

**IFRI
PAPERS**

ASIE.VISIONS, No. 143

NOVEMBER
2024

Taiwan's Rising Space Program

Building Up Industry, Supporting National Security



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Center for Asian
Studies

Space Program

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ISBN: 979-10-373-0938-9

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Cover: © ixpert/Shutterstock.com

How to quote this publication:

Marc Julienne, “Taiwan’s Rising Space Program: Building Up Industry, Supporting National Security”, *Asie.Visions*, No. 143, Ifri, November 2024.

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- “Racing to the Moon: China's Lunar Exploration Program in Competition with the United States”, with Paul Wohrer, *Policy Brief*, No. 4, ReConnect China, October 2023;
- “China in the Race to Low Earth Orbit: Perspectives on the Future Internet Constellation Guowang”, *Asie.Visions*, No. 136, Ifri, April 2023;
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- “China's Ambitions in Space: The Sky's the Limit”, *Études de l'Ifri*, Ifri, January 2021.

Abstract

Taiwan, known for its leadership in semiconductors and information and communications technology (ICT), is now making significant strides in the space industry. While historically modest, Taiwan's space program has seen a transformation since 2020, driven by President Tsai Ing-wen's commitment to expanding the country's space capabilities. Key milestones include the passage of the Space Development Act and the creation of the Taiwan Space Agency (TASA), which has bolstered the resources and visibility of Taiwan's space ambitions.

The government's strategy focuses on two main objectives. First, Taiwan aims to diversify beyond semiconductors, positioning the space sector as a future driver of economic growth. Second, it seeks to enhance national security through space-based assets, particularly low Earth orbit (LEO) communication satellites, to address vulnerabilities in its communications infrastructure.

To achieve these goals, Taiwan is fostering collaboration between TASA, academia, industry and startups, while encouraging private investment in the space ecosystem. Near-term projects include launching the FORMOSAT-8 and FORMOSAT-9 satellites, with longer-term plans for a LEO broadband satellite constellation and autonomous space launch capabilities. Taiwan is also strengthening international partnerships, notably with the United States, Japan and Europe, to support its ambitions of becoming a space power.

Résumé

Taïwan, reconnu pour son savoir-faire dans le secteur des semi-conducteurs et des technologies de l'information et de la communication (TIC), fait désormais des progrès significatifs dans l'industrie spatiale. Bien que modeste par le passé, le programme spatial taïwanais a amorcé sa mue en 2020, sous l'impulsion de l'engagement de la présidente Tsai Ing-wen. Parmi les étapes clés figurent l'adoption de la loi sur le développement spatial et la création de l'Agence spatiale taïwanaise (TASA), qui bénéficie désormais de ressources accrues et d'une plus grande visibilité.

La stratégie du gouvernement repose sur deux objectifs principaux. Tout d'abord, Taïwan cherche à se diversifier au-delà des semi-conducteurs, en positionnant le secteur spatial comme un futur moteur de croissance économique. Ensuite, il vise à renforcer la sécurité nationale grâce aux plateformes spatiales, en particulier les satellites de communication en orbite basse (LEO), pour répondre aux vulnérabilités de ses infrastructures de communication.

Pour atteindre ces objectifs, Taïwan encourage la collaboration entre la TASA, le milieu académique, l'industrie et les start-ups, tout en stimulant les investissements privés. Les projets à court terme incluent le lancement des programmes FORMOSAT-8 et FORMOSAT-9, et, à plus long terme, le développement d'une constellation de satellites de communication en orbite basse et de capacités d'accès autonomes à l'espace. Taïwan renforce également ses partenariats internationaux, notamment avec les États-Unis, le Japon et l'Europe, pour soutenir son ambition de devenir une puissance spatiale.

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Introduction¹

Taiwan is renowned for its strengths in science and technology, notably its cutting-edge advances in information communication technologies (ICT) and semiconductors, in particular, where it has emerged as a global champion. On the other hand, Taiwan is not commonly known as a space power. Although it does have a space program, it has until now been very modest and limited in terms of ambitions.

Indeed, the Taiwanese government took a sharp turn in 2020 toward significantly upgrading its space program and boosting the space industry. From the beginning of her second term, President Tsai Ing-wen took a strong stance on supporting a more ambitious space program. In the two years that followed, a Space Development Act was passed, as well as an Act establishing the new space agency, Taiwan Space Agency (TASA), which is more prominent, higher-profiled, better funded and better staffed than its predecessor, the National Space Organization (NSPO).

This political shift aims at two strategic goals for Taiwan. The first is for space to become a relay of the semiconductor industry. The crown jewel of Taiwan's economy today, its comparative advantages in this industry may erode a decade from now due to global competition and the physical limits of innovation. Hence, Taipei seeks to build on its industrial skills to develop promising new industries, like space.

The second strategic goal is for Taiwan to enhance national security through space-based assets, particularly low Earth orbit (LEO) communication satellites. Being an island within a very volatile geopolitical environment, Taiwan is indeed facing serious communication vulnerabilities that are pushing the government to strengthen "communication resilience" with foreign and (future) homemade internet constellations.

To achieve these two goals, the government needs to stimulate its domestic space ecosystem, boost emulation between the space agency, academic centers, large companies and startups, and help attract private funding to fuel this innovation ecosystem.

Taiwan has also expanded its ambitions in terms of concrete space programs. In the short term, it plans to launch a high-resolution optical

1. The author made three field trips to Taiwan to conduct this research, including a month-long visiting fellowship at the Taipei-based Institute for National Defense and Security Research (INDSR) in May-June 2023. The author expresses his deep gratitude to the INDSR, and especially Dr Sheu Jyh-Shyang, for his close collaboration on this project.

remote sensing satellite constellation (FORMOSAT-8) and two Synthetic Aperture Radar (SAR) satellites (FORMOSAT-9). In the longer term, Taiwan plans to build a LEO broadband communication satellite constellation (B5G) and a launch vehicle and a launch center to gain autonomous access to space.

To become a space power, Taiwan is also developing overseas partnerships with the United States, Japan and Europe, in particular.

Taiwan has a long way to go, and several hurdles to overcome, but the Taiwanese government, under new President Lai Ching-te, is showing strong determination, and Taiwan's industrial base and technological know-how are two powerful levers that can help the space program lift off.

Taiwan's space program taking off

Taiwan is not a newcomer to space. It has had a structured program and a space agency since the 1990s. However, its space ambitions and means have been greatly boosted since 2020.

Genesis

Taiwan's space development started in the early 1990s, accompanying the democratization process from the lifting of martial law in 1987 to the first direct suffrage election in 1996. The space program was officially launched, and the National Space Program Preparatory Office (國家太空計畫室籌備) (NSPPO) was established by Taipei's government in 1991, under the supervision of the National Science Council.

To draw the main orientations of the space program, the Executive Yuan (Taiwan's executive branch) has approved three "Long Term Development Plans" since 1991, which delimit three main phases of the program.

