



CHANG GUANG SATELLITE TECHNOLOGY

Matthew Bruzzese, BluePath Labs

March 2024

KEY TAKEAWAYS

- Chang Guang Satellite Technology Co., Ltd. (CGST) is a PRC company dedicated to space-based imaging and remote sensing. Its primary business is centered around the Jilin remote sensing satellite, with over 100 satellites of a planned 300-satellite constellation launched as of late 2023.
- The Jilin satellite constellation is intended for use in disaster response, environmental protection, agriculture, and resource management, as well as in providing remote sensing capabilities to the PRC military. When completed, the constellation is intended to be able to provide imagery of any spot on the globe every ten minutes.
- Originally established by a research institute of the Chinese Academy of Sciences and the provincial government of Jilin, CGST maintains close connections to the PRC government, the Chinese Communist Party, and the People's Liberation Army.
- Military connections include initial startup support from the PLA Strategic Support Force, provision of satellite imagery services to the military, and participation in Military-Civil Fusion activities. A drop-off in sources acknowledging its military connections around 2020 indicates that CGST has become more wary of publicly discussing these connections.
- The U.S. Government sanctioned CGST in 2023 for its support of Russian mercenary group PMC Wagner.

INTRODUCTION

This paper provides a brief overview of Chang Guang Satellite Technology Co., Ltd. (CGST) [长光卫星技术股份有限公司], its operations, and connections to the People's Liberation Army (PLA), the People's Republic of China (PRC) government, and the Chinese Communist Party (CCP). Previously known in English as Charming Globe, CGST is a remote sensing satellite company based in the PRC. It was officially established in December 2014 as a joint venture of the Chinese Academy of Sciences' (CAS) Changchun Institute of Optics, Fine Mechanics and Physics (CIOMP) and the Jilin provincial government. The company traces its

origins to a research team formed within CIOMP in 2005 that was eventually spun off as a commercial entity led by former CIOMP Director Xuan Ming [宣明].¹

Billing itself as China’s first commercial remote sensing satellite company,ⁱ CGST is emblematic of a new breed of PRC commercial space company that has risen in the past decade—more nimble, outside the purview of the traditional aerospace giants, and at least nominally private—while still highly reliant on government support and beholden to government priorities.² CGST’s business includes the development of satellites and satellite components, satellite in-orbit delivery, remote sensing products, UAV development, and related systems.³ However, the company is primarily known for the Jilin-series of remote sensing satellites (see “Key Products” below), which have a wide range of applications, including agriculture, environmental protection, natural disaster relief, and resource management.⁴ CGST is also a military-civil fusion company whose products are utilized by the People’s Liberation Army (PLA), although CGST appears to be far more circumspect about advertising this aspect of its business (see “Military Connections” below).

Today, CGST claims to have 1.97 billion RMB (approximately \$274 million) in total registered capital.⁵ Between 2019 and June 2022, CGST grew from 437 to 587 employees,⁶ and as of early 2024, the company claims to have over 800 employees.⁷ As of August 2023, CGST is preparing for an initial public offering,⁸ although this does not appear to have been completed as of February 2024.

KEY PRODUCTS

Currently, CGST’s main product is the Jilin-series of remote sensing satellites, with eventual plans to construct a constellation of 300 satellites by the end of 2025 capable of repeat visits to any location on earth every ten minutes.ⁱⁱ

The first Jilin satellite was launched in October 2015, only ten months after CGST’s founding,⁹ a fact that the company often brandishes as part of its own mythmaking. However, it should be noted that the research team which eventually became CGST was initially set up under CIOMP in 2005. This team was already well established and the recipient of significant government and military support by the time it was spun off in 2014.

By August 2023, 108 Jilin satellites had been launched. These satellites are continually upgraded with new features and capabilities. For example, the “Jilin-1 Wide 02A [吉林一号宽幅02A星], launched in 2023, was nearly 1,000 kg lighter than its predecessor, dropping from 1,200 to 230 kg.¹⁰ In 2023, CGST set a record by launching 41 satellites from the Taiyuan Satellite Launch Center on a single rocket.¹¹

ⁱ While technically a private commercial company, CGST grew out of a government research institute and was established by two government entities which remain its largest shareholders. Given its close connections to the PRC national government, Jilin provincial government, and the PLA, it is thus debatable how “private” it actually is.

ⁱⁱ A more comprehensive list of CGST satellites and components can be found at: “Satellites and Components” [卫星与部件], Chang Guang Satellite Technology, Accessed February 2024, <https://web.archive.org/web/20240208195904/http://www.jl1.cn/product2.aspx?id=22>

As of October 2017, data reception mainly relied on three ground stations, located in Changchun (which is owned by the company), Sanya, and Kashgar. CGST claims that the Changchun ground station's addition of two receiving antennas with diameters of 5.4 meters and 12 meters, respectively, has significantly improved satellite data reception.¹²



*CGST Ground stations.*¹³

MILITARY CONNECTIONS

Public evidence indicates that CGST is closely affiliated with the People's Liberation Army (PLA). This connection springs from CGST's roots as a research arm of CIOMP, which itself has strong military connections. CGST founder Xuan Ming (who had previously served as CIOMP's director) described CIOMP as an important contributor to defense modernization via its close cooperation with "multiple services and branches of the PLA."¹⁴ Likewise, CGST's development of the Jilin satellite was referred to as being "built upon a foundation of military-civil fusion (MCF)" laid by Jilin Province and the Central Military Commission's Equipment Development Department (CMC EDD).¹⁵

