FIP's Environmentally Conscious Solutions and GOSAT

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Fujitsu FIP Corporation has been dealing with environmental problems as a business since the 1970s. FIP has expanded into diverse fields from the development of data processing algorithms for many global observation satellites to environmental management support for environmental problems ranging from the plant level to the global level. This paper introduces two of its key solutions: SLIMOFFICE EX and data processing support for GOSAT. The former manages and analyzes performance information essential to environmental management, while the latter is a data processing solution for the Greenhouse gases Observing Satellite (GOSAT). Both were born from FIP's work in environment-related business spanning 37 years. The paper first introduces the flow behind the development of FIP's environmentally conscious solutions and then describes the above two solutions.

1. Overview of FIP's development of environmentally conscious solutions[1),2)]

The environment-related business of Fujitsu FIP Corporation (hereinafter FIP)[note)] began as government business in the scientific and technical fields (**Figure 1**). It was born amidst growing governmental regulations in the face of pollution problems in Japan in the 1970s. The work included simulating air and water pollution, developing industrial estates, performing environmental impact assessments to predict and evaluate the effects of plant construction on the environment, and making pollution monitoring systems linked with telemetry. In the 1980s, the government's focus turned to pollution prevention measures. At this time, FIP used pollution-monitoring know-how and simulations to construct a wide-area network tracking photochemical-smog and create models of wet air pollution by acid fog and rain (acid rain).

The 1990s saw the start of FIP's environment-related business on a global scale. Starting in 1989, FIP undertook original research into a wide-area ozone behavior model that became part of the data processing and operating system for the Improved Limb Atmospheric Spectrometer (ILAS)[3)] for analyzing ozone distributions of Japan's National Institute for Environmental Studies (NIES). FIP also announced the Extended Program for Image Analysis (EXPIA) for analyzing satellite images of the earth's oceans and atmosphere. This program used remote-sensing image data processing technology based on 20 years of know-how in this field. In 1999, FIP worked on the construction of the System for Alaska Middle atmosphere Observation data Network (SALMON) as a Japan-US collaborative project supporting Alaska-based atmospheric observations in the wide arctic region. It also developed the Fip Environmental INformation management

note) Fujitsu FIP Corporation was called Fujitsu FACOM up to 1976 and FIP until 1979.

