2 Development Phase / Products

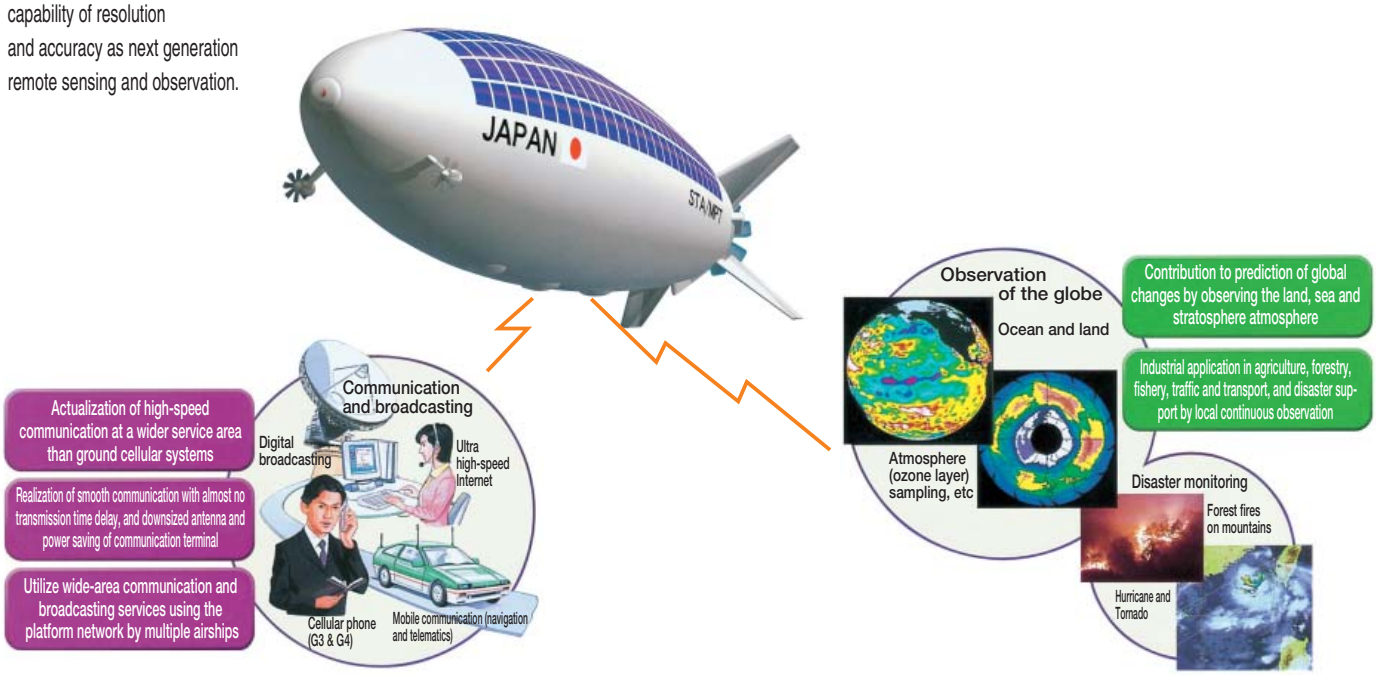
Products other than Automobiles

Aerospace Company

Aerospace Company has been contributing with a remarkable participation in the national governmental project so called Millennium Project *1 in Japan, mostly in the meteorological issue of green house effect, which may cause global warming. We are now developing two unmanned prototype airships to utilize stratospheric platform technology. In the future, it is targeted, the goal using stratospheric airship to realize wide application of telecommunication, broadcasting and remote sensing observation. Stratospheric Platform Airship is expected very long flight duration at 20km altitude geo stationary by benefit of stable calm wind and sunshine.

Currently, we are going ahead in the design and manufacturing stage for two prototypes of airship (48 meters non-powered balloon like high altitude flight testing model and 68 meters unmanned reusable low altitude model) contracted with National Aerospace Laboratory of Japan. Future production models will follow on these prototype airships, we are focusing to install high efficiency solar cells and fuel cells as their pollution-free power sources, which are mandatory for a long stay in the stratosphere.

