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From 1 to 10 million yearly satellite connections

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Abstract

The rapid growth of the satellite industry is reshaping the landscape of ground station operations. KSAT, with a legacy of mission-specific services, is transitioning toward a scalable, standardized, and automated operational model to accommodate the exponential rise in satellite launches and ground station contacts. With over 350 antennas worldwide and a trajectory surpassing three million annual contacts, KSAT is leveraging automation, AI-driven monitoring, and self-service platforms to enhance reliability, efficiency, and cost-effectiveness. Central to this transformation are initiatives focused on real-time system monitoring, incident automation, and adherence to global compliance frameworks such as ITIL, NIST, and ISO. These changes underpin a shift from reactive workflows to proactive problem management and strategic scalability, positioning KSAT to handle more than ten million annual contacts by 2030.

Keywords: Scalability, Resilience, Quality, Operations, Automation

Acronyms/Abbreviations

Kongsberg Satellite Services (KSAT)
Ground Station as a Service (GSaS)
Network Operations Center (NOC)
Service Level Agreement (SLA)
Artificial Intelligence (AI)
Information Technology Infrastructure Library (ITIL)
National Institute of Standards and Technology (NIST)
International Organization for Standardization (ISO)
Application Programming Interface (API)
Key Performance Indicator (KPI)
Radio Frequency Interference (RFI)

1. Introduction

Mission-specific and tailor-made solutions have been our main offerings over the past 60 years. Each project had unique equipment and design. However, this is changing with the rapidly increasing volume of new satellites. To achieve our 2030 goal, we need to standardize and identify similarities in all elements of the value chain.

Over the past decade, we have expanded activities to sites worldwide. The network consists of more than 350 antennas in 31 strategic locations, continuously being expanded and developed to meet new customer demand, and to complete ground coverage. Most of the antennas we build today are multi-mission, shared assets, allowing for cost-efficient customer ground network design. The Ground Station as a Service (GSaS) model attracts new space companies and represents our largest growth opportunity. While custom additions and tailored solutions remain part of our offering, the vast majority of customers benefit from the flexibility of a shared ground network built on a standardized foundation — delivering scalability, cost-efficiency, and faster time to deployment.

Various industry reports, such as those from Bryce Tech, Euroconsult, and Northern Sky Research, estimate that between 2,000 and 3,000 satellites could be launched annually through 2030—potentially even exceeding 4,000 if certain mega-constellations proceed at full scale. Some forecasts project that the total number of satellites in orbit could

surpass 50,000 by the end of the decade, driven primarily by large-scale broadband constellations from companies like SpaceX, OneWeb, and Amazon's Project Kuiper. This surge in orbital assets directly impacts the volume of ground station contacts that must be managed, monitored, and verified.

2. Rapid Growth & Changing Demands

At KSAT, the scale of operations has grown in tandem with this industry trend. Just two years ago, our ground stations facilitated over one million satellite contacts annually. Last year, we surpassed three million. This year, we are on track to exceed four million.

Until recently, each contact underwent a largely manual validation process: network operators closely observed telemetry streams, checked communication parameters, and recorded any anomalies during uplink or downlink. As the industry grows, maintaining such an intensive manual procedure is becoming increasingly impractical, highlighting the urgency of adopting scalable, automated solutions.

As the satellite industry expands at an unprecedented rate, providers like KSAT must accommodate a growing number of spacecrafts. Meeting these demands involves handling millions of annual ground station contacts—each requiring reliable monitoring and data transfer.

The primary goals include:

- Handling Growth: Scaling operational models and resources to match the rapid increase satellites.
- Reducing Cost: Standardizing hardware and procedures to minimize expenses without compromising quality.
- Reliability: Maintaining continuous, high-quality contacts for mission-critical needs.

2.1 Current Challenges

Our two network operations centers (NOCs) are central to monitoring and managing operations. However, as we implement automated detections, aggregated alarms, and self-correcting systems, the traditional role of NOC operators is evolving. Responsibility for anomaly detection and incident oversight is shifting toward the service desk and incident response functions.

This transition presents significant challenges—not only in technology, but in aligning people and processes. Redefining roles, upskilling staff, and embedding new workflows require careful change management. Ensuring clarity, accountability, and cross-functional coordination is essential to maintaining operational resilience during this transformation.

3. Transforming the Operational Concept

To manage millions of contacts with efficiency and precision, KSAT's Network Operations Center (NOC) strategy has shifted from reactive, manual workflows to a proactive, automated, and insight-driven approach.

3.1 Operations Center Workflow

KSAT operates two dedicated network operations centers that maintain continuous situational awareness across both internal infrastructure and external service delivery. Core functions include:

- Asset Overwatch: Continuous monitoring of antennas, modems, and other critical systems to ensure uptime and performance.
- Real-Time System Monitoring: Leveraging integrated data streams and analytics to maintain a live view of system health and service delivery.
- Reporting: Generating actionable insights and performance metrics to inform operational decisions and long-term strategy.
- Scheduling Optimization: Real-time adjustments to ground station usage, dynamically prioritized based on mission demands.
- Incident Coordination: With automation handling routine alerts, network operators are able to focus on the coordination troubleshooting and complex issue resolution.
- Customer Service: Providing responsive, informed support to mission partners and end-users around the globe.

