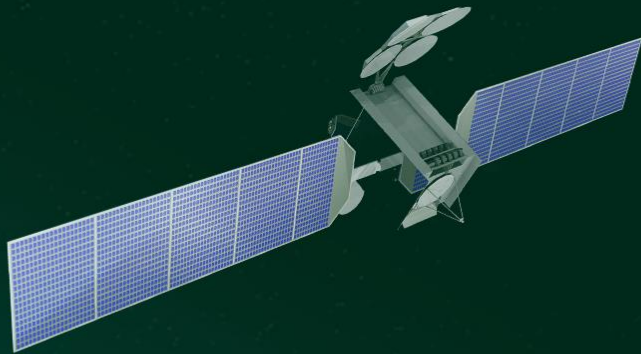




YAHSAT KNOWLEDGE SERIES

# The Evolution of the MENA Space and Satellite Communications Sector

December 2022



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## Foreword



“ Since going public on the Abu Dhabi Stock Exchange in 2021, Al Yah Satellite Communications Company PJSC (Yahsat) is committed to transparently engaging with our investors, customers, and the public to inform them of everything that we do as the UAE’s partner of choice for satellite communications.

This White Paper, the first in a series, helps the reader understand the history of the region’s space activities and the role that Yahsat plays – not only in the past but also how we are shaping the future. The contents of this publication provide a broader context for investors and members of the public to understand the space and satellite landscape in the Middle East and North Africa, with an emphasis on satellite communications.

Yahsat is proud of its history and the role it plays in providing the satellite communications needs of the UAE and the wider region. We are also helping shape the future of space and satellite activities in the nation by developing talent and expertise, world-class manufacturing and research facilities, and sponsoring several educational and commercial initiatives to establish a thriving space industry.

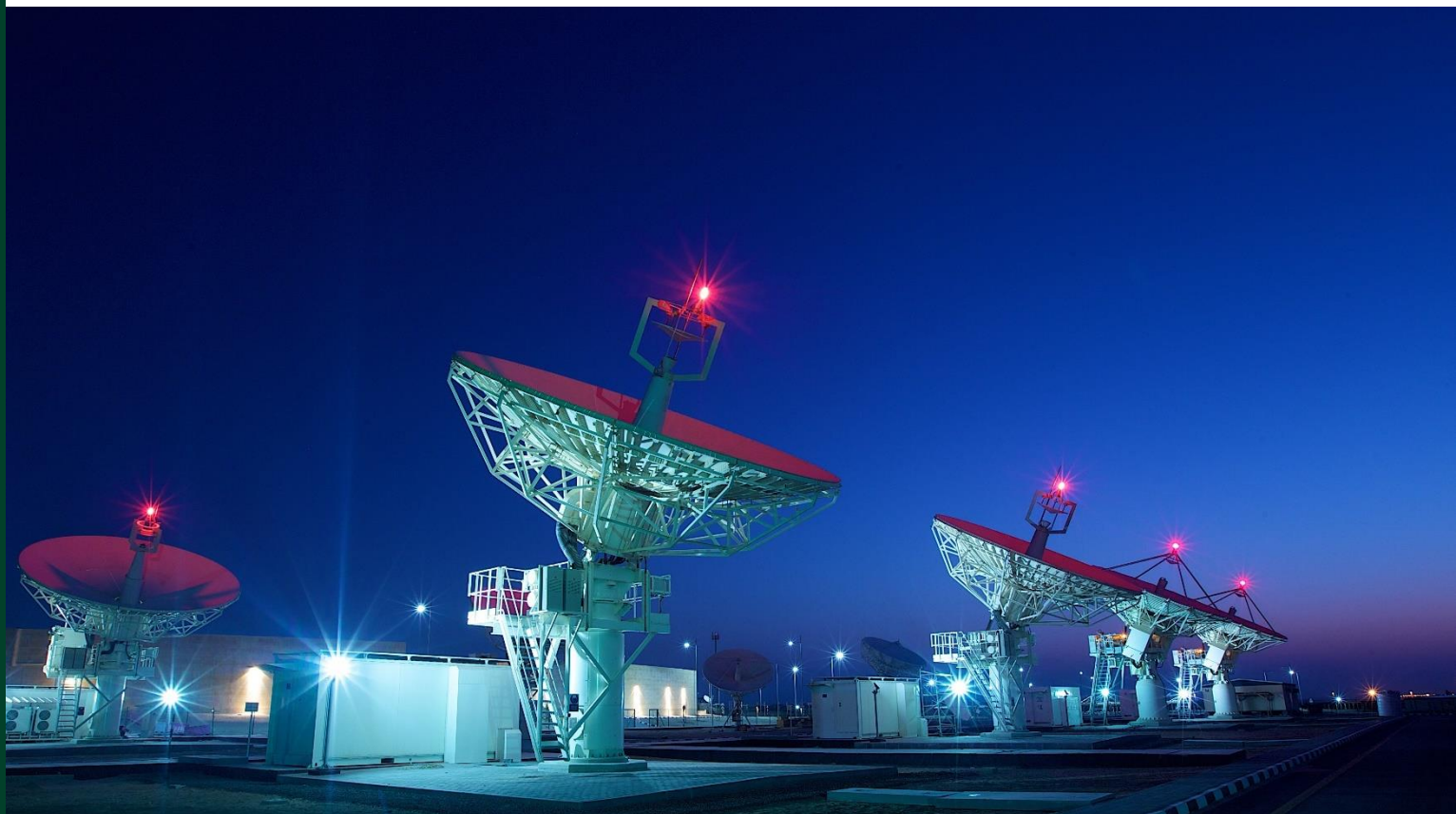
Through this and other publications and events, Yahsat will continue to engage and educate our shareholders and others about the fundamentals of our business, the challenges and opportunities that we face, and the markets that we operate in and are actively developing.

