

Origins and Current State of Japan's Reconnaissance Satellite Program (U)

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On 28 November 2009, Tokyo successfully launched its fifth indigenously produced *joho shushu eisei* or “intelligence-gathering satellite.” According to Japanese media, this second-generation satellite can identify objects as small as 60 cm, a marked improvement over Japan's first generation electro-optical satellites that were only able to identify objects as small as 1 m. The November 2009 launch marked the continuation of Japan's reconnaissance satellite program, which put its first satellites into orbit in early 2003. Two more satellites were successfully launched individually in late 2006 and in early 2007—a pair of satellites had been lost in a catastrophic launch failure in late 2003, and one of the original pair launched in 2003 reportedly ceased functioning in March 2007. The satellite orbited last year was to complete a three-month testing period before replacing the first electro-optical satellite launched in 2003, which was designed to have a five-year lifespan.^a

It is commonly held that North Korea's August 1998

Taepo Dong missile launch over the Japanese archipelago spurred Tokyo to undertake a crash program to build and launch its own reconnaissance satellites. A survey of the open source record of events prior to the summer of 1998, however, shows that Japanese political leaders were in the final stages of reviewing plans for a reconnaissance satellite program using technology under development since the 1980s.

Officials from the Liberal Democratic Party (LDP), the Cabinet Intelligence and Research Office (CIRO), and the then-Defense Agency (DA) had been actively studying the possibility of establishing a program to build and launch dedicated reconnaissance satellites since at least the early 1990s. By August 1998 Japanese political leaders were in discussions with Japanese conglomerates to build and launch reconnaissance satellites. The advanced nature of the discussions and Japanese technology firms'

^a “Japan Launches H-2A Rocket Carrying New Intelligence-Gathering Satellite,” Kyodo World Service, 28 November 2009.

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Origins

By the early 1990s, Japanese government-supported research into satellite and remote-sensing technologies was coming to fruition. The Science and Technology Agency (STA), responsible for supporting research in the area, had been deeply involved in research and development of remote sensing technologies for research observation satellites since the mid-1980s.

In partnership with Japan's National Space Development Agency (NASDA), STA supported development of the Marine Observation Satellites (MOS-1 and MOS-1b), launched in February 1987 and February 1990, respectively; the Japan Earth Resources Satellite (JERS-1), launched in February 1992; and the Advanced Earth Observation Satellite (ADEOS).^a STA was also in the preliminary stages of developing the Advanced Land Observation Satellite (ALOS), which would have a resolution of sev-

eral meters and at that time was scheduled to be launched in 2002. The Agency would draw heavily from technology developed for ALOS in building its first-generation reconnaissance satellites in the early 2000s, as detailed below.

Moreover, Tokyo employed its indigenously developed observation satellites for reconnaissance in the late 1980s and early 1990s. In August 1993, an unnamed "military official in Tokyo" provided the *Yomiuri Shimbun* with three overhead imagery photos of Chinese airfield and port construction on Woody Island in the disputed Paracel Islands. The photos were taken from the MOS—Japan's first earth observation satellite.

The newspaper published the images in its 21 August 1993 edition. The photos showed the progression of construction activity on the island on 14 November 1987, 14 June 1989, and 17 April 1991. The first photo showed no activity; the second showed evidence of a port facility and airstrip construction begun sometime in 1988. The final image showed that dredging operations had been completed and a port facility large enough to support a 4,000-ton frigate or submarine was functioning, according to the unnamed "military official" quoted by *Yomiuri*.^b

Notwithstanding the relatively poor resolution, the imagery's implication was clear: a Japanese-built satellite was producing overhead imagery of possible foreign military sites in Asia. And while the *Yomiuri Shimbun* did not report specifically which offices had access to the imagery, the DA most likely had seen the photos; it was by then purchasing imagery from commercial vendors. The DA had purchased and analyzed imagery from Landsat (with a resolution of 30 m) since at least 1985 and from France's Spot satellite (with a resolution of 10 m) since 1987.^c The Ground Self-Defense Forces (GSDF) had also ordered reconnaissance photography from Landsat in the early 1990s of regions around Japan including the Russian-held Northern Territories.^d By the time Tokyo launched its own reconnaissance satellites in 2003, it had more than a decade of experience using overhead imagery.

^b "Chugoku ga Seisashoto ni Wan mo Kensetsu, Nansashoto de no Sakusen Yoi ni, *Yomiuri Shimbunsha ga Eisei Shashin wo Nyushu*" [China Constructs Port on Paracel Islands, Allows For Easy Operations in Spratly Islands; Yomiuri Receives Satellite Photos], *Yomiuri Shimbun*, 21 August 1993: 4.

^c Taoka, Shunji "Japan's Turning Point Toward Spy Satellites and Information Independence; Decision Made To Launch Satellites in Four Years," *Aera*, 11 January 1999: 46–50.

^d "Jieitai no Eisei Riyo, Honkakuka; *Supabado-B Tosai no Chuokeiki 7gatsu Kado*" [SDF Use of Satellites Taking Shape; Transponder on Superbird-B Operational from July], *Asahi Shimbun*, 31 May 1992: 3.

^a Science and Technology Agency, "Roles and Activities 1994," 21 February 1995, 1–38.

Tokyo began to actively explore the possibility of creating a reconnaissance satellite program dedicated to government use in 1991, as the US Operation Desert Storm in Iraq drew to a successful conclusion and as the political situation in Eastern Europe, the Soviet Union, and on the Korean peninsula proved increasingly uncertain. On 6 March 1991, during interpolations at the House of Representatives' Foreign Affairs Committee, Foreign Minister Taro Nakayama, speaking of the rigors involved in conducting diplomacy and gaining timely information from counterparts abroad, expressed support for introducing reconnaissance satellites. "If we don't receive intelligence from America we won't know anything," he said, and therefore "of course it would not be strange for Japan to have its own so-called diplomatic satellite [*gaiko eisei*]."

