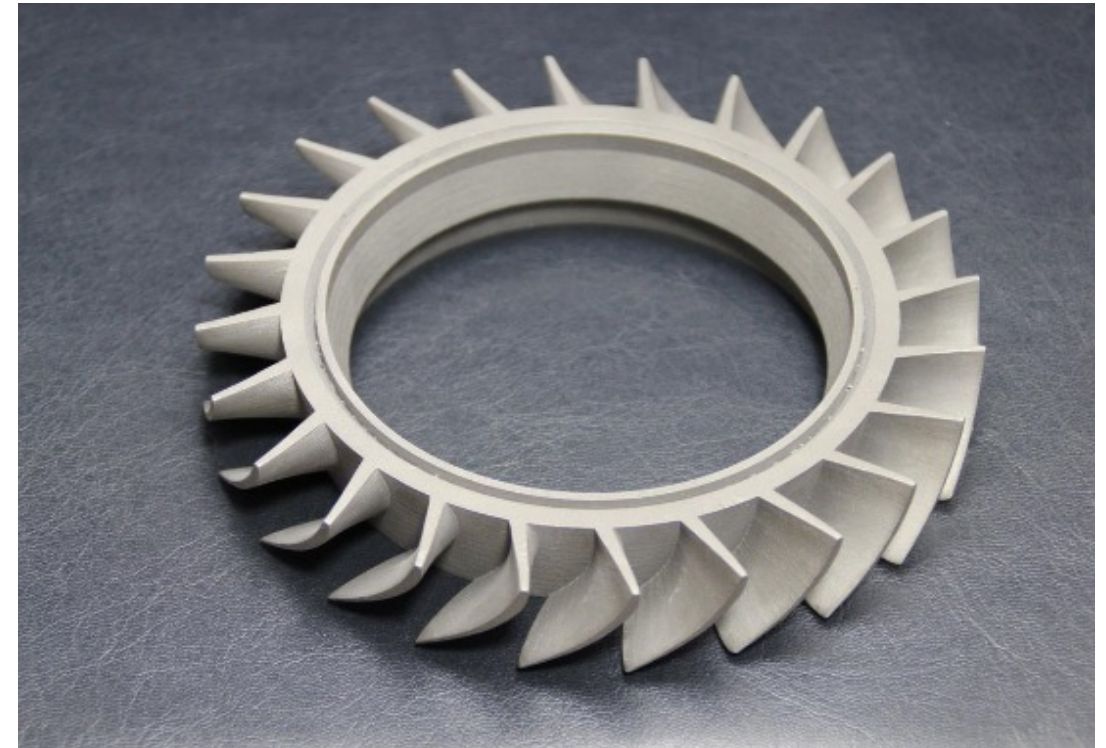
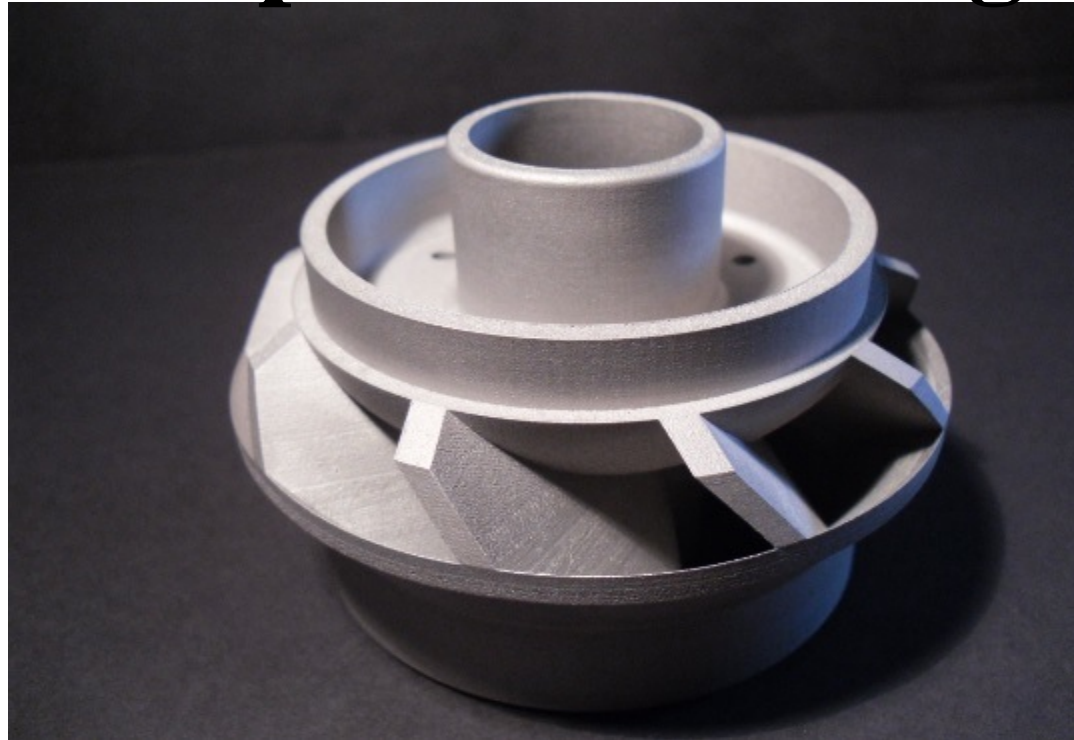


