Innovative Design/Manufacturing Technologies

New Production 2020 Project

Innovative Manufacturing — Manufacturing of New Function, High Performance and Unprecedented High Added Value

In order to prevail against recent fierce international competition, businesses need to create high-value-added products. The objectives of this program are to develop innovative manufacturing technologies leading to products comprised of unconventional materials and functions satisfying a variety of personal and business needs, and to build a platform/system where those technologies can be used. The goals of the program are for the creation of high-value-added products spurred by new ideas conceived through experiencing new technologies, and to strengthen Japan's industrial competitiveness and revitalize its regional areas.

Program Director

Naoya Sasaki

Hitachi, Ltd.
Corporate Chief Engineer, Research & Development Group

Profile

Dr. Naoya Sasaki joined Hitachi, Ltd. in 1982. He assumed the duties of corporate chief engineer in 2014. Throughout his career, Dr. Sasaki has been engaged in the development of mechatronic products and the development and spread of mechanical systems technologies and molecular simulation technologies. He holds a Ph.D. in engineering. Dr. Sasaki is the chairman of the Japan Society of Mechanical Engineers.
He has been named a fellow of the Japan Society of Mechanical Engineering, and he has also been named a fellow of the Japan Society for Computational Engineering and Science.
He is also a member of the Japanese Society of Tribologists.

Research and Development Topics

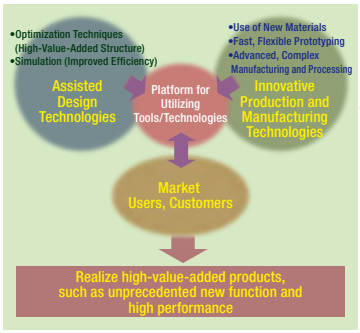
1 Research and develop innovative production and manufacturing technologies

Research and develop innovative production and manufacturing technologies that make possible new structures, complex shapes, greater function, better quality and lower cost. Priority will be placed on promoting 3D fabrication technologies aimed at the diverse application of materials and the development of new materials, and on functionality-adding technologies, such as bonding and surface treatment technologies which add resistance or other diverse functionality.

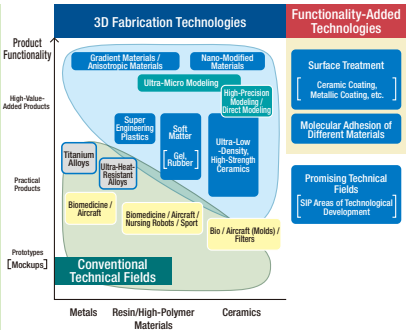
2 Research and develop assisted design technologies utilizing optimization and simulation

Research and develop technologies which make possible diverse functional design, based on needs, value and performance, as well as high-quality product design, incorporating a variety of data such as production and manufacturing conditions. A particular focus will be placed on strengthening and promoting assisted design technologies, such as simulation and optimization, with a goal of realizing high-value-added product design.

●Approach to Innovative Manufacturing

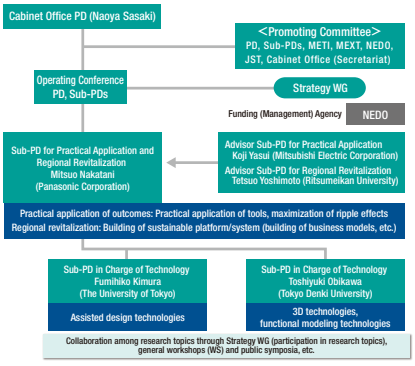


●Positioning of Innovative Production andManufacturing Technologies



Implementation Structure

The Promoting Committee is chaired by the Program Director (PD). The Cabinet Office serves as secretariat. The Committee is composed of relevant ministries, agencies, and experts who provide overall coordination. This committee uses funds and management capacity offered by the New Energy and Industrial Technology Development Organization (NEDO).
The Committee has selected the best research and development personnel as needed through open recruitment.



Exit Strategies

Develop tools from R&D results, provide technologies

Focus on more promising and advanced industrial areas, such as healthcare and the auto industry, as a technology area expected there, we focus on functional addition technology such as 3D fabrication technologies and surface treatment/bonding technologies.
Provide tools/technologies to industry which contribute to their practical application in business, such as manufacturing equipment and software.