Pointing to the increasingly precarious political situation around Japan, he said the important "thing to think about is watching the military situation and military maneuvers in the entire Asian region using reconnaissance satellites [*teisatsu eisei*]."^a With this political mindset gaining ground within the LDP, CIRO began a "top secret" study of reconnaissance satellites as early as 1991, according to the security

^a *Kokkai Kaigiroku*, "Shugiin: Gaimu Iinkai," No. 5, 6 March 1991, <http://kokkai.ndl.go.jp/>.

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affairs journalist Tsuyoshi Sunohara.^b

Following North Korea's test launch of Nodong missiles into the Sea of Japan in May 1993, the DA's Defense Policy Bureau also began studying the possibility of introducing reconnaissance satellites. The bureau at the end of January 1994 finalized a then-classified report, called the "Outline for Photo-Reconnaissance Satellites." The study examined the possibility of building indigenous satellites with the help of four major Japanese defense contractors—Mitsubishi Heavy Industries (MHI), Mitsubishi Electric (MELCO), NEC, and Toshiba. MHI would provide its H2 rocket technology to launch the indigenous satellites, and the other companies would develop and build the satellites and components.

Remote-sensing technology developed by STA could also be used on the satellites, according to the outline. The bureau noted, however, that a constellation of five to seven satellites would cost up to ¥1 trillion, not a small sum for a country mired in recession. The fact that this study took place was leaked to

^b Sunohara, Tsuyoshi, *Tanjo Kokusan Supai Eisei: Dokuji Johomo to Nichibei Domei* [The Birth of an Indigenous Spy Satellite: Independent Intelligence Network and the Japan-US Alliance] (Nihon Keizai Shimbunsha, 2005), 7–8.

the *Mainichi Shimbun* in August 1994, as Tokyo neared completion of its first post-Cold War National Defense Program Outline revision.^c

The same week the "Outline" was leaked, the government released a rather forward-looking report prepared by a nine-member Defense Policy Council chaired by Kotaro Higuchi. The Higuchi report, prepared at the same time as Tokyo was conducting a review of its National Defense Program Outline, suggested that Japan should develop reconnaissance satellites, strengthen its C4I capabilities, build a missile defense system, and incorporate midair refueling capabilities.

In the summer of 1994, however, the newly inaugurated Tomiichi Murayama administration—the country's first Japan Socialist Party (JSP)-led administration in over a generation—was not in a position to support such wide-ranging proposals. Many members of the JSP continued to refuse even to recognize the constitutionality of the Self-Defense Forces (SDF), and the 72-year-old Murayama had great difficulty

^c "Teisatsu Eisei, Hoyo Fukume Kento; 'Kaihatsuhi Ha Ichchoencho'—Boeicho Ga Himitsu Kenkyu Ripoto" [JDA Secretly Studied Reconnaissance Satellites Including Possession; 'Development to Cost Over 1 Trillion Yen'], *Mainichi Shimbun*, 15 August 1994: 1.

The DIH's imagery division will start [in 1997] as a section to buy commercial imagery and conduct imagery data processing.

in convincing his party to change its platform in this regard as he attempted to gain greater credibility in foreign affairs. The Murayama administration was in no position politically or ideologically to support the development of reconnaissance satellites, and thus a possible program would not be discussed openly for another 18 months, following the inauguration of an LDP-led government.

Shortly after the LDP regained power in January 1996, with Ryutaro Hashimoto becoming prime minister, the party's Research Commission on Foreign Affairs and the Research Commission on Security began to hold joint meetings on the possibility of introducing indigenously built reconnaissance satellites. Their first meeting on the subject, on 15 May 1996, was attended by officials from the Ministry of Foreign Affairs (MOFA), the DA, and representatives of Japan's electronics giant NEC.

The NEC representatives stated that a reconnaissance satellite, a second satellite to serve as a spare, a data-transmission satellite, and construction of a ground station would cost roughly ¥210 billion and could be operational by 2003. The representatives claimed their reconnaissance satellites would have 30-cm resolution,

which they said was very near US capabilities.^a Potential satellite capabilities aside, NEC's participation at the meeting suggested that discussion within the LDP had moved beyond *whether* to build reconnaissance satellites to *how* they could be built.

Following these initial discussions, MOFA requested funds to study the reconnaissance satellite issue in the Japanese FY1997 and FY1998 budgets, although the requested amounts—a mere ¥5.24 million in FY1998, for example—were miniscule.^b Moreover, MOFA stressed that the money was to be spent reviewing the idea only and could not be used for research or development. Part of the reason MOFA could not budget more money was political: the LDP was still in a coalition government with the JSP and was constrained in providing funding for even small government studies of a potential reconnaissance satellite program. The LDP remained hopeful, however, and continued to review plans internally in 1997 and 1998.

Indeed, as the Defense Intelligence Headquarters (DIH) was

^a Haruyuki Aikawa, "LDP Researches Domestic Spy Satellite Development," *Mainichi Shimbun*, 16 May 1996.

^b "US Opposes Japan's Plan for Spy Satellites," *Kyodo News Agency*, 7 January 1998.

established in early 1997, it was increasingly clear that Tokyo envisioned some sort of reconnaissance satellite program in the medium-term. As the politically well-connected daily *Sankei Shimbun* noted ahead of the DIH inauguration on 4 January 1997, "The DIH's imagery division will start as a section to buy commercial imagery and conduct imagery data processing. The DA, with a plan to possess its own satellites in the future, will accumulate analytical know-how" in this division.^c With Japan's technological base and a basic analytical structure in place, all that was needed was a political decision to move forward with a reconnaissance satellite program. This in turn required solid public backing, which at the time was ambivalent, given the country's continued economic malaise.