It is my hope that you will join us in shaping this exciting future!

**Ali Al Hashemi**  
Group Chief Executive Officer

1 December 2022





## Introduction

The Arab world's contribution to humanity's understanding of our cosmos is immeasurable, thanks to the great astronomers from the region. This tradition of discovery continues to this day as more and more Arab countries put astronauts into orbit and send robotic probes to Mars, Venus, and beyond. A significant part of this new flourishing in Arab exploration includes the growing number of satellite operators in the Middle East, of which Yahsat – the United Arab Emirates' premier satellite company – is an undoubted leader.

Yahsat is a public company listed on the Abu Dhabi Securities Exchange and is a subsidiary of Mubadala Investment Company PJSC. The name 'Yahsat' is derived from Al Yah, Arabic for the North Star, or Pole Star, a historically and symbolically important star in Emirati history used by sailors and Bedouins to navigate at night. Yahsat offers multi-mission satellite communications services in over 150 countries across Europe, the Middle East, Africa, South America, Asia, and Australasia. No other company in the region can offer the range of satellite services across the world as Yahsat. As disclosed on 8 November 2022, Yahsat reported double digit revenue and growth for the first nine months of 2022.<sup>1</sup>

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<sup>1</sup> See "Yahsat Reports Double Digit Revenue and EBITDA Growth for the First Nine Months of 2022," 8 November 2022, <https://www.yahsat.com/en/news-and-media/news/2022/yahsat-reports-double-digit-revenue-and-ebitda-growth> At the time of the publication of this White Paper this statement is accurate.

Yahsat operates a fleet of five satellites, with a sixth satellite being prepared for launch in H1 2024 and service in H1 2025. Yahsat satellites can reach 80 percent of the world's population and help drive economic and social development for people in many countries. Yahsat does this by providing the most advanced satellite communications services in the region.

Harnessing the spirit of innovation, sound business practices and management, as well as an eye on the future, Yahsat is not only providing value to its customers and investors, but also to the nation and region as a whole by helping shape space programmes and economies for decades to come.

This White Paper is an introduction to the Arab world's space and satellite sector and the role of Yahsat in the region and globally. Yahsat believes that by engaging openly with its customers, investors, and members of the public, it can not only provide a greater understanding of its mission and activities, but also inspire the next generation to reach further than ever before.

## MENA in Space

Over 800 years ago, Arab civilization made immense contributions to human knowledge and discovery as Arab astronomers charted the planets and stars of the cosmos. Their outstanding legacy endures to this very day as the knowledge they contributed and the methodologies they created are used by scientists around the world.

Today an Arab flourishing in space is taking place before our very eyes. This renaissance has its roots in the 1980s, when the pan-Arab satellite communications organization, ARABSAT, launched its first communications satellite. In 1985, His Royal Highness Prince Sultan bin Salman Al Saud became the first ever Arab astronaut when he orbited the Earth on the U.S. Space Shuttle as a payload specialist to launch an ARABSAT communications satellite. In 1987, Syrian cosmonaut Muhammed Faris orbited the Earth on board a Soviet Soyuz spacecraft. Since then numerous satellite communication companies have sprung up across the region, and more and more Arab countries have launched their own Earth observation satellites.

