

Quality has been central to the development and production of automobile components at DENSO since the company's inception. Thanks in large part to this relentless quest for excellence, DENSO today supplies components and systems to automakers around the world. As the first step in the creation of any product, R&D is vital to preserving and enhancing quality. DENSO is constantly expanding its base of core technologies to hone its competitive edge by supplying products in step with and ahead of the latest market trends.

Today, DENSO's R&D programs need to address the challenges posed by the restructuring and realignment of the global automobile industry. The greatest challenge is raising quality while lowering prices. There are many ways to accomplish this. We try to create products that suffuse existing functions and can be made in an innovative way that strikes just the right balance between cost and quality. We also use different materials and production processes to bring down costs. But any solution to this dilemma must originate at the R&D level.

At the same time, R&D programs need to target three key aspects of automobile performance that will be most in demand by drivers and society at large: safety, environment, and comfort. Here, we will draw on core technologies to devise new ways to meet these needs, and in the process, elevate the DENSO brand to a higher plateau.

### > THE ROLE OF THE R&D SYSTEM

We conduct far-reaching R&D activities in a number of facilities located in Japan and overseas. R&D is principally undertaken by DENSO Research Laboratories, the Corporate R&D Department at corporate headquarters, Nippon Soken, Inc., and DENSO IT Laboratory, Inc. In fiscal 2001, the year ended March 31, 2001, we formed a software development team to focus on this area of growing importance to our business. With the goal of making our software development more efficient, this team's primary responsibility will be reexamining software architecture and devising software development tools.

R&D covers all aspects of operations from powertrains, thermal equipment, and electric and electronic systems and components to telecommunications and industrial equipment. Synergies between technologies and business operations assist the development of innovative components and systems. All this contributes to our goal of manufacturing the world's best products.

Expenditures in R&D for fiscal 2001 totaled ¥177.0 billion, 10.6% more than in the previous year. This figure amounted to 8.8% of net sales.

In the current fiscal year, we are boosting investments in software, a field that is certain to become one of our core technologies of the future. DENSO IT Laboratory was established in Tokyo in August 2000 to



*from left:*

A motor generator for electric and hybrid vehicles

An audio-visual communication navigation system, which plays an important role in transport telematics

A laser radar and a distance control ECU for an adaptive cruise control (ACC) system

develop core software for telematics equipment, such as advanced car navigation systems. DENSO now operates four software development companies.

> **MEETING INDUSTRY DEMANDS WITH DENSO TECHNOLOGY**

Safety, environment, and comfort will shape the automobile industry in the 21st century. And our technologies are in place to support automakers in all three of these areas.

