Wonder News

PASCO deploys geospatial information expertise to improve aging infrastructure

BY TERUHI FUKANO

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MAIN POINTS

From fiscal 2014, the government and road administrators will launch full-fledged inspections for aging social infrastructure, which is likely to boost PASCO's earnings over the medium and long terms. Much of Japan's infrastructure was built during its postwar boom from 1955 to 1973, and will require massive investments for repair and replacement over the next few decades. As costs for repair, management and overhaul of social infrastructure continue to swell, it could result in constraints for new infrastructure project funding due to expected further declines in long-term public investment as Japan faces an era of declining birthrates and an aging population. The government intends to use advanced technologies, including geospatial information and analysis to implement highly reliable, low-cost, efficient inspections required for the vast amount of road maintenance.

Maps and surveys have played important roles in developing social infrastructure in nations over the course of history. The Japanese government aims to deploy Intelligent Transport Systems (ITS) by around 2020. This would involve a paradigm shift in social infrastructure, as ITS transforms roads into a smart "infrastructure system". In order to achieve such an infrastructure system, it will inevitably require more advanced and accurate mapping data.

The company heavily relies on orders from the public sector. If the company management aims to achieve robust, sustainable business growth, the company needs to seriously commit to expanding its private sector and overseas businesses, and diversify earnings.

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COMPANY BACKGROUND

Pacific Aerial Survey Company (PASCO) was founded in Japan in 1953 by an aerial survey engineer. The company now provides leading geospatial information services in Japan. The company stumbled when it launched its property business in 1969 and expanded to resort and residential development. After the Japanese property bubble burst, the property business placed an enormous debt burden on the company. Although the company disposed of all property assets and withdrew from the business in March 1999, it still faced financial difficulties which prevented it from surviving on its own. Ultimately, the company was rescued from the brink of collapse by SECOM (9735). SECOM took a stake in the company in August 1999 and has been the company's top shareholder since then, holding 69.8% of outstanding shares as of March 2013, and sending a chief executive officer and chief financial officer into the company. The company has been diversifying its geospatial information expertise and services accumulated in the public sector to the private sector. Moreover, the company has been expanding its overseas business through strategic mergers and acquisitions since fiscal 2003.

WHAT IS GEOSPATIAL INFORMATION?

There are two types of geospatial information - "static" and "dynamic". "Static" information includes various types of maps, databases and statistics, for example land-use, geology, hazards, city planning, infrastructure and topography. "Dynamic" information captures changing topography through continuous or steady observation. "Digital maps" are formed into virtual images of the ever-changing nation by combining static and dynamic geospatial information, and then including various human activities such as population, traffic and economic statistics.

COMPETITIVENESS

PASCO is expected to take full advantage of its strengths in collecting dynamic information. Since the company was established, the company has developed abundant experience in collecting "static" data as an aerial surveying company. Besides PASCO, there are three major survey companies in Japan including Kokusai Kogyo (unlisted), Asia Air Survey (9233) and Aero Asahi (unlisted). PASCO is the only company which is able to collect geospatial data covering ground and water

areas using airborne and satellite surveys in Japan. PASCO is able to provide competitive mapping solutions with a wide range of options in terms of cost, timeframes, map accuracy and surveying range. Furthermore, the company's strength is that it is able to create "original mapping" solutions tailored to the purpose of its users through diversified data collection methods.

VIGOROUS EFFORTS TO GAIN ORDERS

Providing real-time aerial photography of devastated areas faster than competitors often plays a crucial role in gaining geospatial information service orders. The company, therefore, attempts to ensure that its airplane is the first to arrive at devastated areas, in the event of a natural disaster, and provides real-time aerial photography to central and local governments. Based on the aerial photos, central and local governments can evaluate the full extent of damage and are likely to place orders with the company to collect highly accurate surveys and provide analysis of geospatial information, for example, gauging the change in terrain. The geospatial data is used by the government agencies and researchers to compile specific evacuation plans.

DEMAND IN PUBLIC SECTOR CHANGES FOR SURVEYS

The public sector has shifted its purpose of surveys from "construction" of new public infrastructure to "preservation treatments" of existing infrastructure. The company heavily relies on orders from the public sector, which exceeded more than 75% of total orders in the past five years. The highest was over 81% in fiscal 2012 due to the 2011 tsunami disaster and a subsequent rise in demand for disaster relief and reconstruction related surveys in areas of northern Japan. Reconstruction-related orders appear to have peaked out. However, the company's public sector work is most likely to remain high even after fiscal 2014, in view of an increase in orders relating to maintenance and repair of aging social infrastructure.