It is eagerly expected that new type of service and business using undeveloped traffic free air space in the stratosphere, will grow up quickly and broadly in the fields where useful to the public and commercial market. In the information and communication area, advanced information services such as next-generation cellular phones, digital high definition television broadcasting, and telematics are strongly expected to develop as new businesses. In the area of global observation, Stratospheric Platform Airship will not only enable long duration and continuous observation to support rescue/restoration/reconstruction project by its wide coverage area where serious disaster happened, but also monitoring and survey of various type of pollution caused at the land, sea and atmosphere. When one of production models of stratospheric airship enter in service, it will be able to cover an area more than 100km radius with its high capability of resolution and accuracy as next generation remote sensing and observation.



Completed Assembly of 48 Meters Model

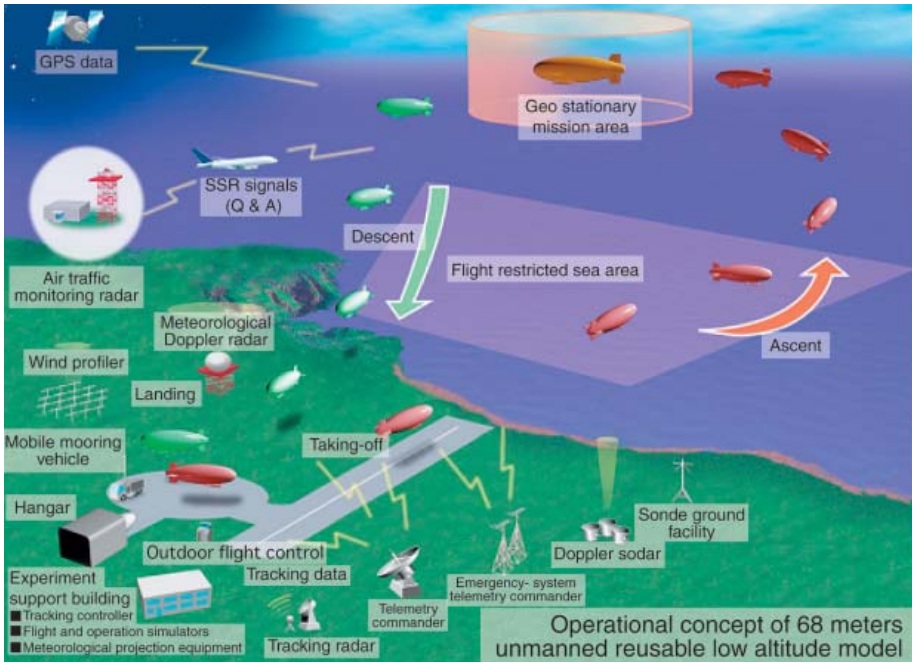
In March 2003, assembly of 48 meters non-powered balloon like high altitude flight-testing model was completed in the NAL airship hangar at Hitachi seaport in Ibaraki prefecture. At present, preparations for a test flight and experiments in July 2003 are being made. The airship will stay at an altitude of 15km over the Pacific Ocean with a mission payload to analyze global warming gas (CO_2) density in the atmosphere and accumulate fresh air into bottles then bring back for precise analysis. This effort will reflect to development of next-generation analytical technology for earth environment.

48 Meters Model

*1 Millennium Project: Funded by the national government. Joint industry-university-administration projects are planned in the three areas of informatization, aging society and environmental measures, which are very important or urgent to the Japanese economy and society, so as to cope with the current issues people are facing and to keep current with technological innovation that creates new industries.