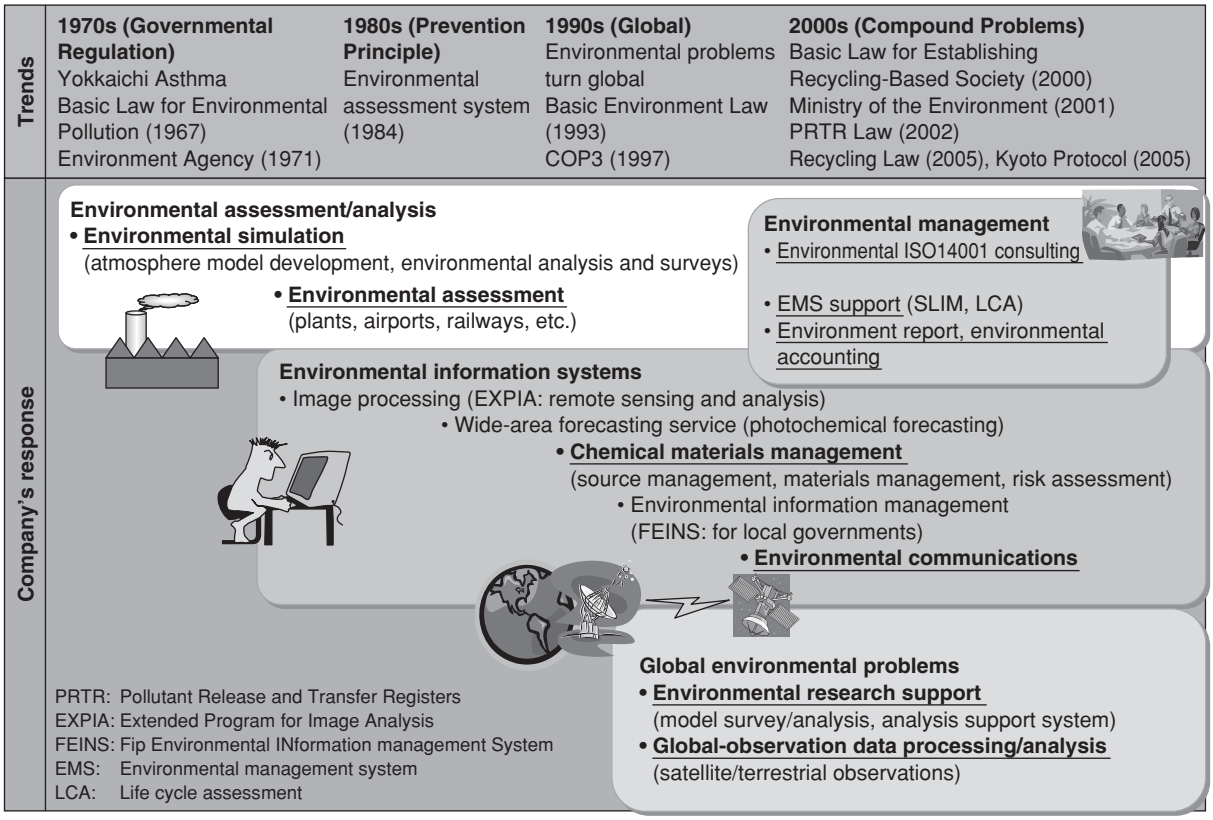

Figure 1
Environmental problems and FIP's response.

System (FEINS), an environmental information management system, which was born from past involvement with environmental problems of local governments. This system supported the acquisition and management of local environmental characteristics by many local governments.

Also in 1999, FIP constructed an ISO14001 environmental management system and received certification for its headquarters in December of that year. This was followed by ISO14001 certification for all of its offices in 2001. FIP expanded this know-how into an environment-related business targeting private enterprises. In 1999, for example, FIP began to market SLIMOFFICE,[4] an environmental monitoring system for corporate offices for calculating the amount of CO_2 emissions caused by administrative and clerical work, and EVERSLIM, an environmental management system for supporting environmental impact assessments. Then, in 2000, FIP began a service for supporting the construction of ISO14001 environmental management systems.

In the 2000s, FIP enhanced and systematized its local government solutions and environmental management solutions. In 2000, FIP announced its "environmentally conscious solutions for local governments" to provide total support for environmental administration from consulting to operation and help realize the electronic government (e-Government) concept. In the same year, FIP placed the CLENALIFE series of products on the market to provide waste information management systems supporting government activities in the field of waste management. Next, in 2002, FIP developed a corporate ledger system supporting the administrative management of chemical materials based on the Pollutant Release and Transfer Register (PRTR) Law enforced in

2002. In the area of environmental management solutions, 2007 marked the initial marketing of SLIMOFFICE EX,[5] an environmental management information system providing total support from the collection of environment-related information in relation to business activities to management analysis using environmental management indexes. Then, in relation to the carbon footprint of products (a topic currently receiving much attention in light of global warming), FIP began to provide the LCASLIM package of systems supporting life cycle assessment (LCA). This package targets both a company's present products and ones slated for development. It supports the estimation and analysis of carbon dioxide, nitrogen oxide, and other substances emitted by a product throughout its life cycle from material procurement to final disposal. In the above way, FIP's environment-related business has come to be divided into three major solution systems: environmental research solutions, environmental administration solutions, and environmental management solutions.[6]

2. SLIMOFFICE EX

Dealing with the environment in the course of business activities has become a necessity in the corporate world. Corporate environmental activities now take on many forms from managing chemical materials and waste and other law-abiding activities to enhancing product competitiveness and the company's image by developing environmentally conscious products. In many of these activities, determining current conditions by collecting and managing environmental performance data (referred to below as "environmental data") is essential. And as environmental activities become increasingly varied, the load associated with collecting environmental data has begun to put pressure on all of a company's environmental activities. Many companies are coming to recognize the usefulness of improving management by using environmental data, but their lack of manpower for environmental data collection and their lack of experience in environmental management analysis have prevented them from undertaking specific measures.

The SLIMOFFICE EX environmental management information system is a solution that provides total support from the collection of a company's environmental data to the practice of environmental management. The three functions described below help to reduce the burden of collecting environmental data and put environmental management quickly into practice (**Figure 2**).

1) Environmental data collection workflow function

SLIMOFFICE EX enables data-collection requests to be made from the environment department at headquarters to individual environmental-data management offices over a Web system that runs on an intranet. Users at individual management offices can download Excel files from their browsers and input and upload data. They can also engage in data collection activities conforming to internal controls using intra-office application and approval functions.

