

Young-wan Choi CEO of CSO Co., Ltd

An “eye” for viewing Earth from space: Ultra-compact, high-performance optical cameras powering the space industry and the AI and data sectors

As the New Space era gains momentum, the space industry is rapidly shifting toward a private-sector-led model. In the satellite sector in particular, camera performance is drawing attention as a key factor in data value and commercial competitiveness, since data accuracy directly translates into the competitiveness of applications and services. Data produced through trusted, space-heritage systems is increasingly being recognized as a national strategic asset that underpins AI and data-driven industries. To secure the quality and reliability of input data, the industry needs a small, lightweight, high-clarity “space-proven eye”. Against this backdrop, CSO Co., Ltd is drawing attention with high-performance cameras built on optical technologies refined over many years. A key advantage is that these cameras enable high-level observation even with small, efficient satellites. As it prepares for a space age shaped by “small but powerful satellites”, CSO aims to set a new standard for ultra-compact, high-resolution space optical cameras.

By Eun Ae Kim / ©Sung Rae Park



R&D in space optical cameras as a data production infrastructure supporting national, industrial, and security decision-making

Satellite cameras must achieve the kind of precision that would let you read the date on a coin on the ground from an aircraft traveling at tens of thousands of kilometers per hour, without blur. In the space environment, where intense vibration, temperature swings, and vacuum conditions hit all at once, it is far from an easy task. CSO is showcasing a precision observation system that can continuously produce accurate

data without jitter, even as a satellite travels at tens of thousands of kilometers per hour. At the same time, the company is taking on the technical challenges needed to help usher in the space age, through high-performance space optical cameras that can be mounted on small satellites while still capturing crisp views of distant ground scenes.

Behind that effort is CEO Young-wan Choi, who has spent more than three decades designing, assembling, and testing satellites' "eyes", building fully integrated systems so they can retain their performance in the extreme environment of space

through to the very end. Over the years on the front lines of optical technology development, he repeatedly witnessed the same pattern: core technologies and experience built up through hard work would scatter within an organization once a single business, project, or program ended. He was also left with a sense of regret that, even as the New Space era reshapes the industry around private-sector-led players, parts of the market still operate within a government-led supply structure. That understanding became the foundation for CSO. He said the gap in technology and experience

between the current generation and the next was too large for him to choose retirement. Instead, he decided to start the company to put decades of design know-how, lessons from failure and iteration, and domestic and global networks to more meaningful use.

That resolve sharpened during the pandemic. As he watched specialized optics companies and skilled talent decline worldwide, he concluded that the time had come to consolidate decades of experience and technology into a single specialist organization that could compete globally. He

said he founded CSO to continue a meaningful challenge in the highly demanding field of space optics. Today, CSO develops space optical cameras as a data production infrastructure supporting national, industrial, and security decision-making.

"CSO isn't a passive supplier that works only for the government. We're a private-sector-led space optics specialist organization, built to connect directly with the global market. What we want to leave behind is a structure where the space optics technology and experience built up in Korea can be accepted in the global market and carried forward naturally to the next generation."

Delivering "reliable" data through miniaturization and lightweight design of optical camera systems

CSO's business spans three main areas. First, it builds electro-optical camera systems for ultra-small satellite platforms: Earth-observation cameras designed to capture high-resolution imagery even on size- and power-constrained platforms such as CubeSats and small satellites. This stands in contrast to conventional satellite optics, which historically evolved around larger satellites. Second, it develops next-generation ultra-high-resolution optical payload technology, a core capability that determines image quality. By precisely arranging multiple mirrors, the company delivers performance close to that of a large telescope within a compact volume. In other words, it enables sharper ground observation while reducing a satellite's size and weight. Third, it develops optics for applications including very low Earth orbit (VLEO), infrared observation, deep-space exploration, defense, UAV, and national security. Beyond Earth observation, it is expanding into infrared-sensor-based observation, optical systems for deep-space exploration, and high-performance optical systems for defense, UAV, and national security applications. This includes infrared optics that capture thermal and nighttime information invisible to the human eye, as well as mission-tailored spaceborne "eyes" designed for diverse environments where high reliability and accuracy are required even in compact form factors. Across all three areas, the company is pursuing the same objective: delivering reliable

data through miniaturized, lightweight optical camera systems.