As the scope and scale of operations grow, the responsibilities within the NOC have begun to outpace the capacities of both the display systems and personnel. This increasing complexity underscores the need for more advanced tools and adaptive systems to maintain operational excellence.

3.2 Scalability Program

At the heart of KSAT's transformation is a comprehensive scalability program—an overarching initiative composed of multiple aligned projects, each contributing to the development of a scalable and intelligent operations framework. The program targets thousands of interconnected systems spanning communications, infrastructure, security, and facility components.

Central to this effort is the full automation of system monitoring, reducing the need for manual oversight while enhancing visibility and responsiveness across the network. The program emphasizes robust data capture and mining, turning operational telemetry into actionable insights. These insights not only drive real-time decisions but also inform long-term optimizations.

Looking forward, the vision is a tightly integrated operations environment where tickets are automatically generated and enriched with detailed metadata—system ownership, mission context, SLAs, points of contact, and more. This ensures precise incident management, secure information flows with clear prioritization and routing, allowing operators to focus on strategic anomalies while routine issues are resolved with minimal friction. It's a model built for scale, resilience, and responsiveness.

3.3 Automation and Orchestration

Integrating AI into operations offers significant benefits. AI can optimize workflows, enhance anomaly detection, and automate routine tasks, thereby improving efficiency and accuracy. For example, AI algorithms can analyze vast amounts of data to identify patterns and predict potential issues before they occur, enabling proactive maintenance and reducing downtime. Moreover, AI-driven tools can assist in resource allocation, ensuring optimal use of the network's capacity and improving service delivery.

However, allowing AI access to information raises security concerns. Protecting sensitive data from unauthorized access and ensuring AI systems adhere to strict security protocols is crucial. Implementing robust cybersecurity measures, regular audits, and stringent access controls can mitigate these risks. Additionally, transparency in AI decision-making processes and continuous monitoring can help maintain trust and reliability in AI-driven operations.

4. Building Scalable Processes & Systems

Addressing the surge in contacts requires forward-looking solutions that are both robust and flexible. As demand increases, scalability becomes a key factor in ensuring operational efficiency and long-term sustainability. This involves building systems that can adapt to growth without compromising performance, security, or reliability. These improvements ultimately aim to enhance customer satisfaction, streamline employee workflows, and provide a clearer system overview.

4.1 Standardization & Automation

KSAT's global ground network is built on a foundation of standardization and automation, designed to deliver scalability, consistency, and operational excellence. As systems evolve, automated frameworks are increasingly outperforming traditional manual processes—delivering faster response times, improved reliability, and greater efficiency.

Automation now manages a broad range of routine tasks: incident tickets are generated and escalated without delay, standard procedures execute with minimal human input, and orchestration ensures that all components work in seamless harmony across the network. This shift allows our skilled teams to focus on higher-value work, such as resolving complex incidents and driving long-term improvements.

AI further strengthens these capabilities by enhancing anomaly detection, optimizing resource use, and learning from operational data to prevent potential issues before they arise. These tools not only streamline service delivery but also enable proactive management at scale. However, with increased reliance on AI comes the responsibility to safeguard operational data through robust cybersecurity measures, access controls, and transparent monitoring.

Despite the strength of our standardized, automated solutions, KSAT continues to offer tailored services for customers with special requirements and critical operations. These custom solutions remain essential for missions that demand unique configurations or heightened levels of assurance. Even so, experience has shown that in many cases, the automated approach now exceeds manual performance in speed, precision, and dependability.

By balancing advanced automation with customer-specific flexibility, KSAT delivers a comprehensive, future-proof ground service model—one that adapts to diverse mission needs while continuously pushing the boundaries of operational efficiency.

Operational focus is evolving across teams:

- 1. Line (Service Desk): Focus shifts from monitoring to efficient incident management and response.
- 2. Line Engineering Support: Emphasis on problem management over incident resolution.
- 3. Line Engineering Support: Develops into a proactive force that reduces incident frequency and enhances service resilience.

Standardized systems, agreements, documentation and automated issue resolution significantly reduce the burden of daily operations. Well-maintained knowledge articles minimize errors and enhance consistency, while automation of known issues accelerates resolution and improves accuracy. As a result, incident and problem management shifts operator focus from passive monitoring to active resolution and proactive troubleshooting, leading to more efficient workflows and stronger service delivery.

4.2 Customer Self-Service

KSAT's evolving service model emphasizes flexibility, automation, and scalability through two key offerings: Customer Self-Service and Ground Stations as a Service (GSaS). Together, these elements reshape how customers interact with satellite ground services, aligning technological advancement with operational efficiency.

The Customer Self-Service portal empowers users to manage core functions autonomously. It delivers real-time data insights, automatic reporting, and configurable parameters, all within a secure interface. By exposing APIs, the platform ensures seamless integration into customer systems, minimizing manual intervention and enhancing satisfaction through greater control and transparency.