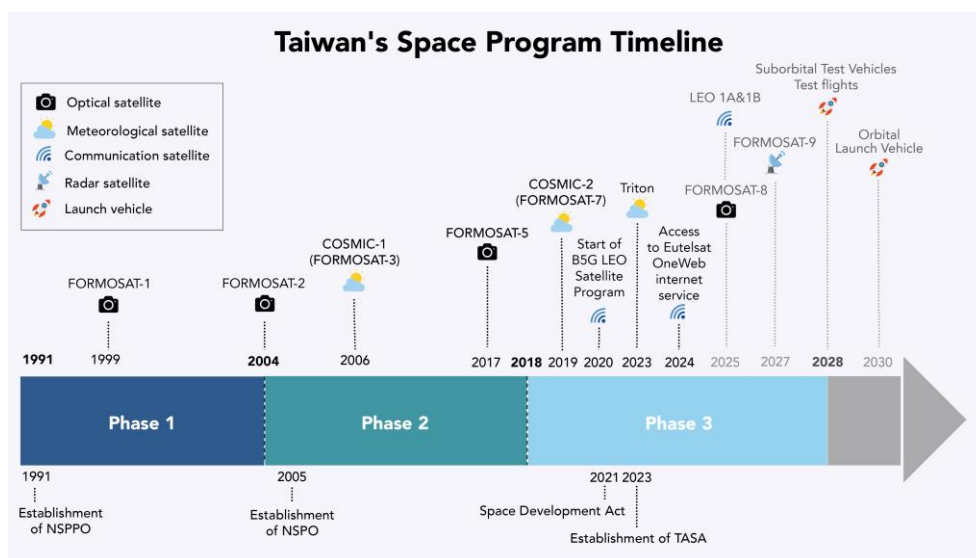
The first phase extended from 1991 to 2004.² It was dedicated to creating a national satellite construction and operation capability. Taiwan's first satellite program was FORMOSAT-1, a scientific experimental satellite for Earth observation developed with the assistance of the United States (US), and launched from Cape Canaveral in January 1999. The second satellite, FORMOSAT-2, was also an Earth observation scientific platform, jointly developed with the French company Astrium, and launched in 2004 from Vandenberg, California. A third program, launched in 2006 but still part of the first phase, is COSMIC-1 (Constellation Observing System for Meteorology, Ionosphere, and Climate) (or FORMOSAT-3), a constellation of six meteorological satellites jointly developed with the US.

In 2003, on the brink of the second phase, the NSPPO was slightly renamed as the National Space Program Office, but also downgraded and merged into the newly established National Applied Research Laboratories (NARLabs), under the supervision of the National Science Council. In 2005, it became the National Space Organization or NSPO (國家太空中心).³

2. "Promoting the Development of Taiwan's Space Science and Technology", Executive Yuan, August 2, 2022, available at: www.ey.gov.tw.

3. Taiwan Space Agency website: www.tasa.org.tw.

During the second phase, from 2004 to 2018, Taiwan focused on developing its first fully indigenous satellite. It took some time; since FORMOSAT-5 took off only in 2017 aboard a Falcon 9 rocket, from US territory. This Earth observation satellite is still operational today. Two years later, the COSMIC-2 constellation (or FORMOSAT-7) succeeded COSMIC-1, which was decommissioned in 2020. The six new satellites for meteorological purposes were put in orbit on a Falcon Heavy launcher. Finally, and with some delay, the Triton meteorological satellite was launched in October 2023 from Kourou, French Guyana, aboard the European Vega rocket.



Source: Ifri, 2024.

Contemporary developments: accelerating the pace

Taiwan is currently in the third phase (2019–2028) of its space program, developing high-resolution optical remote-sensing satellites, ultrahigh-resolution optical satellites, and synthetic aperture radar satellites. The National Science and Technology Council (NSTC), which defines the objectives of the program, also emphasized the mission “to protect Taiwan and ensure the safety of people’s lives and property”,⁴ through a broader satellite network that can help better monitor and react to natural disasters and security threats.

This third phase is also the time for Taiwan to expand its space ambitions and, even more so, its industrial and human resource capacity.

4. “The Executive Yuan officially approved the third phase of my country’s long-term plan for the development of national space science and technology” (行政院正式核定我國第三期國家太空科技發展長程計畫), National Science and Technology Council (NSTC), January 15, 2019, available at: www.nstc.gov.tw.

This trend, evident since 2020, seems to have put Taiwan in another orbit of space development despite the multiple challenges that come with it.

Three important milestones indicate the Taiwanese government's support and determination to upgrade the space program.

Tsai Ing-wen's second-term inaugural speech, May 20, 2020

In her inaugural speech on May 20, 2020, starting her second term as President of the Republic of China (ROC-Taiwan), Tsai Ing-wen announced the development of six core strategic industries, including “national defense and strategic industries”, which comprise military, aviation and space.⁵ From this moment on, space's strategic and national security dimension has become the main driver.

Yet, the link between the space program and the armed forces has drastically decreased ever since, both in official discourse and in terms of the institutions involved in the space program. Taiwan wants to showcase a fully civilian space program for two reasons: first, not to provoke any harsh reaction from across the Taiwan Strait, and second, to show its international partners that Taiwan is a responsible stakeholder committed to promoting peace and stability in the region.

Although the Taiwanese space program has a strong strategic dimension today, it is purposely and entirely civilian.

With the election of Lai Ching-te as new ROC president in January 2024, the focus on space does not seem to be questioned. In his inaugural address on May 20, 2024, President Lai reminded that, when he was premier (2017-2019) and then vice-president (2020-2024), he had “visited various industries throughout Taiwan” and knows “well what [the] industry needs, and also what it is capable of”.⁶

He ranked the aerospace industry as the second priority for industry development (after the development of artificial intelligence for sustainable development). In particular, he called for the development of “the next generation of medium- and low-orbit communications satellites, bringing Taiwan's space and aerospace industries squarely into the international sphere”.⁷

5. “Inaugural address of ROC 15th-term President Tsai Ing-wen”, Office of the President of the ROC (Taiwan), May 20, 2020, available at: <https://english.president.gov.tw>.

6. “Inaugural Address of ROC 16th-term President Lai Ching-te”, Office of the President of the ROC, May 20, 2024, available at: <https://english.president.gov.tw>.

7. *Ibid.*

Taiwan's Space Development Act, 2021

To further boost, regulate and draw the roadmap of the space program, the Taiwanese government, through NSTC, drafted the Space Development Act, which was promulgated in June 2021 and implemented in January 2022.

The first of its kind in Taiwan, the Act aimed at regulating space activities that were already developing significantly at that time, especially in the field of launchers, and at preventing any uncontrolled initiatives by private actors. At the same time, it drew more clearly the government's ambitions in space.

According to the Act, the government authority in charge of space (NSPO at that time) is responsible for designing space policy, establishing a “launch center”, registering launch vehicles and spacecraft and providing permits for them, and developing international exchanges (article 5).⁸

Establishment of the Taiwan Space Agency, TASA, 2023

In the wake of the implementation of the Space Development Act, the Legislative Yuan passed in April 2022 the Act for the Establishment of the Taiwan Space Agency (TASA). Taking effect in January 2023, the Act abolishes the NSPO and establishes TASA in its stead.

TASA (which, opportunely, sounds like the American space agency NASA, although the Mandarin version remained unchanged: 國家太空中心) is an “administrative corporation” under the supervision of the NSTC. Consistent with the government line, this reform also aims “to enhance the national space technology research and development capabilities, to implement the national space strategies and plans, and to promote the development of space activities and space industry”, as stated in article 1 of the Act.⁹

TASA is in charge of devising and implementing space technology plans, promoting international cooperation, driving the development of the space industry, and handling the construction of the launch center, as already provided for in the Space Development Act.

TASA is governed by a board of directors approved by the Premier of the Executive Yuan. The chairperson of the board is the Minister of the NSTC, namely Prof. Wu Tsung-Tsong (吳政忠) from 2023 to May 2024, succeeded by Prof. Wu Cheng-Wen (吳誠文). A Director General heads TASA, Dr Wu Jong-Shinn (吳宗信).

8. Space Development Act, Laws and Regulations Database of The Republic of China (Taiwan), available at: <https://law.moj.gov.tw>.

9. Act for the Establishment of the Taiwan Space Agency, Laws and Regulations Database of the Republic of China (Taiwan), available at: <https://law.moj.gov.tw>.

Therefore, TASA is more prominent, autonomous, and more potent than its predecessor NSPO, which was placed under the leadership of NARLabs. This indicates the government's willingness to boost its space program by having a higher-profile agency on a par with its international counterparts.