In the UAE, His Highness Sheikh Zayed Bin Sultan Al Nahyan - the Founding Father of the nation - put the country on the path to becoming a space power through his visionary leadership that has built a great nation whose ambition cannot be constrained. In the early 1970s, while visiting Spain, Sheikh Zayed and his advisors happened to watch one of the Apollo moon landings on television. While some of the advisors expressed skepticism that the landing had even occurred, Sheikh Zayed said, "If it is God's will, man can achieve anything; nothing is impossible."<sup>2</sup>

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<sup>2</sup> Quoted from Anand Raj Ok, "Dream to destiny: How Shaikh Zayed's vision inspired a nation's interstellar exploits," *Gulf News*, July 23, 2020 <https://gulfnews.com/friday/art-people/dream-to-destiny-how-shaikh-zayeds-vision-inspired-a-nations-interstellar-exploits-1.2308742#>



H.H. Sheikh Zayed being shown a model of the U.S. space shuttle by scientists and astronauts from the U.S. space agency NASA in 1976. Credit: Gulf News Archive.

The Founding Father did live to see his dream become reality. In 2000, the UAE's first communications satellite, Thuraya-1, was launched, and at the time, it was the heaviest commercial satellite ever launched. Since then, the UAE has launched 16 satellites into orbit, to include Earth observation satellites. The UAE also created the institutions needed to build a solid and long-term space programme. Founded in the year 2006, the Mohammed Bin Rashid Space Centre (MBRSC) has enabled the UAE to make significant strides in the field of space exploration. In 2014, the UAE established the UAE Space Agency under Federal Law by Decree No. 1., to provide national policy guidance and regulations for its space programme.

One of the crowning space achievements of the UAE, the fruits of Sheikh Zayed's dream, is the Emirates Mars Mission (also known as Al Amal or Hope) that was launched in July 2020 and successfully entered Mars orbit on 9 February 2021. The Al Amal probe, built by the Mohammed Bin Rashid Space Centre (MBRSC), monitors the atmosphere and climate of Mars, and the data it collects contributes to humanity's scientific understanding of the Red Planet. The UAE is one of only seven countries to send a probe to Mars.<sup>3</sup> While led by the UAE, this mission contributes to science by bringing together many countries and working with them collaboratively.

The other crowning achievement to date is the launch and safe return of the UAE's first astronaut, Hazza Al Mansouri. On 25 September 2019, Al Mansouri, along with a Russian cosmonaut and an American astronaut, was launched from the Baikonur Cosmodrome in Kazakhstan on board a Soyuz spacecraft to the International Space Station in orbit several

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<sup>3</sup> On the Emirates Mars Mission see <https://www.emiratesmarsmission.ae>

hundred kilometers above the Earth's surface. Al Mansouri's mission, called 'Zayed's Ambition', lasted eight days on board the ISS before returning to Earth on 3 October 2019.<sup>4</sup>

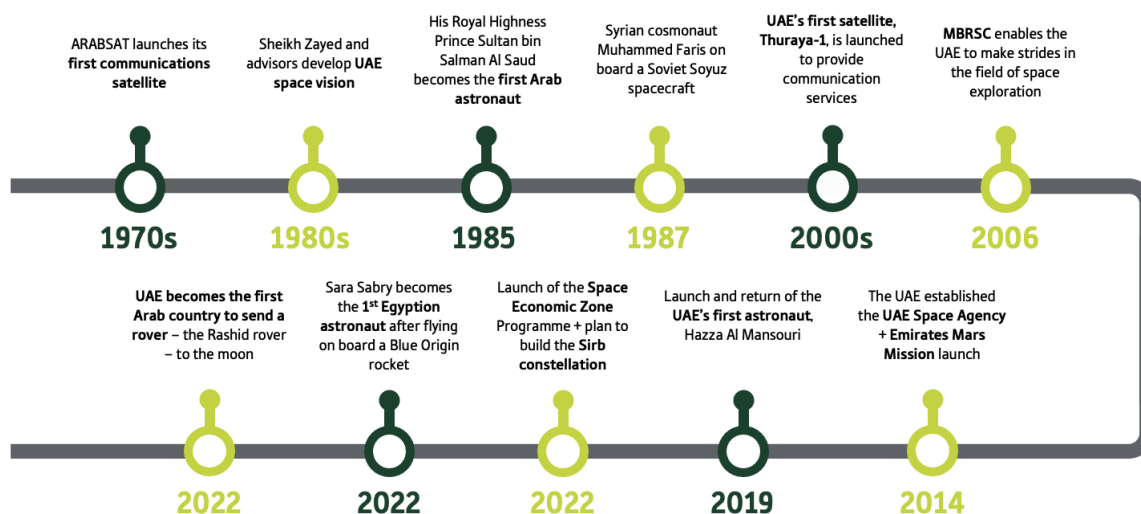


Figure One: Timeline of the region's major space activities. Source: AzurX.