CURRENT SITUATION AND ISSUES OF SOCIAL INFRASTRUCTURE

Much of Japan's infrastructure, including roads, ports, airports and sewers, which were built during its postwar boom from 1955 to 1973, will require massive investments for repair and replacement over the next few decades. The nation's road network reached 1.2 million km, while there are about 9,700 tunnels and 160,000 more-than-15 meter-long bridges as of 2012 (see Figure 1 and Figure 2).

Figure 1 BRIDGES BY ROAD ADMINISTRATORS

Road type	Total bridges No. of sites	over 15m & less than 100m No. of sites	over 100m No. of sites
National expressway	6,991	3,726	3,265
National highway （by MLIT）	12,608	8,744	3,864
National highway (by Pref)*	13,416	10,970	2,446
Prefectural road	34,339	28,887	5,452
Municipal road	91,643	86,826	4,817
Total bridges	**158,897**	**139,153**	**19,744**
% of total bridges			
National expressway	4.4	2.7	16.5
National highway （by MLIT）	7.9	6.3	19.6
National highway (by Pref)*	8.4	7.9	12.4
Prefectural road	21.6	20.8	27.6
Municipal road	57.7	62.4	24.4

* under jurisdiction of Prefecture

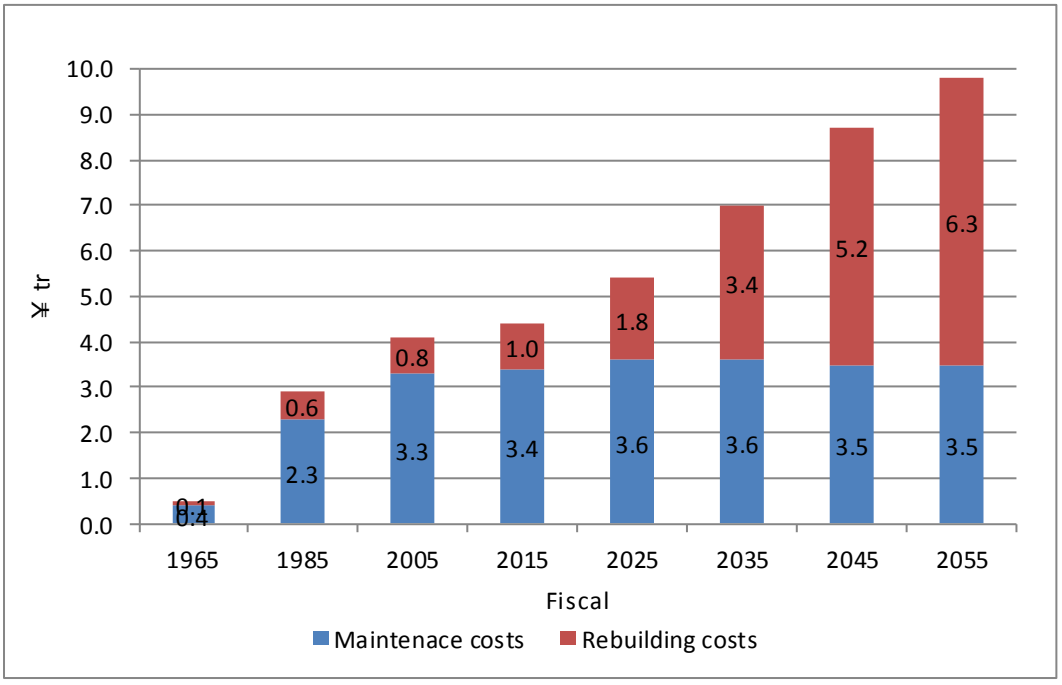
Source： *MLIT*

Figure 2 TUNNELS BY ROAD ADMINISTRATORS

Road type	Total tunnels No. of sites	over 500m No. of sites	over 1,000m No. of sites
National expressway	835	501	283
National highway （by MLIT）	1,398	500	210
National highway (by Pref)*	2,378	627	242
Prefectural road	2,540	449	145
Municipal road	2,549	145	31
Total tunnels	**9,700**	**2,222**	**911**
% of total tunnels			
National expressway	8.6	22.5	31.1
National highway （by MLIT）	14.4	22.5	23.1
National highway (by Pref)*	24.5	28.2	26.6
Prefectural road	26.2	20.2	15.9
Municipal road	26.3	6.5	3.4

