

ARTHUR D LITTLE

# SATELLITE CONNECTIVITY FOR INDUSTRY - A HIGH-FLYING FUTURE

Beyond Terrestrial Limits -  
Global Trends and KSA Context

## ■ EXECUTIVE SUMMARY

Industries operating in remote and infrastructure-challenged environments face persistent connectivity gaps that hinder digital transformation and limit the ability to scale Industrial AI-driven operations.

Satellite communications (satcom) offers scalable, enterprise-grade solution that enables rapid time to value for industrial operators extending connectivity beyond the economic and technical reach of terrestrial networks.

This white paper explores how evolving satellite technologies including LEO, MEO, and narrowband IoT constellations are enabling real-time operations, powering the flow of industrial data required for Industrial AI applications, boosting workforce safety, and reducing cost barriers across sectors such as energy, mining, logistics, and emergency response.

While not a substitute for fiber, 5G, or fixed wireless access (FWA) in well-connected regions, satellite serves as a critical complement delivering coverage and resilience in locations where terrestrial infrastructure is unavailable, impractical, or economically unviable.

The global industrial satcom market is projected to reach 25 billion USD by 2030 with Saudi Arabia positioned as a key growth region. To fully realize satcom's potential, it is essential to coordinate efforts across regulatory reform, deployment of local ground infrastructure (such as gateways and PoPs), seamless integration with enterprise and terrestrial networks, and innovation in business models. The time is now for industrial leaders to embed satellite connectivity into their digital strategies and future-proof their operations.

## 1.

## THE CONNECTIVITY CHALLENGE IN INDUSTRIAL TRANSFORMATION

Across industries, the shift toward digital operations powered by AI, IoT, cloud, and edge computing is placing unprecedented demands on connectivity. High-speed, low-latency networks are becoming foundational for enabling applications such as remote monitoring, predictive maintenance, and autonomous operations that are powered by Industrial AI. In well-connected regions, terrestrial technologies such as fiber, 5G, and Fixed Wireless Access (FWA), have emerged as preferred solutions, offering high bandwidth (up to 10 Gbps), low latency (as low as 1ms), and strong spectral efficiency (often exceeding 5–10 bits per Hertz).

However, these technologies come with significant deployment requirements, including dense infrastructure, proximity to existing backhaul, and favorable terrain conditions. In many industrial sectors, particularly those operating in remote, offshore, or harsh environments, such conditions do not exist. Oilfields, mining camps, long-haul logistics corridors, and temporary survey or construction sites often lie well beyond the economic or technical reach of terrestrial infrastructure. Deploying cellular base stations in these settings can cost between USD 1 million and 5 million for a medium-sized industrial site, even without accounting for backhauling costs. This level of investment is not always economically justifiable, especially for time-bound or lower-density operations.

As a result, terrestrial connectivity often becomes infeasible, creating a critical barrier to digital transformation at the operational edge. This lack of connectivity directly hampers the adoption of Industry 4.0 technologies. Without reliable data transmission, industrial sites struggle to implement remote monitoring, predictive maintenance or digital twins. Field teams are cut off from real-time insights, relying instead on delayed data or manual processes. This not only reduces operational efficiency but also increases safety risks and limits the scalability of Industrial AI-driven operating models in remote environments.

The implications for workforce productivity and safety are equally significant. Personnel in disconnected environments often lack access to digital tools that support inspections, safety protocols or remote support in temporary or mobile operations such as seismic surveys, construction or emergency response, teams frequently operate offline, leading to delays and lost data.

In such environments, rather than replacing terrestrial networks, satellite connectivity acts as a strategic complement, reducing deployment timelines, avoiding stranded CAPEX, and enabling operational continuity. It bridges coverage gaps and extends digital capabilities to the operational edge. While satellite systems generally exhibit higher latency and lower spectral efficiency than fiber or 5G, recent advancements, particularly in LEO and MEO constellations, have significantly improved their performance and responsiveness. LEO/MEO systems now offer latency in the range of 30–70 milliseconds and downlink speeds of up to 1.5 Gbps per terminal compared to over 600 milliseconds and sub-50 Mbps for legacy geostationary (GEO) systems.