The twin drivers of Taiwan's space development

Taiwan's space development is propelled by two strategic drivers: industrial capacity and national security.

Space as a new engine for Taiwan's industry

Taiwan's industry is very capable and competitive in the fields of computing and semiconductors. As is well known, Taiwan has mastered the production of the most high-end semiconductors, which are indispensable to manufacturing the best processors in the world.

As of 2024, Taiwan Semiconductors Manufacturing Company (TSMC), the world leader in the field, can produce 7nm, 5nm and 3nm semiconductors. It has announced it will produce 2nm in the next couple of years¹⁰ and aims to reach 1.4nm and 1nm by the end of the decade. After this, the limits of physics may put a stop to Taiwan's strategic advantage in this field, at least for this kind of technology. This is where space comes in. With the development of space-based services and the race for Low Earth Orbit (LEO) internet mega-constellations, the global space industry and its supply chain are expanding quickly. To lower costs, the most efficient and innovative as well as cost-effective industrial production processes are of strategic importance for space companies.

Therefore, Taiwan is looking to capitalize on its expertise and manufacturing know-how in ICT to become a stakeholder in the global space value chain as a supplier of components and subsystems, and to become an autonomous space power in its own right. In this way, space may become the relay for its technology industrial base.

As President Tsai stated when she visited NSPO headquarters in September 2021, Taiwan "must secure a strategic position in the space industry's supply chain". She further stressed that it was important for Taiwan to find "a niche [in the supply chain] with strategic significance".¹¹

10. C. Davies, J. Song, "Semiconductor Giants Race to Make Next Generation of Cutting-edge Chips", *Financial Times*, December 11, 2023, available at: www.ft.com.

11. S. Park, "'Taiwan Must Secure a Strategic Position in Space Industry's Supply Chain': President", *Space News*, September 15, 2021, available at: <https://spacenews.com>.

Mind the "TSMC syndrome"

By applying its industrial know-how to space technologies, Taiwan may find such a “niche” in two fields. First, Taiwan may become the “TSMC of space” by producing high-end and cost-effective core components for satellites. Second, Taiwan may become the “Foxconn of space” by developing innovative mass-production processes for satellites, becoming a main integrator and assembler for space companies worldwide.

On the one hand, it is a pragmatic and ambitious target to leverage industrial advantage and integrate new global supply chains. On the other hand, a question arises about the consistency of trying to reach two potentially contradictory targets simultaneously: to become an autonomous space power with a comprehensive program, and to find a “niche” expertise within the space industry’s global supply chain.

Taking TSMC’s success as a model to replicate may bear some risks for the Taiwanese space program. This is what one may call the “TSMC syndrome”: TSMC’s success story is at the forefront of the collective psyche in Taiwan, and most entrepreneurs wish to become the “TSMC of space” by supplying the one satellite component or subsystem that every space industry in the world would pay for. With the ongoing competition between mega constellation projects, ranging from hundreds to thousands of satellites (for example, SpaceX’s *Starlink*, Eutelsat’s *OneWeb*, Amazon’s *Kuiper*, the Chinese *G60 Starlink* and *Guowang*),¹² many believe that the satellite manufacturing market will prosper greatly in the coming decades. However, although TSMC is an industrial, technological and strategic success, it did not make Taiwan a giant smartphone manufacturer or a world leader in artificial intelligence or video games. In other words, becoming the “TSMC of space” may not suffice for Taiwan to become an autonomous space power.

Prioritizing human talent and diversified funding channels

That said, and with the ambition to build up an aerospace industry in Taiwan, the government has identified a need for two primary resources: human talent and investments.

The Space Development Act underlines the importance of promoting the “popularity of space science” through education, and “cultivating talents in the space industry” (article 9). It further provides in article 14 that TASA shall work with the Ministry of Economic Affairs to “encourage the private sector to invest in space enterprises” as well as “promote necessary

12. For more on this topic, see M. Julienne, “China in the Race to Low Earth Orbit: Perspectives on the Future Internet Constellation Guowang”, *Asie.Visions*, No. 136, Ifri, April 2023, available at: www.ifri.org.

incentive measures”, “cultivate talents in the space industry” and “help incubation of startups in the space industry”.¹³

The American “New Space” model is never far, and the Taiwanese government is willing to attract private funding into the space industry. Over the past twenty years, private investors have been rather reluctant to invest in the embryonic Taiwanese aerospace industry, which has uncertain and only long-term profitability. However, this situation seems to be evolving now, with the booming global space industry and an ostensibly committed government space policy. In addition, large Taiwanese corporations are themselves interested in space for their own businesses. The best example is Foxconn (otherwise called Hon Hai Technology Group), which is entering the electric car industry and plans to develop autonomous vehicles that require Internet of Things satellite constellations.¹⁴

Regarding human talents, TSMC is a blessing but also a curse for Taiwan: in the context of a talent shortage and a low average wage in Taiwan, TSMC is drawing talent, including aerospace engineers, into its booming industry with attractive wages. Consequently, the budding aerospace industry has trouble recruiting.

Nonetheless, a new generation of space enthusiasts is emerging across Taiwan. They come from scientific and engineering backgrounds, as well as social sciences and business. Some of them come together in the Taiwan Space Generation¹⁵ network, established in 2023, which brings together young entrepreneurs, scientists and students who are working or interested in space issues.

National security: harnessing international support and promoting “communication resilience”

A mature and vibrant space industry would prove to be a new engine for Taiwan's economy, but also indirectly an asset for national security. Indeed, it is hoped that the space industry will become Taiwan's new “silicon shield”. The expression, otherwise called Taiwan's life insurance”, refers to the semiconductor industry today and the assessment that the US, Europe and Japan are too reliant on Taiwan's chips to abandon the island to the People's Republic of China (PRC) in the event of invasion.

13. Space Development Act, *op. cit.*

14. “Smart Open Electric Vehicle Platform”, Foxconn website: www.foxconn.com.

15. Taiwan Space Generation: <https://tsg-space.org>.

Likewise, finding a “niche”, as former President Tsai put it, in the global space industry’s supply chain could make Taiwan vital for such a strategic industry and, in this way, harness the political support of international partners.

In a document available online, the Taiwan Executive Yuan assesses that, in the long run, the space industry is expected to become the new “mountains protecting the country” (護國群山), just like the semiconductor industry has been providing Taiwan with the “silicon shield”.¹⁶

From a more direct security perspective, Taiwan needs space-based systems for national security. Given its sensitive strategic environment – the PRC’s military maneuvers around the island, tensions in the South China Sea, the Senkaku/Diaoyu islands dispute between China and Japan, instability on the Korean peninsula, and the risk of natural disasters – space-based remote sensing and telecommunications are critical for crisis prevention and response.

On the telecommunications front, Taiwan, being an island, relies on 14 submarine cables for its internet connection. These cables are vulnerable to natural disasters and sabotage. In 2006, an earthquake cut off eight cables and provoked massive internet disruption on the island for weeks.¹⁷ In February 2023, Chinese ships cut (officially by accident) two cables connecting Taiwan’s main island with the Taiwanese-controlled Matsu Islands in the north of the Taiwan Strait, near the continent’s shore.¹⁸

Taiwan does have geostationary satellites, but with very limited bandwidth and high latency, making them inadequate for crisis management in densely populated areas.

To address such communication weaknesses, former Minister of Digital Affairs Audrey Tang promoted the concept of “communication resilience” (or “digital resilience”), which now dominates Taiwan’s telecommunications policy, not only in space. According to Minister Tang, communication resilience must be based on two dimensions: the “plurality” of networks and their “decentralization” (“decentralized topology”).¹⁹

LEO satellite constellations would allow the island to strengthen its communication resilience in the context of increased coercion from the PRC and the high risk of natural disasters.

16. “Promote the Development of my Country’s Space Science and Technology” (推動我國太空科技發展), Executive Yuan, August 2, 2022, available at: www.ey.gov.tw.