Operational Concept 68 Meters Unmanned Reusable Low Altitude Model

In April 2003, completed detail design and started fabrication of 68 meters unmanned reusable low altitude model. While the test airship implements a stationary flight at an altitude of 4km, it will repeat experimental testing with instrumented on board payload of information communication and broadcasting so as to establish design, manufacture and operation technologies required for development of production model of stratosphere platform airship in the future. In summer 2004, the test airship equipped with two electric motors and propellers, automatic flight control and communication experiment equipment will start flight and communication experiments as well as monitor the low-altitude atmosphere and implement observation with high resolution imagery at the NAL test flight facility in Taiki, Hokkaido.



Industrial Products Company

Industrial Products Company produces multi-purpose engines, known as the Robin. These engines are used in machines that support our life such as industrial products, leisure-related equipment and electric generators.

In August 2002, the company started producing a new engine for ATVs *1 ,ES50PL. The new ATV of Polaris *2 , Predator, where this engine is mounted, has been highly esteemed in the US market since its launch in December 2002. It was awarded “SPORT QUAD OF THE YEAR” by US ATV magazine *ATV sport*.

New engine ES50PL

Main Activities to Reduce Environmental Impacts

◆Improved fuel economy and cleaner exhaust gas

In fiscal 2002, we produced the following results due to the EX engine series put on the market.

Fuel economy: Improved 8% compared with the data in 1995

Exhaust gas: Reduced 34% compared with the data in 1995

◆Reduction of environmental impacts

We started using unleaded paint used for the exterior of multi-purpose engines and application equipment. We start unleading the basic colors, including the standard paint color, Robin yellow, from production in April 2003.

◆Development of multi-purpose engines for LPG and CNG fuels

In fiscal 2002, we experimentally produced an engine for LPG, EH65D LPG for evaluation testing by some OEMs. The Motoruc, a fixed platform truck equipped with EH41D CNG for CNG fuel, is being operated by monitors for introduction to the market.

*1 ATV: All Terrain Vehicle, four-wheel off road buggy
*2 Polaris: US company that annually produces about 240 thousand units of recreational vehicles such as ATVs and snowmobiles.

ES50PL, New Engine for ATVs

The ES50PL, is a water-cooled 4-cycle single-cylinder DOHC gasoline engine, of which displacement is 499cc. It is integrated with a fifth speed manual transmission by wet-type multi-plate clutch. The Polaris Predator is a high performance model used for ATV races. To meet its requirements, the ES50PL satisfies the US CARB exhaust emission standards and actualizes high output (50HP/8000rpm). It is also designed to be light and compact, including the transmission integrated.

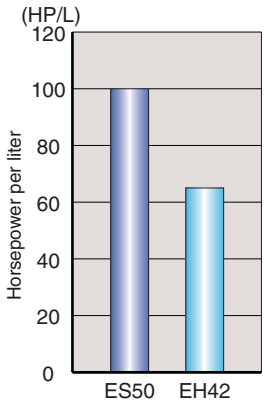
ATV Predator

◆Cleaner exhaust emission and higher output

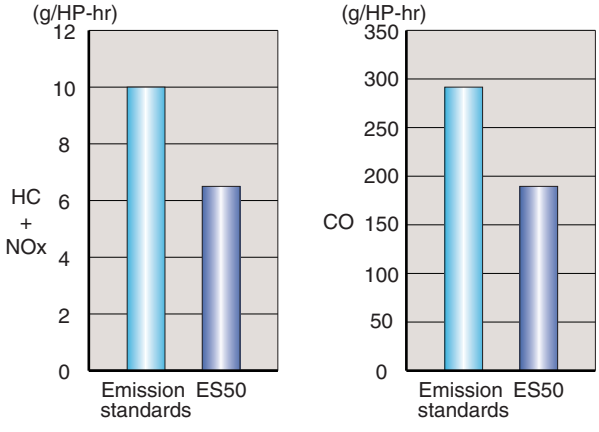
To meet the US CARB exhaust emission standards and enhance the output, the ES50PL adopts the DOHC-4 valve and the pent roof type combustion chamber, realizing higher compressibility of the engine.

By CAE *1 analysis, we optimized the port shape and the intake and exhaust valve diameters.

