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In-Orbit Data Centers Market - Global and Regional Analysis: Focus on Future Deployment, Ecosystem, and Challenges

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Abstracts

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This report will be delivered in 7-10 working days.In-Orbit Data Centers Market Overview

The in-orbit data centers market is projected to be $1,776.7 million in 2029, and it is expected to grow at a CAGR of 67.40% and reach $39,090.5 million by 2035. The in-orbit data centers market experiences rapid advancements, driven by breakthroughs in AI automation, quantum storage, and high-efficiency solar power. Companies like NVIDIA Corporation, IBM, and Hewlett Packard Enterprise Development LP, in collaboration with National Aeronautics and Space Administration (NASA) and European Space Agency (ESA), for the exploration to deploy scalable, radiation-hardened data centers in space, capable of handling AI model training, real-time analytics, and cloud computing at unprecedented speeds. As autonomous maintenance systems improve, these orbital data hubs have potential to become a cost-effective, carbon-neutral alternative to terrestrial data centers. By 2035, gigawatt-scale computing clusters in low Earth orbit (LEO) and cislunar space are expected to enable seamless, ultra-secure data processing, revolutionizing industries from telecommunications to deep-space exploration.

Introduction to In-Orbit Data Centers

The market study conducted by BIS Research defines in-orbit data centers as space-based computing facilities designed to process, store, and transmit vast amounts of

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data directly from orbit, reducing reliance on terrestrial infrastructure. These advanced systems utilize satellites, AI-driven edge computing, radiation-hardened servers, and optical communication networks to handle critical workloads in low Earth orbit (LEO). The market encompasses hardware components (servers, storage systems, networking devices), power sources, deployment systems, and AI optimization technologies. Driven by the exponential growth in data consumption, AI applications, and satellite communications, in-orbit data centers aim to address challenges related to latency, bandwidth constraints, energy efficiency, and climate impact positioning them as next frontier in global cloud computing and data processing.

Market Introduction

The in-orbit data centers market is emerging as a transformative solution to address the growing demand for efficient and sustainable digital infrastructure. By utilizing the unique advantages of space, these data centers use advanced satellite systems for low-latency data processing, reduced terrestrial energy consumption, and improved global connectivity. Designed with cutting-edge components like radiation-hardened processors, free-space optical communication, and modular payloads, they offer scalable and innovative platforms for AI, IoT, and cloud computing applications. With increasing investments in space technologies, rising data traffic, and sustainability goals, the market is poised for substantial growth, redefining how data is processed and stored globally.

Industrial Impact

The industrial impact of the in-orbit data centers market spans sectors like telecommunications, AI, cloud computing, and space exploration, driving innovation in data processing and global connectivity. These space-based centers enable real-time data analytics, reduce terrestrial infrastructure dependency, and address latency challenges for applications such as disaster management, defense, and advanced research. By utilizing sustainable energy solutions like solar power and cutting-edge technologies in radiation-hardened systems and optical communications, they align with global sustainability goals. Moreover, this evolution promotes collaboration among aerospace companies, technology providers, and government agencies, creating opportunities in satellite manufacturing, engineering, and data management. In-orbit data centers redefine the digital ecosystem by enhancing efficiency, scalability, and innovation across industries.

Infrastructure developers (Star Cloud, Inc., NTT Corporation, Axiom Space, Inc. and

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OrbitsEdge), Comunication Companies (Skyloom, SKY Perfect JSAT Holdings Inc. and Kepler Communications Inc.), Data Processing Companies (KP Labs.), Data Center Hardware Companies (Advanced Micro Devices, Inc., NVIDIA Corporation, IBM and Hewlett Packard Enterprise Development LP) and Space Agencies (National Aeronautics and Space Administration and European Space Agency (ESA)) These companies have been focusing on strategic partnerships, collaborations, and acquisitions to enhance their product offerings and expand their market presence.

Market Segmentation:

Segmentation 1: by Component

- Antenna
- Power Source
- Payload
- Servers
- Storage Systems
- Networking Devices
- Others

Payload to Lead the Market (by Component)

Payload is expected to lead the in-orbit data centers market by component, driven by its critical role in housing and operating advanced computing, storage, and networking systems in space. With payloads encompassing radiation-hardened servers, high-capacity storage systems, and optical networking devices, companies like Hewlett Packard Enterprise (HPE) are innovating to ensure robust performance in harsh space environments. The payload segment is further boosted by advancements in modular, lightweight, and energy-efficient technologies designed for seamless integration into satellite systems. As payloads form the operational backbone of in-orbit data centers, their significance is amplified by the growing demand for high-performance data processing, AI-driven analytics, and secure communications for industries like defense,

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telecommunications, and earth observation.

Segmentation 2: by Region

U.S.