In addition to its significant support from CAS and the Jilin provincial government, CGST also appears to have received early support from the PLA Strategic Support Force (PLASSF), which is responsible for the PLA's space mission. For instance, in the early stages of the Jilin satellite's development before its own facilities were set up, CGST relied on the Xi'an Satellite Measurement and Control Center [西安卫星测控中心], a PLASSF facility also known as the 26th Test and Training Base [第 26 试验训练基地].¹⁶ The military utility of CGST's imagery and remote sensing technology is often hinted at in the company's public technology demonstrations. These have included capturing imagery of targets such as Groom Lake within the Nevada Test and Training Range,ⁱⁱⁱ¹⁷ a former military airfield in California,¹⁸ and a major French port.¹⁹

However, CGST rarely addresses its military connections in Chinese-language materials, and never at all in its English-language materials, preferring to emphasize its work in fields such as environmental protection and disaster relief. While CGST will occasionally (and always in Chinese) nod to the military applications of its products, such as its brief mention of the "broad

ⁱⁱⁱ More commonly known as Area 51 in popular parlance.

application in national defense” of one of its satellites,²⁰ the company’s relationship with the military is mostly inferred through its extensive contacts with military entities and personnel. This ranges from more casual contacts, such as participation in military competitions²¹ or study exchanges with military units,²² to hosting senior military, government, and Party officials and participation in major military exhibitions. Notably, most references to these engagements are at least three to four years old, suggesting CGST has recently limited public discussion of its military connections.



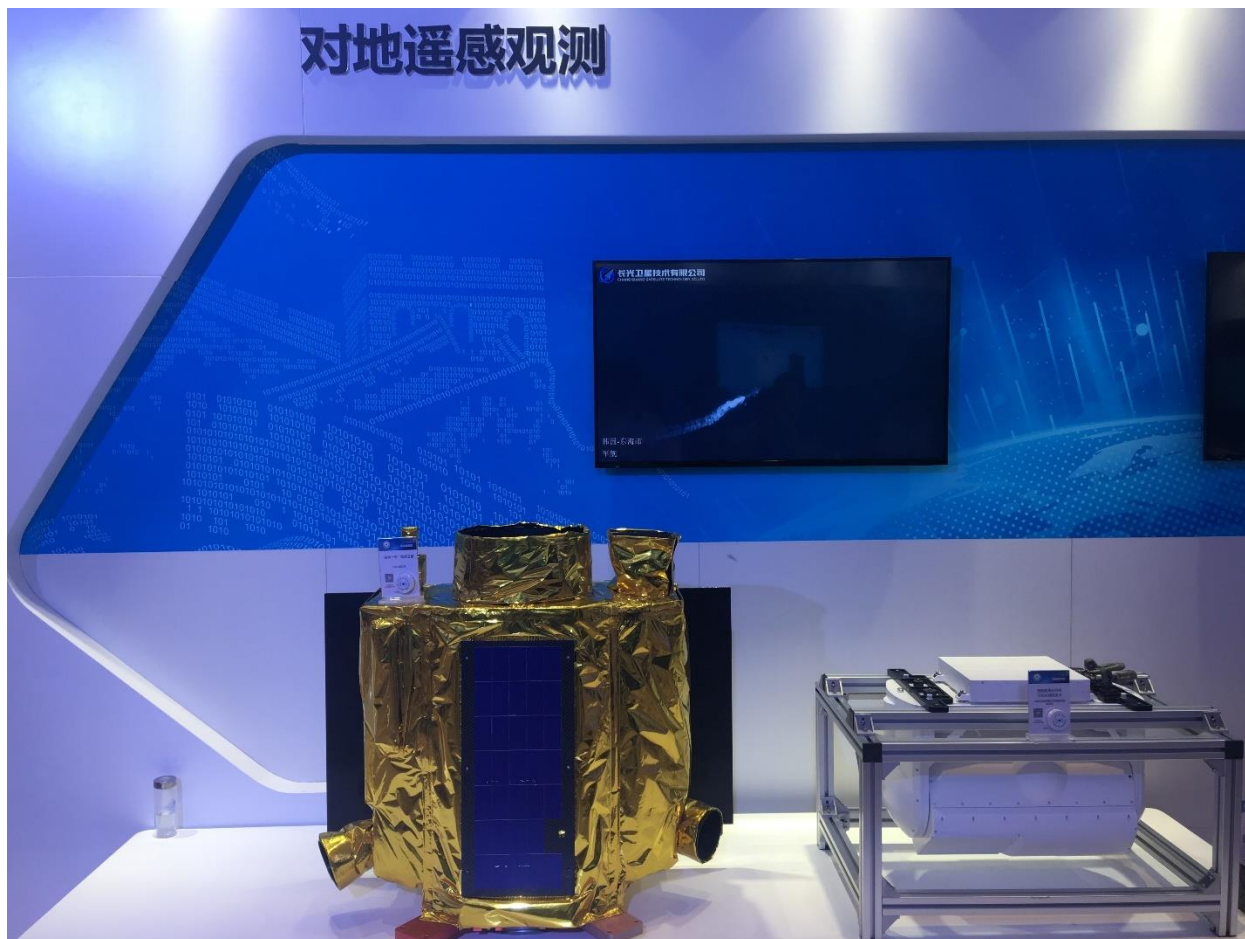
A CGST Delegation to the Air Force Aviation University’s museum, holding a banner which says, “Strengthen National Defense, Cultivate Patriotic Feelings.”²³