Output Comparison



Exhaust emission levels

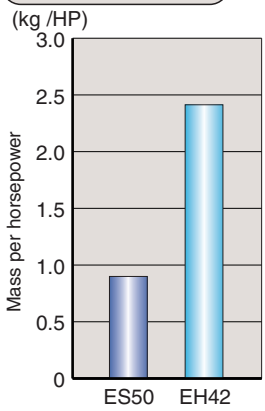


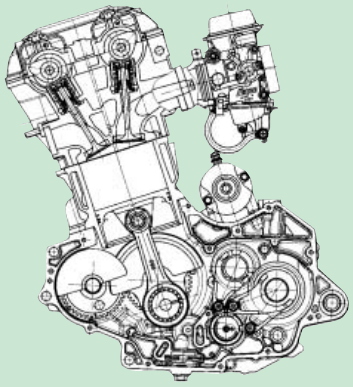
*1 CAE: Computer-Aided Engineering

◆Light and compact design

The ES50PL is designed for thorough weight reduction by CAE analysis. In addition to that, it adopts plated cylinders and the dry sump lubrication system, optimizing the transmission shaft and shift system layout. Its weight is drastically reduced, actualizing the dry mass of 43.2kg, which is 22kg lighter than the previous engine (EH42PL).

Mass Comparison





Engine integrating a fifth speed manual transmission

Reduction of Environmental Impacts in Transport

Robin engines produced at the Saitama Manufacturing Division are shipped every day. We are trying to reduce CO_2 emissions in the distribution process by partially shifting truck transport to Japan Freight Railway Company (JRF) container transport and enhancing the loading efficiency. We also adopt returnable pallets to reduce packing materials.

Transporting Robin engines by using JRF containers

Eco Technologies Company

Eco Technologies Company deals with a variety of products that contribute to creating comfortable living environments and resource recycling society, including the refuse disposal system for skyscrapers as well as various vehicles and equipment for waste collection, transport and recycling. Under the organizational change in 2002, wind power generation business moved from Aerospace Company to Eco Technologies Company. Handling the generation system to produce clean energy, Eco Technologies Company contributes to conservation of the global environment with its ecological products.

Vehicles/Facilities for Collection, Transport and Storage of Waste

◆Large press-style refuse collection vehicle, LP2038

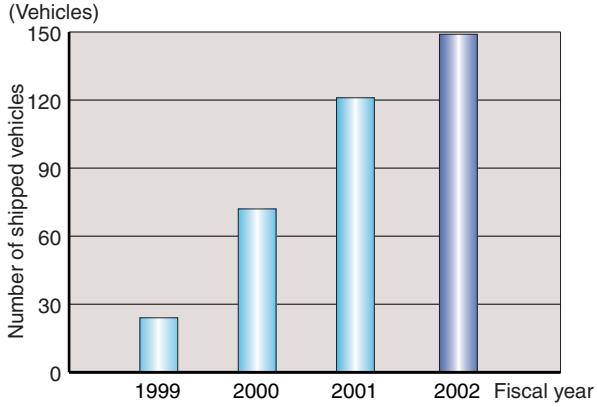
To cope with refuse disposal operations covering wide areas, we put LP2038, our first 20m³ refuse collection vehicle, on the market. This vehicle is fit for wide-area refuse disposal with its excellent loading performance, the largest hopper capacity of the class and the fastest loading speed of the class. In November 2002, it was delivered to Nasu Town of Tochigi Prefecture as an intermediary transport vehicle.

General 4 m³ refuse collection vehicle (left) and large 20m³ press-style refuse vehicle (right)

◆CNG refuse collection vehicles

The number of shipped CNG refuse collection vehicles that use compressed natural gas (CNG) as their fuel for clean emissions is increasing year by year.

CNG Refuse Collection Vehicles Adopted



◆Transit facility (Nasu Town, Tochigi Prefecture)

This is a transit facility, where combustible refuse collected by refuse collection vehicles is transshipped to large refuse vehicles we developed for efficient transport to the incineration facility. Equipped with the screw feeder and the rotary drum, the facility takes all possible measures against offensive odor, dust and wastewater treatment.

