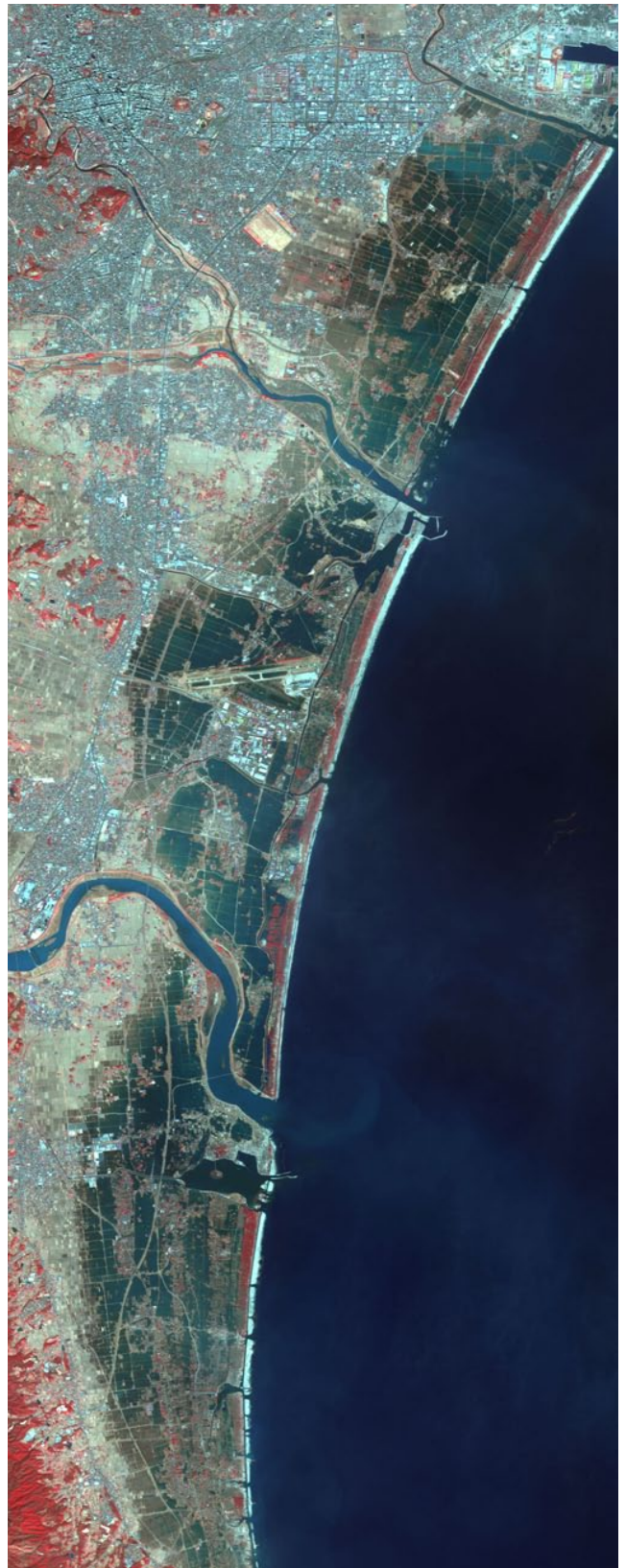


ALOS satellite view of Sendai in the Tohoku region showing the extensive flooding of the airport and vicinity. Credit: JAXA



Japan

Japan's Space Program After the Disaster

By Paul Kallender-Umezu

FRIDAY, MARCH 11, 2011 14:46. WITHIN seconds of the swaying beginning, it was apparent that the tremor ripping through Tokyo was no ordinary quake. It takes a force of nature to make a building as substantial as the Ministry of Economy Trade and Industry, feel like it is “swimming”. The whole building felt like it had bounced off its foundations and was floating, like a cup and saucer back and forth over a table on a ship plowing through a major storm.

At one minute, when even strong quakes usually begin to subside, the author did something he's never done in 20 years living and working in Japan—he joined the Ministry staff in huddling in disbelief under the nearest desk as flat panel displays lurched drunkenly, files shot off tables, and chairs rolled leisurely across aisles. The surges that started rippling through the substantial 17-story bunker of concrete and masonry that houses the Ministry just kept coming.

Sometime during the third minute, the swaying, accompanied by the odd scream, had subsided. Emerging, we stood in shock as data started pouring out of the NHK news bulletin showing a “*kyodai jishin*” (megaquake) initially registering magnitude 8.8, soon upgraded to 8.9 (and subsequently 9.0), occurred hundreds of miles away off the shore of the north eastern Tohoku

seaboard. They showed a map which was lit up crimson flashing with tsunami warnings. An hour later, the shock turned to horror as we watched a Self Defense Force (SDF) helicopter's live video of a titanic black tsunami rolling through fields and villages, smashing houses and tossing and engulfing cars like little toys in its wake. It is a sight I will never forget.