2) Standard templates and environmental management analysis function

SLIMOFFICE EX is equipped with standard templates that incorporate environmental-data collection know-how. It includes ten types of analysis indexes established on the advice of Professor Katsuhiko Kokubu, Graduate School of Business Administration, Kobe University, and enables environmental management to be initiated immediately.

3) Excel-template-file registration function

SLIMOFFICE EX includes a function for registering custom template files so that all kinds of Excel files can be used for data collection. This means that Excel files used for existing activities can also be used after SLIMOFFICE EX has been introduced. As a result, a company's data-collection know-how built up from experience can still be applied after the deployment of this solution.

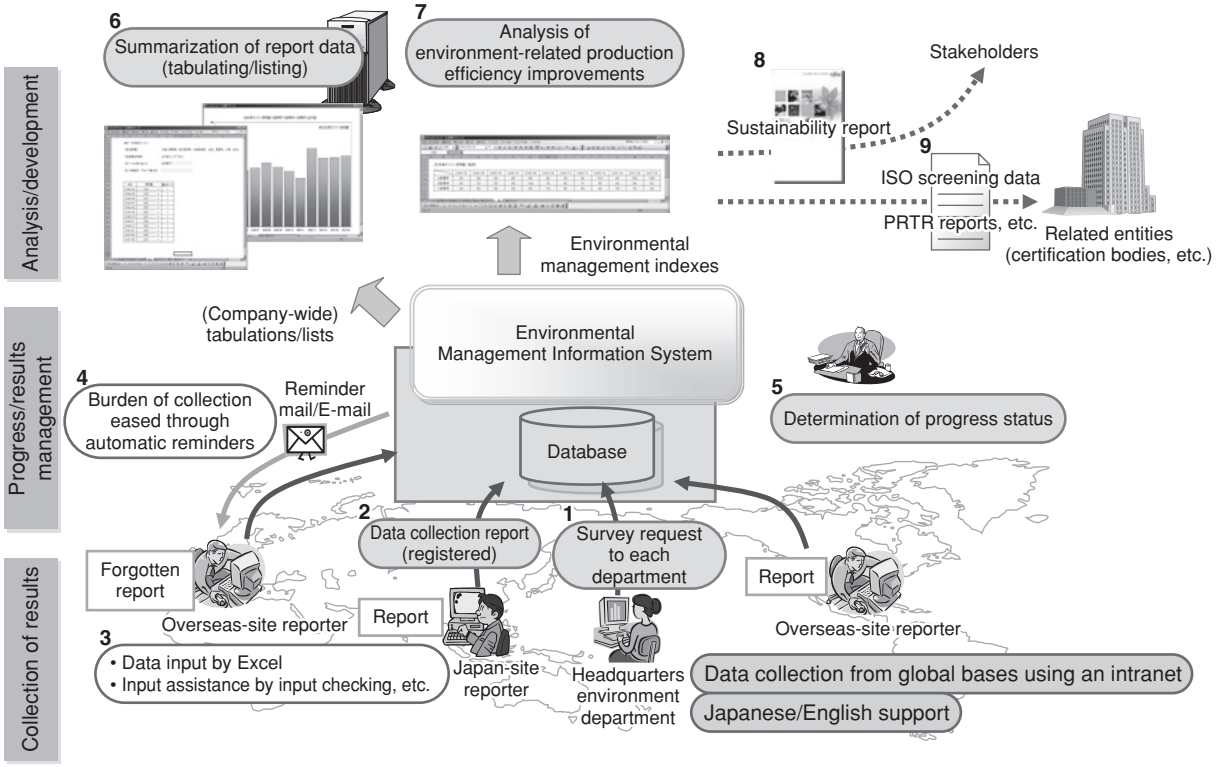

Figure 2
Total solutions concept. Upper left number of each explanation is the order of system use.

Sales of SLIMOFFICE EX began in 2007, and since then, four companies have introduced it in their operations. The Fujitsu Environment Office also uses SLIMOFFICE EX to collect environmental accounting data, and it has seen a big load-reduction effect, with man-hours for data collection reduced to 1/7 and the data-collection period reduced to 1/15 of previous values.

The range of corporate environment-related activities such as reduction of CO_2 emissions and trading in emissions permits is expected to broaden even more from here on. Under these conditions, the amount of environmental data to be collected will steadily increase. The SLIMOFFICE EX template-file registration function enables data collection using all kinds of Excel files, thereby mitigating the cost of system upgrading when new activities are begun. The general-purpose characteristics of SLIMOFFICE EX give this solution high value in corporate activities that appear to be expanding.