And the region and the UAE is only beginning its space journey.

Bahrain and Oman will soon launch their first satellites,<sup>5</sup> and Saudi Arabia recently announced its intention to send its first astronaut, a woman, to the International Space Station in 2023.<sup>6</sup> Egypt intends to follow suit by sending its own astronaut into space in the near future,<sup>7</sup> while Sara Sabry became the first Egyptian astronaut in August 2022, when she flew to the edge of space on board a Blue Origin New Shepard rocket.<sup>8</sup> In December 2022, the UAE became the first Arab country to send a rover – the Rashid rover – to the moon.<sup>9</sup> In early 2023, the UAE will send its second astronaut, Sultan Al Neyadi, to the International Space Station for a six-month mission.<sup>10</sup> In 2028, the UAE will launch a spacecraft that will pass by the planet Venus and then rendezvous with seven asteroids in the Asteroid Belt between Mars and Jupiter.<sup>11</sup>

The UAE and Saudi Arabia are looking to attract entrepreneurs, start-ups and companies from around the world to contribute to the development of their respective private space sectors. In

<sup>4</sup> See [https://www.mbrsc.ae/team/hazaa\\_ali\\_almansoori/](https://www.mbrsc.ae/team/hazaa_ali_almansoori/)

<sup>5</sup> See "First Bahraini-built satellite to launch by December 2023," *Arab News*, 22 August 2022 <https://www.arabnews.com/node/2147506/middle-east>; and "Oman's first satellite set for orbit," *Zawya*, October 5, 2022, <https://www.zawya.com/en/economy/gcc/omans-first-satellite-set-for-orbit-ajlftwnf>

<sup>6</sup> See Jeff Foust, "Saudi astronauts to fly on AX-2 mission to ISS," *Space News*, November 1, 2022 <https://spacenews.com/saudi-astronauts-to-fly-on-ax-2-mission-to-iss/>

<sup>7</sup> See "Egypt To Send An Egyptian Astronaut To The International Space Station," *Space in Africa*, October 18, 2019, <https://africanews.space/egypt-to-send-an-egyptian-astronaut-to-the-international-space-station/>

<sup>8</sup> See Sarwat Nasir, "Sara Sabry: Blue Origin launches Egyptian engineer on its suborbital spaceflight," *The National*, August 4, 2022, <https://www.thenationalnews.com/uae/2022/08/04/sara-sabry-blue-origin-launches-egyptian-engineer-on-its-suborbital-spaceflight/>

<sup>9</sup> See <https://u.ae/en/about-the-uae/science-and-technology/key-sectors-in-science-and-technology/space-science-and-technology>

<sup>10</sup> See Sarwat Nasir, "UAE astronaut Sultan Al Neyadi to travel to space station in February on six-month mission," *The National*, November 4, 2022 <https://www.thenationalnews.com/uae/2022/11/04/sultan-al-neyadi-to-launch-to-space-station-mid-february-on-six-month-mission/>

<sup>11</sup> See <https://u.ae/en/about-the-uae/initiatives-of-the-next-50/projects-of-the-50/emirati-interplanetary-mission-2028>



January 2022, the UAE Space Agency launched the Space Economic Zone Programme, the first space-tech hub in the UAE.<sup>12</sup>

Finally, the UAE as well as many other Arab countries plan to build and launch many more communication satellites to provide further connectivity to the region and the world; as well as providing greater understanding of our environment and planet with more cutting-edge Earth observation satellites. The security of the UAE also increasingly relies on the use of communication and reconnaissance satellites, and new systems are planned to ensure our national security.<sup>13</sup> In the summer of 2022, the UAE Space Agency announced its plan to build the Sirb constellation of radar imaging satellites to be launched later this decade.<sup>14</sup>

Yahsat plays an important role in the UAE's space dream, and this will be explored in the next section.

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<sup>12</sup> See "UAE Space Agency to launch first Space Economic Zone in Masdar City," *WAM – Emirates News Agency*, 20 January 2022, <https://www.wam.ae/en/details/1395303013281>

<sup>13</sup> See [https://space.oscar.wmo.int/satelliteprogrammes/view/falcon\\_eye](https://space.oscar.wmo.int/satelliteprogrammes/view/falcon_eye)

<sup>14</sup> See Jeff Foust, "UAE announces plans for radar satellite constellation and space fund," *Space News*, July 18, 2022, <https://spacenews.com/uae-announces-plans-for-radar-satellite-constellation-and-space-fund/>

## Yahsat: The UAE's Space Pioneer

Satellite communications are crucially important to the economy and critical infrastructure of the nation, and Yahsat is the UAE's national provider of choice for the country's satellite needs.

