WHITE PAPER

C-CERT: Making Satellite Data Trustworthy at Scale

Why it matters, what exists today, and why its development is worth funding

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Summary

The problem. Commercial satellite data is becoming the decision layer for the real world. It already shapes decisions about security, assets, crops, infrastructure, and financial risk through products that range from raw imagery and measurements to analytics and decision-ready intelligence. Yet the market has scaled faster than trust: buyers still lack a common quality standard for comparing products across vendors, sensors, and applications.

The product. C-CERT makes satellite data quality visible, comparable, and usable. It takes any supported data product and produces a standardized certificate with a numeric score, letter grade, and a clear assessment of whether the data is fit for the intended use. Its tests are physics-based and traceable to international standards; each grade is anchored to references, from the data itself to trusted satellites and surveyed calibration sites, and the certificate shows the evidence behind it. Like a nutrition label, it tells buyers what they are getting and whether it is good enough for the job. It is a validated prototype (roughly TRL 4–5), already proven on real NASA mission data.

The customers. Defense, intelligence, and civilian agencies that buy commercial satellite data products, the data providers themselves, data platforms and marketplaces, and quality-sensitive commercial industries from insurance to agriculture. C-CERT can serve all of them.

The investment case. The near-term funding ask is a focused 18-month engineering build that moves C-CERT from validated prototype to operational beta. The work is productization, not basic research: hardening ingestion across commercial data sources, automating certification at scale, adding APIs and monitoring, and building the quality-history database behind vendor rankings and procurement benchmarks. As certification volume grows, the platform's accumulated quality record becomes stronger, more valuable, and harder to copy.

Figure 1. An actual C-CERT run (EMIT L2A, Central Valley, CA): Grade A overall, yet flagged Caution for camouflage and concealment detection with the cause shown inline. Each certificate also carries an RGB thumbnail and a SHA-256 hash and QR code for independent verification [1].

Why it matters

Supply is exploding. The Satellite Industry Association reported 14,266 operational satellites at the end of 2025 [2]. NASA Earthdata projects NASA's Earth science archive could grow toward nearly 600 petabytes by 2030 [3], and commercial systems are adding their own volume, with EarthDaily expecting its constellation to generate about 100 terabytes per day [4]. Manual, mission-by-mission calibration cannot scale to that world.

What remains scarce is trust. Independent quality verification has not kept pace with the speed, volume, and variety of commercial satellite data. Buyers need a shared way to compare quality across vendors, sensors, and product types before using the data for critical decisions.

What C-CERT does

C-CERT (Certified Calibration and Earth-observation Rating Tool) is an automated, sensor-agnostic, patent-pending platform that applies physics-based tests to characterize the measurements in a satellite data product. It assesses how well the product preserves the physical signal, how stable and accurate the measurements are, and whether the data is fit for the intended use. C-CERT then produces a standardized quality certificate: an overall score from 0 to 100, a letter grade from A to D, and a breakdown showing exactly where the data is strong or weak. Every score is traceable to recognized quality and uncertainty frameworks: QA4EO, ISO 19157, and the Guide to the Expression of Uncertainty in Measurement (GUM). The result is an independent way to translate complex sensor and measurement quality into a simple market signal buyers can use in procurement, tasking, acceptance, and downstream analytics.

Figure 2. The C-CERT pipeline: an input scene runs through five independent modules (M1–M5) to produce a standardized report card. Modules can run alone or as a full pipeline [1].

How does it know what is correct? C-CERT checks each scene against the strongest reference available for that product and location. Some checks come from the data itself and require no outside source. Others compare the scene with global references, such as trusted satellites or known natural features, so C-CERT can assess data quality anywhere on Earth. Where stronger evidence is available, such as surveyed control points or calibration sites, C-CERT uses it to support the highest-confidence grades. The certificate shows which references were used, so buyers can see not only the grade, but also how much evidence stands behind it.

Certification is per application. C-CERT does not treat quality as one-size-fits-all: a scene may be suitable for target detection but weaker for camouflage or concealment detection. The certificate's fitness-for-purpose matrix shows which uses are suitable and which require caution, so a buyer comparing two products over the same target can see which has stronger geolocation, radiometric stability, information content, and mission fitness before committing the data to mission planning or AI exploitation (Figure 1).