モデル名	ProX300	ProX200	ProX100
レーザー出力（波長1,070nm）	出力500W	出力300W	出力50W
造形容積	250x250x300mm	140x140x100mm	100x100x80mm
外形寸法	2400x2200x2400mm	1200x1500x1950mm	1200x770x1950mm
重量	約5,000kg	約1,500kg	約1000kg

Source: Canon Marketing Japan Inc.  
3D Systems Corporation



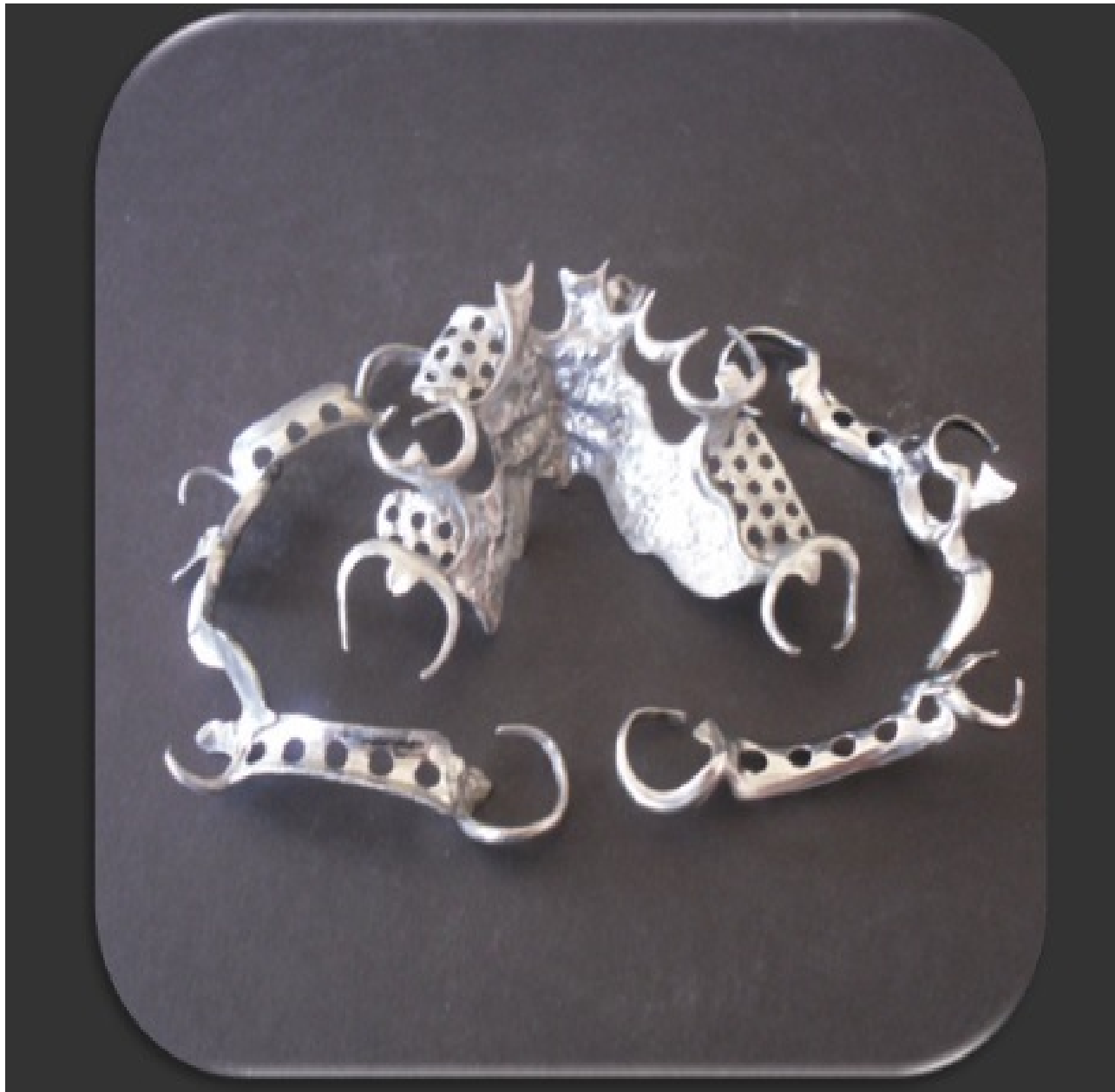
# Example of Sintering



**Industrial Parts, Trial Pieces, Customization, etc**

Source: Canon Marketing Japan Inc.  