In 2018, CGST hosted several senior officials from the National Development and Reform Commission^{iv} for a briefing on the Jilin satellite’s many applications, including “military intelligence” [军事情报].²⁴ CGST has also taken part in an annual MCF exhibition, the “Exhibition and Forum on High-tech Equipment Achievements of Civil-Military Fusion and Development” [军民融合发展高技术装备成果展览暨论坛活动] hosted by the CMC EDD and the State Administration of Science, Technology and Industry for National Defense (SASTIND),^v as well as other government organs. This exhibition is described as the “most authoritative, comprehensive, and exemplary national exhibition in the field of military-civil fusion for Chinese arms and equipment.” At the exhibition, CGST demonstrated its technology to multiple high-ranking PLA leaders, including CMC vice-chairmen Xu Qiliang and Zhang Youxia, and CMC members Wei Fenghe, Li Zuocheng, Miao Hua, and Zhang Shengmin. A CGST press release

^{iv} The main government body tasked with guiding the PRC’s economic development.

^v The main government body tasked with overseeing the PRC’s national defense industrial base.

boasted that the event “expanded the company’s popularity in the military and greatly promoted cooperation between the company and the military.”²⁵



*CGST's display from the 3rd MCF exhibition and forum in 2017 appears to show its capabilities tracking ships in the open ocean.*²⁶

The PLA is less circumspect about the military applications of CGST’s Jilin-series satellites, with stories covering Jilin payload launches appearing on military TV programs such as CCTV-7’s “Military Report” [军事报道].²⁷ One such military program interviewed Li Zongli [李宗利], a Deputy Chief of Staff of the PLASSF Space Systems Department,²⁸ about the launch, which he described as having “great significance” in expanding PRC launch capabilities.²⁹ Further, the PLASSF has published imagery taken from CGST satellites on its public social media accounts.³⁰

The PLASSF has also publicly collaborated with CGST on at least one large-scale civil engineering project.³¹ This project, related to water usage and conservation, involved the PLASSF Information Engineering University [战略支援部队信息工程大学], as well as the Yu Shui Design Co. [豫水设计公司] and North China University of Water Resources and Electric Power

[华北水利水电大学]. The project, entitled “Key Equipment and Technology for Water Resources Supervision, Space-Ground Collaborative Intelligent Sensing and Management for Supervision of Water Resources” [面向水利监管的天空地协同智能感知及管理关键装备与技术], utilized remote sensing satellites to monitor water conservation and predict flooding. In 2023, Henan province awarded the project a 1st Class Merit for S&T Progress.³²

In addition to the PLASSF, CGST has worked with other key government and commercial actors in areas relevant to national defense. In 2021, CGST signed a comprehensive cooperation agreement with Huawei, which has been both sanctioned by the U.S. Commerce Department’s Bureau of Industrial Security³³ and named as a military company by the U.S. Department of Defense.³⁴ The agreement seeks to develop new products for aerospace, satellite remote sensing, and other industries, including satellite intelligent remote sensing. The agreement is designed to combine the relative strengths of the two companies: CGST is tasked with providing remote sensing data and services, while Huawei will utilize its advantages in cloud computing, AI, 5G, and big data technologies.³⁵

In June 2023, CGST collaborated with the CAS Aerospace Information Research Institute [中国科学院空天信息创新研究院] to conduct a high-speed laser communications test using the Jilin-1 MF02A04 satellite. This test successfully and accurately transmitted data via narrow beam optical transmission at speeds of 10 gbps to a ground station. In the same month, CGST also launched the Jilin-1 02A 01 and 02 satellites equipped with laser communications payloads for testing technologies related to inter-satellite and satellite-ground high speed communications.³⁶ The successful development of this technology could offer the PLA faster and more secure data transfer capabilities, particularly in austere environments, and overcome limitations related to the PRC’s relatively small ground station infrastructure.

In December 2023, the U.S. Treasury Department Office of Foreign Assets Control (OFAC) sanctioned CGST, not for its connections to the PRC military, but for its role in supporting Russian mercenary firm PMC Wagner in its combat operations in Ukraine. Specifically, OFAC alleges that CGST provided high-resolution observation satellite imagery to Wagner via another PRC entity, Beijing Yunze Technology.³⁷ According to an Agence France-Presse investigation, in 2022, Beijing Yunze Technology sold two CGST satellites to a company owned by Wagner leader Yevgeny Prigozhin and reached a contract to provide imagery of Ukraine and other areas where Wagner operates. While unsubstantiated, the AFP reports that this imagery may have also included parts of Russia later invaded by Wagner in its 2023 coup attempt.³⁸

FURTHER PARTY AND GOVERNMENT CONNECTIONS

As with every PRC company, all CGST operations are overseen by a company Party Committee led by Party Secretary Jia Hongguang [贾宏光].³⁹ The company has its Party work guidelines posted on its website, which state that “The work of the (CGST) Party branch must closely focus on the basic line of the Party, serve the central mission of the Party...and give full

play to the role of the Party branch as a fighting fortress.”⁴⁰ Further, a significant portion of Chairman and CEO Xuan Ming’s 2024 New Year’s letter to the company is concerned with Party building. In the letter, Xuan vows to focus on Party building, integrate Party building with business work, “implement the spirit of the 20th Party Congress,” and utilize its contingent of Party members to provide a “Red Engine” for growth.⁴¹ Elsewhere, Xuan Ming has cited his patriotic duty to reduce the country’s reliance on foreign satellite imagery as his primary motivation for founding the company.⁴² Considering the prominence given to the CCP and the central role of the Party Committee on the company’s Chinese-language website, it is notable that all mention of the CCP is conspicuously absent on the company’s English-language website.