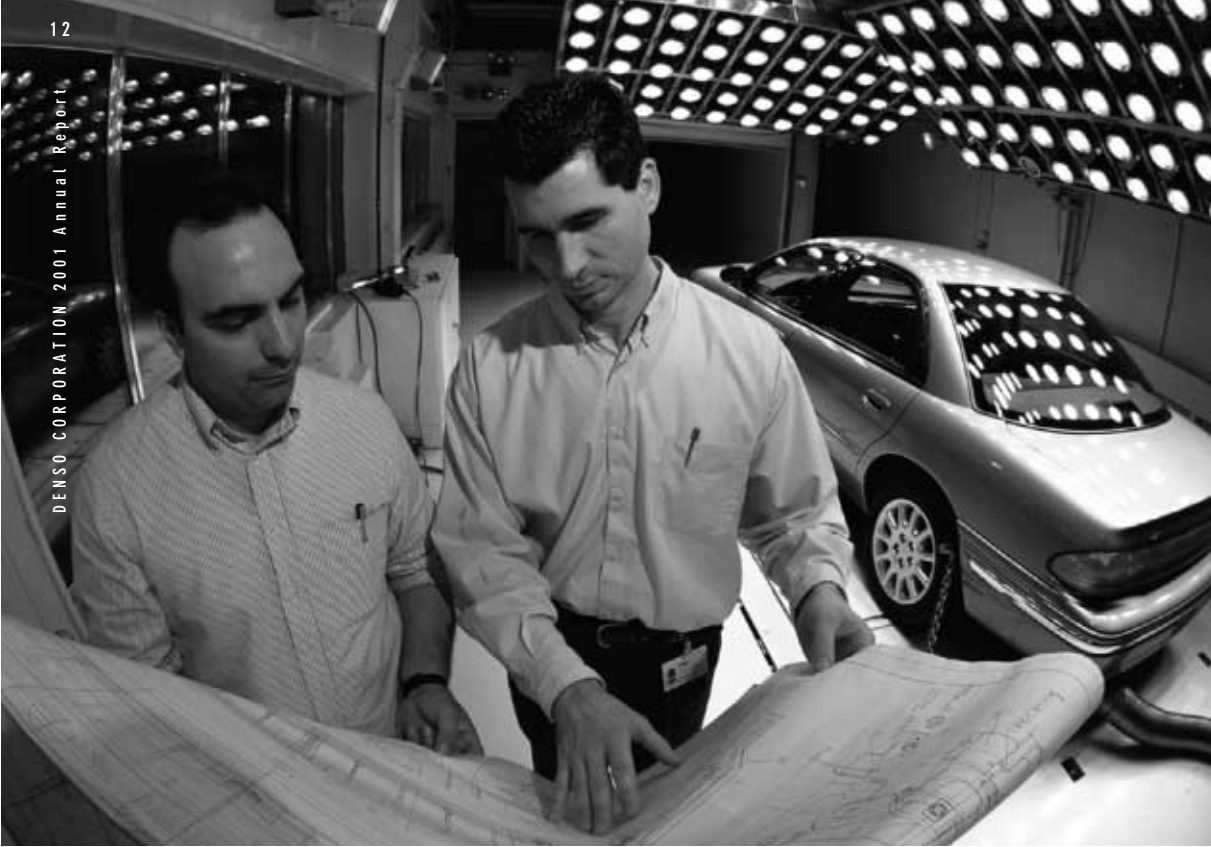
For example, in the area of comfort, we are developing adaptive cruise control (ACC) systems, telematic navigation systems, electronic toll collection (ETC) systems, fleet management systems with global positioning systems and satellite communications, and human-machine interfaces, which bring IT to the automobile. R&D efforts are targeting smart airbags, antilock braking systems (ABS), and vehicle stability control (VSC) systems to improve automobile safety. We are also at work on environmentally friendly products such as common rail fuel injection systems, gasoline direct injection systems, and motor generators, convertors, inverters, and battery ECUs for electric and hybrid vehicles. In all these endeavors, we are constantly looking to fuse our knowledge of core technologies and automobiles into an organic, coherent whole.

> **MAKING THE WORLD'S BEST PRODUCTS**

Through the years, DENSO has always channeled its energies into creating the world's best products—products that can meet the expectations of our customers. The figures tell the story. At present, we hold the world's highest market share in a range of different products. We hope that a number of new products will also grow to command leading market shares. For example, we believe we have struck gold with our equipment for hybrid vehicles and common rail fuel injection systems. In fiscal 2001, new developments included our segment conductor (SC) alternators and cooling modules.

In April 2001, we began selling a water-heating system that uses carbon dioxide as a coolant. This system has attracted attention for its environmentally sound technology, which achieves total equivalent warming impact 1,700 times lower than hydrofluorocarbons (HFCs). Applying this coolant to car air-conditioning systems is also a distinct possibility.

In fiscal 2001, we became the world's first company to launch mass production of cooling modules. Integrating a radiator and an air-conditioning condenser in a single unit, the cooling module reduces by around 40% the space required by conventional models. Moreover, it improves the cooling performance of both the engine coolant and the air conditioner refrigerant. Our ability to address the issue of heat transfer testifies to DENSO's dedicated efforts to unlock new heat transfer technologies.



*Linking all associates together are DENSO's superior technical capabilities and a powerful commitment to quality.*





*from left:*

A cockpit module that mainly includes an air conditioning unit, an instrument cluster/panel, and a navigation system

A supply pump and injectors for the ECD-U2P common rail system

A radiator-condenser cooling module

#### > RAISING R&D EFFICIENCY

Automobile manufacturers are dramatically reducing the time needed to introduce new models. And we must move quickly to do the same. We are harnessing IT to expedite product development and are attempting to bring greater satisfaction to customers by halving production lead times in pursuit of higher levels of productivity.