17. “Taiwan Building Digital Resilience in Face of Earthquakes and Potential of Conflict with China”, *The Straits Times*, May 30, 2023, available at: www.straitstimes.com.

18. H. Wu, J. Lai, “Taiwan Suspects Chinese Ships Cut Islands’ Internet Cables”, AP, April 18, 2023, available at: <https://apnews.com>.

19. Interview with Minister Audrey Tang, Taipei, May 30, 2023.

The war in Ukraine is another very strong security motive to push communication resilience, which triggered a shift in Taiwan's defense policy. After the Russian invasion of Ukraine in February 2022, the Taiwanese watched and learned from Ukraine's strong civil society resistance and the role of unmanned aerial vehicles (UAVs) on the battlefield as well as that of LEO broadband satellites (*Starlink* constellation) in both maintaining connectivity on the front and across the country and preventing part of Russian cyberattacks thanks to the network's decentralized characteristic.

Off-the-shelf LEO constellation solutions

There are two complementary ways for Taiwan to overcome its vulnerabilities in communications. The first is to look for off-the-shelf solutions among foreign providers to fill the gap. The second is for Taiwan to develop its own constellation.

The most obvious off-the-shelf solution would be Elon Musk's *Starlink* constellation, which proved very effective in Ukraine. *Starlink* is fully operational and consisted of over 6,000 satellites as of summer 2024, half of the planned target. However, looking more closely, *Starlink* would be a risky choice for Taipei because of its owner's inconsistency and political views.

Elon Musk's attitude toward the war in Ukraine proved fickle. At the beginning of the war, he provided terminals and broadband signal to Ukrainian troops. But in September 2022, he wrote to the Pentagon that he would stop providing his technology to the Ukrainians for free. His position toward the Kremlin also started to shift, as he called for negotiations with Vladimir Putin and redrawing the map of Ukraine.²⁰ In September 2023, Musk limited *Starlink*'s signal over the Black Sea to prevent the Ukrainian army from attacking the Russian fleet.²¹ In February 2024, the Ukrainian forces claimed that Russian troops were also using *Starlink*, which the Kremlin and Musk denied.²²

While Musk is ambiguous and volatile vis-à-vis the Russian government, he is much more straightforward regarding the PRC. Indeed, Musk is also the head of Tesla, a company for which China is an important market and a significant production base with Tesla's Shanghai Gigafactory. Hence, Musk would unlikely help Taiwan, even on a purely commercial basis, in the context of increased cross-strait hostility. Furthermore, Musk makes no secret of his alignment of view with the Chinese Communist Party

20. R. Farrow, "Elon Musk's Shadow Rule", *The New Yorker*, August 21, 2023, available at: www.newyorker.com.

21. « Elon Musk reconnaît avoir empêché une attaque de l'Ukraine sur l'armée russe », Radio Canada, September 8, 2023, available at: <https://ici.radio-canada.ca>.

22. J. Marson, T. Grove, "Russia Using Thousands of Musk's Starlink Systems in War, Ukrainian General Says", *The Wall Street Journal*, February 15, 2024, available at: www.wsj.com.

in Taiwan. For instance, in October 2022, he suggested applying the Hong Kong model to Taiwan:

“My recommendation... would be to figure out a special administrative zone for Taiwan that is reasonably palatable, probably won't make everyone happy. And it's possible, and I think probably, in fact, that they could have an arrangement that's more lenient than Hong Kong.”²³

In September 2023, he reproduced the Chinese Communist Party's narrative, sounding like he was endorsing it:

“Their [Beijing's] policy has been to reunite Taiwan with China. From their standpoint, maybe it is analogous to Hawaii or something like that, like an integral part of China that is arbitrarily not part of China mostly because ... the US Pacific Fleet has stopped any sort of reunification effort by force.”²⁴

Last but not least, according to a report in *The Wall Street Journal* in October 2024, Musk has since 2022 been in regular contact with Vladimir Putin, who once asked him not to activate the *Starlink* satellite internet service over Taiwan as a “favor” to Chinese President Xi Jinping.²⁵

Consequently, *Starlink* is not an option for improving Taiwan's communication resilience. Using Musk's network might, on the contrary, increase its vulnerability toward the PRC. Taipei still has one source of leverage on Musk, which is TSMC's semiconductors that Tesla vehicles need, but it is not a lever that Taipei is willing to use, or as a last resort.

The other operational constellation that Taiwan can use is the French-owned Eutelsat *OneWeb* with its 630-strong LEO satellites. In November 2023, the largest Taiwanese telecommunication service provider, Chunghwa Telecom, signed “an exclusive multi-million-dollar distribution partner agreement for Low Earth Orbit (LEO) satellite services” with Eutelsat *OneWeb*. Alex Chien, Executive Vice-President of Chunghwa Telecom, clearly stated Taiwan's aim to reduce reliance on submarine cables with space-based solutions:

“Taiwan is an island and relies heavily on submarine cables for external connectivity, with satellites serving as a secondary option. Therefore, satellite services are essential communication tools for the Taiwanese government and businesses. By integrating Eutelsat OneWeb's LEO satellite service with our Geostationary Orbit (GEO) satellite service, Chunghwa Telecom takes the first step towards establishing a

23. R. Khalaf, “Elon Musk: ‘Aren't You Entertained?’”, *Financial Times*, October 7, 2022, available at: www.ft.com.

24. H. Davidson, “Taiwan Tells Elon Musk It Is ‘Not for Sale’ After Latest China Comments”, *The Guardian*, September 14, 2023, available at: www.theguardian.com.

25. T. Grove, W. P. Strobel *et al.*, “Elon Musk's Secret Conversations with Vladimir Putin”, *The Wall Street Journal*, October 24, 2024, available at: www.wsj.com.

multi-orbit satellite service portfolio.”²⁶

Chunghwa Telecom announced that Taiwan would have Eutelsat *OneWeb* 24-hour internet service starting in late October of this year. Internet access will go through three ground stations based overseas in Japan, Thailand and Guam. The Ministry of Digital Affairs plans to deploy 700 terminals across Taiwan's main island and archipelagos by the end of this year.²⁷

Taiwan's second way to overcome communication vulnerability is to build up its own constellation. This is a mid-to-long-term goal, considering the time needed to develop, test, produce and launch the selected satellites. TASA and private aerospace stakeholders are already working on it. This high-priority program (detailed later on in the report), goes by the name of Beyond 5G LEO Satellite (B5G).

26. “Chunghwa Telecom Selects Eutelsat OneWeb for Low Earth Orbit (LEO) Satellite Services”, Eutelsat OneWeb, November 15, 2023, available at: <https://oneweb.net>.

27. “Taiwan Could Get 24-hour LEO Satellite Coverage by End of October”, CAN, October 14, 2024, available at: <https://focustaiwan.tw>.

Taiwan's space ecosystem

The Taiwanese space ecosystem is currently densifying and expanding. Under the TASA's leadership, public actors, private companies and universities are finding their space.

Government-linked actors

Since 2020, Taiwan's government has promoted a more active business-oriented top-down approach. This has led to a reshuffling of government-linked institutions, with TASA's rise and the military's marginalization.

TASA

Among state actors, TASA is clearly the main player. It is in the driver's seat of the space program. It provides the program's main orientations that shape, to a certain extent, how other actors will be involved and contribute.