Figure 3

COST ESTIMATES FOR CURRENT MAINTENANCE AND REBUILDING TO BE SUSTAINED



Source: MLIT

According to estimates by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), more-than-two-meter long road bridges which are over 50 years old accounted for about 16% of total bridges in 2012 and will surge to about 65% by 2032. If the government continues to maintain and improve the conditions of roads and bridges as it has been, an immense future cost for social infrastructure looks inevitable (Figure 3).

ASSET MANAGEMENT

"Asset management" draws attentions to appropriate methods of operation and maintenance for social infrastructure. Asset management is originally a financial term, where the value of assets is maximized in view of risks associated with financial assets such as cash, stocks and bonds. Asset management for social infrastructure regards social infrastructure as "assets" and aims to improve overall value of the assets. Replacing the reactive post-incident repair and maintenance system, a proactive maintenance cycle is now used, consisting of inspection, diagnosis, repair and record, as well as implementation of "preventive maintenance" and small-scale repairs when infrastructure structural deficiencies are relatively small. With these measures, the government could curb rebuilding costs by overhauling and revamping aging roads, bridges and tunnels at an early stage instead of rebuilding from scratch.

The US government has taken the lead in practicing asset management for social infrastructure. Aging infrastructure, most of which were built during the New Deal in 1930s, become evident in the mid-1970s in US. In particular, a number of serious incidents triggered by crumbling roads and bridges resulted in the loss of human lives. After the 1973 oil crisis, the US government faced a shortage of federal funding for the development of social infrastructure due to fiscal austerity. It is said that the shortage of investments in maintenance and construction led to the decay of the infrastructure.

In Japan, aging infrastructure has drawn increasing attention, particularly in the wake of an accident in December 2012, where concrete ceiling panels in Sasago Tunnel fell onto a heavily travelled highway in central Japan. The public works budget was slashed by one third in fiscal 2013 from the peak of ¥14.9 trillion in fiscal 1998 due to Japan's strained public finances. A further decline in long-term public investment is expected as Japan faces an era of full-scale declining birthrates and aging population. As costs for repair, management and overhaul of social infrastructure continue to swell, it could result in constraints for new infrastructure project funding.

EXTEND INFRASTRUCTURE'S SERVICE CYCLE

The MLIT requires all road administrators to inspect road, bridges and tunnels every five years from fiscal 2014. The Ministry will allocate a budget of ¥268.4 billion in total for "preventive measures for maintenance of road backlogs" for fiscal 2014.

PREVENTIVE MEASURES FOR AGING INFRASTRACTURE BY ROAD TYPES

(1) NATIONAL HIGHWAY

Figure 4 **BURDEN SHARING OF ROAD DEVELOPMENT PROJECTS**

Road type		Road Administratro	Burden is carried by	Burden sharing		Road length（km）* (% of total length)
				Develop/Improvement	Maintenance/Repair	
National Expressway	Toll	Minister	Expressway companies	Develop/improvement and repair are financed by borrwoings. Debt and management expense are repaid with toll revenue.		7,920
	Under jurisdiction of MLIT		National Gov. Prefectures**	National Gov: 3/4 Pref.Gov：1/4	National Gov: 10/10	0.7%
National Highway	Under jurisdiction of MLIT	<Develop/Improvement> Minister <Maintenance, repair & other management> Under MLIT: Minister Other： Prefecture**	National Gov. Prefectures**	National Gov: 2/3 Pref.Gov：1/3	National Gov: 10/10	23,205 1.9%
	Under jurisdiciton of Pref.		National Gov. Prefectures**	National Gov: 1/2 Pref.Gov：1/2	Maintenance：Pref Gov. Repair：subsidized up to 1 /2 by National	31,909 2.6%
Prefectural Road		Prefecture**	Prefecture **	Subsidized upt o 1/2	Maintenance：Pref Gc Repair: subsidized up to1/2 by National Gov	129,457 10.7%
Municipal Road		Municipality	Municipalities	Can be subsidized up to 1/2 by National Gov	Maintenance：Municipalities Repair: subsidized up to1/2 by National Gov	1,020,286 84.1%

* Road length： "2012 annual report on road statistics" by MLIT

** Prefecture includes ordinance-designated city

Source：*"Road types" by MLIT*

National highways under jurisdiction of the MLIT form the central backbone of the arterial road network, along with national expressways, and also have a key function as an emergency transportation road. Hence, the MLIT prioritizes maintenance and repair of the highways over any other roads, and covers all costs relating to the highway (Figure 4).