"Through our differentiated capabilities, we've delivered on what the market has been asking for: even small satellites should be able to see as well as large ones. We didn't stop at design. We actually built the cameras, assembled them, tested them, and took in-space operation into account to drive commercialization. That competitiveness comes from know-how we've built up through real satellite operations."

Ultra-high-resolution performance is central to that competitiveness and is widely seen as a key capability of the company's optical systems. Moving beyond a 30 cm resolution level, which is sufficient to distinguish the outline of a standing person or the shape of a vehicle from orbit, the company is now pushing toward resolutions below 10 cm. The aim is to reach a level where even small changes in objects on the ground can be identified. To do so, it is optimizing the full stack as a single system, from optical design and sensor operation to jitter correction and data reconstruction. The goal is to align and tune the entire observation chain with precision.

Miniaturization and lightweight design are also among its core strengths. While many high-resolution satellite cameras are built around large, heavy telescope structures, the company has focused from the outset on designs tailored to ultra-small and small satellites. To implement that design philosophy, it has applied multi-mirror structures, high-precision alignment, and an optical architecture that reduces unnecessary volume. It has also built capabilities to withstand space-environment factors such as vibration, temperature variation, and radiation. Spaceflight subjects optical systems to extreme conditions, from intense vibration during launch to repeated temperature swings after orbital insertion, ranging from tens of degrees below zero to tens of degrees above zero. The company says it has achieved an optical alignment structure that remains stable even under these conditions. This reflects system-level stability engineering, not just component design.

Beyond optical hardware, competitiveness in modern Earth observation no longer comes



from image capture alone. It depends on how quickly and accurately meaningful information can be extracted. With AI/ML analysis in mind, the company has designed an architecture that minimizes image distortion, ensures consistent radiometric quality, and secures stable time-series data. Building an AI/ML-ready data-processing pipeline provides clean raw data well-suited for model training. The final element is super-resolution. It leverages minute positional differences that naturally occur as a satellite moves while imaging a target, using subpixel information to reconstruct finer details with greater precision. Young-wan Choi said the method is physics-based and grounded in optical design and sensor operation. In simple terms, it produces a sharper single image by combining multiple frames that are each slightly different.

Finding possibilities in a new frontier called space, and taking on the challenge of building fully integrated systems that actually work in orbit

CEO Young-wan Choi studied physics. His path, from developing Uribyol-2 (KITSAT-2) in the 1990s and co-founding Satrec Initiative to later establishing CSO, opened the door to a new journey into space. With no dedicated personnel for satellite cameras at the time, he took on that role himself. It was an unfamiliar field, but he said it helped him rediscover his strengths and aptitude. As he carried out optical design and system development in real programs, he found himself drawn deeper into the work.

That early hands-on role later developed into a system-level perspective. CEO Choi gained experience defining and building every step from scratch, from optical design to assembly, alignment, and testing. Through that process, he came to see space optics not as a matter of individual components or theory, but as a fully integrated system technology that spans design, manufacturing, alignment, testing, and in-orbit operations. He added that the experience itself, working in a private-sector-led effort to build up satellite capabilities and pursue commercialization, became a starting point for shaping the mindset needed for the New Space

era.

"Our system integration strategy isn't about simply lining up technologies. It's closer to designing a single refined mechanism that spans space and ground-based services. That end-to-end continuity is why our optical cameras remain reliable across different environments and missions."

A camera that performs well on the ground is fundamentally different from one that can provide reliable data in orbit for years. Behind a single image captured in space lies the convergence of countless factors, from optical design and sensor operation to structural stiffness, vibration, and temperature swings during launch and in-orbit operations, as well as how the resulting data is processed and interpreted. For CSO, developing space optical cameras starts with a simple question: "Can this camera truly be used in space?" The company treats each technical element as part of one continuous flow, repeatedly checking whether the system can deliver its intended performance under real space conditions. For example, pushing resolution higher to sharpen an image can increase the risk of blur from even minute jitter. CSO addresses that trade-off by co-optimizing sensor operation and data-processing algorithms starting at the optical design stage. The goal is to go beyond a camera as a "photo-taking device" and build a system that can reliably produce data. The same standard applies throughout assembly and alignment, through testing, and even in scenarios that assume in-orbit operations. CEO Choi said the team tracks how each design choice will affect real services through to the end, using that insight to raise the overall level of technical maturity.