The UAE has operated its own communication satellites since 2000, when Thuraya-1 was launched. Before the UAE Space Agency and MBRSC, there was the Thuraya Telecommunications Company - the first satellite communications company in the UAE. Founded in 1997, Thuraya was the first commercial company in the region to provide mobile-satellite services where users can communicate with each other using satellite handheld telephones linked by satellite. Thuraya soon expanded its satellite fleet with the launch of Thuraya-2 (2003) and Thuraya-3 (2008) and extended its coverage to over 150 countries throughout Europe, the Middle East, much of Africa, Asia, and Australia.



Al Yah 1 launch. Source: Yahsat.

From 1997 until 2007, Thuraya was the only satellite company in the UAE, and the only private company from the region providing mobile-satellite services. In January 2007, the Mubadala Investment Company PJSC in Abu Dhabi incorporated the Al Yah Satellite Communications Company, better known today as Yahsat, to provide multi-mission satellite communications to the UAE government as well as to commercial customers in the region and beyond. Named after the North Star, also known as the Pole Star, Al Yah was an obvious choice of name for the new satellite company.

In April 2011, Yahsat's first satellite, Al Yah 1, was launched. Its second satellite, Al Yah 2, was launched in April 2012, and the third satellite, Al Yah 3, was launched in January 2018. Whereas Thuraya's satellites provide mobile-satellite services including voice, broadband and narrowband data connectivity to small form factor terminals, Yahsat's satellites can provide everything from high-speed broadband internet and television broadcasting services through to secure communications for the government and Armed Forces.

In August 2008, Yahsat reached an agreement with the UAE Armed Forces to be its primary provider of the secure satellite communications that provide command and control for deployed UAE military units and headquarters in the UAE. Yahsat continues to provide this important service and is a proud partner of the UAE Armed Forces.

In August 2018, Thuraya became a subsidiary of Yahsat, and the two companies combined their satellite fleets and services. Today Yahsat is the leading commercial satellite communications provider in terms of range of services and extent of geographical coverage, not just in the UAE but throughout the region. Yahsat provides customers with mobile-satellite services through its Thuraya satellites, and broadband internet, broadcasting, as well as high-capacity IP services through its Al Yah satellites.

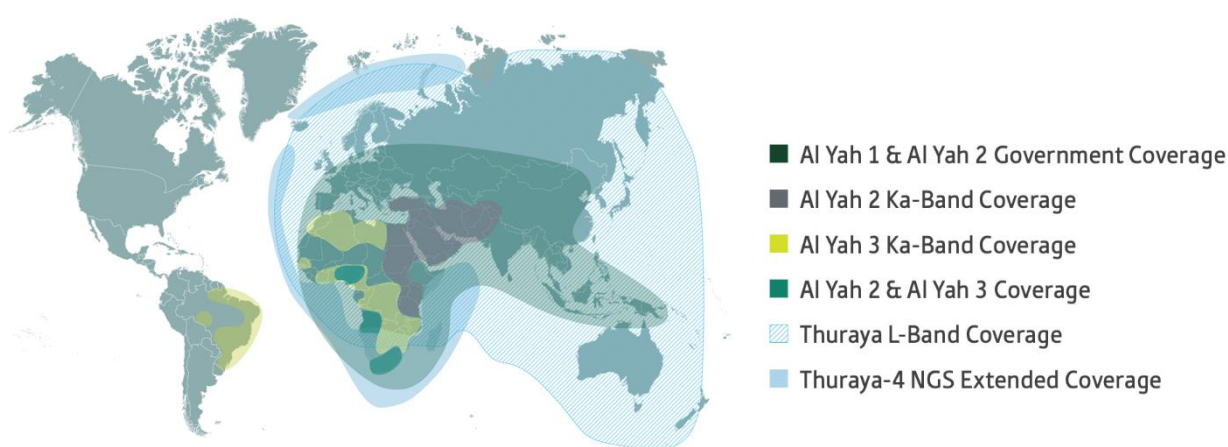


Figure Two: Geographical coverage of all Yahsat satellites. Source: Yahsat.