Where development stands today

C-CERT has been proven end to end on real U.S. Government mission data. On NASA EMIT hyperspectral data with 285 spectral bands over well-characterized USGS calibration sites, it produced the certificate shown in Figure 1: Grade A, 95.0 out of 100, every module in the A range, and one per-application caution. Behind that score is scientific analysis that a buyer can inspect. For information content (M5), C-CERT reconstructs the scene from its spectral building blocks and confirms that the data carries enough information to distinguish materials and targets for demanding downstream analysis.

The method holds on a second sensor class, too. The SAR extension already runs on real Sentinel-1 scenes, not simulations. Across two acquisitions over the U.S. East Coast, the prototype's integrity and radiometric

modules found a 0.1 percent missing-line artifact the vendor metadata never flagged, independently verified at the pixel level a vendor's claim that radio-frequency interference had been detected and mitigated, and caught a data-packaging effect that silently tripled a key quality metric between two distributions of the same scene, a trap that would mislead any buyer comparing products.

More than one hundred automated tests exercise the framework, and every check produces an evidence figure pointing to the exact pixels behind each finding.

The fundable gap: Operational service

The opportunity is defined by a specific, fundable gap. C-CERT today is a validated prototype, roughly TRL 4 to 5, operated by its developers. The next phase is engineering: hardening the platform across commercial vendors, extending it across sensor types, and proving it can run at operational scale. Throughput, monitoring, customer-facing interfaces, and the quality-history database behind vendor rankings still need to be built.

The development plan. The path from prototype to operational beta is 18 months and gate-controlled. Gate 1 hardens the current prototype and expands ingestion across commercial vendors and sensor types. Gate 2 automates the pipeline, adds the API, engineers throughput and monitoring, and brings in outside evaluation partners. Gate 3 launches the operational beta with customer onboarding, vendor-ranking products, and interfaces for tasking and collection systems. Each gate has clear exit criteria, so funding continues only when the evidence supports it. The plan also maps onto federal small-business R&D programs, SBIR/STTR and the SpaceWERX STRATFI vehicle, which provides $3–15 million over 48 months by blending government and private matching capital, so government can co-finance the roadmap without diluting equity [5].

Who the customers are

The same certificate serves five customer groups whose interests align around a common quality signal:

Customer group	What they buy and why
Government and defense buyers	Defense, intelligence, and civil agencies (DoD, Space Force, Navy, NGA, NRO, NOAA, USGS, FEMA) increasingly buy commercial satellite data products for operations. They subscribe to independent grading so data can be trusted before it enters mission planning and AI exploitation pipelines, and they can fund C-CERT as a shared, vendor-neutral benchmark.
Satellite data vendors	Commercial EO and SAR providers pay a small per-scene fee to certify their products and display the grade as a credibility badge that shortens government sales cycles and differentiates them from uncertified competitors.
Platforms and marketplaces	Data marketplaces, cloud pipelines, and tasking or scheduling systems embed the certification engine and pay per call or per volume. Marketplaces in particular need a trust layer: buyers on the Global Data Marketplace, which recorded more than 800 purchases in 2025 with NATO now among the buyers, currently have no independent quality signal.
Quality-sensitive industries	Insurance, agriculture, energy, engineering, and conservation firms that stake money on satellite-derived answers subscribe to grade data before relying on it, and buy vendor-quality rankings built from accumulated certification history.
Allied and international	NATO and allied nations procuring satellite data products from different vendors under different standards adopt a common, standards-traceable certification methodology for coalition information sharing.

Government demand is already large and funded. Under the National Reconnaissance Office's Electro-Optical Commercial Layer, Maxar, BlackSky, and Planet hold commercial-data contracts worth up to about $3.24 billion, $1.02 billion, and an initial $146 million, together serving more than 500,000 federal users [6], [7], [8]. The National Geospatial-Intelligence Agency's Luno program adds about $490 million in ceilings for commercial analytics [9], [10]. These buyers are exposed to the operational and financial consequences of bad data, which makes them natural early funders of a vendor-neutral quality benchmark.

Revenue follows the same map: per-scene certification fees from vendors, grading subscriptions from buyers, usage fees from embedded platforms, government funding for the shared standard, and add-on ranking and reference-data products. Growth starts with access fees and subscriptions, scales with certification volume, and compounds because every certified data product strengthens the reference baseline behind every future certificate.