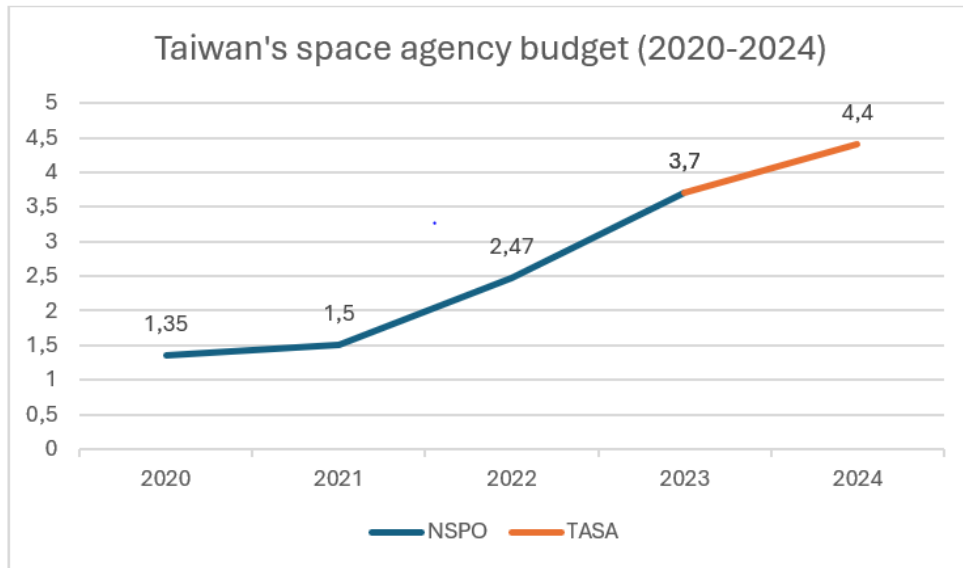
TASA's first budget in 2023 was NT\$3.7 billion (US\$113 million). In 2024, it reached NT\$4.4 billion (US\$134 million), representing a 16.7% increase.²⁸

This evolution is even more significant considering a broader timeframe. Between 2021 and 2022, NSPO's budget increased by 65%, from NT\$1.5 billion (US\$45.8 million) to NT\$2.47 billion (US\$75 million). The shift from NSPO to TASA, from 2022 to 2023, was accompanied by a 50% budget increase, from NT\$2.47 billion to NT\$3.7 billion (US\$116 million).²⁹

TASA's budget is still relatively modest, but it indicates a clear trend and a clear level of government support and determination.

28. "TASA's 112th and 113th Annual Business Plan and Revenue and Expenditure Budget Report", TASA, 8th Session of the 10th Legislative Yuan (國家太空中心 112 及 113 年度業務計畫及收支預算案報告, 國家太空中心, 立法院第 10 屆第 8 會期), available at: <https://ppg.ly.gov.tw>.

29. TASA 112 Annual Budget Assessment Report (行政法人國家太空中心 112 年度預算評估報告).



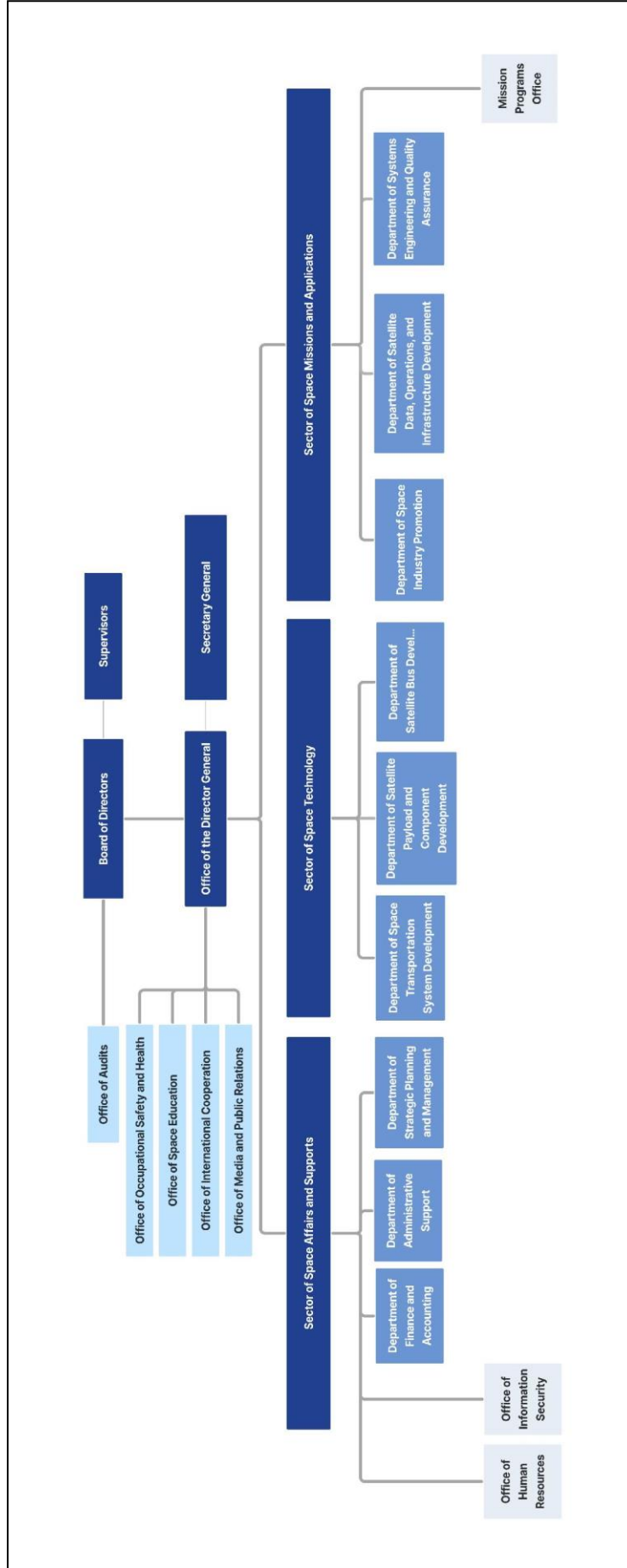
Sources: "TASA's 112th and 113th Annual Business Plan and Revenue and Expenditure Budget Report", TASA, 8th Session of the 10th Legislative Yuan (國家太空中心 112 及 113 年度業務計畫及收支預算案報告, 國家太空中心, 立法院第 10 屆第 8 會期); TASA 112 Annual Budget Assessment Report (行政法人國家太空中心 112 年度預算評估報告).

A similar assessment can be drawn from the evolution of the TASA workforce. With 225 employees under NSPO in 2021, TASA has a staff of around 350 in 2024, and targets 600 to 650 by 2028.³⁰

Looking at TASA's official organizational chart, one can deduce that the agency focuses on the "space transportation system", satellites (payloads and buses) and ground infrastructure. The Department of Space Industry Promotion is also worth noting as it gives consistency to TASA's mission to help stimulate the industry.

30. Interview with TASA official, January and July 2024.

TASA's Official organizational chart



Source: TASA's website: www.tasa.org.tw.

Industrial Technology Research Institute (ITRI)

The Industrial Technology Research Institute (ITRI) is globally renowned for semiconductors research, with the semiconductor world leader TSMC originally being a spin-off of ITRI in the late 1980s.

ITRI's core expertise is ICT; it has little experience in aerospace engineering and the space environment. Its involvement in the space program focuses on communication payload design for LEO satellites.³¹

Ministry of Digital Affairs

Although it is not directly involved in the space program, the Ministry of Digital Affairs (MoDA) plays an important role in deciding the specifications for communication standards, including granting authorization for foreign telecommunications providers and developing domestic systems.

Minister Audrey Tang has played a key role in defining the technical standards required for LEO internet satellites (for foreign providers and for developing the domestic constellation).³² She was also instrumental in articulating a political narrative to explain to the political elite and public opinion the importance and urgent need for Taiwan's communication resilience to use existing LEO internet constellations and to develop its own.

Military

The Ministry of National Defense (MND) is necessarily interested in the military applications of space-based systems. Taiwanese armed forces used to have their own military space program, formerly driven by the armament bureau: the National Chung-Shan Institute of Science and Technology (NCSIST), which is now an administrative corporation like TASA. NCSIST, for instance, developed the short-range ballistic missile Tien Chi and has its own launch test facility on the east coast of Taiwan.