One initiative is a digital engineering system that integrates all processes from product planning to production. Incorporating computer simulations from the outset removes the need to create a number of prototypes at different operational stages. Instead, the entire product development sequence can be realized digitally and concurrently. As such, we need only build a single prototype for final verification. The system integrates automakers' computer-aided design (CAD) software with our own to share three-dimensional data in all stages of the product development sequence. Digital engineering is being introduced throughout our operations in Japan and overseas.

Software has become an essential component in nearly every category of automotive systems. DENSO has raised productivity in R&D by adopting an innovative emulator for prototyping software. Our emulator enables engineers to virtually check the performance of engines without reprogramming the engine ECU.

#### > DEVELOPING A TEAM OF SKILLED RESEARCHERS

The development of skilled researchers is a critical task for any company that relies on R&D to bring forth the products that will shape its future. DENSO Research Laboratories is working to educate outstanding researchers in a number of ways. For example, we invite leading overseas researchers to Japan to share their knowledge. We stress that learning from our past projects is vital for the benefit of the company. And our senior researchers are committed to passing on their know-how, skills, and experience to young people coming through the ranks.

#### > BALANCING PERFORMANCE AND COST ISSUES

Ensuring high performance at a low cost might seem contradictory. But we are resolving this issue by reexamining our products from the design stage onward. The main emphasis is on devising techniques that lower costs without sacrificing performance. For example, air-conditioning systems have been completely redesigned for Toyota Motor Corporation's Vitz and other compact vehicles to save costs while maintaining performance.

We continue to identify ways to bring down costs while ensuring that the products we have spent years refining to achieve superior quality do not suffer as a consequence. This necessitates going back to the drawing board. Only from the design and R&D stage can new product concepts emerge.

> **FUTURE TECHNOLOGIES**

At present, we are working on a range of exciting new technologies that will offer greater safety and comfort for drivers, as well as exert less impact on the environment. Safety is a particularly current theme. Here, we introduce some examples of how we are helping provide drivers and passengers alike with vehicles that offer the very latest in safety technology.

Our approach to safety in R&D has evolved over the years. Initially, we based our R&D efforts on the concept of "active safety." Technologies were designed to avoid accidents. This involved creating superior handling and braking capabilities. Later, we also developed safety technology under the concept of "passive safety." This meant designing technologies on the premise that a collision is imminent at all times. A prime example is the airbag. The main thrust of our efforts now is back on active safety. We are focusing on three forms of technology.

The first is stand-alone technology that enhances safety within the vehicle. Laser radar and millimeter wave technology are generating new ways to make cars safer. The laser radar has already been utilized in our ACC systems, which reduce driving loads by adjusting the distance to the preceding vehicle. We are also working on millimeter wave technology. Vehicles of the future will be able to automatically avoid collisions by detecting and moving out of the way of obstacles in front of them. Image recognition technology, meanwhile, uses a laser to recognize objects in front of a sensor. The sensor can measure the time taken for the laser to reflect off objects and come back to the sensor, and compute the shape of the objects in line with distance. It can thereby achieve three-dimensional sensing. This image recognition technology is another possibility for future automobiles.

Second is technology that links the vehicle with its infrastructure. We are currently developing VSC systems that are linked to car navigation systems. The car navigation system recognizes data on the road conditions up ahead, for example if there is a sharp curve, and feeds this information to the VSC, thus avoiding potential danger.

Infrastructure is our third theme. We are working to develop technologies that prevent collisions as part of the traffic infrastructure, such as sensors laid down on existing roads. Road sensors are helping to prevent accidents by detecting whether roads pose a threat due to rainfall or snow.

As of March 31, 2001, DENSO operated in 27 countries and regions worldwide through 142 subsidiaries and 22 affiliates, including 76 production centers. Under this global system, we conduct business with virtually all of the world's automakers.

The auto industry today faces various issues that are spurring change. Manufacturers are finding it difficult to produce more vehicles due to lackluster demand in a mature market, and they are being pressured to address vehicle-induced environmental problems. Innovative technologies are presenting new and exciting growth opportunities. In response to slowing growth in their markets, automakers are reducing costs by manufacturing vehicles on common platforms and developing models for sale worldwide.