Build a system for creating high-value-added products

Build a platform where regional SMEs and microenterprises can experience and use tools/technologies even after the end of SIP.
Enable businesses to create highvalue-added products, spurred by new ideas conceived through the experience.
In addition, provide SIP manufacturing network that domestic and foreign enterprises can access tools / technology one-stop.Continue to provide advanced tools / technology on a one-stop basis through the WEB portal even after the end of SIP.

Efforts towards spreading

Development of database, data utilization, technology development aiming at improving usability of manufacturing equipment such as 3D printers developed for manufacturing technology of Society 5.0 era.

Progress to Date

Practical Application, Dissemination and Expansion of Tools/Technologies

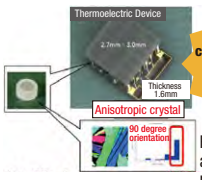
In past research and development, the program has laid out the framework enabling businesses to utilize a number of technologies and tools that are already at the practical application level.
For instance, the processing head comprising six superposed beams for use in laser coating, which was developed by the SIP research team led by Professor Tsukamoto of Osaka University's Joining and Welding Research Institute (JWRI), has been applied by the Yamazaki Mazak Corporation to its hybrid multi-tasking machines.
In addition, on November 1, 2016, D-Light Matter, Inc. (DLM) was established by a team led by Professor Furukawa of Yamagata University's Life-3D Printing Innovation Center (LPIC), as a means of creating business through the practical application of gel materials in devices based on the results of SIP research and development.
Professor Nakano et al. Of Osaka University and Panasonic Corporation have developed a technology that demonstrates high functionality in the required direction by controlling the atomic arrangement of metallic materials and improved the cooling characteristics of cold thermal devices by 70% Achieve. And plan to develop and commercialize optical communication module Laser Diode temperature control and amusement machine from fiscal 2018.
In addition, Professor Nishiwaki of Kyoto University and Co., Ltd. developed a system that supports design planning based on topology optimization for designers, a part of the technology for automatically converting the shape obtained as a result of optimization into CAD model was incorporated into KUINTO's software and commercialized

Practical application of a processing head used in laser coating to a hybrid multi-tasking machine

Multi-laser metal deposition (new technology) | Processing head | Yamazaki Mazak Corporation's hybrid multi-tasking machine

Practical use of high-performance Thermoelectric Device

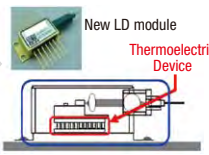
Customized high-performance Thermoelectric Device Using Anisotropic Material



Cooling characteristics 70% UP (compared with conventional)

Development completed in 2017 Commercialized since 2018

The world's first ultra-compact and high-efficiency Laser Diode(LD) module



Realizing high performance by aligning crystal orientations in required directions

Establishment of university-initiated venture for world's first 3D gel printing technology

Service menu

Water content: 90%
Breaking stress: 10-40 MPa

High-strength gel

3D gel printer

Practical application of automatic conversion technology of CAD model with shape optimization

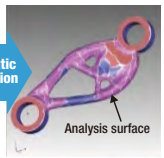
Automatically recognize the analysis surface * from the result of shape optimization and automatically convert it to CAD model

CAD model generation program
S-Generator

Optimized shape to CAD
Output a solid model that also holds the analysis surface

Optimal structure

Automatic conversion



CAD Model

*Analysis surface (surface that can be represented by a numerical formula such as cylinder, cone, sphere)

Program Director **Naoya Sasaki** Interview

Practical Application of Innovative Production and Manufacturing Technologies, Centered Around 3D Fabrication Using New Materials

The goal of this program is for manufacturing to achieve high added value, boosting the competitiveness of Japan's manufacturing industry.
During the program's final year, activities focusing on production and manufacturing technology, aiming at commercialization of research results on some themes are accelerating.
In conjunction with this, we are promoting efforts to build places and mechanisms to utilize tools / technologies developed to realize innovative manufacturing across industries, academia and government, trial use of external users, and dissemination to the industry after the end of SIP.