(2) METROPOLITAN EXPRESSWAY

The Metropolitan Expressway Company will invest approximately ¥630 billion in the reconstruction of the expressway over the next ten years, starting from fiscal 2014

(Figure 5). Total length of the expressway managed by the company is 301.3 km as of December 2013. More than 50% of the expressway is 30 years old or older (Figure 6). In view of the Tokyo 2020 Olympic Games, the Metropolitan Expressway Company will accelerate its work to maintain and improve the conditions of the expressway in accordance with the central government's intent to further strengthen Tokyo's capital functions

Figure 5

METROPOLITAN EXPRESSWAY

AGING INFRASTRUCTURE MEASURES

	Length	Projected Spending
	about (km)	about (Yn bn)
Large-scale Rebuilding	8	380
Large-scale Repair	55	250
Total		630

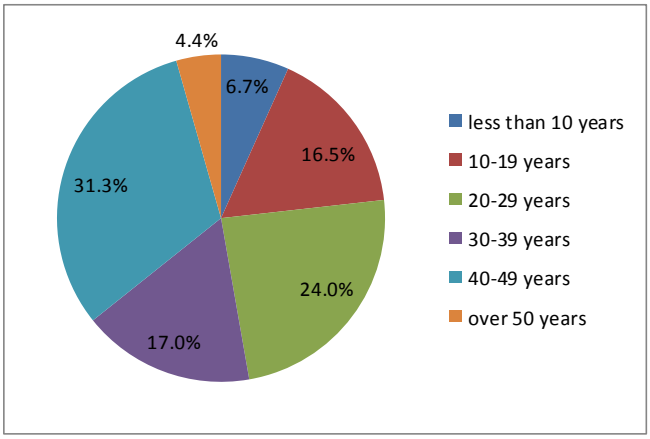
Total length of Metropolitan Expressway: 301.3km

Source: "Summary of Rebuilding Plan for Metropolitan Expressway "

Figure 6

METROPOLITAN EXPRESSWAY

NUMBER OF YEARS ELAPSED



(3) NATIONAL EXPRESSWAYS

Figure 7

NATIONAL EXPRESSWAY

NUMBER OF BRIDGES BY YEARS ELAPSED

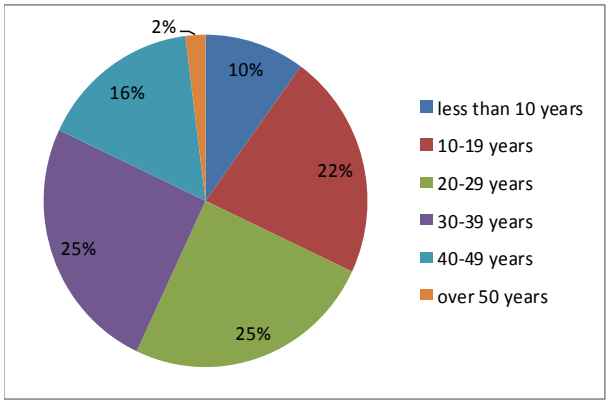
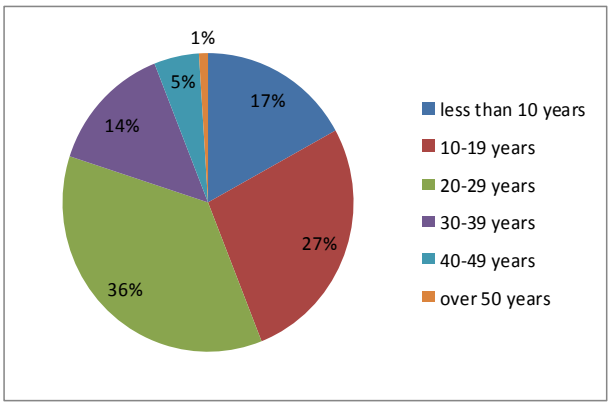


Figure 8

NATIONAL EXPRESSWAY

NUMBER OF TUNNELS BY YEARS ELAPSED



Source: "Summary for large-scale rebuilding and repair plan of highways managed by East, Central and West Expressway companies" issued on January 22, 2014

The East, Central and West Expressway companies operate about 9,000 km of expressways across Japan as of January 2014, of which about 40% are 30 years old

or older. More-than-50 years-old expressways are expected to double, accounting for 80% of total expressways in 2050. Roughly 43% of bridges and 20% of tunnels are more than 30 years old (Figure 7 and 8).