Why it makes sense to invest in its development

The market is large, and the timing is right. C-CERT is a quality layer on top of the commercial Earth-observation and satellite data economy, so it scales with the products flowing through that market. Satellite data services are already a multibillion-dollar market and are projected to grow sharply by 2030 [11], [12], while the larger geospatial analytics market that consumes these products is measured in the tens of billions of dollars [13], [14]. Independent assurance is already a large global business in other industries [15], [16]. Satellite data is missing that layer, and the investment logic is straightforward: as more satellite data is bought, sold, and embedded into decisions, the need for independent quality assurance grows with it.

The position is open, and the method is proven. Quality assurance for Earth observation already exists (QA4EO [17], CEOS Analysis Ready Data [18], and ESA's Earthnet Data Assessment Project [19]), but all are manual, expert-driven, and mission- or provider-level; none issues the independent, automated, per-product certificate a commercial buyer needs, and C-CERT's traceability to QA4EO, ISO 19157, and GUM makes those frameworks its foundation, not its rivals. The hardest question in deep-tech investing, whether the method works, is already answered: C-CERT has proven itself on real government mission data and caught real defects. What remains is engineering: deployment, throughput, vendor onboarding, and productization. That is execution risk, not science risk, with each gate matching funding to proof.

The team is built for this, and the asset compounds. Sensors and Data Intelligence LLC is a U.S.-owned small business of remote-sensing scientists and engineers with more than 70 combined years calibrating and validating government satellite missions, more than 35 missions supported, more than 100 operational products delivered to NOAA, and more than 200 peer-reviewed publications. And the longer C-CERT operates, the harder it becomes to copy: every certified product adds to a standards-traceable history of vendor and sensor performance, the foundation for higher-margin products such as vendor rankings and procurement benchmarks. The moat is the accumulated record and the standards traceability behind it.

Team and teaming approach. SDI delivers C-CERT as the independent quality layer within a team that includes Global Marketing Insights (maritime-domain and GEOINT expertise), CompassData (global ground-control reference data), and NV5 (enterprise collection planning, analytics, and systems integration), so C-CERT plugs into existing tasking and analytics platforms rather than replacing them.

Risks and how they are managed

Adoption. Vendors may resist a grade they cannot control, but C-CERT never issues a single verdict. Because certification is per application, the same product can earn an A for one use and a D for another, so a certificate maps where the data excels rather than stamping it pass or fail. No vendor is simply "good" or "bad"; each learns exactly which applications its data serves best. That makes the grade a selling tool rather than a threat, and paired with buyer and funder demand for vendor-neutral assurance before mission use, it pulls vendors in rather than pushing them away.

Neutrality. A certificate is only as valuable as its independence. C-CERT relies on standards traceability, a reproducible and transparent methodology, and outside evaluation partners and third-party governance (introduced at Gate 2) to keep the grade credible.

Reference data. Grades are only as good as their references. C-CERT manages that risk through a tiered evidence model: self-consistency checks, global references, and high-confidence calibration sites. Every certificate discloses which references it used, so buyers can distinguish a strong grade supported by high-confidence truth data from a provisional grade based on weaker evidence. Beyond the free and public sources available today, SDI is evaluating partnerships and commercial venues for higher-fidelity reference truth, which would raise the ceiling on its most demanding, highest-confidence grades.

Incumbent response. A standards body or large vendor could extend an existing framework toward automated grading. C-CERT's advantage is first-mover accumulation of a cross-vendor quality history and its position as the neutral commercial implementation of the standards those bodies publish.

Funding cycles. Reliance on federal demand carries budget and timing risk. C-CERT pairs non-dilutive government funding with commercial subscription revenue and matches spending to the gate milestones.

The bottom line

The next phase of the satellite data market will not be defined only by who collects or delivers the most data. It will be defined by who can prove which data is reliable enough to use. C-CERT is built to become the independent quality layer that lets buyers compare data, vendors prove performance, and marketplaces scale with confidence. With the science proven and the remaining work reduced to gate-controlled engineering, funding now supports a rare position: defining the quality standard for a market before that standard exists.

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