Nowadays, the military has almost no role in the space program, to the extent that the MND had to transmit all its research on satellites to TASA in order to prevent resource dispersal and to centralize the R&D work in TASA.³³ As several Taiwanese interlocutors told the author, this was not so painful because the space culture was noticeably underdeveloped within the military anyway.³⁴ Due to the lack of efficiency of the military in the space realm and, as explained before, due to the political sensitivity of space

31. Interview with an ITRI official, Hsinchu, May 2023.

32. Interview with Minister Audrey Tang, Taipei, 30 May 2023.

33. Interview with MoND official, Taipei, June 2023.

34. Interviews with aerospace professionals, including former military, Taiwan, May-June 2023.

affairs, the Tsai administration purposefully centralized efforts and budgets under TASA, a fully civilian agency.

Eventually, the military will benefit from Taiwan's civilian space systems and space-generated data, but it will not have its own space assets in the foreseeable future.

Academia

The academic landscape for aerospace studies in Taiwan is both old and dynamic. The Department of Aeronautics and Astronautics of the **National Cheng Kung University** (NCKU) in Tainan is Taiwan's oldest space engineering department, dating back to the 1970s. One of its most renowned scientists is Prof. Miao Jiun-Jih (苗君易), former chairman of the Department and director general of NSPO between 2008 and 2018.

The Center for Astronautical Physics and Engineering at the **National Central University** (NCU), in Taoyuan, is very active in space science, especially for payloads and CubeSat engineering. Under the guidance of Prof. Loren C. Chang (張起維) the center is about to launch the first scientific payload for lunar lander use aboard the HAKUTO-R Mission 2 of the Japanese company Ispace Inc., expected in late 2024.³⁵

The **National Yang Ming Chiao Tung University** (NYCU), in Hsinchu, is the bedrock of rocket science in Taiwan. Current TASA director general Dr Wu Jong-Shinn founded the Aerothermal & Plasma Physics Laboratory there in 2007, which became the Advanced Rocket Research Center (ARRC) in 2012, still under his leadership.³⁶ This is where Dr Wu got his nickname of "Uncle Rocket" (火箭阿伯). More recently, another rocket team was set up in NYCU: the Aerospace Systems & Aerodynamics Research Laboratory (ASARe Lab).³⁷ Both teams work on suborbital research rockets. They regularly conduct rocket test flights from the Syuhai Rocket Research Launch Site in Pingtung, southeast Taiwan. The most recent one was in July 2024, when they launched the *Asfaloth* sounding rocket jointly developed by ARRC and ASARe Lab.³⁸

Established more recently in 2003, the Institute of Astrophysics of the **National Taiwan University** (NTU) in Taipei is also emerging as an important academic center for space science.

35. L. C. Chang *et al.*, "The Deep Space Radiation Probe: Development of a First Lunar Science Payload for Space Environment Studies and Capacity Building", *Advances in Space Research*, May 21, 2024, available at: www.sciencedirect.com.

36. Advanced Rocket Research Center's website: <https://arrc.tw>.

37. Aerospace Systems & Aerodynamics Research Lab's website: www.asarenycu.com.

38. "New Milestone in Space Exploration: NYCU ASARe Team Successfully Launches Sounding Rocket in Taiwan for the First Time", NYCU, July 22, 2024, available at: www.nycu.edu.tw.

These academic institutes maintain partnerships with foreign universities in the US, Japan and Europe in particular, allowing their students to learn from experienced space powers. Most of the senior scientists in Taiwan's space program were trained in the US and maintain close connections with their host university there.

Today, aerospace science and engineering are crucial for Taiwan to reach its ambitions in space. It will need a large pool of talent if it wants to build a satellite manufacturing industry, civilian launchers, and a deep space science program.

A stumbling block nowadays is the incompatibility between the theoretical need to recruit talented scientists and engineers and the actual number of positions being created, as well as between the attractiveness of wages at home and abroad. With an aerospace engineering degree, it is more attractive to work in the US than in Taiwan, or to work in Taiwan but in the semiconductor industry rather than space.

These issues are nonetheless well-identified. As provided by the Space Development Act of 2021, the government, on the one hand, intends to increase the "popularity of space science" through education and to "cultivate talents in the space industry", and on the other hand to increase budgets and to attract private investments in space, precisely to stimulate this burgeoning industry.

Private sector

The private sector is of prime importance for Taiwan's space development, probably much more than in other countries. Because of Taiwan's singular situation of being recognized as a sovereign state by only 12 countries and because of the fundamentally dual-use dimension of space systems, it is even more sensitive for Taipei authorities to develop such technologies than for any other country: on the one hand, it could trigger an overreaction from Beijing; on the other, some international partners could be concerned about potentially destabilizing effects.

Therefore, private investments in commercial technology development are Taiwan's safest way forward, and limited military involvement is in Taiwan's best interest.

The government's role is nonetheless decisive in incentivizing investors and the private sector to engage in this industry because the government supports it, invests in it, and constitutes a potential client and end-user.

Although it took some time to attract the attention of large industrial and investment stakeholders, the aerospace ecosystem's private actors are increasingly committed.

Among the big players, Foxconn, the giant electronic assembler, has already taken the space path to expand toward new businesses. In November 2023, a SpaceX rocket put in orbit two experimental communication satellites co-developed by Foxconn, the German company Exolaunch, and Taiwan National Central University (NCU), with Foxconn as the client and end-user.³⁹ Foxconn invests in promising new technologies like AI, quantum computing, semiconductors and satellites. In 2020, it established the Hon Hai Research Institute to work on R&D in these fields.⁴⁰ Space represents a twofold interest for the company: first, it could become a satellite manufacturer in the expected booming satellite market; second, Foxconn has already expanded toward the business of electric vehicles, and the next step is to develop autonomous vehicles, which require 5G connectivity, including from space.

Foxconn is an example of a company that stimulates the space industry with its own investments and business orientation, but also by working with academic research institutes like NCU and startups like Tron Future (see below).

Chunghwa Telecom is also involved in space but on a more modest scale. To date, it does not intend to develop its own system but wishes to “collaborate with government satellite research institutions, academic units, and satellite industry vendors to collectively promote the development of the domestic satellite industry”.⁴¹

Taiwan has quite a dynamic ecosystem of space startups, even though many of them complain that the market is immature, investors’ risk aversion is too high, and government support is insufficient.⁴² This report does not intend to be exhaustive, but it is worth mentioning a few that are especially ambitious and promising.

Tron Future was established in 2018 by a CalTech-trained scientist, Dr Wang Yu-Jiu. It has developed into two main fields: anti-drone technologies and space communication systems.⁴³ The latter focuses on phased array communication, including satellite communication, Synthetic Aperture Radar (SAR). In less than six years, Tron Future opened four sites across Taiwan, filed more than 80 patents, and hired around 150 people (including 70% of engineers).⁴⁴ Interestingly, Tron Future is very well integrated into

39. H. Ryugen, T. Tamehiro, “Foxconn Rockets into Satellites in Search of Life Beyond iPhone”, *Nikkei Asia*, December 19, 2023, available at: <https://asia.nikkei.com>; “Electronics Giant, Foxconn, Awards Exolaunch with Contract to Deploy the Group’s First Satellites”, Foxconn, November 6, 2023, available at: www.foxconn.com.

40. Hon Hai Research Institute: www.foxconn.com.

41. “Chunghwa Telecom Selects Eutelsat OneWeb for Low Earth Orbit (LEO) Satellite Services”, *op. cit.*

42. Fieldwork in Taiwan, May and October 2023.

43. TronFuture website: www.tronfuture.com.

44. Interview with Tron Future representatives, Taipei, May 2023.

the ecosystem with highly diversified partnerships, like with TASA (and NSPO before), the MND, Foxconn, and several university laboratories.