The LDP Commissions on Foreign Affairs and Security met jointly again in the summer of 1998. On 15 August—two weeks before North Korea tested its Taepo Dong missile—NEC representatives again submitted a study on a reconnaissance satellite program, asserting that the company could build two reconnaissance satellites and one data-relay satellite with "initial funding of

^c "Joho Honbu Kongetsu-matsu ni Hassoku, Eisei Gazo no Busho mo" [Defense Intelligence HQ To Commence Operations at the End of This Month, Will Have Satellite Imagery Posts As Well], *Sankei Shimbun*, 4 January 1997: 3.

approximately ¥210 billion.”^a But by this point, two years after the LDP had begun actively entertaining proposals for a reconnaissance satellite program, NEC's rival, MELCO, had prepared a proposal of its own.

On 25 August, MELCO President Ichiro Taniguchi presented his company's ideas on building reconnaissance satellites at the LDP's "Science, Technology, and Information Roundtable Discussion.”^b He told the 18 representatives that not only would his company's satellites provide for greater national security, they could also be used to ascertain damage after large-scale natural disasters and keep watch over Japan's long coast lines.^c Following the 1995 Hanshin earthquake and recent North Korean infiltrations into South Korean waters in 1996, these were increasingly important considerations—and saleable to the public. The price, however, remained about the same at just over ¥210 billion.

^a Yoshihiko Ninagawa, "STA, NASDA Study Improved Satellite Monitoring Resolution," *Sankei Shimbun*, 20 September 1998: 1.

^b Shunji Taoka, "Japan's Turning Point Toward Spy Satellites and Information Independence; Decision Made To Launch Satellites in Four Years," *Aera*, 11 January 1999: 46–50.

^c Tsuyoshi Sunohara, *Tanjo Kokusan Supai Eisei: Dokuji Johomo to Nichibei Domei*, [The Birth of an Indigenous Spy Satellite: Independent Intelligence Network and the Japan-US Alliance] (Nihon Keizai Shimbunsha, 2005), 88.

The [Taepo Dong] launch [in 1998] thus gave the LDP justification to proceed openly with a reconnaissance satellite program.

Six days later, North Korea launched its intermediate-range Taepo Dong missile over Japan. While Pyongyang claimed to have launched a satellite into orbit, Japanese leaders were extremely concerned, as the launch unequivocally demonstrated that the entire Japanese archipelago was within range of North Korean missiles. The launch thus gave the LDP justification to proceed openly with a reconnaissance satellite program.

At a specially convened LDP meeting of local representatives to discuss the missile launch, Prime Minister Keizo Obuchi, who had recently taken over the premiership from Hashimoto, declared it "outrageous" that North Korea had "launched [a missile] over Japan without prior notification." Obuchi informed the audience that his administration had "instructed ministries and agencies concerned to study what [kind of satellite] we would be able to launch and what functions it would be able to perform."^d A reconnaissance satellite, it was widely argued, should at a minimum provide Tokyo with notification of preparations for future launches from North Korea.

^d "Obuchi Supports Launching 'Multipurpose' Satellite," Kyodo News Agency, 10 September 1998.

Political discussions and further review of reconnaissance satellite proposals then proceeded rapidly. The LDP established a "project team to study the feasibility of introducing an intelligence satellite." The team held its first meeting on 10 September, the very day of Obuchi's speech. Unfortunately for NEC, however, executives at the company had just been implicated in a scandal of overcharging the DA and NASDA for contracts. Also that day, senior executives at several companies, including NEC, were arrested and charged with bilking the DA out of millions of yen in defense contracts.

Although NEC was not out of the running for the satellite contract—it had significant technical experience as a result of its work on the ALOS—MELCO was becoming the early, untainted favorite among LDP officials eager to establish a reconnaissance satellite program quickly. By November, when the LDP officially announced the commencement of the program, 11 NEC executives had been arrested in connection with the scandal, and its chances for winning the satellite contract were ruined.^e

Officials from MELCO submitted their detailed proposal,

^e "NEC Executive Indicted in Procurement Scandal," Kyodo, 28 October 1998.

Within six months of the Taepo Dong launch, Japan was officially on the road to building its own reconnaissance satellites.

titled "Study Concerning Multipurpose Information-Gathering Satellite System," to the LDP a month later, on 14 October 1998.^a With NEC out of the running, MELCO was the only real choice left to LDP officials, and the LDP approved MELCO's plan in November. The cabinet approved construction of four satellites—two optical and two synthetic-aperture radar (SAR) satellites—on 22 December.^b By spring of 1999, the Space Activities Commission, in charge of setting Japan's space policy and—more importantly—budgets, formally approved the program and put money into the FY2000 budget to start construction.^c Within six months of the Taepo Dong launch, Japan was officially on the road to building its own reconnaissance satellites, at an initially projected cost of more than ¥200 billion.

During the final stage of the approval process, in March 1999, Japan had another security challenge that served to underscore the need for improved intelligence collection capabilities. US reconnaissance satellites and Japanese SIGINT facilities had identified

apparent fishing vessels from North Korea lingering suspiciously off the coast of the Noto Peninsula. The Japan Coast Guard and units from the Maritime Self Defense Force attempted to halt and board the vessels, but they fled Japan's exclusive economic zone and were later thought to have returned to their base in Ch'ongjin.