Satellite connectivity offers distinct advantages that address the core challenges facing industrial operations in remote and infrastructure-poor environments:

**1. Geographic Reach:**

Satellites provide consistent coverage in remote or offshore areas where terrestrial networks are absent or unreliable.

**2. Cost Efficiency in Low-Density Areas:**

In low-density or hard-to-reach areas, satellite avoids the high capital costs of fiber or cellular rollout, offering a scalable and location-agnostic cost model.

**3. Rapid Deployment:**

Satellite links can be activated within days once regulatory approvals and ground stations are in place, supporting both permanent facilities and time-bound operations.

**4. Infrastructure Independence:**

Operating independently of terrestrial infrastructure, satellite ensures continuous operations during natural disasters, network failures, or infrastructure outages.

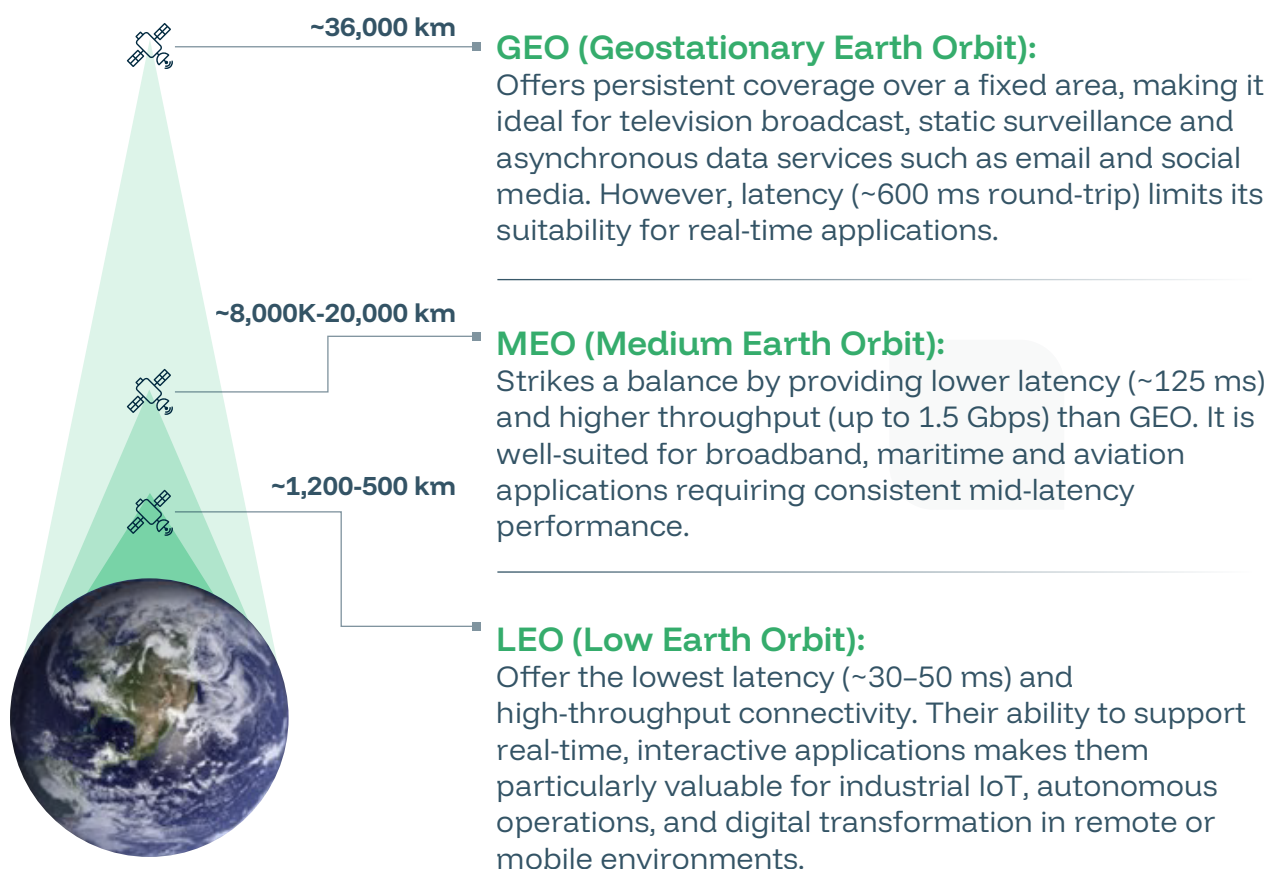
As industrial transformation continues to push deeper into geographically dispersed and infrastructure-scarce territories, a hybrid approach to connectivity is emerging as the most viable model. In this architecture, terrestrial networks provide core and urban coverage, while satellite ensures continuity and resilience at the periphery. Together, they enable truly borderless digital operations, ensuring every asset, no matter how remote, can be connected, monitored, and optimized.