As of 2025, the portfolio of services provided by Yahsat will be expanded when its sixth satellite, Thuraya 4-Next Generation Satellite (NGS), becomes operational. Thuraya 4-NGS will allow Yahsat to provide communication services for the growing market segments including IoT, government and maritime services.<sup>15</sup> In October 2022, Yahsat acquired a minority stake in eSAT Global Inc., an innovative U.S. Internet of Things satellite connectivity company that will let Yahsat participate in this fast-growing market.<sup>16</sup>

The history of Yahsat is not just the story of being the foremost satellite operator in the UAE and of its corporate growth, but it is also a story of providing key technologies and connectivity for capacity building in the UAE, as part of the nation's economic diversification and is also leading the way in the UAE's efforts to reduce its carbon emissions.

<sup>15</sup> See <https://www.thuraya.com/en/services/thuraya-4-ngs>. The information provided at this link is accurate at the date of publication of this white paper.

<sup>16</sup> See "Yahsat Acquires a Minority Stake in eSat Global," 11 October 2022, <https://www.yahsat.com/en/news-and-media/news/2022/yahsat-acquires-a-minority-stake-in-esat-global>. The information provided at this link is accurate at the date of publication of this white paper.

In August 2022, Yahsat joined the UAE Climate-Responsible Companies Pledge as part of the UAE's Ministry of Climate Change and Environment's Net Zero 2050 Strategic Initiative.<sup>17</sup> Yahsat has committed to reduce its carbon emissions over the coming years in line with the national effort. In the near-future, Yahsat will also announce other initiatives to include its commitment to be a responsible and sustainable satellite operator.

In economic diversification, Yahsat is pivotal in supporting the efforts of the UAE Space Agency through the National Space Science and Technology Center (NSSTC) and Space Technology and Innovation Centre at Khalifa University which develop space initiatives, research on strategic space technologies and applications, and the funding of small satellite (CubeSat) research programmes and technology demonstrators. Yahsat also runs the Yahsat Space Laboratory at Khalifa University, providing satellite manufacturing equipment and facilities. Yahsat funded and provided technical support for two student-led CubeSat missions - MYSat-1 launched in 2018 and DhabiSat in 2021. Furthermore, in partnership with Khalifa University, the company supports the advanced education of Emirati satellite engineers, who, one day, will be able to build Yahsat's satellites here in the UAE.<sup>18</sup>

The UAE is working to become the biggest space hub in the region, to include satellite manufacturing and applications, as well as space services such as satellite insurance, financing, and law firms. As the UAE's largest commercial satellite company, Yahsat is at the centre of these activities and is proud to contribute to the nation's future space development.

As important as these activities are, however, Yahsat's core business is satellite communications, and the next section of this White Paper provides a guide to how Yahsat does this.

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<sup>17</sup> See "Yahsat Joins UAE Climate-Responsible Companies Pledge," 1 September 2022, <https://www.yahsat.com/en/news-and-media/news/2022/yahsat-joins-uae-climate-responsible-companies-pledge>. The information provided at this link is accurate at the date of publication of this white paper.

<sup>18</sup> See Space Systems and Technology Programme, <https://www.yahsat.com/en/about-yahsat/space-program>. The information provided at this link is accurate at the date of publication of this white paper.

## Understanding Yahsat's Core Business: Satellite Communications

Until the early 1960s, global communications were provided by submarine cables which traversed the world's oceans as well as by radio relay networks. Both technologies helped shape the modern world, and submarine cables are still a prominent component in global communication networks. But neither are good enough: radio-relay is unreliable due to weather and atmospheric conditions, while submarine cables cannot provide communications to remote or inhospitable regions, or for those requiring communications while on the move, such as airplanes and ships.

The first communications satellite, developed cooperatively by the United States, United Kingdom, and France, was called Telstar and was launched from Cape Canaveral, Florida, in July 1962 by NASA, the American space agency. Since 1962, thousands of communication satellites have been launched, belonging to over 40 countries. As of November 2022, there are over 2,300 communication satellites in various Earth orbits.<sup>19</sup>

### Earth Orbits

There are three main orbits at different altitudes around the Earth.

**Low-Earth Orbit (LEO)** starts at about 160 kilometres altitude and extends to about 2,000 kilometres altitude. In LEO, most Earth observation satellites orbit the Earth, as does the International Space Station. Since the late 1990s thousands of communication satellites are also orbiting in LEO, taking advantage of the short distance to the Earth's surface to provide rapid communications taking nanoseconds between satellite and user. Among the more famous satellite communication users of LEO are Iridium and SpaceX's Starlink.