The incident also reinforced the Japanese perception of a growing threat from North Korea, and Japanese media began to cite yet another reason to launch reconnaissance satellites. The conservative newspaper *Sankei Shimbun* observed in an article on intelligence satellites, following the Taepo Dong launch, "There emerged a heightened need for using the reconnaissance satellites" to watch for "spy ships" originating from North Korean ports.^d

ALOS, "Parent" of Reconnaissance Satellites

For technology and expertise, Tokyo immediately turned to the domestic satellite then under development, ALOS. With development beginning in the early 1990s, ALOS was to be Japan's most advanced

observation satellite to date. It was to have three main sensors: the Panchromatic Remote Sensing Instrument for Stereo Mapping (PRISM), with 2.5-m resolution, the Advanced Visible and Near Infrared Radiometer type-2 (AVNIR-2), and the all-weather Phased Array type L-band Synthetic Aperture Radar (PALSAR) with a 10-m resolution. Importantly, MELCO had been a major contractor on the project. Once the reconnaissance satellite program was approved, the company began work using technologies developed initially for ALOS.

The LDP, as Japan's ruling party, had announced its intention to use ALOS technologies for reconnaissance satellites in its "Proposals on the Introduction of Intelligence Satellites" in early November 1998.^e A month later, after the government formally approved the program, the former chief of development for the ALOS project was named the first director and acting program manager of the "Preparatory Office for Intelligence-Gathering Satellites" at NASDA.^f

On 1 April 1999, the first day of the new fiscal year, Chief Cabinet Secretary Hiromu Nonaka announced the decision to

^a Taoka.

^b "Cabinet Approves Plan To Launch Spy Satellites," *Kyodo News Agency*, 22 December 1998.

^c "Space Activities Commission Decides on FY2000 Space Budget Plans," *Nikkan Kogyo Shimbun*, 5 August 1999: 6.

^d "Cabinet Information Research Office To Launch Reconnaissance Satellites in FY03," *Sankei Shimbun*, 26 January 2002.

^e "LDP Proposal on Intelligence Satellites," LDP Web site.

^f "NASDA, *Joho Shushu Eisei de Junbishitsu wo Kaisetsu*" [NASDA Establishes Preparatory Office for Intelligence-Gathering Satellite], *Nikkan Kogyo Shimbun*, 15 December 1998: 5.

proceed with development of the satellites using indigenous technologies. That same day, NASDA upgraded the "Preparatory Office" to a "Research Office," and transferred 13 personnel from the ALOS project to the reconnaissance satellite program as NASDA "will apply ALOS technology" during construction, according to the industry newspaper *Nikkan Kogyo Shimbun*.^a Inevitably, as Tokyo's attention turned to reconnaissance satellites, ALOS construction was delayed by a number of years.

Nongovernment defense analysts began to speculate about the capabilities of future reconnaissance satellites built from ALOS technologies. Keiichi Nogi, a well-versed military affairs commentator writing for the defense journal *Gunji Kenkyu*, called ALOS the "parent satellite" of the reconnaissance satellite program and noted that "if the performance of the charge-coupled devices (CCDs) and optics is improved, achieving 1-m ground resolution at the original altitude [of 700 km] would not be impossible."^b Other Japanese media outlets also suggested ALOS technolo-

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gies would be improved to provide greater resolution, with *Sankei Shimbun* reporting that the number of CCDs to be used in ALOS's PRISM sensor might be doubled, thereby making it possible to improve the resolution to 1.2 m.^c Regardless, excitement grew within the defense community as the program took shape.

Launch

Tokyo originally scheduled the launch of all four satellites for mid- to late-2002 but, citing a delay in parts procurement, it postponed the launch until early 2003 for the first pair of satellites and late summer 2003 for the second pair.^d On 28 March 2003, Japan successfully launched the first two indigenously produced reconnaissance satellites on its H-2A rocket from the Tanegashima Space Center.

The March launch placed into orbit one satellite with an optical system with approximately

a 1-m resolution and another with a SAR that reportedly had a resolution of 1–3 m. Most reports noted that 3 m was probably the best resolution possible, as the SAR satellite operated in the L-band with a frequency between 0.4 gigahertz and 1.5 gigahertz, accounting for the 3-m resolution.^e Sunohara quoted a Japanese imagery specialist who asserted that a 1-m resolution would be quite difficult with the L-band radar and that a 3-m resolution was more likely.

For better resolution, the satellite would have to use a higher frequency C-band or X-band radar at 8–9 gigahertz, which Sunohara suggested might be included in third-generation satellites after 2011.^f Most analysts noted, however, that while the SAR satellite produces only poorer-resolution monochrome images, it has a distinct advantage over an optical system because it can be used at night and during inclement weather.

^a "Seifu, Joho Shushu Eisei no Kokusan wo Kettei" [Government Decides On Domestic Development of Intelligence-Gathering Satellites], *Nikkan Kogyo Shimbun*, 2 April 1999: 2.

^b Keiichi Nogi, "Summing Up the Pluses and Minuses of Japan's Reconnaissance Satellite Development," *Gunji Kenkyu*, December 1998: 60–74.

^c Yoshihiko Ninagawa, "STA, NASDA Study Improved Satellite Monitoring Resolution," *Sankei Shimbun*, 20 September 1998: 1.

^d "Joho Shushu Eisei, Uchiage 15-nen ni Enki, Seifu Kettei, Buhin Chotatsu ga Okureru" [Government Decides To Postpone Launch of Intelligence-Gathering Satellites Until 2003, Supply of Parts Late], *Sankei Shimbun*, 14 June 2001: 2.

^e Yuta Sagara, "Peaceful Use Principle in Japan's Policy Crumbling," *Kyodo*, 6 March 2003.