## 2. SATELLITE COMMUNICATIONS ENTERING A NEW ORBIT

Traditionally, satellite communications have relied on Geostationary Earth Orbit (GEO) satellites. While GEO remains valuable for its wide coverage and predictable positioning and is ideal for applications such as broadcast, surveillance and services that can tolerate some latency, it can experience higher latency compared to MEO and

LEO. However, advancements in high throughput GEO satellites have significantly increased the bandwidth and capacity available, allowing GEO to support a wider range of interactive and data intensive applications. The landscape is now rapidly evolving with the rise of Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) constellations.

LEO satellites offer ultra-low latency and high throughput. Their proximity to Earth enables responsive, high-capacity connectivity suited for bandwidth-sensitive and interactive use cases such as industrial IoT, cloud integration and remote automation. With dense constellations covering the globe, LEO systems can serve remote areas that previously had no viable connectivity options.



MEO satellites offer a balance between GEO and LEO systems, combining lower latency and higher throughput than GEO with broader coverage using fewer satellites than LEO. They support consistent Quality of Service (QoS) and symmetrical throughput, making them well-suited for applications requiring reliable and secure connectivity across sectors such as aviation, maritime and industrial operations.

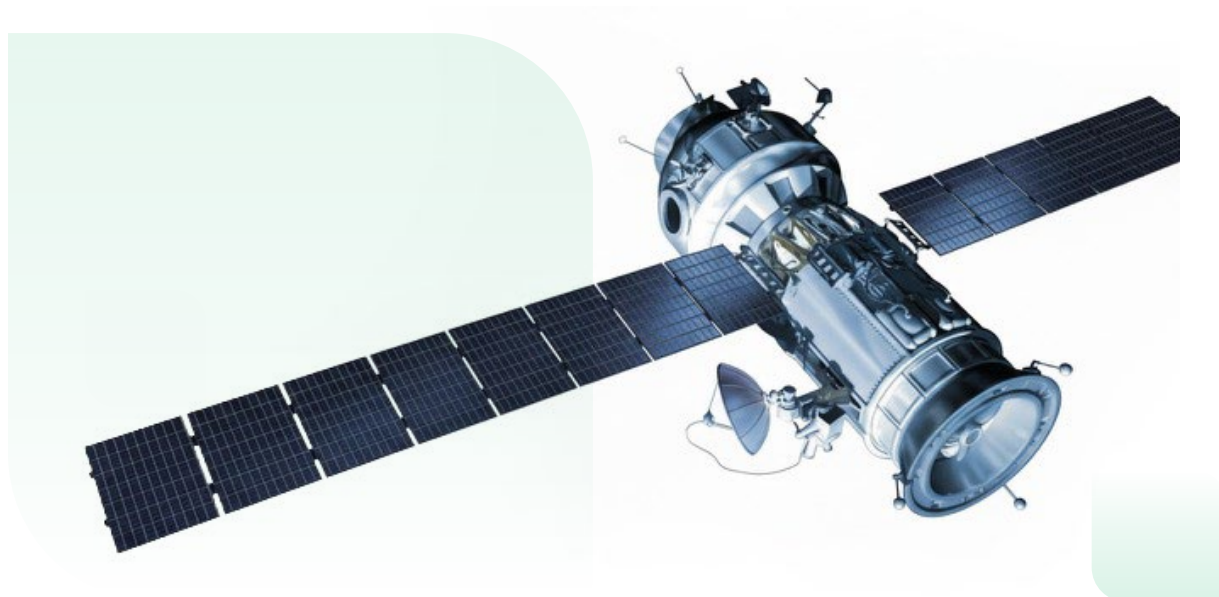
While the GEO segment remains stable and mature – led by providers such as SES, Eutelsat, Inmarsat and Arabsat momentum is increasingly shifting toward LEO and MEO systems. SES continues to advance the MEO segment