3. GOSAT: Greenhouse gases Observing Satellite[7),8)]

3.1 Global warming and GOSAT

Atmospheric concentrations of carbon dioxide, methane, and other greenhouse gases have been increasing significantly as a result of human activities since 1750, giving rise to the phenomenon of global warming. The Intergovernmental Panel on Climate Change (IPCC) has reported in the IPCC Fourth Assessment Report that the effects have reached the global scale and have come to include abnormal climate such as torrential rains and droughts, rises in sea level due to melting of the ice caps, and changes in life-bearing habitats and in the number of their inhabitants. To enable the introduction of measures for controlling global warming, prompt monitoring of greenhouse gases and enactment of emissions-

reduction policies have become global issues, and in Japan, the GOSAT project is moving forward.

The Greenhouse gases Observing Satellite (GOSAT) will be the first satellite in the world to simultaneously observe the concentrations of carbon dioxide and methane—the major greenhouse gases—from space. It will orbit the earth at an altitude of 666 km and will make one complete revolution around the earth in about 100 minutes. Every day, GOSAT will orbit the earth about 14 times. It will return to the same orbit after about three days, or 44 orbits, providing observation of the entire planet at a high frequency. The satellite is scheduled to be launched in the winter of fiscal 2008 and is expected to operate for five years after launch. The Ministry of the Environment (MOE), NIES, and Japan Aerospace Exploration Agency (JAXA) are jointly promoting this project. JAXA has been in charge of satellite development, launch, operation, data acquisition, and level-1 data processing. NIES will develop and improve methods of deriving greenhouse gas concentrations, perform higher-level processing, validation, and distribution of data, and estimate the carbon flux using models. MOE will contribute to the creation of international policies for reducing carbon emissions.

3.2 Observation sensors and data processing

GOSAT is equipped with an instrument called the Thermal And Near-infrared Sensor for carbon Observation (TANSO), which actually consists of two sensors: a Fourier transform spectrometer (FTS) and cloud aerosol imager (CAI). The FTS sensor makes use of optical interference and observes the spectra of sunlight reflected off the earth's surface and the spectra of light emitted by the atmosphere and earth's surface. The CAI sensor observes the state of the earth's atmosphere and surface during the daytime in image form. The optical interference signal observed by the FTS is converted to spectra through a mathematical conversion called a Fourier transform, and cloud- and aerosol-related data are prepared from CAI observations. From these FTS and CAI data, column abundances (expressed as the total number of molecules of target gases over the unit surface area or as the ratio of target gas molecules to the total number of molecules in dry air per unit surface area) of carbon dioxide and methane at observation points having few clouds and aerosols can be calculated. Next, analysis using an atmospheric transport model can be performed to estimate the carbon flux distribution throughout the earth and the three-dimensional distribution of carbon dioxide.

The GOSAT Data Handling Facility (GOSAT DHF) for continual processing of GOSAT data is being set up by NIES at its Tsukuba site. After being received and subjected to level-1 processing by JAXA, data collected from GOSAT will be delivered to GOSAT DHF via a high-speed network in the Tsukuba district (Tsukuba wide area network). Then, using the delivered GOSAT data and reference data collected from related organizations in Japan and abroad, GOSAT DHF will calculate column abundances of carbon dioxide and methane and estimate the worldwide carbon flux and the three-dimensional distribution of carbon dioxide in conjunction with outside computing centers. FIP is in charge of developing a data processing operational system for use at GOSAT DHF and a method of deriving greenhouse gas concentrations (**Figure 3**). It was already engaged in the development of a data processing operational system for a satellite-borne ozone layer observation sensor developed by NIES, the development of an ozone-concentration derivation technique, and the provision of various types of research support. This know-how and experience in environmental and atmospheric studies has also been put to use in setting up GOSAT DHF.