Late last year, CSO posted notable achievements, including the "200 Million Dollar Export Tower" and a "Top Industry Award" for the second consecutive year. The company was also selected for the Baby Unicorn Fostering Project run by the Ministry of SMEs and Startups in 2025. CEO Choi said those awards gave him confidence that he was on the right path. He has spent decades at the leading edge of private-sector satellite development and commercialization, charting a course that did not previously exist.

Over more than 30 years, he built a technical track record by developing and supplying satellite cameras for multiple overseas governments, yet one question continued to stay with him: were those outcomes simply the product of timing and circumstances, or the result of accumulated capability and deliberate choices? Relaunching CSO was also his way of pursuing an answer. He wanted to be evaluated again on the technology itself, not on past credentials or titles. Reaching the "200 Million Dollar Export Tower" milestone not long after CSO was established in 2023, he said, confirmed that his experience and achievements were no coincidence. He added that CSO will continue to prove its technology and experience through in-space demonstration and global projects, while making tangible contributions to the space industry and playing a meaningful role in global markets.

"Since leading CSO, I've realized that a company doesn't grow on a CEO's individual capability or judgment alone. It grows on the strength of the organization. I've felt that a business can truly grow only when people come together and start moving on their own. Those experiences led to two messages for me: don't be afraid of mistakes, and make sure you learn from them. Technology development and business always come with unexpected problems. That's why I often say that trying too hard not to make mistakes can actually become a disaster. An unresolved problem simply means there's still work left unfinished. As CEO, I want to support a people-centered organization where each person's capability connects to the vision, and to keep working through the problems that remain, one by one."

From Hypothesis to Validation: "DaejeonSAT" as a Turning Point for Demonstrating CSO's Technology and Experience

Even with its distinctive ultra-high-resolution space optics capabilities, CSO recognizes that in the New Space era, trust is hard to build through technical explanations or prototypes alone. The technology has to fly, operate in space, and be validated with data. To close that gap, CSO joined DaejeonSAT, an ultra-small satellite development project led by Daejeon. DaejeonSAT is described



as the country's first CubeSat-class satellite developed with local space companies taking the lead. It was selected as a secondary payload for the fifth Nuri rocket launch, which is slated for the second half of 2026, with the launch date to be finalized later.

Within DaejeonSt, CSO is responsible for the core technologies behind the high-resolution optical camera system mounted on the ultra-small satellite. The company has engineered an integrated system to ensure that optical performance can be realized and maintained under tight size and power constraints, as well as under the conditions imposed by launch and the space environment. CEO Young-wan Choi said CSO remains responsible through to the end, ensuring the camera can withstand launch shock, maintain focus despite temperature swings after orbital insertion, and ultimately transmit meaningful data. The project is expected to

show how CSO's end-to-end approach, spanning design, assembly, alignment, testing, and in-orbit operations, performs in a real mission. It is also expected to mark a starting point toward formal recognition of CSO's space-proven technology, in CEO Choi's view, which makes the project larger than a single satellite mission.

"DaejeonSAT isn't just a satellite. It's an experiment to change how we observe Earth. By testing new observation approaches in the space environment, we're taking the first step toward setting the direction for what comes next in Earth observation."

If DaejeonSAT succeeds, it would demonstrate that sub-meter, high-resolution imagery can be secured through relatively affordable platforms such as ultra-small satellites, rather than relying on large, expensive satellites as in the past. Its significance is even greater because that capability would be demonstrated in space. It

also points to a shift away from an approach that depends on a single high-performance satellite. By operating multiple satellites in a constellation, far more data could be collected more frequently. The large volumes of observation data accumulated in this way are expected to create new value through AI/ML analysis.

Beyond the technical implications, DaejeonSAT's success would also signal another step in the evolution of the New Space era, increasingly shaped by private-sector-led players. It signals a new phase in which capabilities that have shifted from the public sector to the private sector can be shared back with the public, creating synergy. Securing high-resolution imagery reliably and at a lower cost could serve as a catalyst for strengthening national intelligence collection and decision-making capabilities. CEO Choi said DaejeonSAT could become a signal that we are entering an era in which Earth observation

data is used more often and more meaningfully.