Transit facility (Nasu Town, Tochigi Prefecture)

Recycling Equipment

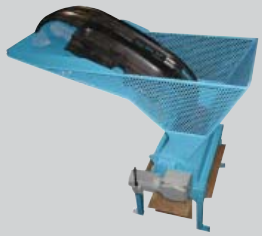
◆Bottle Hunter (Automatic color sorting equipment for glass and PET bottles)

Making a good combination of our unique epoch-making feeder, sorter and image processing and recognition technologies, the Bottle Hunter accurately sorts glass bottle pieces and PET bottles as well as fouled and labeled glass bottles. Bottle Hunters contribute to enhancement of the recycling percentage.

Bottle Hunter (Automatic color sorting equipment for glass and PET bottles)

◆Bumper crusher

This small crusher was developed for recycling of bumpers replaced for repair at sales stores throughout Japan. It crushes resin bumpers for mini-sized and ordinary-sized motor vehicles into recyclable pieces (about 15cm square pieces). It improves the bumper transport efficiency, reducing CO_2 emissions.



Bumper crusher

"Fuswton," Refuse Sorting and Conveyance System for Skyscrapers

The "Fuswton" is installed at skyscrapers in Tokyo such as Roppongi Hills (54-storied) and Nippon Television Tower (32-storied). It saves energy with vertical conveyance using gravity and contributes to recycling with separate storage using the sorter.

Roppongi Hills

Wind Turbine Generator Systems

◆Subaru 40kW Wind Turbine Generator System

In fiscal 2002, when the demand for clean energy increased, volume production of the Subaru 40kW Wind Turbine Generator System, SUBARU 15/40, was started and 4 units (see the table below) were installed. Having the advantages of operation from a gentle wind blowing at a speed of 2 meters per second and low noise, they are working at local government facilities and university research facilities that do not require large systems. They are used for enlightenment on environmental conservation and research of new energy.

	Customer	Location
1	NEDO verification research	Myanmar
2	Engineering College, Nihon University	Koriyama City, Fukushima Prefecture
3	Tochigi Science Museum	Utsunomiya City, Tochigi Prefecture
4	Hikisa Training Center, Suzuki Motor Corp.	Hikisa Town, Hikisa County, Shizuoka Prefecture

◆Subaru 100kW Wind Turbine Generator System

The two NEDO solitary island windmills (100kW) installed in Izena Island of Okinawa in March 2002 accomplished all the development goals as a result of the operation test over a year. Their research was completed in March 2003. As the fruits of our 4-year research, it showed that their structure was strong enough to stand large typhoons and they ensured stable supply of quality power even in a small island.

As the Subaru 100kW Wind Turbine Generator System, SUBARU 22/100, it is expected to work as a domestic windmill suitable to the island nation of Japan having isolated islands and mountainous areas, as well as winds unique to Japan, at the areas where large systems are hard to install and the natural environment should be preserved.

NEDO verification research

Engineering College, Nihon University

Tochigi Science Museum

Suzuki Motor Corp.

House Division

House Division launched a circulating-type flush toilet house, which was an independent flush toilet house with a function to recycle the wash water and installable without water supply and drainage facilities.

The circulating-type flush toilet house has a system to purify processed water with mineral ionic liquid for recycling use. The toilet is friendly to the environment, saving water resource and not directly discharging excrement.

It is useful as a toilet for pleasure resorts, campsites, golf courses and cottages where water supply and drainages facilities are insufficient. It also works as a temporary toilet for long-term construction sites and bathing resorts, and as a public facility for schools and parks.

Log toilet house

Mechanism: Mineral ionic water to which mineral ionic liquid is added circulates in the processing tank for oxidation and sedimentation of excrement. The purified mineral ionic water is reused for the toilet. The clean water is continuously usable since mineral ion water decomposes the substances generating malodor and kills bacteria.