The GOSAT system makes it possible to ascertain the global distributions of carbon dioxide and methane and the geographical distribution of and seasonal and inter-annual variations in the flux. This basic information is expected to con-

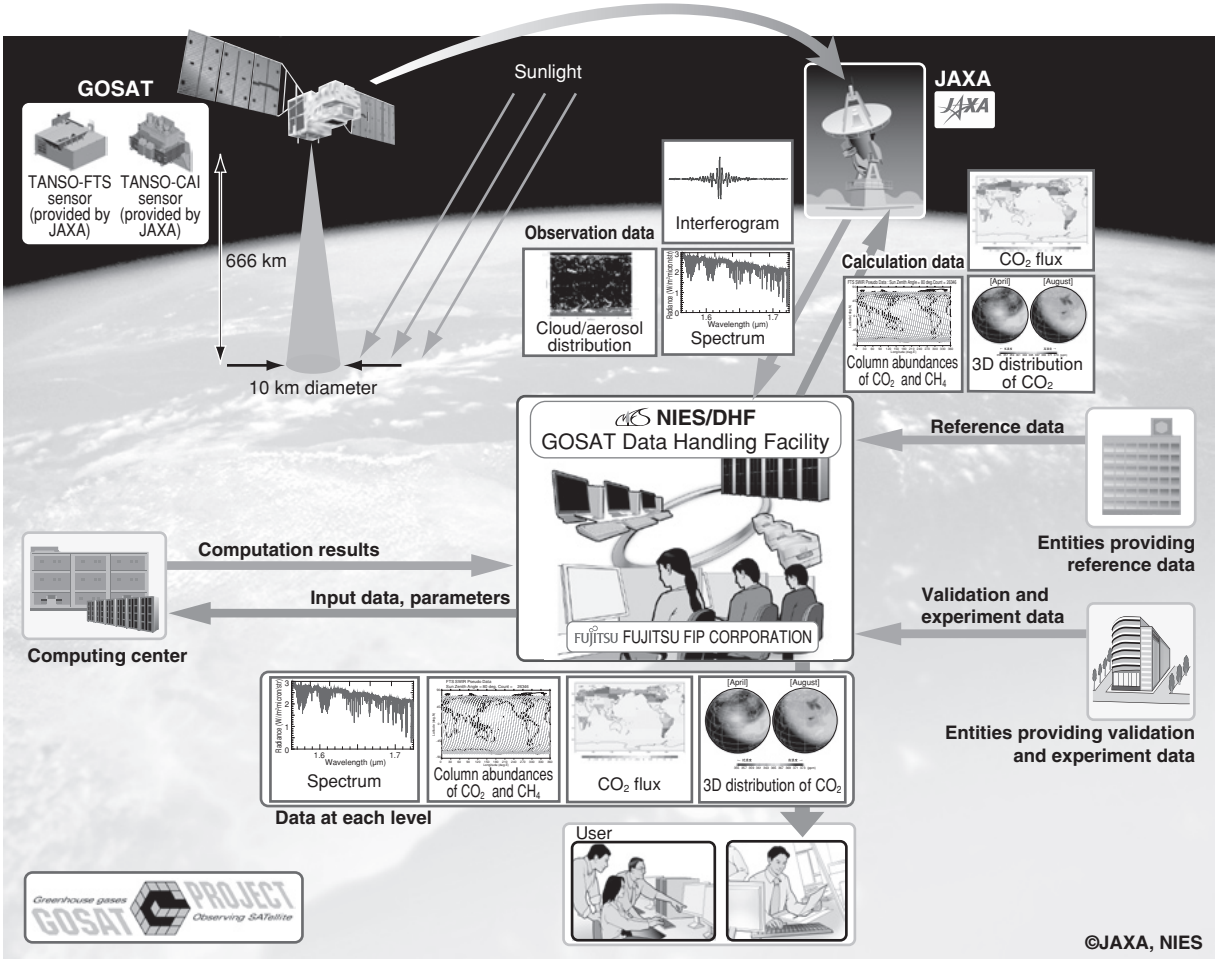

Figure 3
Overall view of data processing.

tribute to the development of advanced climate-change prediction techniques in the future and the formulation of global warming countermeasures such as policies for reducing carbon emissions.

4. Conclusion

Today, the world is faced with an urgent global warming problem. The world must achieve a low-carbon society as a measure for controlling global warming. In a low-carbon society, we can expect supply chain management based on software as a service (SaaS) to be the norm and customer servers to be concentrated in Internet data centers (IDCs). FIP has many data centers in Japan, and it must strive to reduce their CO_2 emissions to promote green information technology (Green IT) in its own corporate activities. It must also research climate change on the global scale in a synergetic manner and support corporate environmental management to reduce CO_2 emissions. In these ways, FIP hopes to fulfill its corporate social responsibility in preserving the environment.

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