^f Tsuyoshi Sunohara, *Tanjo Kokusan Supai Eisei: Dokuji Johomo to Nichibei Domei* [The Birth of an Indigenous Spy Satellite: Independent Intelligence Network and the Japan-US Alliance] (Nihon Keizai Shimbunsha, 2005), 208–209, 226.

The preponderance of the early imagery was reportedly taken of targets in North Korea, including nuclear facilities at Yongbyon and missile launch facilities at Musudan-ri.

The first satellites orbited the earth in a solar synchronous quasirevolution orbit at 400–600 km in altitude 15–20 times a day. (Sunohara, citing “multiple” sources, placed the orbit at 470 km.^a) It was popularly claimed that the two satellites were able to take an image of any place on earth at least once a day, a central goal of the program. With the March 2003 launch behind them, the Japanese scheduled the launch of the second pair—like the first, one equipped with an optical sensor and the other with SAR—for August. In addition, the government revealed it planned to launch two “reserve satellites” in 2006 and two second-generation satellites by early 2009. The second-generation optical satellites were to have a 0.5 m resolution.^b

The satellites launched in March began transmitting imagery in late May. The preponderance of the early imagery was reportedly taken of targets in North Korea, including nuclear facilities at Yongbyon and missile launch facilities at Musudan-ri. The

satellites were also said to have photographed WMD facilities in Russia, China, and the Middle East.^c In one reportedly successful use of the satellites, Tokyo captured imagery of a rail line 150 km north of Pyongyang, where a massive explosion took place on 22 April 2004 shortly after a train carrying Kim Chong-il home from China had passed by. Pyongyang initially explained that the accident was caused by contact of electrical wires with ammonium nitrate fertilizer loaded on a train at the station, but Japan's monthly *Gendai* interviewed an unnamed North Korean official who claimed that the blast had been an attempt to assassinate Kim: “The blast at Ryongchon was simply not an accident—it was a terrorist assassination attempt on the Dear Leader,” the official asserted.^d

Whatever the case, KCNA, the state-run television station in North Korea, reported that the explosion damaged buildings as far as 2 km from the epicenter, and caused extensive damage especially in a 1.5-km radius of the blast. After viewing the

imagery, Japanese officials determined that the damage was not as great as Pyongyang had let on, and they judged the damaged area to have a maximum radius of 1 km. Once Japanese policy makers—including Prime Minister Koizumi—viewed the photos and independent damage assessments, Tokyo concluded the North exaggerated the damage in a bid to gain more international aid.^e

The August launch was postponed until 29 November 2003. The launch was ill-fated, however, as the satellites were unable to reach orbit when a procedure to jettison one of the rocket's fuel tanks failed. The tank remained partially attached to the rocket. NASDA destroyed the rocket in flight to keep it and its cargo from crashing uncontrollably to the earth's surface.^f The failure, the first of the H-2A rocket after five successful launches, also set back Japan's growing space-launch program. Before the failure the Japan Aerospace Exploration Agency was scheduled to launch up to 17 satellites by 2007 on the H-2A and M-5 space launch vehicles. All of these launches would be significantly delayed, however.

The mishap greatly disappointed DA and other govern-

^a Tsuyoshi Sunohara, *Tanjo Kokusan Supai Eisei: Dokuji Johomo to Nichibei Domei* [The Birth of an Indigenous Spy Satellite: Independent Intelligence Network and the Japan-US Alliance] (Nihon Keizai Shimbunsha, 2005), 179.

^b “Japan To Launch Two ‘Spy’ Satellites in March, Start Full-Fledged Operations in July,” *Yomiuri Shimbun*, 6 January 2003.

^c “Japan's ‘Spy’ Satellites Start ‘Full-Fledged’ Photo Surveillance Over DPRK,” *Asahi Shimbun*, 6 September 2003.

^d “Koizumi's Grave and Kim Chong-il's Betrayal; Interview With North Korea's Diplomatic Source in Beijing; Pressure From Hu Jintao, which materialized in Japan-North Korea Summit,” *Gendai*, July 2004: 28–36.

^e “Protecting Japan Part III: Eyes in the Sky Vital for Security,” *Yomiuri Shimbun*, 8 June 2004.

^f “Rocket Failure a Double Setback,” *Asahi Shimbun*, 1 December 2003.

ment officials, who had planned to have four reconnaissance satellites available for robust coverage of potential trouble spots in Asia and elsewhere. But Japan still had two satellites in orbit, and it continued with plans to build and launch next-generation satellites as well.

As it was working on its rockets and sensors, the Japanese government was also developing a basic data relay capability. Had the technology been included in the satellite program as earlier proposals had suggested, the first-generation of reconnaissance satellites might have data-relay capabilities provided by geostationary satellites positioned as high as 22,000 miles or more. As it was, on 20 February 2003, as preparations were under way to send up the first satellites in March, the Japanese successfully tested the "Kodama" Data Relay Test Satellite (DRTS) to relay images of the Indian subcontinent and Sri Lanka taken by the Advanced Earth Observation Satellite (ADEOS-II) to the Tsukuba Space Center and the Earth Observation Center in Japan.^a

It is likely that by now the Japanese do have a relay capability for their reconnaissance satellites, possibly using the DRTS, although there has been no mention in Japanese media of the existence of such a capability associated with the recon-

^a "Eiseikan Tsushin Jikken ni Seiko" [Inter-Satellite Communications Experiment Successful], *Air World*, May 2003: 124.

As the satellites were being constructed, Japan built data reception stations.

naissance satellite program. As noted above, much of the technology used in the ALOS was applied to the reconnaissance satellites, and NEC's original ¥210-billion proposal included a data-relay satellite. MELCO most likely included a provision for one in its proposal, which had a similar price tag. With such a capability, Japanese analysts would have the ability to provide policy makers with analysis of near real-time imagery of areas as far as Central Asia, the Indian subcontinent, and perhaps the Middle East.

