

Digital data spatial-temporally certified via Galileo GNSS authentication: The ATLHAS System

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Digital data is everywhere, but it presents a fundamental issue: it is often difficult to prove, in a reliable and independently verifiable way, that it corresponds to a specific physical event, location, and moment in time. An image, a video, a document, or a digital record can be modified, reused, or taken out of context without providing sufficient evidence of its original conditions of acquisition.

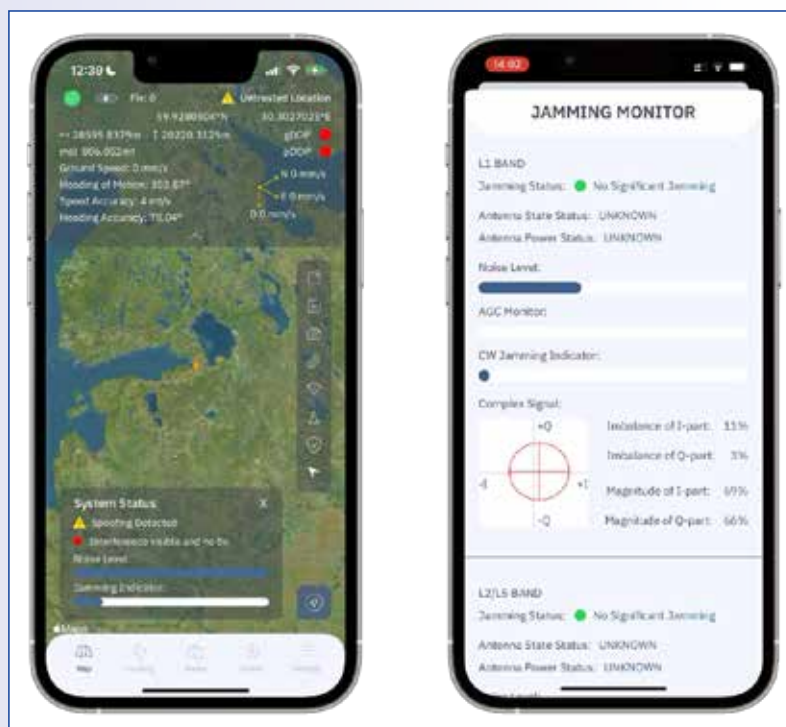


Fig. 1 - ATLHAS ensures the integrity and authenticity of territorial data through advanced anti-spoofing services and an integrated Jamming Monitor system: the platform combats fraudulent activities of falsifying geographical coordinates, timestamps and images, monitoring in real time the GNSS frequency bands (L1, L2, L5) and promptly detecting any signal irregularities, to protect the reliability of any digital information.

In response to this gap, Erasmico S.r.l. has developed ATLHAS, a system for the spatial-temporal certification of digital data based on Galileo and EGNOS.

ATLHAS enables digital data to be treated not merely as information, but as independently verifiable evidence.

This is achieved by combining authenticated Galileo GNSS signals with cryptographic binding, allowing position and time data — SpaceStamp and TimeStamp — to be directly associated with digital content.

Unlike traditional approaches, which certify data after its creation, ATLHAS is designed to certify data at the source, at the moment of acquisition, in space and time.

This means that an image, document, video, or travel track can be cryptographically linked to an authenticated physical event. Once this link is established, any subsequent modification becomes detectable, and the data can always be independently verified against its original space-time reference.

ATLHAS is the result of a multi-year collaboration with EUSPA (EU Agency for the Space Programme). This collaboration has led to operational projects such as EGNSS4ALL, EGNSS4CAP and SEN4ALL, as well as applications such as “GEOTAG” for Common Agricultural Policy payment validation, “BlockIdentity”, a GNSS-based micro-notarization app awarded First Prize in the Cybersecurity

Track 1 of the MyGalileoSolution 2022 competition, and “WorkStamp”, designed for the certification of internal logistics processes within large enterprises.

How it works

- **Data capture:** A file — image, video, audio, document, or digital record — is acquired together with GNSS-derived spatial and temporal data.
- **Position verification:** Signals are validated using authenticated Galileo services. Where available, accuracy can be enhanced through SBAS/EGNOS and RTK, enabling positioning accuracy from meter to centimeter level, depending on the receiver, environment, and operational context.
- **Certification:** A cryptographic hash of the content is bound to authenticated position and time data, supporting traceability, integrity verification, and auditability.
- **Integrity verification:** At any time, the content can be checked against its original space-time reference, making later alterations detectable.
- **Contextual validation:** Additional metadata — including position, time, direction, field of view, and acquisition context — can be combined with visual analysis to support the detection of inconsistencies, misuse, or contextual manipulation.

Applications

ATLHAS can be used across multiple high-impact domains, including:

- Agri-environmental monitoring and EU Common Agricultural Policies controls
- Territorial and geo-archaeological surveys
- Insurance and claims management
- Legal and evidentiary processes
- Logistics and transport traceability (including aviation/drones)
- Infrastructure and construction monitoring

ATLHAS provides an infrastructure for independently verifiable spatial-temporal data, strongly supporting audits and compliance processes.

Technical capabilities

- Integration with Galileo authenticated signals (OSNMA)
- Support for SBAS (EGNOS) and RTK high-accuracy positioning
- Compatibility with mobile devices and low-cost hardware
- API-based integration into existing systems
- Operation in both connected and low-connectivity environments



fig. 2 - ATLHAS enables precision perimeter mapping and tracking of aerial or drone surveys (SAPRs). By integrating certified geolocation and timestamp data, the system supports the authentication of inspections, routes, and survey logs. The comparison with a GNSS ground survey highlights how certified spatial-temporal data can reduce inconsistencies, time, and operational costs.



Fig. 3 - ATLHAS ensures centimeter-level precision through the integration of multi-frequency GNSS positioning, utilizing SBAS and RTK correction technologies to achieve accuracy up to 20 cm and 2 cm, respectively.

Positioning and impact

ATLHAS introduces a paradigm shift: digital data is no longer merely recorded, but generated with a native, verifiable link to authenticated space-time references.

Without a verifiable link to physical reality, digital data remains inherently contestable. ATLHAS addresses this gap by connecting digital content to authenticated position and time data, creating a technical basis for verification, auditability, and evidentiary support.

Conclusions

ATLHAS transforms digital information into verifiable evidence by establishing a cryptographic and spatial-temporal link between digital content and the physical context in which it is acquired.

The result is a robust validation process: the multimedia file becomes cryptographically bound to its original space-time reference, making subsequent alterations detectable and allowing independent verification of the data's origin and integrity.



Fig. 4 - The ATLHAS system generates Analytical Certified Reports designed to support the verification of the spatial and temporal origin of physical or logical-digital events. The technology creates a georeferenced and tamper-evident register, associating coordinates and timestamps with each certified event in a verifiable and auditable manner.

ABSTRACT

Digital data is everywhere, but it presents a fundamental issue: it is often difficult to prove, in a reliable and independently verifiable way, that it corresponds to a specific physical event, location, and moment in time. An image, a video, a document, or a digital record can be modified, reused, or taken out of context without providing sufficient evidence of its original conditions of acquisition.

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KEYWORDS

Digital data; galileo; GNSS; atlhas system; EGNOS; certified data

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ATLHAS

FROM DATA TO DIGITAL EVIDENCE

ATLHAS introduces a new standard: native spatiotemporal data certification. By integrating authenticated signals from Galileo constellation, every piece of content is securely bound to its exact time and location.



Verifiable



Tamper-proof



Legally Admissible

ATLHAS

The Infrastructure for Data Trust.



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