Reinforcing our longstanding business connections with global automakers is critical to our growth. We have focused on a number of initiatives to bolster our global operations. We are lowering costs without sacrificing quality. We are promoting modularization, backed by our ability to propose new products and systems to automakers. And we are refining our ability to supply quality products anywhere in the world. For fiscal 2002, ending March 31, 2002, we have formulated strategies for all three major regions. In the Americas, we will build upon our established production centers and sales channels to further bolster our presence. In Europe, our efforts will focus on increasing production of diesel injection pumps in Hungary and air-conditioning and electrical components in Italy. And in Asia, we will increase local procurement and consolidate production activities at the most advantageous locations.

> **GLOBAL DISTRIBUTION OF BUSINESS**

DENSO's global system transcends borders and products. A key emphasis of the system is that businesses around the world complement one another. Locations for overseas operations are selected based on a range of crucial factors. First, we make a selection based on where our major customers themselves are operating and what their needs are. Next, we seek an optimal production network both globally and regionally, considering the complexity of products, procurement of materials, delivery, regulations, and other aspects of the business environment. In Japan for instance, we focus on production of products that demand a high degree of accuracy, such as precision processing, and that require highly advanced technology to add value.

> **RESTRUCTURING PRODUCTION IN ASIA**

Until recently, most Asian countries imposed regulations requiring that auto components be manufactured locally. As these restrictions are lifted, domestic producers, including members of the DENSO Group, must compete for the first time with imported components that are often cheaper. To remain competitive, we are purchasing more materials locally and centralizing at strategic locations production activities that had been spread over many countries. For example, we now manufacture electrical components at DENSO (Thailand) Co., Ltd., exporting the finished items to Malaysia, Indonesia, Taiwan, and elsewhere in Asia.



from left:

Magneti Marelli Climatizzazione S.p.A.

Materials Technical Center at DENSO International Singapore Pte. Ltd.

Mobile autonomous robots that work in association

To promote the shift to local procurement, we established a Materials Technical Center (MTC) within DENSO International Singapore Pte. Ltd. in April 2000. The MTC formulates procurement plans for our 24 production centers in 10 countries and regions throughout Asia and Oceania, and identifies and forges relationships with suppliers in the region. The MTC also provides support activities, such as studying, reviewing, and evaluating items supplied by existing and potential vendors. We are aiming to raise the level of local procurement in Asia and Oceania from 54% to 90% by 2003.

> **GLOBAL MANAGEMENT**

As enshrined in our long-term management vision, DENSO Vision 2005, networks and self-reliance are key themes in today's era of consolidated management and globalization. To facilitate direct communication between corporate headquarters and local managers, we hold a global strategy conference at each business group.

This provides a forum at which head office participants and local managers share and discuss their respective long-term strategies. One specific result of the conference involved the Thermal Systems Group, which engaged in discussion on deriving complementation in the ASEAN region. Plans were formulated for local procurement and selection of suppliers, and later implemented. The end result was a substantial reduction in costs.

> **CUSTOMER-CENTRIC SALES**

Our sales policy is to meet customer demand by drawing on all our strengths in R&D, technology, quality control, manufacturing, and services. We focus our energies on forging long-term relationships with customers under a business framework that engenders their trust.

Our sales mission is to respond to customers' demands with one voice. This credo runs through all our business groups. Our Sales Department is the collective gateway for dealing with customers. Today's diverse customer demands go beyond the framework of a single business group, requiring cooperation across the board. As such, the Sales Department, which is not tied to any particular business group, is uniquely positioned to serve as the gateway to clients. We must strike the right balance in each product of quality, cost, and supply, or we will lose customer faith. An integrated sales group is therefore the perfect way to respond accurately to customer needs.