through its O3b and O3b mPOWER constellations. Meanwhile, the LEO segment is experiencing rapid expansion, driven by ambitious initiatives – both from the established players such as Eutelsat with OneWeb, and Telesat with Lightspeed and new entrants such as Starlink and Amazon Kuiper each racing to redefine global connectivity paradigms. Beyond these orbit-based developments, a parallel ecosystem is evolving in the narrowband segment for industrial IoT applications. Providers such as Iridium, Globalstar, Orbcomm, AST SpaceMobile, and OQ Technologies are enabling ultra-low-bandwidth use cases in environments where power, data volume and connectivity frequency are limited.

“NB-IoT constellations are purpose-built for massive machine-type communication in remote environments. Our low-power, low-bandwidth satellites are optimized to connect distributed industrial sensors efficiently and reliably even in areas far beyond terrestrial signal range”

– Omar Qaise, CEO, OQ Technology

Together, these orbit-based and use-case specific innovations are reshaping the satellite communications landscape. They are making industrial-grade satellite connectivity viable across a broader set of use cases, geographies and operational environments setting the stage for rapid adoption and market growth.



## 3.

## INDUSTRIAL SATCOM: A \$25 BILLION MARKET BY 2030

The industrial satcom market is entering a phase of accelerated growth. Globally, the market for industrial satellite connectivity is projected to grow at a CAGR of 20% between 2025 and 2030 reaching approximately 25 billion USD by 2030. This momentum is fueled by advancements in satellite technologies, declining service costs and the increasing need for resilient, always-on connectivity across industries.

LEO and MEO constellations are expected to drive this growth accounting for over 80% of the global market. Certain regions are poised to outpace global growth rates with Saudi Arabia emerging as a key market driven by the Vision 2030, which focuses on building robust digital infrastructure and accelerating industrial diversification. Large-scale investments in sectors such as energy, mining, manufacturing, and mega-projects such as NEOM and Red Sea Global are creating strong demand for reliable connectivity across geographically dispersed and infrastructure-poor areas. Satellite connectivity, with its scalability and rapid deployment advantages, is well-positioned to address these needs.

“Saudi Arabia’s vast geography presents a unique connectivity challenge. Many industrial zones, oilfields, and mining projects operate far from terrestrial networks. Satellite connectivity gives us an agile, practical, scalable and cost-effective way to bring these critical sites online quickly and reliably.”

– Eid Al Harbi: Digital Industrial Connectivity President, Aramco Digital

As a result, Saudi Arabia’s industrial satcom market is forecasted to grow much faster than the global average, with demand expected to reach 1 billion USD by 2030.