3D Systems Corporation

# Example of Sintering



**Dental Plate etc.**

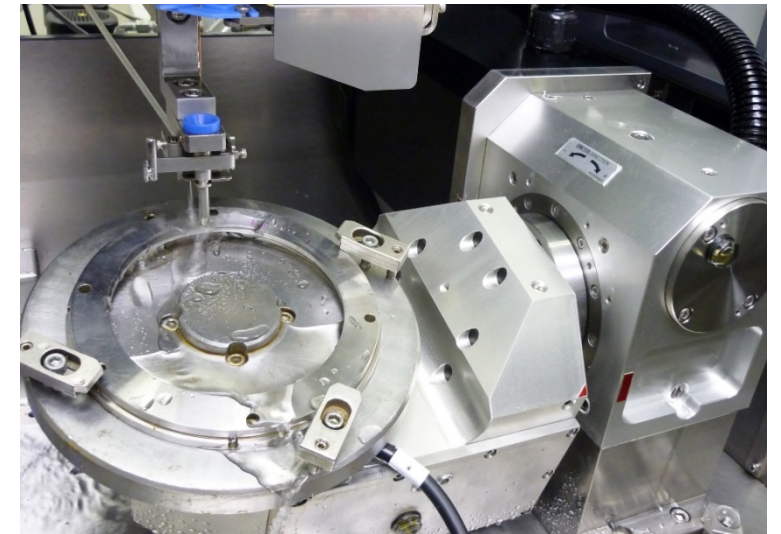


**Source: Canon Marketing Japan Inc.  
3D Systems Corporation**



# Innovation from Tribology Center

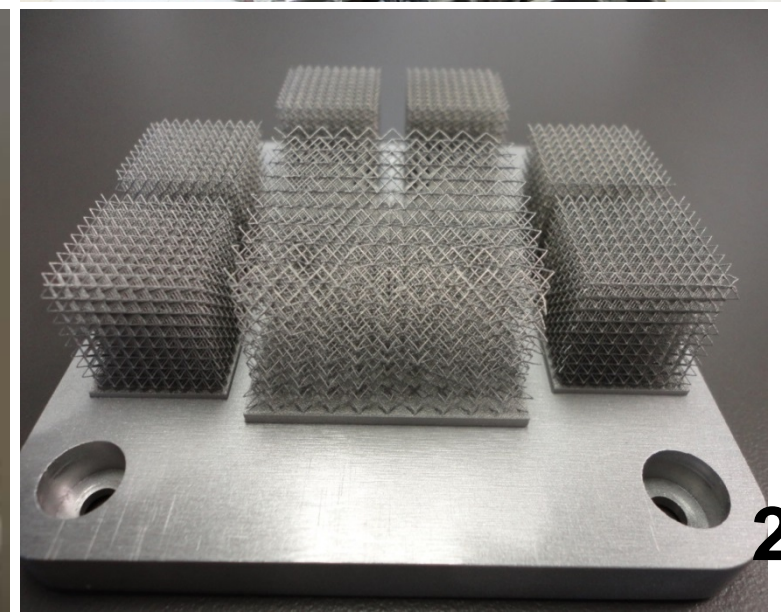
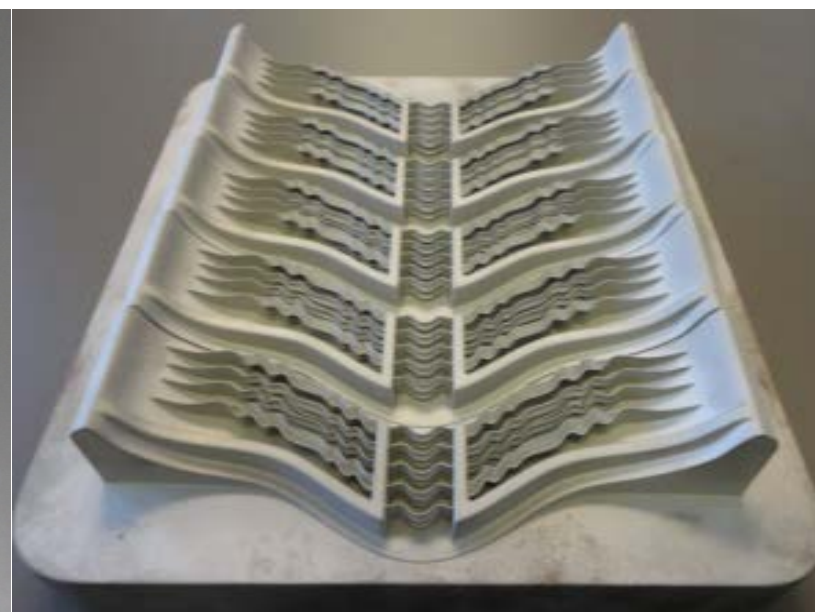
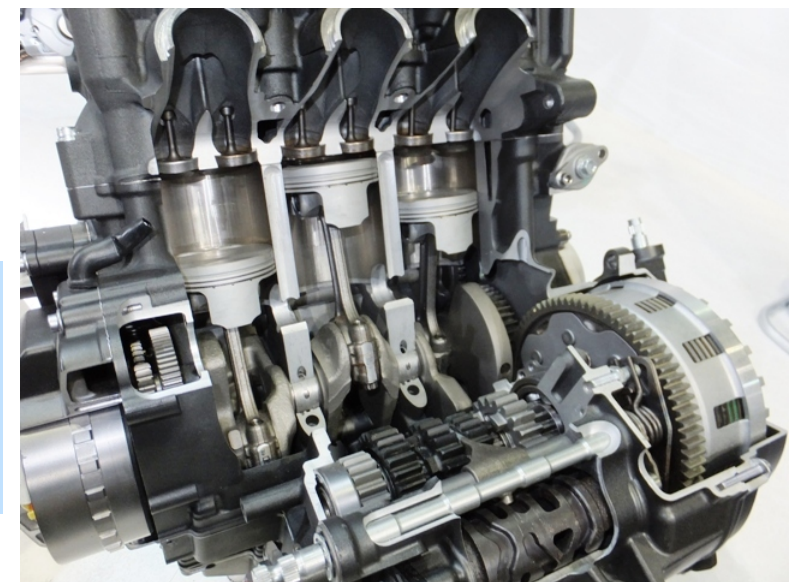
## 1. Advanced Precision Processing & Metal Mold Methods