Ground Facilities

As the satellites were being constructed, Japan built data reception stations in the north in Tomakomai in Hokkaido and in the south at Akune, Kagoshima Prefecture. Each site has one receiving antenna—covered by a giant greenish-bluish dome—and a two-story building adjacent to it, as reported by local papers that provided pictures of the facilities.^b The main substation, which has two receiving antennas and a two-story building, is located north of Tokyo in Kitaura, Ibaraki Prefecture, and serves as a backup to the main control and analysis cen-

^b A photo of the northern site can be viewed on the 27 November 2001 edition of *Tomamin*, a local news service provider in Hokkaido, available at <http://www.tomamin.co.jp/2001/tp011127.htm>.

ter in Ichigaya, Tokyo.^c The construction of the facilities was completed in December 2001, more than a year ahead of the launch of the first pair of satellites.^d Another satellite reception station is located on the western side of Australia near Perth.

Imagery analysis is conducted in the Cabinet Satellite Intelligence Center (CSIC) of Cabinet Intelligence and Research Office (CIRO). Given CSIC's designation as a special "center," its director presumably has a rank about equal to the CIRO deputy director. The center's first director was a retired general, Masahiro Kunimi, who had previously served as the first head of the Defense Agency's DIH in 1997. He was called out of retirement to head CSIC because of his experience in intelligence matters.

When CSIC began operations in the summer of 2001, it had approximately 20 SDF personnel and 180 personnel from other ministries and agencies. Kunimi told *Sankei Shimbun* that approximately 300 people would eventually work for CSIC.^e An additional 80 would be needed to operate the four receiving centers, bringing the

^c "Joho Shushu Eisei Uchiage Junbi Tchakutchaku: 15nen Natsu ni Mazu 2ki" [Preparation for Intelligence Satellite Launch Proceeds Apace: First 2 Devices Set for Summer 2003], *Asagumo*, 2 August 2001: 1; and *Nihon Keizai Shimbun*, 29 July 2002.

^d *Yomiuri Shimbun*, 31 December 2001.

The expanded Directorate for Geospatial Intelligence would perform “three-dimensional map intelligence” in addition to imagery analysis.

total number to 380 personnel, but *Nihon Keizai Shimbun* questioned whether this would be enough for 24-hour operations.^a Hiroyuki Kishino, a career Ministry of Foreign Affairs official, was promoted to deputy director from his position as the first chief of the Imagery Analysis Department on 5 August 2003 as the satellites were becoming operational.^b (In an indication of CSIC's high-profile, following his two years' service there Kishino was given the choice position of minister to Britain in 2004, and he was promoted to Envoy Extraordinary and Minister Plenipotentiary to Britain in early 2005.^c)

CSIC's five-story “core center,” which manages and operates the satellites, was constructed on the north side of the Defense Ministry headquarters^d in Ichigaya, Tokyo, where the DIH is also located. Indeed, a Japanese-language sign adja-

cent to the back gate of the Defense Ministry headquarters identifies the incongruously deep-silver building rising above the walls of the compound as the Cabinet Satellite Intelligence Center. The defense daily *Asagumo* reported that the facility was specially shielded to protect it from eavesdropping on electromagnetic signals emanating from the building.^e

The DIH Imagery Directorate was created in 1997 by the merger of the “Central Geography Unit” of the GSDF with the satellite imagery analysis divisions of the other SDF branches. When it was first established, analysts worked mainly with imagery purchased from US companies, but by 1997 it was “rumored” that Japan would “eventually receive its own reconnaissance satellites,” according to *Sentaku*.^f The Imagery Directorate was expanded to a “Directorate for Geospatial Intelligence,” with 40 additional imagery analysts in April 2003, bringing the

total number of imagery analysts there to 160. The number of personnel devoted to imagery analysis—civilian and uniformed—rose to 321 by mid-2004.^g

The expanded Directorate for Geospatial Intelligence would perform “three-dimensional map intelligence” in addition to imagery analysis, in the words of defense analyst Buntaro Kuroi.^h The significance of this step should not be overlooked, as three-dimensional imagery would be a necessary requirement for developing detailed maps of terrain features, a prerequisite for terrain-contour mapping technology in guidance systems for cruise missiles and other precision-guided weapons.

To support IMINT operations, the DA in March 2001 inaugurated the Imagery Intelligence Support System (called the *gazo joho shien shisutemu*).ⁱ According to the Defense Research Center's Isao Ishizuka, this system provides reconnaissance photographs from IKONOS satellites (owned by Space Image) with resolution as sharp as 82 cm to imagery analysts.^j Construction began on the system in 1997 with a projected cost of ¥16.1 billion.

^e Interview with Masahiro Kunimi, “*Joho Shushu Eisei, Uchiage 15-nen ni Enki, Seifu Kettei, Buhin Chotatsu ga Okureru*” [Government Decides To Postpone Launch of Intelligence-Gathering Satellites Until 2003, Supply of Parts Late], *Sankei Shimbun*, 14 June 14, 2001: 2.

^a “Government To Launch Monitoring Satellites in 2003 To Bolster Crisis Management,” *Nihon Keizai Shimbun*, 29 July 2002.

^b “*Naikaku (Jinji)*” [PMOR [Personnel]], *Nihon Keizai Shimbun*, 5 August 2003: 4.

^c “Japan Names Omori as Ambassador To Oman,” *Jiji*, 28 January 2005.

^d The Defense Agency was upgraded to a ministry in 2007.