Figure 9

NATIONAL EXPRESSWAY : AGING INFRASTRUCTURE MEASURE

	Type of Works	Length (km)	Projected Spending (Yn bn)
Large-scale Rebuilding	Bridges	240	1,760
Large-scale Repair	Bridges	510	420
	Embankment	1,230	480
	Tunnels	130	360
	Subtotal	1,870	1,260
Total		2,110	3,020

Source: "Summary for large-scale rebuilding and repair plan of highways managed by East, Central and West Expressway

According to “the large-scale rebuilding and repair plan for national expressways” compiled by the three expressway operators in January 2014, they will invest over three trillion yen over the next 15 years for large-scale repair works to overhaul almost 2,110 km of expressways including roads, bridges and tunnels which are at risk of serious structural deterioration (Figure 9).

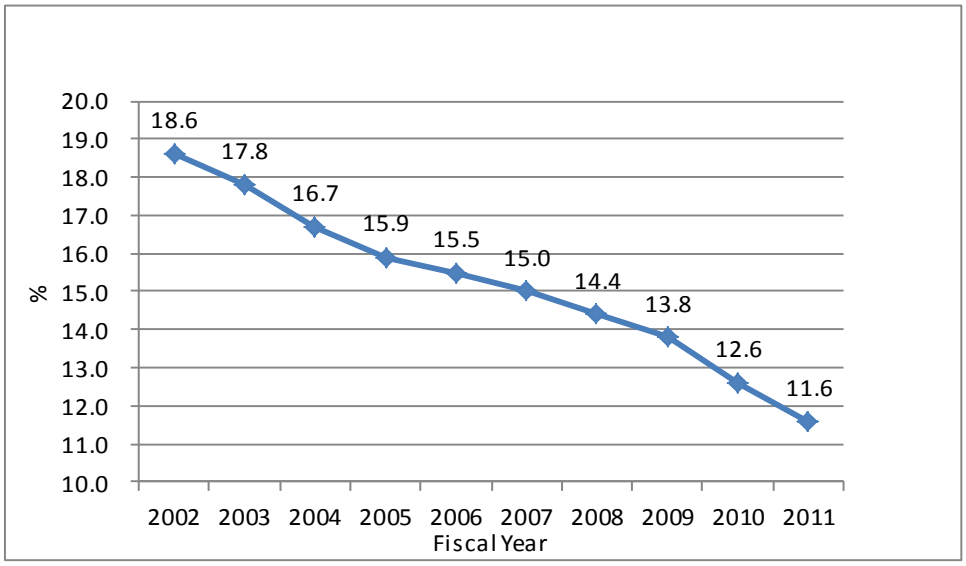
Based on the latest inspection results and maintenance records, the plan identifies sites which will require large-scale repair and development as of January 2014. However, the required investment amount is likely to exceed the initial assumption, as they find additional repair work as the infrastructure continues to age during this period.

(4) MUNICIPAL ROADS

Municipalities manage the largest portion of road length, in addition to large numbers of bridges and tunnels (Figure 4). Nevertheless, civil engineering costs as a percentage of annual spending have been declining over the past ten years as many of the municipal governments are experiencing a fiscal squeeze due to increased welfare spending (Figure 10). In particular, it is obvious that municipalities have not been conducting periodic inspection of infrastructre due to shortfalls in public finances (Figure 11).