While the formation of a company Party Committee is not unusual, as a major national technology company working in a strategic space, CGST does appear to enjoy the favor of the PRC government and Party leadership. For instance, in 2023, CGST hosted Premier and CCP Politburo Standing Committee member Li Qiang,⁴³ who urged the company to implement the instructions of General Secretary Xi Jinping and the CCP Central Committee and discussed the role of CGST in Xi’s plans for regional revitalization.⁴⁴ In addition to its relationship with the national government, CGST enjoys close relations with both the Jilin provincial government and the Changchun municipal government. CGST is often cited by both governments as a key driver of industrial renewal for the region and has been bestowed a wide array of honors and awards by both.⁴⁵

The greatest example of CGST’s role in local renewal efforts is its ongoing construction of the Aerospace Information Industrial Park [航天信息产业园],^{vi} which is expected to cover 216,000 square meters in Changchun, capital of Jilin province when completed. The first phase of the park was completed in 2018 and covers 96,700 square meters.⁴⁶ The park will eventually comprise a complete industrial chain for satellite R&D and production, including facilities for optical processing, camera assembly and adjustment, integrated electrical testing, satellite assembly and environmental testing, and other plants, as well as an integrated KM6000 space environment simulation test system, 1,000 cubic meter reverberation laboratory, visible light-short-wave infrared radiation calibration system, and other advanced equipment.⁴⁷ Most importantly, the park is also expected to eventually form an industrial cluster spurring the development of other high-tech companies in the region.⁴⁸

CGST has provided conflicting estimates of the plant’s eventual production capacity. At one point, the company stated it hopes to manufacture 30 satellites and 200 UAVs per year,⁴⁹ while in other places, CGST has said it seeks annual production of 100 satellites in the first phase,⁵⁰ or annual production of 200 satellites (possibly by the end of the second phase).⁵¹ In an article from May 2022, founder Xuan Ming stated that 16 satellites had been produced between March and mid-May, suggesting a capacity of 75-80 satellites per year in 2022.⁵²

^{vi} Located at Shengbei Street, Beihu S&T Development Zone, Changchun, Jilin Province [长春市北湖科技开发区盛北大街]

CONCLUSION

Despite its emergence less than a decade ago, CGST has quickly become emblematic of a new breed of private commercial space companies in the PRC. These companies are marked by a high degree of innovation, a startup ethos, and less reliance on the traditional state-owned aerospace giants, while still being closely tied to the government and highly reliant on government support. CGST has developed increasingly high-tech satellite and sensing technologies that one U.S. expert described as the “gorilla in the room” of PRC space operations, with imagery resolution that is “spectacular.”⁵³ In addition to this core business, CGST is also exploring the cutting edge of related fields such as space-based laser communications and intelligent remote sensing. The company has benefitted from significant government backing, with close ties to CCP leadership, and national, provincial, and municipal governments. It also appears to receive significant military support. Although in recent years, CGST has become more circumspect about publicly discussing its military ties, the company was heavily supported by the PLA in its early years, and its satellites have clear applications in areas such as detection of enemy ships at sea. As it emerges onto the world stage, CGST is representative of the PRC’s increasingly impressive capabilities in space and the narrowing technological gap between itself and the U.S., a prospect that should concern U.S. policymakers.

APPENDIX I: STRUCTURE

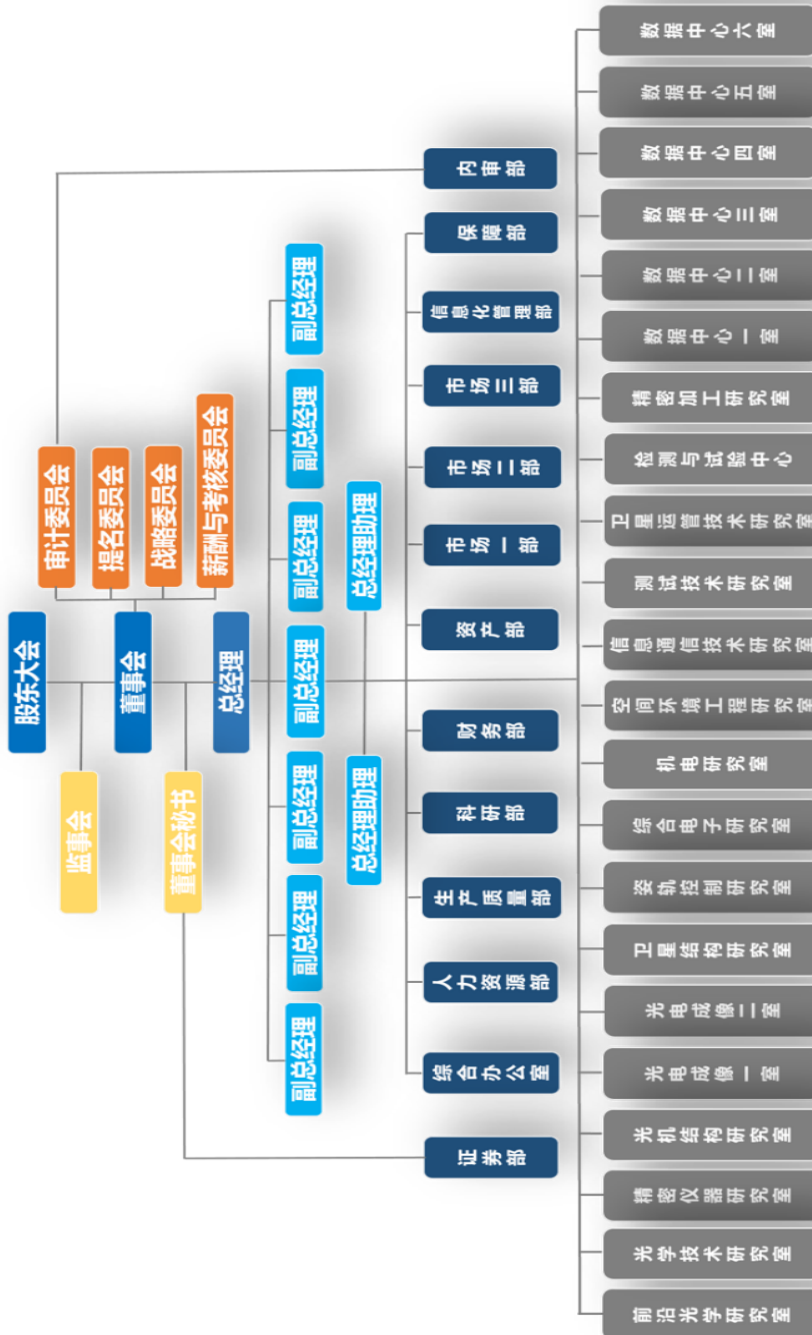
CGST's structure includes 13 departments and 22 research offices. Executive-level departments include:

- Securities Department [证券部]
- Integrated Office [综合办公室]
- Human Resources Department [人力资源部]
- Production Quality Department [生产质量部]
- Scientific Research Department [科研部]
- Financial Affairs Department [财务部]
- Assets Department [资产部]
- 1st Marketing Department [市场一部]
- 2nd Marketing Department [市场二部]
- 3rd Marketing Department [市场三部]
- Informatization Management Department [信息化管理部]
- Support Department [保障部]
- Internal Auditing Department [内审部]

The 22 research offices include the following:

- Frontier Optics Office [前沿光学研究室]
- Optics Technology Office [光学技术研究室]
- Precision Instruments Office [精密仪器研究室]
- Optical Machinery Structure Office [光机结构研究室]
- 1st Optoelectrical Imagery Office [光电成像一室]
- 2nd Optoelectrical Imagery Office [光电成像二室]
- Satellite Structure Office [卫星结构研究室]
- Attitude and Orbital Control Office [姿轨控制研究室]
- Integrated Electronics Office [综合电子研究室]
- Electro-mechanical Office [机电研究室]
- Space Environmental Engineering Office [空间环境工程研究室]
- Information and Communications Technology Office [信息通信技术研究室]
- Testing Technology Office [测试技术研究室]
- Satellite Operations and Management Technology Office [卫星运管技术研究室]
- Test and Experimentation Center [检测与试验中心]
- Precision Processing Office [精密加工研究室]
- 1st Data Center Office [数据中心一室]
- 2nd Data Center Office [数据中心二室]

- 3rd Data Center Office [数据中心三室]
- 4th Data Center Office [数据中心四室]
- 5th Data Center Office [数据中心五室]
- 6th Data Center Office [数据中心六室]



Chang Guang Satellite Technology corporate structure.⁵⁴

APPENDIX II: SUBSIDIARIES

Identified subsidiaries include:

1. Zhejiang Changguang Satellite Information Technology Co. Ltd. [浙江长光卫星信息技术有限公司]
 - Address: Building C8, Geographic Information Town, Yuping Road, Maoyang Street, Deqing County, Zhejiang Province [浙江省德清县舞阳街道玉屏路,地理信息小镇 C8 栋]
 - Business scope: satellite information technology consulting, satellite and intelligent unmanned aerial vehicle system applications, remote sensing technology, geographic information systems. engineering, computer hardware and software, information technology, network technology, data processing technology research and development, technical consulting, transfer of technical results, intelligent unmanned aerial vehicles, computer hardware and software, remote sensing information products.⁵⁵
2. Hainan Changguang Satellite Information Technology Co., Ltd. [海南长光卫星信息技术有限公司]
 - Address: 4th Floor, R&D Building, No. 18 North Guangfu Road, Shiziling Industrial Park, National High-Tech Industrial Development Zone, Haikou, Hainan Province [海南省海口国家高新技术产业开发区狮子岭工业园光伏北路 18 号研发办公楼 4 层]
 - Established in May 2018
 - 49% ownership stake held by Hainan Riqinghe Technology Investment Co., Ltd. [海南日清和科技投资有限公司]
 - Business scope: satellite information technology consulting, satellite and intelligent unmanned aerial vehicle application systems, remote sensing technology, geographic information systems engineering, computer hardware and software, information technology, network technology, data processing technology R&D, technical consulting, transfer of technical results, civilian intelligent unmanned aerial vehicles, computer hardware and software, remote sensing information products, sales and technical services.⁵⁶