^e “*Joho Shushu Eisei Uchiage Junbi Tchakutchaku: 15nen Natsu ni Mazu 2ki*” [Preparation for Intelligence Satellite Launch Proceeds Apace: First 2 Devices Set for Summer 2003], *Asagumo*, 2 August 2001: 1; Some Japanese internet mapping services available on the Internet helpfully label the building too: Mapion.co.jp labels the building directly to the north of Defense Ministry Headquarters as “*Naikakufu Joho Senta*” [Cabinet Satellite Center].

^f “Defense Agency Intelligence Headquarters,” *Sentaku*, May 1997: 126–29.

^g “Larger Staff Set for Analyzing Information Satellite Data,” *Yomiuri Shimbun*, 16 July 1999.

^h Buntaro Kuroi, “Special Project: What Are Japan's Foreign Intelligence Capabilities Now? (Part 2),” *Gunji Kenkyu*, November 2005: 232–41.

ⁱ http://jda-clearing.jda.go.jp/hakusho_data/2003/2003/html/15311300.html

Once operational, the system helped to supply satellite imagery acquired by Quickbird IKONOS commercial satellites, and it reportedly connects CSIC and the Directorate for Geospatial Intelligence at DIH via high-capacity data cable.^a Japan also orders imagery from the commercial imaging satellites Radarsat, Landsat, and Spot.^b If the system can be used with commercial satellite imagery, one can reasonably suppose that it can be used with imagery obtained from Japan's reconnaissance satellites as well.

Follow-on and Future Intelligence Satellites

Japan successfully launched a third satellite on 10 September 2006 and a fourth one five months later. According to one industry newspaper in late July 2000, construction of these additional satellites had been planned as a "contingency" for a launch failure during either of the first launches in 2003—a plan that proved prescient.^c

^j Isao Ishizuka, "Joho Shushu Eisei Seiko no Joken" [Requirements for Successful Information-Collection Satellites], in *DRC Nenpo 1999*, available at www.drc-jpn.org/AR3-J/mokuji-j.htm.

^a Kuroi, 232–41.

^b See comprehensive list of satellites used by Japanese ministries and agencies on Cabinet Web site, www8.cao.go.jp/cstp/tyousaikai/cosmo/haihu03/siryoushu-5.pdf.

^c "Seifu, Rainendo Kara Joho Shushu Eisei no Kokeiki Keikaku ni Chakushu" [Government Begins Planning Successor Intelligence-Gathering Satellites From Next Fiscal Year], *Nikkan Kogyo Shim-bun*, 28 July 2000": 2.

Once the first-generation satellites were completed, Japan began development of next-generation reconnaissance satellites.

While still considered first-generation satellites, these back-up satellites apparently included improvements over the two already in orbit. The CCDs employed on the back-up optical satellite had been scheduled to be upgraded by 2005 from 8-bit to 11-bit radiometric resolution, according to Sunohara, increasing the grey values (and therefore the image quality) in the black-and-white images from 256 to 2048. The optical satellite would be capable of taking 1-m black-and-white images and 5-m color images, and have more powerful "pointing" or slewing capabilities. The SAR satellite was also reported to have a 1- to 3-m resolution, although because it was to continue to employ L-band radar, its resolution is likely limited to be around 3 m as noted previously.^d

Once the first-generation satellites were completed, Japan began development of next-generation reconnaissance satellites. Plans to build these satellites were officially approved on 13 June 2001, when the "Intelligence-Gathering Satellite Promotion Committee" headed by Chief Cabinet Secretary Yasuo Fukuda approved the indigenous development of optical

technology capable of a 50-cm resolution. These second-generation satellites were scheduled to be ready for launch by early 2009.^e

Second- and later-generation satellites to be launched after 2009 were to have improved, shorter solar panels to allow for greater maneuverability. The satellites would also be equipped with improved reaction wheels to allow slewing along all three axes. The reaction wheels, essentially weighted spheres that cause the satellite to turn when they spin in a particular direction, are part of the attitude control system that adjusts the satellite's position for precision targeting. While the first-generation satellites are equipped with reaction wheels limited to slewing on one axis, the next-generation satellites were designed to be able to slew along all three axes, thereby expanding the number of potential surface targets within range at any given moment in orbit. The satellites were also to be lighter than the 2-ton first-generation satellites, with an expected weight of around 1.2 tons.^f

One question for speculation is whether Japan will ulti-

^d Tsuyoshi Sunohara, *Tanjo Kokusan Supai Eisei: Dokuji Johomo to Nichibei Domei* [The Birth of an Indigenous Spy Satellite: Independent Intelligence Network and the Japan-US Alliance], *Nihon Keizai Shimbunsha*, 2005, 225.

^e "Seifu, Jisedai Joho Eisei, Noryoku wo Ohava Kojo" [Government To Improve Capability of Next-Generation Intelligence-Gathering Satellite], *Nihon Keizai Shimbun*, 13 June 2000 (evening edition): 3.

^f Sunohara, 226–27.

Until recently, one significant impediment to further development of space-based systems was the so-called Peaceful Use of Space policy.

mately build other types of satellites, such as SIGINT, MASINT, or launch-detection satellites. One vocal proponent of additional satellite capabilities is Toshiyuki Shikata, a retired GSDF lieutenant general who speaks and writes prolifically on a wide range of security-related matters and who has consistently called for the development of a wide variety of satellites. He told the *Yomiuri Shimbun* in 2006, for example: "This country should have at least eight satellites to be able to take photos" of missile bases and other sites "twice a day."^a He has made similar calls in his monthly column in *Securitarian*,^b and he has called for the construction of a satellite to intercept communications and for a launch detection satellite.^c Shikata has significant access to policy makers—he addressed the Expert Panel on Space Development and Utilization (an advisory panel to the Prime Minister) in January 2002, and he has served as a consultant to Tokyo Governor

Shintaro Ishihara on crisis management.