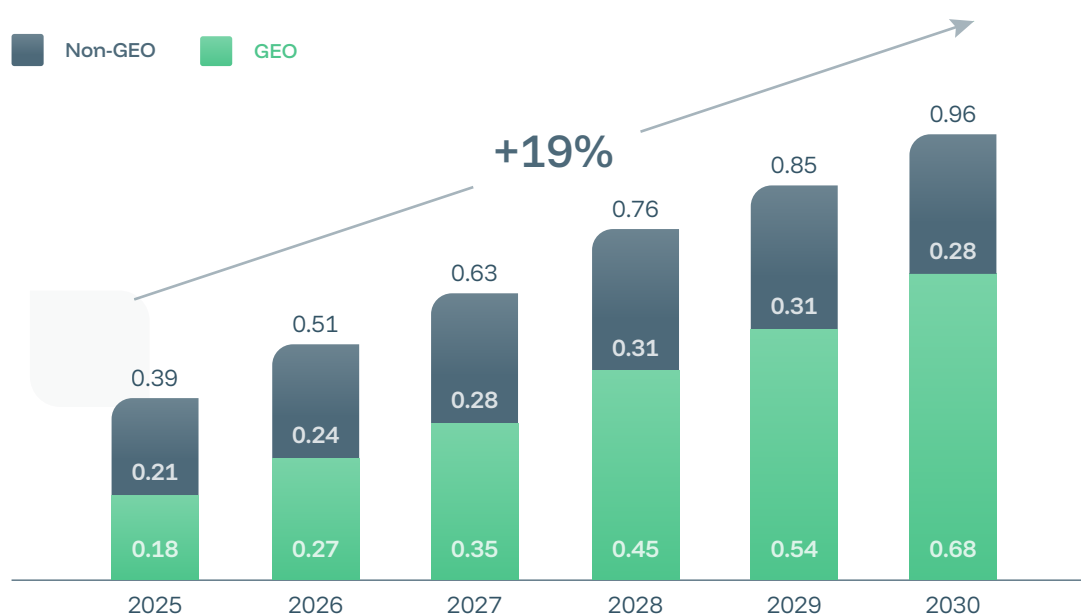


Figure 2: KSA Industrial satcom market size, 2025-2030, USD Billion

Much of this growth will be fueled by the expanding availability of LEO and MEO services. Although Non-GEO offerings in the Kingdom are currently limited, the market is poised for rapid expansion as more global operators enter. International providers such as Starlink, SES, and Amazon Kuiper are expected to adopt a partnership-driven model, collaborating with local service providers to navigate regional complexities and accelerate market entry, following the precedent set by OneWeb and STC. As industrial requirements intensify, the satcom ecosystem is evolving to meet the demands of digital-first, geographically diverse operations.

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## 4.

## INDUSTRIAL USE CASES: A STRATEGIC LEVER ACROSS SECTORS

### SATELLITE CONNECTIVITY - USE CASE EXAMPLES

Satellite connectivity unlocks several use cases across industries and critical sectors. Satellites are acting as strategic enablers – unlocking new capabilities such as Industrial AI, improving operational efficiency, and strengthening resilience.

#### OIL & GAS



- Low-latency, high-throughput links enable seamless SCADA connectivity, video surveillance, and crew welfare services in harsh, remote environments

#### UTILITIES (POWER, WATER, ETC.)



- Highly available, SLA-backed bandwidth ensures reliable operations, monitoring, and control for critical infra-structure

#### MINING



- High-throughput connectivity (up to 1.5 Gbps per terminal) supports sensor-rich environments and real-time operational analytics

#### PUBLIC SAFETY & EMERGENCY SERVICES



- Reliable, high-speed connectivity ensures consistent delivery of critical public services, bridging the digital divide

#### MARITIME & LOGISTICS



- Global maritime coverage with seamless, low-latency connectivity for safety systems, navigation, and logistics coordination

#### CONSTRUCTION (GIGA PROJECTS)



- Rapidly deployable, high-bandwidth solutions enable digital workflows, site surveillance, and collaboration tools in unserved areas

Case-studies of several high-impact use cases demonstrate how satellite communications are making a tangible difference:

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■ **Oil & Gas – Aramco's Satellite-Backed Operational Connectivity:**

Aramco extensively leverages VSAT networks to connect nearly all of its upstream and downstream sites across the Kingdom. This satellite-enabled backbone supports a wide range of critical applications from voice and data services to SCADA integration, real-time monitoring and remote asset management. It allows Aramco to maintain operational continuity across remote oilfields, offshore platforms, and pipeline networks that lie far beyond terrestrial coverage. This infrastructure ensures that mission-critical systems remain online, supports real-time environmental monitoring, and crew welfare.

■ **Mining – DD Mining's Remote Site Connectivity:**

iNet Communications and Eutelsat, provide high-speed satellite connectivity to DD Mining's remote operations in Guyana. It enables real-time monitoring, enhances worker safety, and ensures continuous communication with headquarters. Satellite has replaced manual processes with digital tools,

improving decision-making and operational efficiency without requiring major infrastructure investments.