ENDNOTES

- ¹ "Changguang Satellite: Leading China's Commercial Spaceflight" [长光卫星：领跑中国商业航天], Chinese Society for Geodesy Photogrammetry and Cartography, 31 July 2023, <https://web.archive.org/web/20230731072040/https://www.csgpc.org/detail/21534.html>
- ² Neel V. Patel, "China's surging private space industry is out to challenge the US," *MIT Technology Review*, 21 January 2021, <https://www.technologyreview.com/2021/01/21/1016513/china-private-commercial-space-industry-dominance/>
- ³ "Chang Guang Satellite Technology Co., Ltd.," Changchun Institute of Optics, Fine Mechanics and Physics, Accessed February 2024, https://web.archive.org/web/20240208184912/http://english.ciomp.cas.cn/Spinoffs/SpinoffsList/201508/t20150806_151114.html
- ⁴ "Changguang Satellite: Leading China's Commercial Spaceflight" [长光卫星：领跑中国商业航天], Chinese Society for Geodesy Photogrammetry and Cartography, 31 July 2023, <https://web.archive.org/web/20230731072040/https://www.csgpc.org/detail/21534.html>
- ⁵ "About Us," Chang Guang Satellite Technology, Accessed February 2024, <https://web.archive.org/web/20230625020605/https://www.jl1global.com/about/>
- ⁶ "Changguang satellite information disclosure contradictory, the official website publicity is suspected" [长光卫星信息披露自相矛盾，官网宣传疑有水分], Sohu, 22 August 2023, https://web.archive.org/web/20240207182824/https://www.sohu.com/a/713902546_100161973
- ⁷ "Message from the Leader" [领导致辞], Chang Guang Satellite Technology, 1 January 2024, <https://web.archive.org/web/20240207220003/http://www.jl1.cn/about.aspx?id=10>
- ⁸ "Changguang satellite information disclosure contradictory, the official website publicity is suspected" [长光卫星信息披露自相矛盾，官网宣传疑有水分], Sohu, 22 August 2023, https://web.archive.org/web/20240207182824/https://www.sohu.com/a/713902546_100161973
- ⁹ "Changguang Satellite: Leading China's Commercial Spaceflight" [长光卫星：领跑中国商业航天], Chinese Society for Geodesy Photogrammetry and Cartography, 31 July 2023, <https://web.archive.org/web/20230731072040/https://www.csgpc.org/detail/21534.html>
- ¹⁰ "The Jilin-1 satellite is new again and has lost a lot of weight compared to its predecessor" [“吉林一号”卫星再“上新”较上一代大幅减重], *S&T Daily*, 1 August 2023, <https://web.archive.org/web/20240208195044/http://www.stdaily.com/index/kejixinwen/202308/e1978a089a8b477087d150c5f669a3e5.shtml><http://www.stdaily.com/index/kejixinwen/202308/e1978a089a8b477087d150c5f669a3e5.shtml>
- ¹¹ "China successfully launches 41 satellites, including Jilin 1 Gaofen 06A sat" [我国成功发射吉林一号高分 06A 星等 41 颗卫星], Xinhua, 16 June 2023, <https://web.archive.org/web/20240208204452/http://www.news.cn/tech/20230616/a213489e18804a3c906426b1a13b52de/c.html>
- ¹² "Commercial Remote Sensing Satellite Ground Stations" [商业遥感卫星地面接收站], Chang Guang Satellite Technology, 31 October 2017, https://web.archive.org/web/20240208201857/http://www.jl1.cn/aboutlb_view.aspx?id=80
- ¹³ "Commercial Remote Sensing Satellite Ground Stations" [商业遥感卫星地面接收站], Chang Guang Satellite Technology, 31 October 2017, https://web.archive.org/web/20240208201857/http://www.jl1.cn/aboutlb_view.aspx?id=80
- ¹⁴ Jiang Nan [姜楠], Wang Xiaohui [王晓慧], "Changchun Institute of Optical Mechanics hosts August 1 military association to celebrate the 85th anniversary of the founding of the Chinese People's Liberation Army" [长春光机所举办八一军所联谊会 共庆中国人民解放军建军 85 周年], Changchun Institute of Optics, Fine Mechanics, and Physics, Chinese Academy of Sciences, 1 August 2012, https://web.archive.org/web/20121011012527/http://www.ciomp.cas.cn/xwdt/yw/201208/t20120801_3623458.html
- ¹⁵ "Jilin Creates Aerospace Information Industrial Park: Boosting the Development of High-Tech Industry" [吉林打造航天信息产业园：助推高新技术产业发展], Chang Guang Satellite Technology, 13 October 2018, https://web.archive.org/web/20240207154119/http://www.jl1.cn/news_view.aspx?id=1058