For CSO, what comes after the in-space demonstration is just as important. Once the in-space demonstration through DaejeonSAT is complete, CSO's technology will shift from a "promising technology" to a "proven product." As the conversation moves from promises of potential to validated results, the way the company engages with customers will change at a fundamental level. By demonstrating both design and in-space operation, CSO can present a decisive standard of trust in discussions with customers, partners, and investors. This will not only demonstrate technical maturity but also help reinforce the company's identity. An in-space demonstration will also be a clear turning point for the engineering team. Assumptions made during design, judgments made during testing, and choices made in operational scenarios will be validated with real space data, and the full process will be built up as accumulated experience. CEO Choi said that experience could become an asset that fundamentally reshapes design standards and decision-making for the next products and projects.

Envisioning a Future Where Space Optics Technology Born at a Korean Company Gains Global Acceptance

Over the past several decades, CSO has built trust with partners as it developed satellite optics technologies. Building on experience validated through real operations, the company has begun taking its first steps into global markets. Its early push has focused on developing countries, where the need for Earth observation data for environmental management, agricultural productivity, and disaster response is increasingly recognized, even as practical constraints make it difficult to adopt large satellites or ultra-expensive systems.

One example of that approach is a project now underway in Kazakhstan. CSO is supplying six medium-resolution satellite cameras for environmental and agricultural monitoring to Kazakhstan's space agency. Infrared observation technology plays a particularly important role in the project. By helping monitor crop growth

conditions, soil moisture, and environmental changes more precisely, infrared observation can provide practical support for agricultural and environmental management in developing countries. CEO Young-wan Choi emphasized that CSO is one of the few technology companies capable of offering cost-effective observation solutions based on ultra-small and small satellites to these countries. He added that interest from other countries is also gathering around regional hubs such as Singapore and Dubai. CSO is building a long-term cooperation model that includes data utilization and operations.

This momentum is also expanding beyond developing countries. Large companies in the United States and Europe are also showing interest in CSO's technology and approach. CSO is being viewed not as a "low-cost alternative," but as a technology leader capable of bringing ultra-high-resolution optics to small platforms. CEO Choi said CSO's global strategy is not a short-term plan aimed at specific markets, but a broadly scalable approach grounded in technological competitiveness. He added that it is now necessary to move beyond a government-only, supply-chain-centered model and build product capabilities and data production capacity that can compete on the same standards as the world's leading companies and earn recognition. In particular, he noted that Earth observation and the AI data market, especially those built around satellite constellations, can become truly competitive only when designed from the outset with a global market in mind.

"Space technology is ultimately built through people, trust, and in-space demonstration. The trust we earn through in-space demonstration will be the foundation for expanding where our optical technologies can be applied. We're not focused on aggressive overseas expansion. Instead, we're building a structure where proven technology builds trust, and that trust, in turn, expands the market. And we'll help create a path for space optics technology developed in Korea to gain acceptance in global markets."

CSO's optical technologies are expanding beyond Earth observation into defense, UAV, and national security applications. Some observers

note that these capabilities could also connect to core requirements for technically demanding missions such as deep-space exploration. This reflects CSO's effort to move beyond the idea of simply "selling cameras" and build a connected structure that produces observation data and links it to real-world use in policy and industrial settings. CEO Choi said that once an in-space demonstration is added, CSO will be able to offer repeatable product lines and service models, rather than one-off, project-based deliveries, which could lead to follow-on orders and longer-term business. To get there, he argued, the industry needs regular, repeatable in-space demonstration of optical and sensor payloads, much as launch vehicle reliability is built through repeated Nuri rocket launches every year. That kind of repeatability, he added, is needed to establish a pathway for being formally recognized as a "system capable of producing AI/ML-ready data". He also said that if a sustained in-space verification program is created, with private companies participating and constellation operations in mind, domestic firms could expand beyond technology development into data exports and the services sector. In his view, government policy has a role in building the final link that connects developed technologies to AI/ML-based data industries and global markets.

Against this backdrop, 2026 would be a defining year for CSO, a moment to demonstrate whether the capabilities the company has been building can perform as intended in practice. After years spent developing technology, strengthening the organization, and preparing to engage with the market, he said the company has reached the stage where it can test whether that work translates into results. He outlined a plan to build long-term partnerships around a space qualification milestone through DaejeonSAT and to enter the U.S. market, where technical standards and verification requirements are among the most stringent. With a growth model built on trust and space-proven technology, CSO aims to become a company needed by both global markets and governments. The company's next chapter, built on trust validated in space, deserves support.▲