Europe

Asia-Pacific

U.S. is expected to dominate the in-orbit data centers market, driven by technological superiority, robust space infrastructure, and strategic investments from private and government entities. Companies like Hewlett Packard Enterprise (HPE), NVIDIA Corporation, IBM, and SpaceX, in collaboration with National Aeronautics and Space Administration (NASA) and the U.S. Department of Defense, are pioneering radiation-hardened servers, AI-driven automation, and high-performance computing (HPC) solutions for space-based operations. The country's dominance is further reinforced by its extensive satellite networks, deep expertise in AI and cloud computing, and strong public-private partnerships. With the growing demand for ultra-secure, low-latency computing, the U.S. is well-positioned to deploy in-orbit data centers in the coming years, setting the foundation for next-generation digital infrastructure and interplanetary computing networks.

Recent Developments in the In-Orbit Data Centers Market

Star Cloud, Inc. has raised over $10 million in October 2024 to develop space-based data centers for AI training, aiming to achieve gigawatt-scale capacity. The company plans to launch a demonstration satellite in 2025 as part of Nvidia's Inception program, utilizing 24/7 solar power to reduce energy costs. The company has claimed its space-based data centers will be significantly more cost-effective than terrestrial alternatives, though challenges remain about launch costs, system durability, and infrastructure maintenance.

NTT Corporation and Sky Perfect JSAT, through their joint venture Space Compass in April 2022, are pioneering space-integrated computing networks to enhance global connectivity by linking terrestrial, aerial, and space-based communication via high-speed optical transmission. This initiative supports Beyond 5G and 6G networks, utilizing High-Altitude Platform Stations (HAPS)

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and low Earth orbit satellites for seamless data exchange and real-time Earth observation.

Axiom Space, Inc. is advancing commercial space infrastructure by developing the world's first orbital data center as part of Axiom Station, set to launch its first module in 2026. Initially integrated with the ISS before becoming an independent platform, this data center will utilize optical inter-satellite links (OISLs) in collaboration with Kepler Communications and Skyloom Global, enabling high-speed data transmission of up to 10 Gbps.

OrbitsEdge is revolutionizing space-based edge computing by planning to deploy high-performance micro data centers in low Earth orbit (LEO) to process vast amounts of satellite-generated data directly in space. Partnering with Hewlett Packard Enterprise (HPE) and Vaya Space in August 2022, the company is integrating compact, high-performance computing (HPC) systems into satellites to reduce transmission latency and bandwidth constraints, making space-based analytics more efficient.

Demand - Drivers, Limitations, and Opportunities

Market Drivers: Increasing Data Center Spending

The growing demand for data centers has drawn interest from a wide range of investors, including growth capital, buyout firms, real estate, and infrastructure investors. In the U.S. market, data center demand measured by power consumption as an indicator of server capacity is expected to grow from 17 gigawatts (GW) in 2022 to 35 GW by 2030 approximately. U.S. represents approximately 40% of the global data centers.

In July 2024 Blackstone, a major investment firm expanded its data center portfolio with $70.0 billion allocated for future developments, in addition to its existing $55.0 billion in assets, including ongoing construction projects. AI's transformative impact, predicting $2.0 trillion in global data center capital expenditures over the next five years, with $1.0 trillion in the U.S. alone.

Due to the growing demand for data centers, the industry faces significant challenges, particularly in managing the vast amounts of data generated by modern applications. This has led to the exploration of innovative solutions, such as in-orbit data centers, to

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address these challenges. For instance, in August 2022 OrbitsEdge partnered with HPE to develop compact data centers housed within satellites in low Earth orbit (LEO). These space-based data centers aim to process and analyze data directly in orbit, reducing the need to transmit large volumes of information back to Earth. This approach not only alleviates bandwidth constraints but also enhances the efficiency of data processing for applications such as Earth observation and satellite communications.

Market Challenges: High Initial Development and Deployment Costs

The development and deployment of in-orbit data centers come with substantial upfront costs, primarily driven by the complexities of space technology, infrastructure, and launch expenses. Establishing a data center in space requires advanced materials, specialized engineering, and high-cost satellite launches, making the initial investment significantly higher. Deploying space-based data centers is still in its early stages, with challenges such as logistical feasibility, regulatory approvals, and the integration of space-to-Earth connectivity adding to the financial burden. Given these constraints, the economic viability of these data centers is often questioned, making investment in this emerging technology a calculated risk.

Despite the high initial costs, in-orbit data centers present a transformative opportunity for the future of computing. The long-term benefits, such as unlimited access to solar energy and reduced dependence on terrestrial infrastructure, can offset operational costs over time. Moreover, the elimination of land and power constraints ensures scalability beyond Earth’s physical limitations.

Market Opportunities: Advancements in Space Logistics and Infrastructure

The evolution of space logistics and infrastructure is paving the way for groundbreaking innovations in data storage and processing, with in-orbit data centers emerging as a transformative opportunity. As space transportation systems become more cost-effective and reliable, the feasibility of deploying high-performance computing facilities beyond Earth's atmosphere is becoming increasingly tangible. The development of automated in-space assembly, refueling stations, and advanced docking mechanisms is reducing operational barriers, making space-based data centers a viable extension of Earth's digital ecosystem.