-
- ¹⁶ "Changguang Satellite: Leading China's Commercial Spaceflight" [长光卫星：领跑中国商业航天], Chinese Society for Geodesy Photogrammetry and Cartography, 31 July 2023, <https://web.archive.org/web/20230731072040/https://www.csgpc.org/detail/21534.html>
- ¹⁷ "America – Area 51" [美国-51区], Chang Guang Satellite Technology, 8 March 2019, https://web.archive.org/web/20240207153635/http://www.jl1.cn/tupian_view.aspx?id=1365
- ¹⁸ "American Airport McClellan International Airport" [美国机场之萨克拉门托麦克莱伦国际机场], Chang Guang Satellite Technology, 18 December 2019, https://web.archive.org/web/20240207153847/http://www.jl1.cn/tupian_view.aspx?id=1931
- ¹⁹ "China Strategic Support Force" [中国战略支援], Weibo, 17 November 2022, <https://web.archive.org/web/20240206220612/https://weibo.com/7774089243/MfsVjeHAe>
- ²⁰ "Video 01~02 Sat" [视频 01~02 星], Chang Guang Satellite Technology, Accessed February 2024,
- ²¹ "Company wins the second prize for "Military-Civilian Integration, Passionate Joint Singing" Invitational Competition to welcome August 1st" [公司荣获迎八一“军民融合、激情联唱”邀请赛二等奖], Chang Guang Satellite Technology, July 2018, https://web.archive.org/web/20240206221859/http://www.jl1.cn/personnel_view.aspx?id=921
- ²² "Armored unit visits for study" [20201230 装甲兵部队来访参观学习], Chang Guang Satellite Technology, 30 December 2020, https://web.archive.org/web/20240206221919/http://www.jl1.cn/visitlb_view.aspx?id=2344
- ²³ "The Party Committee of the Company carried out the theme party day activity of 'Enhancing National Defense Awareness and Cultivating Patriotic Sentiments'" [公司党委开展“增强国防意识 厚植爱国情怀”主题党日活动], Chang Guang Satellite Technology Co., 15 September 2023, https://web.archive.org/web/20220622160505/http://www.jl1.cn/product_view.aspx?id=165
- ²⁴ "Cao Yuanmeng, Deputy Director of the Revitalization Department of the National Development and Reform Commission, and his delegation visited the company for research" [国家发改委振兴司曹元猛副司长一行来访调研], Chang Guang Satellite Technology, 21 March 2018, https://web.archive.org/web/20240207150143/http://www.jl1.cn/news_view.aspx?id=627
- ²⁵ "The company participated in the Third Military-Civilian Integration Development of High-tech Equipment Achievement Exhibition" [公司参加第三届军民融合发展高技术装备成果展览], Chang Guang Satellite Technology, 25 September 2017, https://web.archive.org/web/20240207151300/http://www.jl1.cn/news_view.aspx?id=208
- "The company participated in the fourth military-civilian integration and development of high-tech equipment results exhibition" [公司参加第四届军民融合发展高技术装备成果展], Chang Guang Satellite Technology, 8 October 2018, https://web.archive.org/web/20240207153050/http://www.jl1.cn/news_view.aspx?id=1043
- ²⁶ "The company participated in the Third Military-Civilian Integration Development of High-tech Equipment Achievement Exhibition" [公司参加第三届军民融合发展高技术装备成果展览], Chang Guang Satellite Technology, 25 September 2017, https://web.archive.org/web/20240207151300/http://www.jl1.cn/news_view.aspx?id=208
- ²⁷ "[Military Report]-China Successfully Launches "Jilin-1" Gaofen 02B Satellite" [[军事报道]-我国成功发射“吉林一号”高分 02B 卫星], Chang Guang Satellite Technology, 7 December 2019, https://web.archive.org/web/20240206213006/http://www.jl1.cn/news_view.aspx?id=1923
- ²⁸ "Li Zongli has becomes deputy chief of staff of the SSF Space Systems Department, and is the general leader of the Zhu Rihe parade" [李宗利已担任战支航天系统部副参谋长，系朱日和阅兵将军领队], *The Paper*, 15 November 2017, https://www.thepaper.cn/newsDetail_forward_1865859
- ²⁹ "Noon Defense & Military: Maritime "Sharp Arrow" Long March 11 Successfully Completes "One Arrow, Nine Sats" Sea Launch" [正午国防军事]海上升“利箭”长征十一号成功完成“一箭九星”海上发射, CCTV7, 15 September 2020, <https://tv.cctv.com/2020/09/15/VIDENeBDFAMLroChSFHqJq9K200915.shtml>
- ³⁰ "China Strategic Support Force" [中国战略支援], Weibo, 17 November 2022, <https://web.archive.org/web/20240206220612/https://weibo.com/7774089243/MfsVjeHAe>
- ³¹ "Company project won the first prize for Henan Provincial Science and Technology Progress in 2023" [公司参与项目成果获 2023 年度河南省科学技术进步一等奖], Henan Water & Power Engineering Consulting Co. Ltd., 1 January 2024,

<https://web.archive.org/web/20240206221057/https://www.ysy.com.cn/xinwenzhongxin/qiyedongtai/2024-01-01/3264.html>

³² "Company project won the first prize for Henan Provincial Science and Technology Progress in 2023" [公司参与项目成果获 2023 年度河南省科学技术进步一等奖], Henan Water & Power Engineering Consulting Co. Ltd., 1 January 2024,

<https://web.archive.org/web/20240206221057/https://www.ysy.com.cn/xinwenzhongxin/qiyedongtai/2024-01-01/3264.html>

³³ "Supplement No. 4 to Part 744—Entity List," Code of Federal Regulations, Accessed February 2024, <https://www.ecfr.gov/current/title-15/subtitle-B/chapter-VII/subchapter-C/part-744/appendix-Supplement%20No.%204%20to%20Part%20744>

³⁴ "Entities Identified as Chinese Military Companies Operating in the United States in accordance with Section 1260H of the William M. ("Mac") Thornberry National Defense Authorization Act for Fiscal Year 2021 (Public Law 116-283)," U.S. Department of Defense, 31 January 2024,

<https://media.defense.gov/2024/Jan/31/2003384819/-1/-1/0/1260H-LIST.PDF>

³⁵ "Changguang Satellite and Huawei Deepen Comprehensive Cooperation to Empower Aerospace Information Applications" [长光卫星与华为深化全面合作 为航天信息应用赋能], *People's Daily*, 21 June 2021,

<https://web.archive.org/web/20240207212856/http://jl.people.com.cn/n2/2021/0621/c349771-34786133.html>

³⁶ Chang Guang Satellite, "China's First Operationalized Application of Sat-Ground Laser High-Speed Communication Experiment Succeeds" [我国首次业务化应用星地激光高速通信试验取得成功], Weixin, 27 June 2023, <https://web.archive.org/web/20240207211915/https://mp.weixin.qq.com/s/vg1B2c4MPBEobG2Dv7F26A>