The Great Eastern Japan Earthquake shifted Japan's main island Honshu 2.4 meters nearer China and managed to jolt the Earth on its axis by something between 10 and 25 cm, according to estimates. But as devastating and dreadful as it was to the Tohoku region, killing over 20,000 people and destroying or damaging over 125,000 buildings across 18 Japanese prefectures, the good news is that this monster quake didn't do any substantial damage to Japan's space infrastructure. The factories, space centers and parts suppliers are all located far from the devastated region.

The bad news is that while Japan's limited space recourses and extensive disaster management and observation agreements did a grand, however limited job in providing critical support and information to central and local government and responders, the costs of reconstruction and recovery to Japan as a nation are likely to deal a crippling to long laid out hopes to double Japan's

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space budget to provide a national disaster monitoring infrastructure as envisioned.

The immediate impact of the March megaquake on Japan's space program was, it seems, relatively minimal. Some damage occurred at the 530,000 square-meter Tsukuba Space Center complex, where the Japan Aerospace Exploration Agency (JAXA) runs the country's International Space Station project, said Midori Nishiura, Executive for Public Affairs at JAXA, causing repairs at the Tsukuba visitors center, for example. More serious for Tsukuba, which is situated about midway between Tokyo and Tohoku, was a collapsed roof that caused an 11-day shutdown of a control room for mission operations for the Japanese *Kibo* laboratory on the International Space Station (ISS).

Additionally, repairs have had to be conducted at the Tsukuba's 13-meter diameter space chamber, said Professor Kozo Fujii, Deputy Director General at JAXA's Institute of Space and Astronautical Science, but the delays are not enough to disturb JAXA's mission schedules. "Yes, there was some damage, and I am not allowed to say how much, but we usually have about six months buffer and the delays are easily absorbable," he told *Space Quarterly* in an interview.

The private sector emerged unscathed, according to public relations officials contacted for this article. Both Mitsubishi Electric Corporation (MELCO) and NEC Corp., which have their main satellite factories based in Kamakura and Keihin, sandwiched between Tokyo and Yokohama, reported no damage and no interruptions in production.

MELCO quickly sought to reassure its customers that the ST-2 telecom satellite being built for SingTel and Taiwan's

Chunghwa Telecom would be shipped on time. (The satellite, based on MELCO's DS2000 frame, was subsequently launched in late May.) Similarly Mitsubishi Heavy Industries' complex near Nagoya, where the H-2A medium launch vehicle and H-2B/HTV ISS launch/resupply vehicles are built, is even further away, as is Japan's launch complex in far off Kagoshima, southern Japan.

However in terms of the broader picture, if there is one thing that the Great East Japan Earthquake proved, it was the utility of space assets to provide detailed and useful disaster monitoring information, survey data and emergency communications that proved invaluable assets to central and local government, police and the Self Defense Force, said Futoshi Takiguchi, Manager, Disaster Management Support Systems office at JAXA's Satellite Applications and Promotion Center.

While JAXA is a research and development organization, it was still able to put its on-orbit resources in the form of the cartographical and ground monitoring ALOS (*Daichi*), the WINDS (*Kizuna*) gigabit Internet, and ETS-8 geostationary-to-mobile satellites to good use, Takiguchi said in a July 25 interview with *Space Quarterly* at Tsukuba. Just as importantly, JAXA was able to lever its deep and broad connections with the SENTINAL system, a pan-Asian cooperative emergency disaster monitoring network framework, he said.

First off, *Daichi* swung into operation almost immediately and by the evening of March 11 was already providing disaster mapping of the Tohoku region to Iwate, Miyagi and Fukushima prefectures. "*Daichi* was able to make extensive mapping of the inland flooding and damage that was not

achievable by other assets. We were able to confirm and measure extent and scale of flooding in Minami-Soma that proved invaluable to gauging what rescue resources should be assigned to such areas, helped with search patterns and priorities. We were able to speed the search for victims and help decision makers with reconstruction priorities," Takiguchi said.

ETS-8 and *Kizuna* were able to offer more limited, but still useful help. For example, *Kizuna* provided a range of high definition video conferencing systems for particularly hard-hit cities with central government and responders. "*Kizuna* played a vital role in promoting face-to-face teleconferencing, helping local government coordinate their response," Takiguchi said.

More impressive was how the resources of SENTINAL Asia swung into action, he said, with data provided by FORMOSAT-2, THEOS and CARTOSAT all providing images of the coastline. Further, JAXA was able to utilize its longstanding partnership with the International Charter for Space and Major Disasters to provide data from a slew of resources including SPOT-5, RADARSAT, Terrasar-X, Rapideye, IKONOS, Geoeye and Worldview 1 and 2, among others.