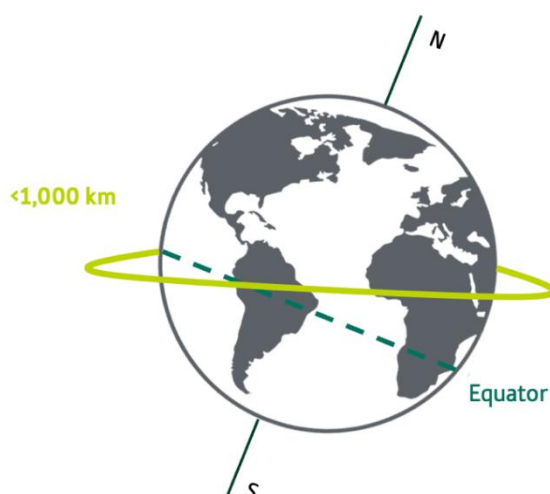


Figure Three: Low-Earth Orbit (LEO). Source: AzurX.

<sup>19</sup> This figure is based on data compiled by AzurX and is accurate at the date of publication of this white paper.

**Medium Earth Orbit (MEO)** starts at 2,000 kilometres altitude and extends to 35,786 kilometres altitude. MEO has traditionally been used by navigation satellites, also known as positioning, navigation, and timing (PNT), such as America’s Global Positioning System (GPS), Europe’s Galileo and China’s Beidou. The first communications satellite, Telstar, also operated from MEO and more recently, British satellite communications company O3B uses the same orbit for its satellites. While MEO extends across a vast distance of near-Earth space, most navigation and communication satellites in MEO operate at an altitude of around 16,000 kilometres.

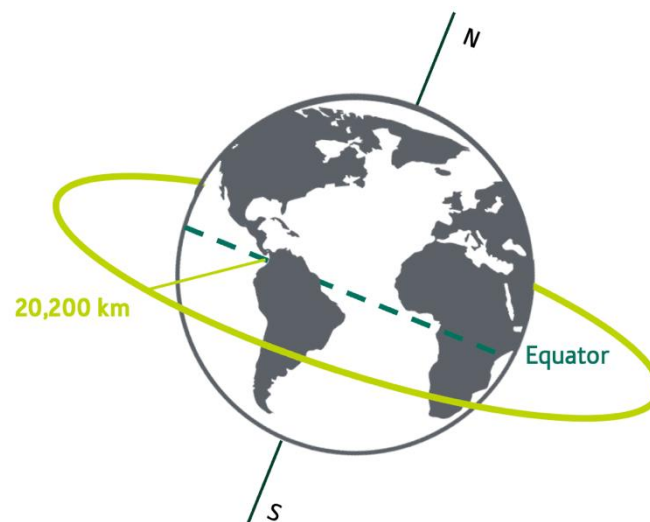


Figure Four: Medium Earth Orbit (MEO). Source: AzurX.

**Geostationary Orbit (GEO)**, also known as Geosynchronous orbit, is at 36,000 kilometres altitude and is where most satellite communications providers place their satellites, to include Yahsat’s Al Yah and Thuraya satellites. Also orbiting in GEO are weather satellites, as well as some military satellites such as missile early warning systems. What makes GEO special for satellite communications is that a single satellite in GEO can provide coverage over a large swath of the Earth’s surface.

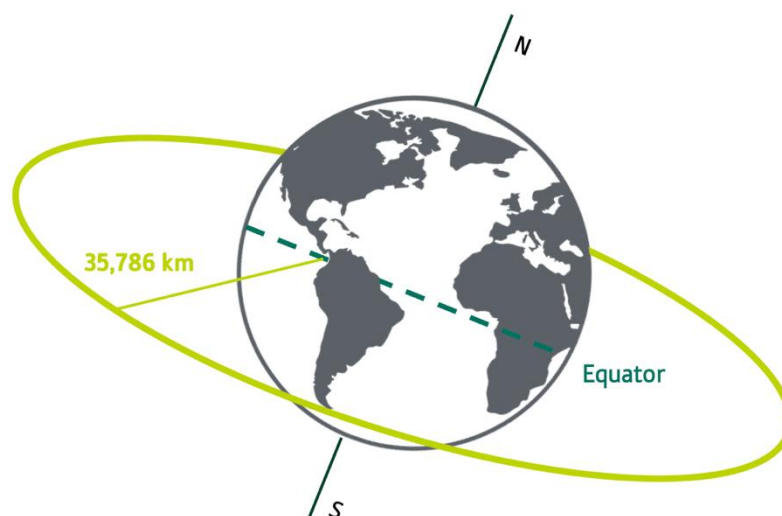


Figure Five: Geostationary Orbit (GEO). Source: AzurX.