> **REGIONAL TOPICS**

**Japan**

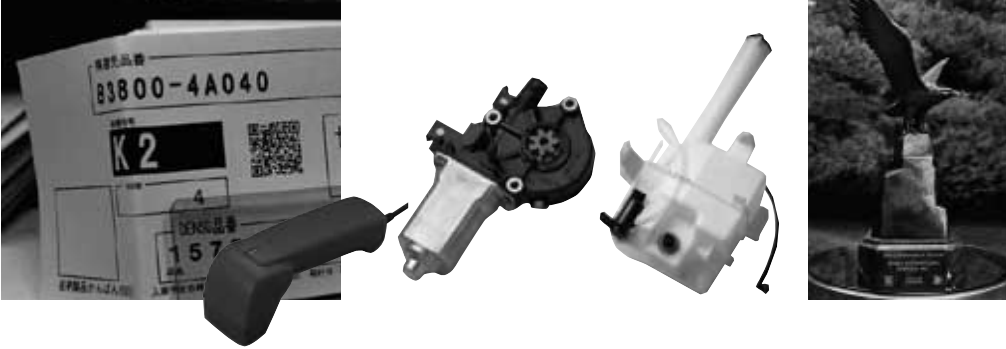
In Japan, more progress was made in shifting administrative services to separate companies, one way to make DENSO more cost competitive globally. During fiscal 2001, we established four new companies, including DENSO Finance and Accounting Center Co., Ltd., a company responsible for our accounting operations, and other companies in charge of employee training and employee benefits. In all, nine such companies have been formed since the spin-off program began.



*As of March 31, 2001, DENSO operated in 27 countries and regions worldwide through 142 subsidiaries and 22 affiliates, including 76 production centers.*







*from left:*

A handheld scanner for two-dimensional QR code

A power window regulator motor

A windshield washer system

DENSO International America, Inc. awarded 2000 Corporation of the Year by General Motors Corporation

A key development was an agreement between DENSO, Aisin Seiki Co., Ltd., Toyota Motor Corporation, and Sumitomo Electric Industries, Ltd. to jointly establish a shared-technology brake development and sales company in July 2001. We have provided 20% of the capitalization of the new company, which deals in both brake systems and parts. The major goal of the new company is to deliver state-of-the-art brake systems and parts to the global market in a timely manner and in response to market needs.

Our electronic systems operations in Japan continue to focus more on software. This past year, we established a new software company to develop leading-edge technologies for the 21st century.

Efforts to bring to market diversified products saw us continuing to refine our development of industrial robots and our independently developed QR code, the industry standard for the data-rich format of two-dimensional labeling code. Although originally developed for in-house use, we now hold the world's top share in sales of small industrial robots.

We also reached agreements with Kyocera Corporation and Kenwood Corporation to develop and produce wireless phones for the Japanese market. The agreements serve a dual purpose. They will enable us to shift the focus of our telecommunication business from wireless phones to telematics. At the same time, they will ensure a continued strong presence in the wireless phone market.

### **The Americas**

Operations continued to progress smoothly in this region. DENSO International America, Inc., our major U.S. subsidiary, was recognized for its all-round performance in quality, service, technology, and price by capturing the prestigious 2000 Corporation of the Year award from General Motors Corporation, beating 30,000 suppliers to the prize. The company was awarded the prize for the first time in 1997. DENSO International America was also recognized as a GM Supplier of the Year for the eighth consecutive year. During the year, we garnered a total of 25 supplier awards from U.S.-based automobile manufacturers, testifying to our strong commitment to this region.

A recent key development was our acquisition in June 2001 of U.S.-based component manufacturer ArvinMeritor, Inc.'s 50% stake in joint venture Purodenso Company. The move, which makes Purodenso a wholly owned subsidiary of DENSO, is designed to expand Purodenso's operations to meet customer needs and reinforce our presence in the Americas. Purodenso is a manufacturer of air, oil, and fuel filters and air induction systems.

### **Europe**

Three major events defined our European thermal systems operations in fiscal 2001. First was the purchase of Magneti Marelli Climatizzazione S.p.A. (MMCL), leading European component maker Magneti Marelli S.p.A.'s Thermal Systems Division. This move followed our acquisition of Magneti Marelli's Rotating Machines Division in 1999. On March 30, 2001, we concluded procedures for the purchase. We plan to expand sales of air-conditioning systems for compact cars, a market sector where significant growth is

foreseen. MMCL operates production centers in six countries, and conducts business with Fiat, Peugeot, Renault, and other major European automakers. We view MMCL as a strategic subsidiary that is uniquely positioned to capitalize on marketing opportunities in Europe.