■ **Logistics – INEOS Oxide's Hazardous Transport Monitoring:**

INEOS Oxide uses satellite-connected sensors to monitor its rail tank fleet carrying hazardous materials. Operating over Globalstar's LEO network, the solution enables real-time tracking of temperature, location, and pressure ensuring regulatory compliance, improving safety, and streamlining logistics across routes with limited terrestrial coverage.

■ **Emergency Response – Starlink's Zero-Day Connectivity:**

In Washington State, emergency teams used Starlink to restore connectivity within minutes during wildfire response enabling fast deployment, coordination, and situational awareness where terrestrial networks had failed.

Across these examples, satellite connectivity proves its value as a horizontal enabler, cutting across industries to power digital transformation wherever terrestrial networks cannot reach.

## 5.

## ENABLERS TO UNLOCK ADOPTION AT SCALE

Despite strong interest and growing visibility of modern satellite solutions, adoption across industrial sectors remains uneven. The core challenge lies in availability, integration and commercial readiness. In many regions, regulatory restrictions are delaying the rollout of LEO and MEO services. At the same time, integration with enterprise systems remains complex and existing commercial models are not fully aligned with industrial use cases. Without local ground infrastructure and tailored service delivery models, even high-performance satellite networks struggle to meet enterprise requirements. Addressing these structural constraints is key to unlocking adoption at scale.

Accelerating adoption will require a combination of enablers that address both supply-side readiness and demand-side expectations.

### i. Regulatory Clarity:

Outdated regulatory processes risk slowing innovation. Simplified licensing, open spectrum policies and standardized technical frameworks are needed to unlock private sector participation and accelerate service deployment. Governments have a critical role to play in enabling a dynamic satellite connectivity landscape.

### ii. Ground Infrastructure Readiness:

Many countries require satellite operators to host local gateways or points of presence (PoPs) due to data residency and compliance regulations. Establishing robust ground infrastructure regionally distributed and locally compliant, is essential to scale service delivery and meet security expectations.

### iii. User Terminal Innovation and Interoperability:

Mass adoption hinges on cost-effective, versatile user terminals that can operate seamlessly across multiple satellite constellations and terrestrial networks. Advancements in antenna technologies, coupled with efforts to drive interoperability and open standards, are critical to lowering total cost of ownership and enabling widespread adoption.

### iv. Ecosystem Development:

Industrial adoption will not scale through isolated efforts. Scaling industrial satellite connectivity will require orchestrated partnerships between global satcom providers, local operators and industrial customers – an area where Aramco Digital is uniquely positioned to act as an ecosystem integrator and commercial anchor.

### v. Technology Maturity:

Sustained innovation in direct-to-device (D2D) communications, edge intelligence and multi-orbit network orchestration must continue. These technologies are essential to deliver enterprise-grade performance, lower complexity and seamlessly integrate satellite services into industrial digital ecosystems supporting the reliable movement of data across Industrial AI environments.

**vi. Business Model Innovation:**

Enterprises will increasingly demand flexible, outcome-based models. Solutions such as Satellite as a Service, consumption-based pricing and managed connectivity offerings will be key to lowering adoption barriers, reducing upfront investment and demonstrating rapid value realization across industrial operations.

“Satellite is no longer on the sidelines and is now recognized as a key enabler of the broader connectivity ecosystem. For industries to scale digital transformation, companies must integrate satellite smoothly into existing network systems and offer flexibility that matches how businesses actually operate. That’s what SES is focused on, delivering reliable high-performance connectivity without the usual complexity.”

– Nick Roullier, Global Head of Practices, SES

Collectively, these enablers will determine whether satellite connectivity remains a niche solution or becomes a foundational component of industrial digital infrastructure. The opportunity is clear – what is needed now is coordinated action to bridge the last mile of adoption.



# 6.

## LOOKING AHEAD: INDUSTRIAL RESILIENCE VIA SATELLITE CONNECTIVITY

Satellite communications are no longer a fallback option; they are a strategic enabler of Industry 4.0. For industrial operators, especially those with assets in remote or dynamic environments, satellite offers reliable, scalable and cost-effective connectivity. As industries demand greater resilience, automation and data-driven operations, satellite's role in the digital infrastructure stack will continue to expand.