Figure 10

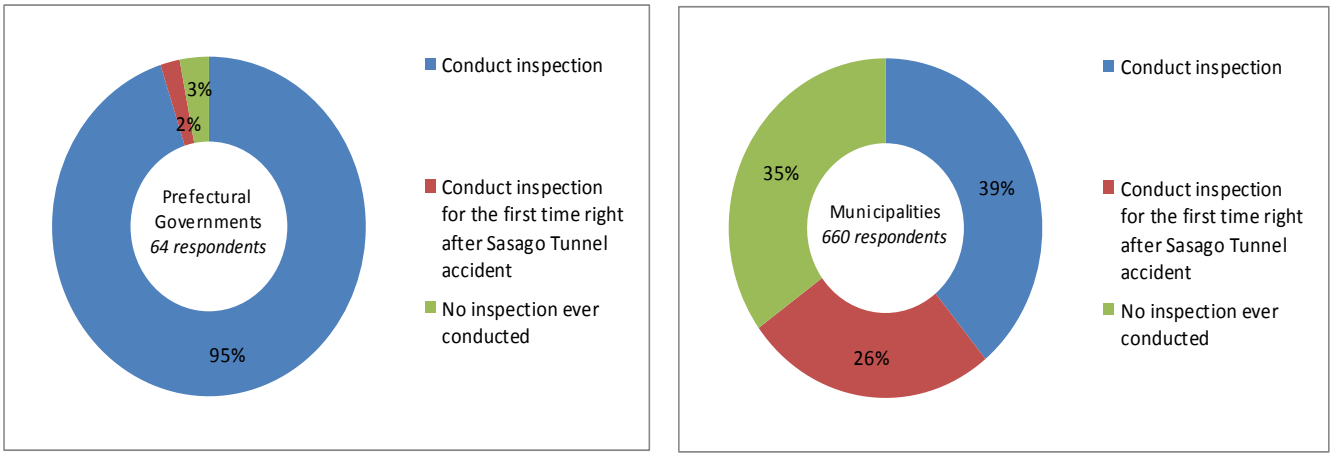
CIVIL ENGINEERING SPENDING AS A % OF EXPENDITURE BY MUNICIPALITIES



Source: "Financial Conditions of Local Government " by MIC in March 2103

Figure 11

INFRASTRUCTURE INSPECTION SURVEY



Source: MLIT

According to “the recommendation for full-fledged implementation to address aging infrastructure” prepared by the MLIT in March 2014, the central government and expressway companies are suggested to fulfill inspection and repair requirements for “important, urgent” bridges on behalf of municipalities, in return for municipal governments consolidating and removing bridges which are less used due to population decline.

OVERHAUL AND ROLE OF GEOSPATIAL INFORMATION IN INFRASTRUCTURE

From fiscal 2014, road administrators will launch full-fledged inspections for roads, bridges and tunnels, in which PASCO could make use of its expertise in the area of inspection and diagnosis in the maintenance cycle of social infrastructure.

As the company deploys remote sensing techniques for gathering geospatial information, it could inspect much broader areas in a relatively short time. Ahead of the government's plan to extend the service cycle of social infrastructure, the company collected 3D geospatial data of national highways across Japan, totaling 23,205 km of road, using vehicles and single-engine aircrafts equipped with high-resolution optical sensors and laser scanners over about two years from 2011 to March 2013. For the national expressways, the company collected 3D data, collaborating with Aero Asahi, and started selling the archived data to expressway operators from fall 2013.

Implementation of high reliability, low-cost, efficient inspections is required for the vast amount of road maintenance. The company collects 3D image data which includes road signs, lighting facilities, traffic information equipment, road surface conditions, tunnels and bridges across the nation's highways. The company archives this data for analysis of each infrastructure, facility and condition, and then identifies deficient spots. Moreover, detailed diagnosis of detected deficient spots is possible as the company can accurately assess the inside of the structure, for example, concrete conditions with infrared thermography cameras and laser sensors. Main inspection methods by road operators are based on visual checks, including palpitation and hammering tests for bridges and tunnels. However, with the current methods road operators are not able to implement accurate inspections in the places where it is structurally difficult to get access to, for example, multi-level stack interchanges. Geospatial technologies are effective for conditions where people cannot access, as well as assisting in reducing workloads and costs.

SIMULATION AND DAMAGE ESTIMATES

The latest archived data the company collected contains raw data imperative to run simulations. For example, weather forecasts uses virtual meteorological models to predicts future changes by loading a range of data, for example, ever-changing temperature, humidity, barometric pressure and wind velocity. Similarly, in road management, the archived data the company collected can be used to estimate

damages including depth and width of flood water by loading data for torrential rains, typhoon, tsunami and river flooding and thus allow the creation of disaster prevention measures such as evacuation plans.