## 2. Energy Conservation

## 3. Manufacturing Revolution by Metal 3D Printing

To support small- and medium-sized Japanese companies to strengthen their competitive advantages and make access to the aerospace industry market

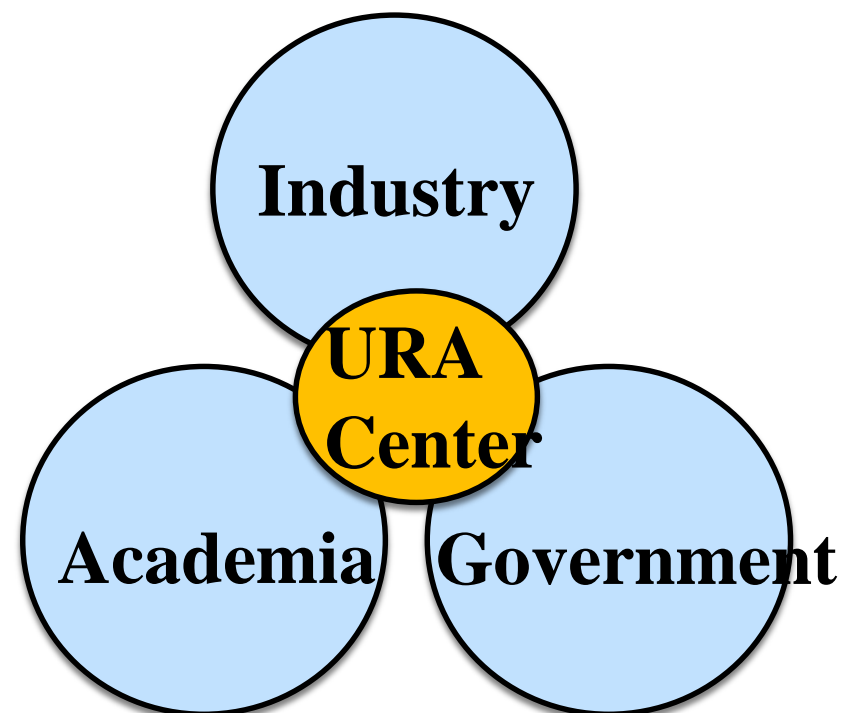


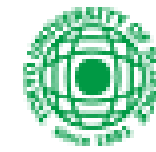


# Conclusion

**Tokyo University of Science (TUS)  
aims to be an internationally competitive university**

**University Research Administration Center  
will play an important role to build a framework for  
industry- academia- government cooperation**





東京理科大学  
TOKYO UNIVERSITY OF SCIENCE

Thank you for your attention !