GSaS builds on virtualization and cloud-native principles to replace legacy hardware with agile, software-defined components. This enables rapid provisioning of mission services and supports scalable, multi-mission operations. KSAT's cloud datacenter, complemented by edge nodes, provides customers with dedicated environments, enabling secure and isolated access to ground services.

The infrastructure further supports global collaboration. By sharing resources across regions, KSAT drives cost efficiency and extends its reach, allowing customers to benefit from a globally orchestrated network without investing in physical assets. These capabilities enable dynamic, responsive mission operations in a growing and competitive space landscape.

Ultimately, this combined approach delivers a customer-centric, future-ready ground network. It lowers operational barriers while expanding possibilities for integration, scale, and global coordination, reinforcing KSAT's position as a leader in next-generation satellite communication services.

4.3 Frameworks and compliance

Framework Integration and System Reliability Implementing industry-standard frameworks such as ITIL and Security Framework Compliance(s) enhances system visibility and ensures consistent performance. Real-time data from infrastructure components is centralized to proactively identify compliance gaps and operational risks, reducing service disruptions and strengthening audit readiness.

ITIL Governance Model. Applying ITIL principles provides structured framework and processes for incident, problem, change, and knowledge management. Incident management enables rapid response mechanisms aligned with compliance requirements. Problem management facilitates root-cause analysis to prevent recurrence of non-compliant behavior. Change management ensures controlled updates to infrastructure and software, maintaining detailed audit

trails. Knowledge management supports centralized documentation, aiding both compliance audits and internal training.

Security Framework Compliance (e.g., NIST, ISO,) Aligning IT operations with security frameworks reinforces compliance and data protection. Role-based access and strict authentication protocols support robust access control. Encryption and secure handling safeguard sensitive data across all stages. Real-time analytics and alerts allow for continuous compliance monitoring, promptly flagging policy deviations. Finally, harmonizing operational and security policies enables seamless integration of frameworks, ensuring full-spectrum compliance.

5. Results - Customer Experience in 2030

By 2030, KSAT has evolved into a fully scalable, intelligent ground service provider. The impact of this transformation is best illustrated through the lens of our customers — both commercial New Space startups and large institutional space agencies. These scenarios showcase how automation, standardization, and self-service have redefined operational interaction and mission assurance.

5.1 New Space Customer Journey: Scalable from Day One

Customer Profile:
A startup operating a 100-satellite imaging constellation focused on environmental monitoring.

Interaction in 2030:

- Within hours of contract signature, the customer provisions their ground network via the self-service portal, selecting service level, coverage regions, and APIs.
- Using the live scheduling view, they optimize their contact windows and make real-time changes as mission parameters evolve.
- All telemetry and payload data is auto-routed to their cloud environment, with latency consistently below SLA thresholds.
- Algorithms automate anomaly detection; the customer receives alerts enriched with diagnostics, proposed fixes, and context — all without manual intervention from KSAT operators.
- The portal offers audit-ready reports and performance dashboards aligned with their own mission KPIs.

Outcome:

- Ground segment was mission-ready in <1 day (vs. weeks historically).
- 99.9% SLA adherence across 500k annual contacts.
- Zero manual support requests in the first 60 days.

5.2 Institutional Use Case: Complex Multi-Mission Operations

Customer Profile:
A government space agency managing Earth observation and scientific payloads with diverse requirements (high data volume, security, custom routing).

Operational Experience in 2030:

- The agency leverages dedicated virtual ground infrastructure via KSAT's cloud-native GSaS model, with full isolation and encryption controls.
- Compliance with security frameworks is monitored via a joint dashboard, ensuring security and data handling obligations.
- AI-driven orchestration reprioritizes critical contacts avoids RFI and initiates protective measures to avoid space weather— automatically escalating to joint mission teams.
- Custom integrations via KSAT's open API allow the agency's internal systems to adjust antenna usage dynamically in coordination with other government missions.

Outcome:

- Incident response time cut by 80% during high-impact space weather.

- 100% mission continuity despite infrastructure stress events.
- Full traceability and auditability for national compliance and mission assurance.

5.3 Strategic Takeaways

Customers now experience faster onboarding, higher reliability, and greater autonomy. KSAT operations shifted from ticket resolution to mission enablement and strategic reliability. Automation, standardization, and AI allow both lean startups and large institutions to operate at scale with confidence.

6. Conclusions

As the satellite industry scales exponentially, KSAT is transforming ground operations to meet the demands of 10 million annual contacts by 2030. This shift centers on automation, AI integration, and service standardization—ensuring operational agility, security, and resilience. With a global network of 350+ antennas and a service model rooted in Ground Station as a Service (GSaS), KSAT delivers mission readiness within hours, zero-touch operations, and seamless scalability for both startups and institutional clients. By embedding compliance (ITIL, NIST, ISO), enabling customer self-service, and orchestrating intelligent workflows, KSAT redefines satellite communications for the New Space era—moving from reactive support to strategic mission enablement at global scale.

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