The second accomplishment in fiscal 2001 was a contract to supply air-conditioning systems for Volkswagen's Passat. Over the years, we have built a proven track record in supplying components for BMW and other luxury vehicles. This agreement, however, marks the first time we have captured an order in Europe to supply components for a vehicle outside the luxury category.

Third, we announced plans to establish a manufacturing company in August 2001 to produce car air conditioners in the Czech Republic. This expansion into Europe further consolidates our leading position in the global automotive air conditioning components sector. The new company will be DENSO's fourth manufacturer of air conditioners in Europe.

**Asia  
and Oceania**

In October 2000, DENSO and subsidiary ASMO Co., Ltd. invested in Poong Sung Electric Co., Ltd., a South Korean automotive supplier that manufactures small motors, fuel pumps, and other electrical automotive components, by purchasing 24% and 16%, respectively, of the company's shares. Renamed DENSO PS Corporation, the company produces and supplies components mainly to Hyundai Motor Company and Kia Motors Corporation.

The Australian market experienced severe competition among automobile component manufacturers. In response, we consolidated our two Australian air-conditioning system production centers in July 2001. The move was designed to streamline our operations in this country and bolster our balance sheet. We now have three bases in Australia: two production centers turning out air-conditioning systems, instrument clusters, and motors and our Australian holding company.

To make the most of the potential for producing automotive air-conditioning systems in the Middle East, we joined forces with local company Abdul Latif Jameel Co., Ltd. in March 2001 to establish DENSO Abdul Latif Jameel Co., Ltd. As our first production center in the Middle East, this joint venture will begin manufacturing air-conditioning systems in October 2001.

In August 2000, DENSO received an additional order for 14,000 units of onboard equipment for ETC systems for the city of Chongqing, China, which is expanding the scope of an ETC systems project under development. At an international contract tender in April 1999, DENSO won a contract to supply 7,000 units of onboard ETC equipment and antennas to the city.

> **GLOBAL ENVIRONMENTAL MANAGEMENT**

The DENSO Group is firmly committed to pursuing business activities that will help to sustain the environment in years to come. In June 2000, DENSO formulated a long-term environmental policy called DENSO EcoVision 2005. The policy articulates our vision for the environmental management of corporate activities in the 21st century. Covering consolidated management of domestic and overseas operations, the policy targets all aspects of our corporate activities, extending from product development and production to environment-related external alliances and information disclosure. We have formulated our Third Environmental Action Plan that contains specific initiatives and targets for achieving "clean" production plants by enhancing environmentally friendly development and design and reducing environmental burdens.

> **ENVIRONMENTAL PROTECTION ACTIVITIES**

In June 2000, DENSO Remani Corporation was formed in Japan to facilitate the reuse of automobile starters and alternators. The company collects used starters and alternators from auto servicing facilities and refurbishes them so they can be resold.

We formulated our Green Purchasing Guidelines in September 2000. Embracing the concepts of DENSO EcoVision 2005, the guidelines set principles for working with suppliers to purchase parts and materials that are as "green" as possible. The overriding objective is to reduce the environmental impact at every stage of our activities. To urge suppliers to be more environmentally aware, the guidelines aim to have each supplier set in place environmental management systems, and monitor and reduce the use of environmentally hazardous substances.

In October 2000, we extended the scope of ISO 14001 certification to all divisions at corporate headquarters, including product development and design operations. We initially acquired ISO 14001 certification at all 14 manufacturing and non-manufacturing sites in Japan as of March 1999, and at 28 DENSO Group companies outside Japan as of March 2001.

Our goal is zero waste sent to landfills at 14 manufacturing and non-manufacturing sites by March 2004. The Kitakyushu Plant and the Anjo Plant achieved this feat in December 2000 and March 2001, respectively. Concerted efforts to achieve zero emissions are also being undertaken at overseas centers.

> **DENSO AND THE COMMUNITY**

One of our major corporate missions is to contribute to societies and communities in which we conduct business. Translating this into reality requires a conscientious effort on our part. In the course of our



*from left:*

Remanufacturing Plant, DENSO Europe B.V.