Responding to Diverse Manufacturing Needs

This program aims to stimulate manufacturing and create new markets supporting local economies, by linking business, universities and public institutions together. The program primarily promotes research that can be used by SMEs and microenterprises. In terms of "innovative production and manufacturing technologies," we are looking at innovative manufacturing technologies that take advantage of the specialized and unique technologies owned by participating businesses and universities.

In particular, this program is focused on unconventional nonferrous materials and production technologies (ceramics, rubber, gel, super engineering plastics, etc.) in which Japan already has a competitive advantage. Here, researchers are developing materials that offer new value, and creating products with unprecedented complex shapes, functions and properties by means of various 3D fabrication technologies as well as molecular adhesion technologies which allow for different materials to be bonded together strongly.

As for "assisted design technologies utilizing optimization and simulation," we are establishing technologies that take full advantage of innovative production and manufacturing technologies, on the basis of techniques for statistically evaluating diverse needs, topology optimization which allow structures and characteristics to be achieved that meet required specifications while also satisfying various constraints, and manufacturing process simulation technologies.

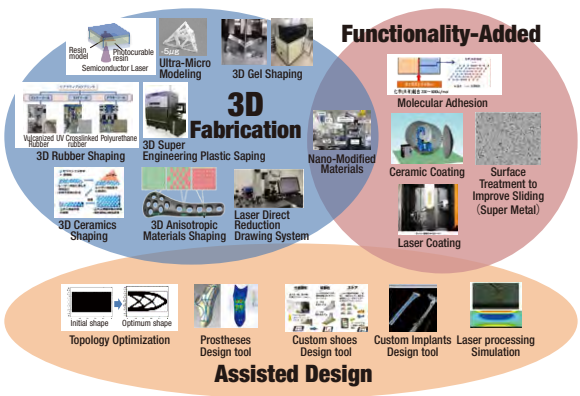
A number of technologies have already reached a level where they can be utilized by business, such as the 3D gel printer and the processing head used in laser coating described on the previous page. It is expected that other high-value-added products will be continue to be created using these technologies.As a new manufacturing technology, we have also achieved results such as the establishment of the basic technology for laser direct fabrication of the world's first ceramics that does not require sintering in a furnace.

Initiatives for Practical Application in the Manufacturing Industry

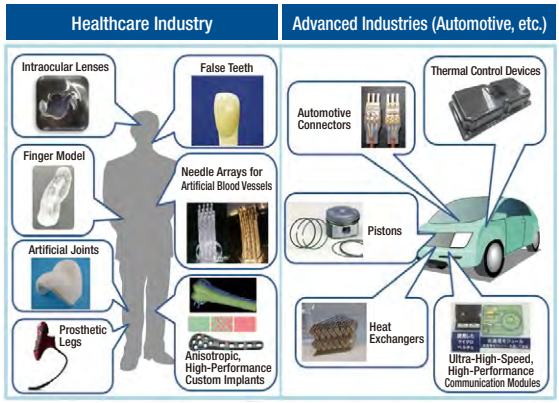
Building on these outcomes, Program Director Naoya Sasaki comments, "Since last fiscal years, by repeating a process of utilizing technologies in business, receiving feedback and further refining them, we have been promoting to improve their degree of versatility and perfection so that industry can employ these technologies for high-value-added manufacturing.To this end, for fiscal 2017 onwards,in terms of innovative production and manufacturing technologies, the target areas linked to exit strategies have been specified as future growth industries, the healthcare industry offering new business opportunities, and the advanced automotive and aircraft industries. A particular focus has been placed on 3D fabrication technologies, centered around 3D printers as a technology creating new added value, and on manufacturing technologies that add high value to components and products, such as surface treatment and bonding. As for design, the focus has been placed on technologies utilizing optimization, which have liberated manufacturing from conventional constraints thanks to 3D printers, and on technologies which support process design corresponding to new manufacturing technologies.