Until recently, one significant impediment to further development of space-based systems was the so-called Peaceful Use of Space policy. This policy referred to a resolution passed by the Diet in May 1969 clarifying Japan's space policy. It stated that "Japan...will proceed with space development as long as it is for peaceful objectives."^d This was generally seen as precluding the Defense Agency or the Self-Defense Forces from using space-based platforms until 1983, when the DA used NTT's "test" communications satellite CS-2/Sakura-2 for communications between the DA headquarters and units on Iwo Jima. This created a public stir, however, because this was the first time the Defense Agency had used a space-based system for defense-related purposes. In 1985, the Maritime Self Defense Force used the 1983 precedent as grounds for a request to use the US Navy's communications satellite Fleetsat.^e The Cabinet ruled that year that such a use was "generalized" and therefore did not violate the "peaceful objectives" of the resolution.^f

^d Quoted in Tamama, Tetsuo, "Nihon no Uchu Seisaku to Anzen Hoshō no Setten" [Points in Common Between Japan's Space Policy and National Security], *Boei Gijutsu Janaru*, June 2002: 23.

^e Yuta Sagara, "FOCUS: 'Peaceful Use Principle' in Japan's Policy Crumbling," Kyodo News Service, 6 March 2003.

The SDF could use satellites as long as the satellites also served a general commercial or scientific purpose as well.

The "peaceful use" policy was less of an issue when the reconnaissance satellite program was established in the late 1990s because of overwhelming public concern following the Taepo Dong missile launch and other aggressive actions by Pyongyang. The DA merely continued to argue that the reconnaissance satellites' functions are "recognized as generalized," and therefore intelligence gathered by the satellites could be used by the SDF.^g

To remove any lingering questions about the legality of the use of space, the ruling LDP in June 2006 drafted legislation that would specifically support Japanese use of space-based systems for national security purposes. Kyodo reported at the time that passage of the bill would "enable the development of high-definition spy satellites and of a satellite capable of detecting the firing of ballistic missiles," and establish a "Space Strategy Headquarters" in the Cabinet Secretariat and a Minister for Space Development to coordinate space development strategies among the various government agencies.^h In addition to clearing up potential legal issues related to Japan's use of space, the bill's proposed creation of a central

^f Tamama, 24.

^g Tamama, 25.

^h "Panel Drafts Outline of Bill To OK Military Use of Space," 2 June 2006.

organization and ministerial post to coordinate space policy pointed to official intentions to pursue a greater variety of space-related projects, which certainly included additional satellites related to intelligence collection and national defense.

The bill had broad bipartisan support, as all three major parties—the governing LDP, its coalition partner the New Komeito Party, and opposition Democratic Party of Japan—supported the legislation in the Diet in early 2008. The bill became law—the *uchu kihonho* or “Space Basic Law”—in mid-2008, after it was passed by both houses of Japan's Diet.

Of particular interest is Article 3, which states that Japan's continued development of space is necessary for its own “national security” as well as the preservation of international community's “peace and security.” The new law thus sanctioned the use of space-based systems specifically for national security purposes, opening the door for the legal development of a wider range of intelligence-related satellites.

Yasuaki Hashimoto, writing for the Defense Ministry-affiliated National Institute of Defense Studies, noted that the enactment of the law indicated that Tokyo was moving away from the use of space strictly for “peaceful purposes equal to nonmilitary purposes” to a “nonaggression” policy of the use of space. In other words, Tokyo can now legally develop the full range of space-based

Tokyo chose to develop an early warning satellite as its next major satellite program as North Korea's potentially nuclear-tipped intermediate-range missiles pose the clearest threat to the Japanese archipelago.

platforms for national security purposes such as “early warning satellites, communications satellites, data relay satellites,” and SIGINT satellites in addition to reconnaissance satellites, according to Hashimoto.

While the enactment of this law makes the use of space-based platforms for national security purposes legal, there are multiple hurdles to their indigenous development and operation, not least of which is cost. But with this law, Tokyo “will be able to examine the merits and demerits of various national security systems” that operate in space, according to Hashimoto.^a

Following a public debate on the “merits” and “demerits” of future satellite systems in the spring of 2009, the Japanese government in June approved a panel recommendation that included the launch of an additional reconnaissance satellite and the development of sensors to be employed on a future early warning satellite.^b The previously planned launch of a reconnaissance satellite sometime in 2011 or later would bring the number of active reconnaissance satellites to

four—considered to be the minimum necessary for a fully operational reconnaissance satellite constellation.

Tokyo chose to develop an early warning satellite as its next major satellite program as North Korea's potentially nuclear-tipped intermediate-range missiles pose the clearest threat to the Japanese archipelago. The satellite is slated to be integrated into Japan's national missile defense system, which has gained ever greater importance after North Korea's successive missile and nuclear tests in the 1990s and 2000s.

Over the past three decades Japan has gradually gained confidence in developing, launching, and employing an increasing variety of space-based systems for national security purposes. The remaining legal hurdles have been eliminated, and Japan is now set to develop a launch-detection satellite for use in an increasingly robust national missile defense system even as it continues to employ more sophisticated reconnaissance satellites. While the costs of other possible future satellite programs might prove prohibitive, Tokyo will no doubt continue to examine a range of possible options as it looks to expand its space-based capabilities.

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^a Yasuaki Hashimoto, “Enactment of the Basic Space Law: Japan's Space Security Policy,” *Briefing Memo*, National Institute of Defense Studies, 27 June 2008.

^b Shiro Namekata, “Space Plan to Double Satellite Launches,” *Asahi Shimbun Online*, 3 June 2009.