Wheelchair factory in Thailand

Wheelchair Basketball Thailand Open 2001

corporate activities, we are working actively to protect the natural environment and to enhance safety and comfort for everyone.

DENSO Vision 2005, our new long-term management vision, emphasizes our goal of "opening the door to possibilities for society." We listen to the views of society, and undertake corporate activities with the well-being of people firmly in mind. At present, a number of specific initiatives are being put into action.

- Contributing to the welfare of the physically challenged by creating barrier-free environments
- Helping to foster the development of young people, the leaders of the next generation
- Protecting the environment to realize a safe, comfortable, and enriched society

> **HELPING TO CREATE BARRIER-FREE ENVIRONMENTS**

As a community-assistance project to commemorate DENSO's 50th anniversary, the Wheelchairs and Friendship Center of Asia (WAFCA) was established by DENSO in April 1999. WAFCA undertakes a variety of activities to assist the physically challenged in Asia.

In fiscal 2001, WAFCA provided extensive support for the construction of a wheelchair factory in Thailand operated by its branch organization, the Wheelchairs and Friendship Center of Asia (Thailand) (WAFCAT). An opening ceremony for the wheelchair factory was held in March 2001. One of WAFCAT's major sports exchange programs for the physically challenged, the Wheelchair Basketball Thailand Open 2001, was held in Bangkok in February 2001, bringing together people from Thailand, Japan, and neighboring countries. WAFCAT also developed a barrier-free model school in Bangkok. Construction of the school was completed at the end of January 2001.

> **SUPPORTING THE DESIRE OF THE PHYSICALLY CHALLENGED TO WORK**

DENSO Taiyo Co., Ltd. was established in 1984 to support the desire of the physically challenged to work by providing them with a place of employment. The company provides safe and accessible work environments and facilities for employees. To enable people with limited scope for physical movement to work efficiently, DENSO Taiyo has modified various tools and machines. Currently, 215 physically challenged employees are engaged in assembly work.

> **DENSO NORTH AMERICA FOUNDATION ESTABLISHED**

In March 2001, DENSO International America, Inc. established the DENSO North America Foundation to extend DENSO's leadership in corporate citizenship by providing skills and resources to help communities prosper through the development of a skilled work force. With future assets totaling approximately



*from left:*

Walk America by DENSO Manufacturing Michigan, Inc.

Home rehabilitation activity by DENSO Sales California, Inc.

US\$15 million at full endowment in 2010, the foundation provides grants to institutions of higher learning for educational and/or scientific purposes, with an emphasis on engineering and technology. The foundation also provides grants to aid people and communities in distress due to the impact of natural disasters.

> **HELPING RAISE THE NEXT GENERATION**

The youth of today have boundless potential. And it is the responsibility of our generation to help unlock it. Only then can an invigorated society for tomorrow emerge.

We are actively involved in promoting exchanges between Japanese and U.S., U.K., and Australian high school students. Exchange programs, which include home stays and sports tournaments, are designed to provide participants with first-hand experience of a culture different to their own. We also showcase our own technologies, holding regular seminars where young people can gain a valuable insight into the sophisticated manufacturing technologies DENSO develops.

> **VOLUNTEER ACTIVITIES**

We continually contribute to local communities by supporting the volunteer activities of our employees around the world.

In Japan, for example, DENSO musicians perform at hospitals and other locations. Employees lead word processor classes at centers for people with disabilities. Since 1993, DENSO volunteers have also helped collect and supply clothing to people in need, mainly in Africa and Asia. Other volunteer activities include visits to welfare facilities, clean-up programs, and environmental conservation activities.

Activities also extend overseas. In April 2001, employees of DENSO Manufacturing Michigan, Inc. (DMMI) raised over US\$18,000 in a Walk America event held by the March of Dimes charity organization. This was the 11th year that DMMI employees had raised the most money in their community. DENSO Sales California, Inc. employees are also actively involved in Christmas in April, the largest volunteer home rehabilitation organization in the U.S., helping to rehabilitate 16 homes and non-profit facilities in April 2001.