Sasaki continues, "Japanese materials and components manufacturers possess highly specialized technologies, as well as

•Main Innovative Tools / Technologies



•Target areas



Innovative Design/Manufacturing Technologies

New Production 2020 Project

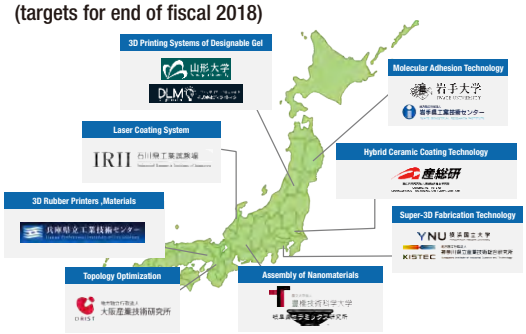
high-quality, high-efficiency production/manufacturing techniques. However, more than a few specialize in custommanufacturing due to divisions of labor. To strengthen the competitiveness of Japan's industries, it is important that regional SMEs and microenterprises be given advanced expertise from universities and public institutions, and that they establish new methods and techniques. To achieve this, an environment is necessary where they can experience and utilize newly developed tools and technologies. My hope is to provide for such a mechanism that can be maintained even after the end of SIP."

In this program, we are building a place to utilize the developed tools / technologies in the regional areas.

Sasaki continues, "For example, we opened a value co-creation platform as a place to utilize newly at the Hyogo Prefectural Industrial Technology Center, which supports SMEs in the Kobe area where rubber is a local industry.

There, we installed the world's first vulcanized rubber 3D printer developed by SIP and opened up as a tool for companies, users and researchers to do manufacturing."

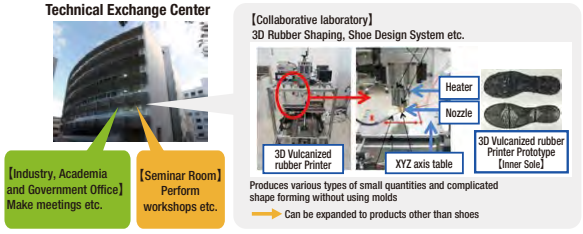
●Places Where Tools/Technologies Are Utilized (targets for end of fiscal 2018)



●Sales Service of Tools / Technology (Plan)

Name of Tool	Business Consultation Company
3D Super Engineering Plastic Saping Printer	ASPECT Inc.
Shape Concept Design System	Quint Corporation
CAD System for Prosthetic Socket	Elysium Co.Ltd.
Multi Beam Laser Coating Machine	MURATANI MACHINE MANUFACTURE Co., Ltd.
Rubber 3D Printer	Kobe Material Testing Laboratory Co., Ltd.

●Examples of utilization places: Hyogo Prefectural Institute of Technology Value Co-Creation Platform

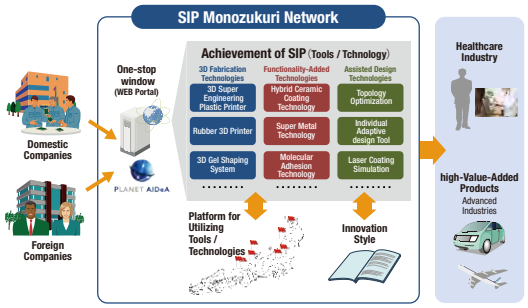


In this way, several tools / technologies have already been set up in local public testing institutes, testing of enterprises is proceeding, and we are also promoting activities to promote regional industry revitalization.

In addition, some tools / technologies are studying product sales and service conversion by participating companies of SIP, "We have finished it as a more versatile and practical tool through test use at companies. It is said.

Building Greater Potential for Japanese Manufacturing

●Concept of SIP Monozukuri Network



The final year of the program celebrates,Sasaki continues, "Thanks to the efforts of the researchers, attractive tools and technologies for innovative manufacturing that have never been done are coming up.Please do touch these tools and technologies.

To that end, we have built a SIP manufacturing network with web-portals (http://www.sip-monozukuri.jp/) that can be accessed on a one-stop basis for the tools, technologies and applications that are the outcome.

Through these, a virtuous cycle is being promoted by industry people to utilize the outcome, and the tools and technologies that are results are further brushed up through utilization, and they are brought up to more attractive tools and technologies, after the end of SIP I would like to finish it as a mechanism to continue.

I believe that the above is the strengthening of industrial competitiveness in Japan that this program was aiming for and the realization of regional creation."

By establishing innovative manufacturing technology using new materials and methods, building a place to utilize that allows anyone to participate, and a network that can access technology information from anywhere, we will raise the underpinnings of our country's manufacturing activities, and develop regional innovation Contributing to.