TiSpace was co-founded in 2016 by Dr Wu Jong-Shinn and Dr Chen Yen-sen, a rocket scientist who worked at NASA and NSPO before becoming an entrepreneur. Today, the company is headed by Dr Chen alone. TiSpace's main product is a three-stage hybrid rocket for LEO, named HAPITH 5. Its ambition is to become competitive in the launch service market by drastically cutting manufacturing costs. With three R&D and production sites across Taiwan, TiSpace is one of the most ambitious Taiwanese startups and likely the only one that intends to manufacture both rockets and satellites.⁴⁵ With the claim "100% made in Taiwan", it clearly targets the international market and already has subsidiaries overseas in Australia, the US and Japan. In Australia, the subsidiary ATSpace was established in 2021 in Brisbane and has access to a launch test facility where it can test its engines. The subsidiary in Japan, JTSpace, was established in 2023 and Japan may host TiSpace's first suborbital launch.⁴⁶ The company's international strategy makes sense for two reasons. First, one major hurdle for a private company to develop rockets in Taiwan is that there is no civilian launching site at the moment, and, for security reasons, private companies are not allowed to build their own launch center and launch rockets. An additional obstacle for TiSpace is that it has little or no relations with TASA and is not involved in government space programs. Launching from abroad would allow TiSpace to continue developing its rockets and reach international customers simultaneously, and overcome the current impossibility of launching from Taiwan.

Rapidtek, established in 2006, initially specialized in radio frequency solutions for the electronics industry. In 2021, it shifted to the space business and now focuses on LEO satellite communication, particularly active electronically scanned array (AESA) antenna, and works with TASA and NCU on CubeSat development. Because LEO satellite communication is a priority for the Taiwanese government and has a huge market potential, there is currently a race to develop smaller and more efficient antennas for satellites and ground terminals.⁴⁷

45. Interview with Dr Chen Yen-sen, Miaoli County, Taiwan, May 2023.

46. "Taiwanese Rocket Startup May Be Early Test of Japan's Space Hub Plans", *The Hindu*, July 26, 2024, available at: www.thehindu.com.

47. Interview with Rapidtek representative, May 2023.

Taiwan's main space programs

In its third phase (2019-2028) of space development, Taiwan is pursuing several programs focusing on LEO communication satellites, optical and Synthetic Aperture Radar (SAR) remote sensing satellites, as well as launch vehicles and a launch center.

Beyond 5G LEO Satellite

The twofold goal of the Taiwan space program – boosting industrial capacity and improving national security – means that LEO broadband communication satellites are of prime importance.

The “Beyond 5G LEO Satellite” program (B5G) started in 2020. The ultimate goal is to develop a domestically owned, controlled and produced broadband satellite constellation. This means developing a bus, a payload and ground equipment, and the industrial base to produce them.

TASA currently focuses on developing two high-performance LEO communication experimental satellites (1A and 1B) that are expected to be launched in 2027 or 2028 (initially hoped to be launched earlier, around 2025-2026), which will orbit at an altitude of 600 km.⁴⁸ These two satellites will serve as experimental platforms for the future broadband communication constellation of several hundred satellites, with the first launches expected around 2030.

Led by TASA, B5G is a joint program involving ITRI and the Ministry of Economic Affairs, as well as the private sector.

Broadband communication satellites are a challenge to Taiwan's industry because traditional space actors have little experience in communications, and traditional communication specialists have no experience in the space environment. The challenge is to get these people to work together and take the extra step toward space-based communication.⁴⁹

48. “Beyond 5G LEO Satellite”, TASA's website: www.tasa.org.tw.

49. Interview with TASA officials, June 2023.

FORMOSAT-8

In keeping with the FORMOSAT remote sensing satellites, the FORMOSAT-8 program is meant to consist of six high-resolution optical remote-sensing satellites (with a raw resolution of one meter) and two ultra-high-resolution satellites (with a raw resolution of less than one meter).⁵⁰

Using the same bus as other FORMOSAT satellites but with an improved payload, these satellites will be deployed on a sun-synchronous orbit at 561 km. FORMOSAT-8 is to “provide multiple daily revisit capabilities and global coverage of satellite images”.⁵¹

The first satellite is scheduled to be launched in 2025, and the rest of the constellation to be put in orbit by 2030.

FORMOSAT-9

FORMOSAT-9 is a remote sensing micro-wave satellite program. It will consist of two Synthetic Aperture Radar (SAR) satellites, the first in Taiwan's history.

Unlike FORMOSAT-8 optical satellites, FORMOSAT-9 SAR satellites can provide images of all weather conditions, regardless of clouds. This is notably useful for resource management, environmental monitoring and disaster monitoring.⁵²

The first is scheduled for launch in 2027, and the second in 2029.

Launch vehicle and launch center

Taiwan still relies on foreign partners to put satellites in orbit. Autonomous access to space is a requirement for its goal of becoming a comprehensive space power. This objective was made clear in the Space Development Act of 2021. It provides that the competent authority (i.e. TASA) is missioned to establish a launch center (articles 5 and 12), register launch vehicles and spacecraft, and provide launch permits. It is no surprise that Dr Wu Jong-Shinn, aka Uncle Rocket, was appointed as TASA's director general.

The launch vehicle program is another clue that Taiwan's space program has reached an unprecedented level. Indeed, until now, Taiwan has only been working on suborbital launchers. In the early 2000s, under the Chen Shui-bian administration (DPP), there was an attempt to start such a program. The US not only refused to help, but it pressured Taipei not to engage on this path, fearing further destabilization of relations with

50. “FORMOSAT-8”, TASA's website: www.tasa.org.tw.

51. *Ibid.*

52. “FORMOSAT-9”, TASA's website: www.tasa.org.tw.

Beijing.⁵³ American concerns about Taiwan's launch vehicle program seem to have persisted until the Trump administration.⁵⁴ Things have changed now. Although there is no indication of any joint program between NASA and TASA on launch vehicles, there is no more political opposition from Washington.⁵⁵

TASA openly communicates about its launch vehicle program. Under the guidance of Dr Wu Jong-Shinn, TASA is developing a three-stage hybrid rocket capable of delivering a 200 kg payload to LEO (the highest altitude is targeted at 400 km). The rocket's incremental development process includes the development of two smaller-scale suborbital test vehicles (STVs), aiming to test-proof different rocket parts.

According to TASA, the two STVs are scheduled to start test flights in 2028, while the orbital launch vehicle (which has not so far been named) may take off around 2030.

TASA's launch vehicle is expected to launch satellites for both public institutions and business corporations. As with the satellite sector, it is intended that the launch vehicle program will boost the rocket manufacturing industry and the components supply chain.⁵⁶

TASA is considering two locations for its future launching center in southern Taiwan: Taitung County and Pingtung County. The exact site is expected to be decided by the end of this year.⁵⁷

53. Interview with TASA official, May 2023.

54. K. G. Chan, "Taiwan Kills Rocket Plan 'Amid US Concerns'", *Asia Times*, July 18, 2019, available at: <https://asiatimes.com>; A. Gillet, "Taiwan: A Serious Up-and-Coming Player in the Space Industry", *Satellite Market & Research*, December 15, 2021, available at: <https://satellitemarkets.com>.

55. Interviews with several aerospace specialists in Taiwan, May 2023.

56. "Launch Vehicle", TASA's website: www.tasa.org.tw.

57. M. Strong, "Taiwan to Pick Rocket Launch Site by End of 2024", *Taiwan News*, March 14, 2024, available at: www.taiwannews.com.tw.

International cooperation

To achieve its space ambitions, Taiwan is seeking all kinds of international cooperation: academic and scientific (joint research projects), commercial (purchasing services and technologies), and institutional (joint space missions). Therefore, Taiwan is noticeably more proactive on the international stage in promoting cooperation with foreign countries in space.