But the main concern is what might have been, said Takiguchi. *Daichi*, already operating beyond its mission life when the tsunami rolled in, ceased functioning on April 22.

With only three domestically built R&D satellites available, and each of them tasked with its own international and domestic missions, JAXA's efforts were arguably impressive. However budget concerns mean that future missions may face delays—just when a major disaster to the Japanese

Tsukuba Space Center
Credit: JAXA



homeland proved how vital development of such assets is, said Takiguchi.

For example, while *Daichi's* replacement satellite ALOS-2 is due for launch in 2015, ALOS-3 remains in research phase with only a project team in place, and there are fears that a preferred launch for 2017 will be jeopardized, he said. "Ideally we would like to launch ALOS-3 in 2016; we would like to bring this forward, as the services of such a mission are strongly asked for by the disaster monitoring community," he said. "We are saying that budget should be found, and we are opposing cuts, but all this is being negotiated," he said.

That's because next year's budget is facing some critical issues, according to insiders in Japan's space establishment, following the June 30 recommendations of a powerful subcommittee at the Strategic Headquarters for Space Policy, Takaaki Iwasa told *Space Quarterly*. Iwasa is the Director of the Office for Space Utilization Promotion at the Ministry of Education Culture, Sports, Science and Technology.

According to the June 30 recommendations, obtained by the author, next year's budget request will focus mainly on investing in building Japan's seven-satellite Quasi-Zenith Satellite System, the regional global positioning system being built by MELCO, and a few choice projects including the 500 kg, 50-cm optical, and 1-meter resolution radar Advanced Satellites with New system Architecture (ASNARO) earth observation satellites being built for the Ministry of Economy Trade and Industry by NEC.

While other programs are going to be allowed to continue to run, Japan's commitment to operating *Kibo* after 2015

remains, as does development of the Epsilon solid rocket. ALOS-3 and the Global Change Observation Mission-Climate (GCOM-C) global environmental monitoring satellites are slated to be delayed, according to the report. Such delays can be for a year, or for several years.

Meanwhile, the Strategic Headquarters for Space Policy was, as this article was being written, in the last stages of three years of on-off negotiations with the Ministry of Education Culture, Sports, Science and Technology (MEXT) and the Ministry of Economy Trade and Industry about finalizing the new government administrative structure in the shape of a new space agency. A final report due August 8 has been delayed until the end of the month as haggling continues over whether MEXT will cede about 30% of its budget to the Prime Minister's Cabinet Office for the new (as yet) unnamed agency, according to Takafumi Matsui, author of the proposal, who is also Emeritus Professor of the University of Tokyo and head of Japan's Planetary Research Center in an interview with the author. MEXT controls about 60% of Japan's 300 billion yen annual government space budget and is reluctant to cede budget or programmatic control, Matsui told *Space Quarterly* on August 9.

MEXT for its part is strongly fighting to have funding maintained to stop significant delays for the ALOS-3 and GCOM-C satellites, Iwasa said in an August 1 interview.

"Both ALOS-2 and ALOS-3 are regarded as very important by the international observer and research community, particularly ALOS-3, with its ability to observe and map undersea volcanoes, for example. We are being told that it will be

extremely expensive to map and observe such dangers without ALOS-3," he said.

But Satoshi Tsuzukibashi, Director of the Industrial Technology Bureau at Keidanren, Japan's most powerful industrial lobby, who also has an advisory role in the Strategic Headquarters for Space Policy, is pessimistic about the ability of the Japanese government to raise the budget significantly, since any wiggle room for space activities budget, like many other technology areas, has been crushed out by the prospect of huge rebuilding recovery costs. With the Japanese government facing unprecedented debt and an estimated \$300 billion in recovery costs from the earthquake and disaster, including cleanup costs for the Fukushima Dai-ichi Nuclear Power Plant, the Strategic Headquarters for Space Policy has no choice but to focus few core critical projects, he said.

The decision is doubly hurtful as it was only three years ago, with the passing of the Basic Space Law passed by the Japanese Diet, that the strengthening of Japan's disaster monitoring missions was mandated including strategic objectives such as the use of space for defensive military purposes and industrialization of Japan's space development. A subsequent implementation strategy drawn up by Strategic Headquarters for Space Policy called Japan's Basic Plan for Space Policy the following June called for a near doubling of the national space budget to be achieved through 2020 and the launch of up to 34 satellites in the same timeframe. In post 2/11 Japan, in an era of reduced expectations, Keidanren's basic policy is now to push forward for the development of (the Quasi-Zenith Satellite System) as one of the most important space infrastructure development projects.