In February 2024, Star Cloud, Inc. secured over $10 million in funding to develop AI training data centers in space, highlighting growing investor confidence in the commercial potential of in-orbit computing. This initiative highlights how advancements

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in space transportation and orbital station infrastructure are catalyzing a new era of data processing at the edge of space. With companies now using satellite-to-cloud connectivity and AI-optimized workloads, in-orbit data centers stand to revolutionize high-performance computing, cybersecurity, and interplanetary data transmission.

How can this report add value to an organization?

Product/Innovation Strategy: The product segment provides insights into the diverse applications of in-orbit data centers based on component, including antenna, power source and payload. Payload further includes servers, storage systems, networking devices and others Continuous technological innovations, growing investments in digital infrastructure, and rising demand for cloud and edge computing have been driving the adoption of these in-orbit data centers. Consequently, the in-orbit data centers market represents a high-growth and high-revenue business model with substantial opportunities for industry players in the future.

Growth/Marketing Strategy: The in-orbit data centers market has been growing at a rapid pace. The market offers enormous opportunities for existing and emerging market players. Some of the strategies covered in this segment are mergers and acquisitions, product launches, partnerships and collaborations, business expansions, and investments. The strategies preferred by companies to maintain and strengthen their market position primarily include product development.

Competitive Strategy: The key players in the in-orbit data centers market analyzed and profiled in the study include professionals with expertise in the automobile and automotive domains. Additionally, a comprehensive competitive landscape such as partnerships, agreements, and collaborations are expected to aid the reader in understanding the untapped revenue pockets in the market.

Research Methodology

Factors for Data Prediction and Modelling

> The base currency considered for the market analysis is US$. Currencies other than the US$ have been converted to the US$ for all statistical calculations, considering the average conversion rate for that particular year.
>
> The currency conversion rate was taken from the historical exchange rate on the Oanda website.

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Nearly all the recent developments from January 2021 to February 2025 have been considered in this research study.

The information rendered in the report is a result of in-depth primary interviews, surveys, and secondary analysis.

Where relevant information was not available, proxy indicators and extrapolation were employed.

Any economic downturn in the future has not been taken into consideration for the market estimation and forecast.

Technologies currently used are expected to persist through the forecast with no major technological breakthroughs.

Market Estimation and Forecast

This research study involves the usage of extensive secondary sources, such as certified publications, articles from recognized authors, white papers, annual reports of companies, directories, and major databases to collect useful and effective information for an extensive, technical, market-oriented, and commercial study of the in-orbit data centers market.

The market engineering process involves the calculation of the market statistics, market size estimation, market forecast, market crackdown, and data triangulation (the methodology for such quantitative data processes is explained in further sections). The primary research study has been undertaken to gather information and validate the market numbers for segmentation types and industry trends of the key players in the market.

Primary Research

The primary sources involve industry experts from the in-orbit data centers market and various stakeholders in the ecosystem. Respondents such as CEOs, vice presidents, marketing directors, and technology and innovation directors have been interviewed to obtain and verify both qualitative and quantitative aspects of this research study.

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The key data points taken from primary sources include:

- validation and triangulation of all the numbers and graphs
- validation of reports segmentation and key qualitative findings
- understanding the competitive landscape
- validation of the numbers of various markets for market type
- percentage split of individual markets for geographical analysis

Secondary Research

This research study involves the usage of extensive secondary research, directories, company websites, and annual reports. It also makes use of databases, such as Hoovers, Bloomberg, Businessweek, and Factiva, to collect useful and effective information for an extensive, technical, market-oriented, and commercial study of the global market. In addition to the aforementioned data sources, the study has been undertaken with the help of other data sources and websites, such as the National Aeronautics and Space Administration (NASA), ISA, and IEA.

Secondary research was done in order to obtain crucial information about the industry's value chain, revenue models, the market's monetary chain, the total pool of key players, and the current and potential use cases and applications.

The key data points taken from secondary research include:

- segmentations and percentage shares
- data for market value
- key industry trends of the top players of the market
- qualitative insights into various aspects of the market, key trends, and emerging areas of innovation
- quantitative data for mathematical and statistical calculations

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Key Market Players and Competition Synopsis

The companies that are profiled in the in-orbit data centers market have been selected based on inputs gathered from primary experts who have analyzed company coverage, product portfolio, and market penetration.

Some of the prominent names in this market are:

Infrastructure developers

Star Cloud, Inc.

NTT Corporation

Axiom Space, Inc.

OrbitsEdge

Comunication Companies

Skyloom

SKY Perfect JSAT Holdings Inc.

Kepler Communications Inc.

Data Processing Companies

KP Labs.

Data Center Hardware Companies

Advanced Micro Devices, Inc.

NVIDIA Corporation

IBM

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Hewlett Packard Enterprise Development LP

Space Agencies

National Aeronautics and Space Administration

European Space Agency (ESA)

Companies not part of the aforementioned pool have been well represented across different sections of the report (wherever applicable).

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