Foreword

Aiming to Create New Value by Integrating Technologies in Various Fields

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As part of the efforts for the revitalization of the Toshiba Group, Toshiba Corporation has created the Research & Development Division to oversee its laboratories, including the Corporate Research & Development Center, the Corporate Software Engineering & Technology Center, and the Corporate Manufacturing Engineering Center, in order to strengthen R&D capabilities.

The objective of the Research & Development Division is to make it possible for the laboratories to work more closely with the production and manufacturing departments from the initial stage of research and development using artificial intelligence (AI) and Internet-of-Things (IoT) technologies. If the activities of individual departments remain confined to optimizing their own products, it is difficult to develop competitive products that truly meet market needs. To develop competitive products, it is important to integrate a wide range of technologies. Specifically, the Toshiba Group aims to develop a comprehensive range of technologies for storage batteries and power electronics, including component and production technologies; combine solutions available in all AI-related fields so as to deliver solutions required by customers; promote cross-functional projects to develop solutions for robotics, a field that is expected to grow in the years ahead; and share and enhance technologies for software/hardware design and process/production management.

In order to achieve these objectives, we are facilitating open innovation, collaborating not only within the Toshiba Group but also with wider communities, including universities in Japan and abroad as well as the RIKEN Center for Advanced Intelligence Project (AIP) and other research institutes.

It is no exaggeration to say that the revitalization of Toshiba is only possible through technological innovations driven by ceaseless efforts and product development based on the innovations achieved. We need to leverage the strengths of the Toshiba Group, which possesses a wide range of technologies, transcending the conventional paths of development built on experience-based technologies and past results. While combining our prowess in all of our business domains, we are committed to the organic integration of various technologies to develop products as well as optimization of the entire process from design to manufacturing using IoT and AI technologies.

The following provides several examples of technological innovations achieved as of March 2018 in each business domain of the Toshiba Group.

In the energy business domain, Toshiba Energy Systems & Solutions Corporation has developed technologies for meeting growing electricity demand while reducing carbon dioxide (CO_2) emissions. It has also delivered power generation systems with high energy conversion efficiency for power generation, transmission, and distribution as well as control systems that realize the efficient operation of electric power facilities. In addition, hydrogen storage systems that have commenced operation across Japan and a newly developed large-capacity DC circuit breaker (DCCB) help utilize renewable energy efficiently. Toshiba Energy Systems & Solutions Corporation has also developed a rotating gantry system using superconducting magnets for scanning carbon-ion therapy, which has entered service for clinical treatment.

In the social infrastructure business domain, Toshiba Infrastructure Systems & Solutions Corporation has developed a system that automatically closes floodgates and land locks via high-reliability satellite links, which has begun operation. It has also delivered a railway propulsion system that allows trains to run on both electrified and non-electrified tracks as well as hybrid propulsion systems that drive an electric motor using electricity from a diesel generator and a battery-assist system. In addition, Toshiba Infrastructure Systems & Solutions Corporation has developed a platform for autonomous robots and a security proxy device using a smartcard technology that enhances the security of IoT.

In the electronic devices business domain, Toshiba Electronic Devices & Storage Corporation has released an ultrasmall photorelay for high-frequency signal transmission, a motor driver integrated circuit (IC) with an anti-stall feedback architecture, and other innovative devices. Toshiba Memory Corporation has continued to improve its BiCS FLASH three-dimensional (3D) flash memories by stacking more layers of flash memory dies, using multilevel-cell technology, and increasing read/write speeds. It has also released solid-state drives (SSDs) using BiCS FLASH flash memories. Moreover, Toshiba Materials Co., Ltd. has developed a phosphor with a shorter decay time and afterglow than those of the conventional phosphor for medical applications.

In the digital solutions business domain, Toshiba Digital Solutions Corporation has launched services designed to accelerate digital transformation, including the SATLYS analytics AI service, which is a new addition to its SPINEX IoT architecture, and the RECAIUS communication AI service for streamlining customer service and support. Also in this domain, Toshiba Corporation has developed a high-speed quantum cryptography system and a technology that uses video feeds from multiple surveillance cameras to track the movements of people in large facilities at high speed and with high accuracy.

A transition is underway from IoT to the Internet of Everything (IoE), in which not only things but also people and processes are interconnected via the Internet. In response, all of the business domains of the Toshiba Group are working in accord to develop new technologies so as to solve social issues. We hope that you will read through *TOSHIBA REVIEW Science and Technology Highlights 2018* and value your feedback, suggestions, and comments.