Andrew Jones, "China's Changguang Satellite demonstrates space-to-ground laser links," *Space News*, 30 June 2023, <https://spacenews.com/chinas-changguang-satellite-demonstrates-space-to-ground-laser-links/>

³⁷ "Treasury Imposes Sanctions on More Than 150 Individuals and Entities Supplying Russia's Military-Industrial Base," U.S. Department of the Treasury, 12 December 2023, <https://home.treasury.gov/news/press-releases/jy1978>

³⁸ "Chinese firm sold satellites for intelligence to Russia's Wagner: contract," France 24, 10 May 2023, <https://www.france24.com/en/live-news/20231005-chinese-firm-sold-satellites-for-intelligence-to-russia-s-wagner-contract>

³⁹ "Changguang Satellite: Leading China's Commercial Spaceflight" [长光卫星：领跑中国商业航天], Chinese Society for Geodesy Photogrammetry and Cartography, 31 July 2023,

<https://web.archive.org/web/20230731072040/https://www.csgpc.org/detail/21534.html>

⁴⁰ "Party Work Guidelines" [党工作规则], Chang Guang Satellite Technology, Accessed February 2024, <https://web.archive.org/web/20240207222142/http://www.jl1.cn/dangjian1.aspx?id=89>

⁴¹ "Message from the Leader" [领导致辞], Chang Guang Satellite Technology, 1 January 2024, <https://web.archive.org/web/20240207220003/http://www.jl1.cn/about.aspx?id=10>

⁴² "Changguang Satellite Dreams of Stars and Seas" [“长光卫星人”铸梦“星辰大海”], Changchun People's Government, 18 May 2022, http://www.changchun.gov.cn/zjzc/mlzc/kj/202205/t20220518_3014052.html

⁴³ "Message from the Leader" [领导致辞], Chang Guang Satellite Technology, 1 January 2024, <https://web.archive.org/web/20240207220003/http://www.jl1.cn/about.aspx?id=10>

⁴⁴ "Li Qiang, member of the Standing Committee of the Politbureau of the CCO Central Committee and Premier of the State Council, visited Changguang Satellite for research" [中共中央政治局常委、国务院总理李强到长光卫星调研], Chang Guang Satellite Technology, 17 November 2023,

https://web.archive.org/web/20240215224922/http://www.jl1.cn/news_view.aspx?id=3952

⁴⁵ "Honors and Qualifications" [荣誉资质], Chang Guang Satellite Technology, Accessed February 2024, https://web.archive.org/web/20240118000245/http://www.jl1.cn/about_lb.aspx?id=97

⁴⁶ "Company Introduction" [企业简介], Chang Guang Satellite Technology, Accessed February 2024, https://web.archive.org/web/20240118000235/http://www.jl1.cn/about_tw.aspx?id=9

⁴⁷ "Jilin Creates Aerospace Information Industrial Park: Boosting the Development of High-Tech Industry" [吉林打造航天信息产业园：助推高新技术产业发展], Chang Guang Satellite Technology, 13 October 2018,

https://web.archive.org/web/20240207154119/http://www.jl1.cn/news_view.aspx?id=1058

-
- ⁴⁸ “Jilin Creates Aerospace Information Industrial Park: Boosting the Development of High-Tech Industry” [吉林打造航天信息产业园：助推高新技术产业发展], Chang Guang Satellite Technology, 13 October 2018, https://web.archive.org/web/20240207154119/http://www.jl1.cn/news_view.aspx?id=1058
- ⁴⁹ “Jilin Creates Aerospace Information Industrial Park: Boosting the Development of High-Tech Industry” [吉林打造航天信息产业园：助推高新技术产业发展], Chang Guang Satellite Technology, 13 October 2018, https://web.archive.org/web/20240207154119/http://www.jl1.cn/news_view.aspx?id=1058
- ⁵⁰ “Introduction to the first phase of the Aerospace Information Industrial Park Project” [航天信息产业园项目一期工程情况介绍], Chang Guang Satellite Technology, 10 November 2017, https://web.archive.org/web/20240208175844/http://www.jl1.cn/aboutlb_view.aspx?id=12
- ⁵¹ “Company Introduction” [企业简介], Chang Guang Satellite Technology, Accessed February 2024, https://web.archive.org/web/20240118000235/http://www.jl1.cn/about_tw.aspx?id=9
- ⁵² “Changguang Satellite Dreams of Stars and Seas” [“长光卫星人”铸梦“星辰大海”], Changchun People's Government, 18 May 2022, http://www.changchun.gov.cn/zjzc/mlzc/kj/202205/t20220518_3014052.html
- ⁵³ “Chinese firm sold satellites for intelligence to Russia's Wagner: contract,” France 24, 10 May 2023, <https://www.france24.com/en/live-news/20231005-chinese-firm-sold-satellites-for-intelligence-to-russia-s-wagner-contract>
- ⁵⁴ “Organization Structure” [组织结构], Chang Guang Satellite Technology, Accessed February 2024, <https://web.archive.org/web/20240118000231/http://www.jl1.cn/about.aspx?id=28>
- ⁵⁵ “Zhejiang Company” [浙江公司], Chang Guang Satellite Technology, Accessed February 2024, <https://web.archive.org/web/20240118000250/http://www.jl1.cn/about.aspx?id=70>
- ⁵⁶ “Hainan Company” [海南公司], Chang Guang Satellite Technology, Accessed February 2024, <https://web.archive.org/web/20240118000239/http://www.jl1.cn/about.aspx?id=71>