DIVERTING KNOWHOW TO THE PRIVATE SECTOR

The company is unlikely to achieve robust growth unless it can increase orders in the private sector. The company's orders from the private sector were ¥5.3 billion in fiscal 2013, accounting for less than 10% of total orders. The company has been diversifying geospatial information expertise and services accumulated in the public sector into the private sector since SECOM (9735) became its major shareholder in 1999. The company expanded its sales through SECOM's corporate customers and now provides a range of cloud computing applications, including area marketing, logistics system services and support services in Business Continuity Programs (BCP). However, sales have stagnated in the private sector.

For business growth, it is crucial that the company expand its customer base to individual users, in addition to governments and corporations. The company, together with automobile makers and telecommunication companies, collects spot data, such as "where most drivers brake" based on positional information. The company and business partners seem to have launched new digital mapping services based on the analysis of big data, which is likely to lead to reducing car accidents, easing traffic congestion and creation of various new services by providing the information on spots where traffic accidents frequently occur.

The data volume of digital mapping is vast, and thus all of the map data is expected to be managed on cloud computing platforms to maintain freshness and availability of the data. This could lead to creation of new, price-competitive services even for individual users. Profitability will increase if the company expands its customer base through cloud computing services.

OVERSEAS BUSINESS

Its loss-making overseas business is a major issue for the company to overcome. The company needs to steadily secure stable orders and to generate profits in its overseas business as early as possible. Overseas orders were low, at about 10% of total orders, in fiscal 2013. The company expanded its overseas network through mergers from fiscal 2003, and has seven overseas subsidiaries around the globe as

of fiscal 2012. There are growing doubts over whether the company can handle the management of each overseas subsidiary. The company intends to strengthen sales and marketing, in particular, in the Southeast Asian countries where rapid development of social infrastructure is underway. It is necessary for the company to introduce advanced technology services in each subsidiary, including consultation and analysis of geospatial information, in addition to its current aerial photography services. Simultaneously, it also needs to address cost reduction efforts by enhancing productivity.

INCENTIVES TO SPUR EMPLOYEES

It is increasingly important for the company to retain highly-skilled engineers. As needs of geospatial information services further expands, there will be a strong demand for engineers in this field. The company has about 1,900 employees in Japan as of fiscal 2012, two thirds of which are engineers. Geospatial information services require a broad range of business processes and knowledge, including civil engineering surveys, aerial surveys, and the collecting, processing and analyzing of weather and satellite data.

The company provides opportunities to all engineers to engage in R&D which is very unique. In general, only limited numbers of employees in any company are allowed to engage in such creative activities as R&D. However, PASCO created a structure which allows onsite engineers to propose ideas generated from day-to-day business activities to the management, including a R&D chief. Once the idea is adopted, the engineer is given a budget and environment to dedicate himself to R&D and turn the idea into reality. In fact, there are a number of successful ideas that developed into production tools and equipment which are now used across the company, and led to productivity enhancement

TARGET TO IMPROVE OPERATING MARGIN TO 10%

The company believes it could further improve profitability on gross profit base in fiscal 2014 thanks to its cost reduction efforts. The company has been improving productivity since fiscal 2010 as a result of the introduction of deliverable-based production software tools. In addition, the company has curbed outsourcing costs by keeping production in-house and effectively managing projects. Improvement in the production process is one of the main R&D themes. The company plans to automate some of the steps in the production process. If successful, the company

could further improve cost competitiveness and could reach its target of raising the operating margin, from 7.7% in fiscal 2013, to 10%.

FUTURE PROSPECTS

Maps and surveys have played important roles in developing social infrastructure in nations over the course of history. The Japanese government aims to deploy Intelligent Transport Systems (ITS) by around 2020. Some say it is already possible to deploy auto-pilot and vehicle-to-vehicle (V2V) communications only if there are dedicated lanes facilitating vehicle to infrastructure (V2I) communications, which involves the wireless exchange of critical operational data between vehicles and highway infrastructure, intended to avoid or mitigate motor vehicle crashes. V2I communications apply to all vehicle types and all roads, and transform roads into a smart “infrastructure system”. In order to achieve such an infrastructure system, a number of issues need to be addressed in Japan, one of which is to promote more advanced map data including improvements in “static” data infrastructure and standardization of “dynamic” data. The question remains whether the company can translate the paradigm shift in social infrastructure into a business opportunity and accelerate its business growth.

(Reporting and writing by Teruhi Fukano; Editing by Nigel Gan)