While fiber, 5G, and fixed wireless access (FWA) deliver high-performance connectivity in well-served environments such as urban, suburban or other dense regions, satellite plays a critical role in extending coverage to locations where terrestrial infrastructure is unavailable, impractical or cost-prohibitive. These include remote industrial zones, offshore facilities, long-range transport corridors and temporary or mobile operations. Rather than replacing terrestrial networks, satellite complements them within a hybrid architecture, helping ensure that industrial connectivity is resilient, continuous and independent of geographic constraints.

While adoption remains uneven today, regulatory momentum, commercial innovation and improving technology are laying the groundwork for broader deployment. In markets such as Saudi Arabia, national investment and early ecosystem activity signal strong future potential. As next-generation satellite services become more widely available, these markets could become important testbeds for industrial-scale adoption.

"At Aramco Digital, we envision satellite connectivity as a critical component of the future industrial connectivity ecosystem. As Industrial AI increasingly moves to the operational edge, seamless integration between terrestrial networks, private wireless infrastructure, and satellite communications will be essential to connect remote assets, enable real-time intelligence, and ensure resilient operations. The convergence of connectivity, edge computing, and Industrial AI will define the next generation of industrial transformation."

– Dr. Ashraf Altahini, CEO, Aramco Digital

Looking further ahead, emerging concepts such as orbital computing and space-based data processing are beginning to reshape how industries think about connectivity, compute, and data exchange. As computing resources increasingly move closer to where data is generated – whether at the industrial edge, across remote industrial environments, or potentially in space – the need for resilient, ubiquitous, and low-latency connectivity will become even more critical. In this future industrial landscape, satellite connectivity will extend beyond connecting remote assets and may increasingly serve as a foundational layer linking distributed industrial and digital computing environments across Earth and space.

The opportunity is clear. Organizations investing in connectivity capabilities today are not only addressing current operational challenges but are also positioning themselves to participate in the next generation of industrial and digital infrastructure ecosystem. As connectivity, edge computing, and Industrial AI continue to converge, satellite communications will play an increasingly important role in enabling the future of industrial transformation.

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## 7.

## NEXT STEPS: TURNING STRATEGY INTO ACTION

To fully capitalize on satellite connectivity, stakeholders across the ecosystem should take the following actions:

- **Industrial Operators:**

Evaluate satcom as the default for greenfield and offshore deployments.

- **Policy Makers:**

Streamline licensing and spectrum allocation to accelerate rollout.

- **Ecosystem Partners:**

Invest in local ground infrastructure and co-develop integration platforms.

- **Tech Providers:**

Create modular offerings that align with OT and IT convergence goals.

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## ■ ABOUT ARAMCO DIGITAL

Aramco Digital is the Industrial AI arm of Saudi Aramco, focused on accelerating industrial digital transformation through advanced connectivity, digital platforms, cybersecurity, and AI-driven solutions. The company enables critical industries with reliable, secure, and scalable digital capabilities that enhance operational efficiency, resilience, and long-term value creation.

Through its integrated portfolio spanning its five business units — Digital Connectivity, Digital Industrial Solutions, Digital Platforms, Digital Business Services, and cybersecurity capabilities through its affiliate Cyberani — Aramco Digital empowers organizations to accelerate their digital transformation journeys and unlock the full potential of Industrial AI.

Aramco Digital supports the Kingdom's digital economy ambitions and contributes to the goals of Saudi Vision 2030 by building future-ready digital ecosystems, enabling national capabilities, and advancing the adoption of transformative technologies across industries.

For more information, visit:  
[www.aramcodigital.com](http://www.aramcodigital.com)

## ■ ABOUT ARTHUR D. LITTLE

Arthur D. Little has been at the forefront of innovation since 1886. They are an acknowledged thought leader in linking strategy, innovation and transformation across technology-intensive and converging industries. They navigate clients through evolving business ecosystems to unlock new growth opportunities. They enable clients to build innovation capabilities and transform their organizations.

Our consultants bring strong practical industry experience and deep knowledge of key trends. ADL operates globally, serving leading enterprises including many Fortune 1000 companies.

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