Taiwan space actors joining the global space community

The most prominent example is the organization by TASA of its first high-level international conference on space, in October 2023 in Taipei: the Taiwan International Assembly of Space Science, Technology, and Industry (TASTI). This one-week conference brought together decision-makers, industrial stakeholders, scientists, aerospace entrepreneurs and students from Taiwan and overseas. President Tsai Ing-wen made a surprise visit and gave a speech at the opening ceremony. Several high-profile Americans attended, such as Dr Michael C. Morgan, US assistant secretary of commerce for environmental observation and prediction; Kevin O'Connell, a renowned expert on space economy and security who has had several positions in the US administration over the past four decades; and Robbie Schingler, co-founder of Planet Labs.⁵⁸

The conference provided the opportunity to bring people from the global space community to Taipei and to showcase Taiwan's main programs, private aerospace ecosystem and academic scene. TASTI is now set to become an annual event.

TASA and Taiwanese space companies are also increasingly present at international events, such as the annual Space Symposium in Colorado Springs or the Satellite Exhibition in Washington DC.⁵⁹

The United States is naturally Taiwan's main partner in space, first because it is the world's leading space power with the most advanced commercial ecosystem, and secondly, because many Taiwanese space engineers and scientists studied in the US and have their own network there.

58. The author attended the TASTI 2023 conference as a speaker.

59. "Taiwan Showcases Tech Prowess at Satellite 2024 in Washington", *Focus Taiwan*, March 20, 2024, available at: <https://focustaiwan.tw>.

The cooperation potential with Europe

Nonetheless, Taiwan is turning to other like-minded countries, particularly in Europe. Taking advantage of improving relations with some Central and Eastern European countries, such as Lithuania, Poland, the Czech Republic and Bulgaria, Taiwan promotes exchanges on space technologies. Corporate representatives from these countries attended TASTI 2023 and the European Innovation Week in Taipei in June 2023, including a full-day session on space issues.⁶⁰ Dr Wu Jong-Shinn was a guest speaker at the Prague Space Security Conference in June 2024, where he met officials from Europe, North America and Japan.⁶¹

The European company Arianespace also worked with TASA as it provided a launch service for the Taiwanese meteorological satellite Triton in October 2023.

France maintains exchanges with Taiwan's space industry. Bilateral cooperation is limited for now, but it may grow in the future. In the early 2000s, France partnered with Taiwan to develop FORMOSAT-2. In 2009, a double master's degree was established between the French aeronautics and aerospace engineering school IPSA and the Taiwanese NCKU. This partnership was initiated by IPSA student Jordan Vannitsen, who pursued his PhD at NCKU and co-founded with Julien Hennequin *Odysseus Space*, the first private space startup in Taiwan, now based in Luxembourg.⁶²

More recently, and as noticed above, in November 2023, the Taiwanese Chunghwa Telecom signed a contract with French Eutelsat OneWeb for space-based broadband communications.

The French space agency CNES renewed the memorandum of cooperation it used to have with NSPO, with TASA in October 2023, a few months after CNES president Philippe Baptiste met with Wu Jong-Shinn at the 38th Space Symposium in Colorado Springs.⁶³ Despite the agreement between CNES and TASA, there is no concrete roadmap for cooperation so far.

Interestingly, Taiwan and Europe are pursuing similar space goals. While Taiwan is seeking “communication resilience” and industrial autonomy, Europe aims at “secured connectivity” and “sovereignty of communication networks”. Indeed, for different reasons and contexts, Europe is also concerned about the vulnerability of communication networks facing natural disasters, as well as increased competition and

60. The author attended the event.

61. “Taiwan's Space Security in Global Spotlight: TASA Debuts at Prague Conference”, TASA, June 20, 2024, available at: www.tasa.org.tw.

62. Odysseus Space website: www.odysseus.space.

63. “38^e Space Symposium – Une présence française renforcée expose sur notre premier pavillon national”, France Science, April 24, 2023, available at : <https://france-science.com>.

hostility among great powers. That was the main motive for the European Union to establish the Governmental Satellite Communications (GOVSATCOM) program, piloted by the European Union Space Agency (EUSPA), an agency only founded in 2021.⁶⁴

GOVSATCOM's goal is to build a resilient, secure and self-reliant satellite communication network, primarily for the EU and member state institutions, including military and security agencies (police, border guards, firefighters). The future constellation for such services is IRIS² – the Infrastructure for Resilience, Interconnectivity and Security by Satellite.⁶⁵

The EU is undoubtedly more advanced than Taiwan in space technologies. Still, the parallel between IRIS² and B5G, and the convergence of interest between Eutelsat OneWeb and Taiwan's "communication resilience" ambition is worth noting.

Finally, one may notice increasing levels of interaction between Taiwan and Japan on space issues at the institutional, corporate and academic levels. Yamakawa Hiroshi, president of the Japan Aerospace Exploration Agency (JAXA), went to Taipei for the Taiwan Innotech Expo in October 2023, where he spoke on a panel with Wu Jong-Shinn. In July this year, JAXA and TASA co-organized the "Japan-Taiwan Space Economy Co-creation Workshop" in Tokyo, gathering around 80 people, to promote cooperation between the Japanese and Taiwanese space ecosystems.⁶⁶

64. GOVSATCOM, EUSPA website: www.euspa.europa.eu.

65. IRIS², EUSPA website : www.euspa.europa.eu.

66. "TASA, JAXA Connect Taiwan and Japan's Space Industries", TASA, July 15, 2024, available at: www.tasa.org.tw.

Conclusion

In 2020, the Taiwanese government resolutely stepped up its space ambitions and took several concrete actions to draw a programmatic roadmap, beef up its space agency, and stimulate private sector and investor engagement. This new orientation is genuine and makes sense for Taiwan's industrial future and national security.

Although the orientation is clear and the strategy consistent, there is still a long road ahead before the outcomes of this policy will become tangible. Several important questions remain.

First, Taiwan, being excluded from international institutions, is not part of the International Telecommunication Union (ITU), which delivers the frequencies to operate satellites. Taiwan therefore has to find other ways to find available frequencies. Over the past two decades, it has succeeded in getting frequencies for a relatively small number of satellites by cooperating with other ITU member states in developing and launching these satellites. This issue has become even more serious today. Taiwan may need more than a few frequencies in the coming decade, especially if it considers launching a hundred-strong satellite constellation. In addition, mega-constellation projects are increasing stress on low and medium Earth orbits, which are becoming overcrowded.

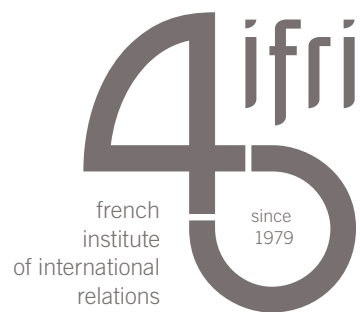
Secondly, even though TASA is currently determined to build a launch vehicle, this program remains fragile and not entirely consensual across the Taiwanese political spectrum. Some would argue that developing a launch vehicle is not desirable for political reasons (i.e., sensitivity *vis-à-vis* China). Others would consider it cost-consuming and not a strategic priority compared to communication and sensing satellites. Hence, a different government, say from the KMT or the nomination of a new TASA director general, may put this program on hold. One may wonder about the potential influence of the US election on this program, but previous Republican and Democratic administrations proved to be somewhat aligned in supporting Taiwan in this way.

Thirdly, talent resources are critical to Taiwan's space program. Efforts should be put into job attractiveness and wages to make space attractive among other science and technology fields.

That said, the Taiwanese government shows strong determination, and Taiwan's industrial base and technological know-how are two powerful levers that can help the space program to lift off.

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