If you looked up at a clear night's sky and could view all the satellites in the various orbits, you would notice that the satellites in LEO move rapidly across your field of view. Satellites in MEO would also move across your field of view, but more slowly. Satellites in GEO, however, will appear to an observer to be stationary in the sky (hence the term geo-stationary). Satellites in GEO are not stationary, however, because a satellite in Geostationary orbit moves around the Earth at the same speed as the Earth's natural spin on its axis.

### Satellite Frequency Bands

To provide satellite communications, Yahsat needs satellites in Earth orbit and user equipment such as satellite telephones and modems on Earth. This equipment in space and on Earth exploits a part of the naturally occurring electromagnetic spectrum that is invisible to human senses. The electromagnetic spectrum is a scarce resource and is regulated at national and international levels. In the UAE, the Telecommunications and Digital Government Regulatory Authority (TDRA) manages national spectrum issues but must coordinate that use with the UAE's neighbors.<sup>20</sup> Internationally, spectrum is regulated by a United Nations' body called the International Telecommunication Union (ITU), headquartered in Geneva, Switzerland.<sup>21</sup>

The electromagnetic spectrum today is used by everything from navigation aids and radio broadcasts through to radars and satellites. Within the portion of the electromagnetic spectrum used by satellites, there are seven prime frequency bands: L-band, S-band, C-band, X-band, Ku-band, Ka-band, and Very High Frequency (VHF) band. In the coming years the Q- and V-bands will be developed and could change the satellite communications landscape.

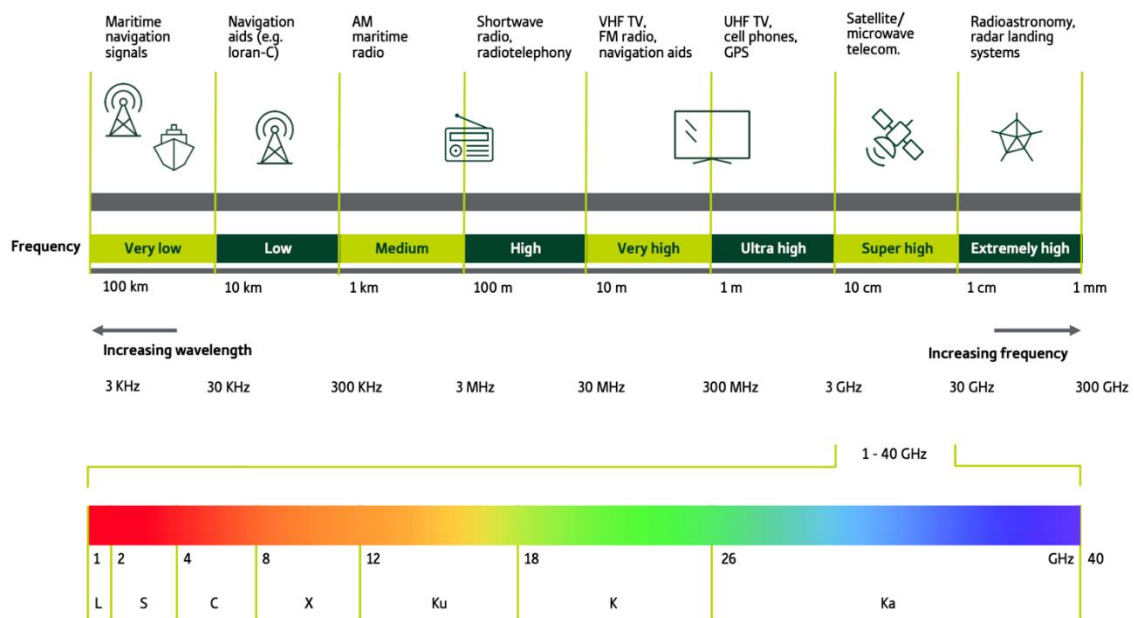


Figure Six: Information Graphic of satellite spectrum and bands. Source: AzurX.

<sup>20</sup> See <https://tdra.gov.ae/en/>

<sup>21</sup> See <https://www.itu.int/en/Pages/default.aspx>

Yahsat's satellites use the L-, C-, Ku-, and Ka-bands to provide their services.

The Thuraya mobile-satellite services satellites use the L-band that are suitable for voice and narrowband data communications, whether it is a satellite telephone conversation or an Internet of Things (IoT) network, which is tracking assets such as ships and vehicles or critical infrastructure such as pipelines. Thuraya satellites also use C-band for communication between the satellite and ground station gateways.<sup>22</sup>

Yahsat's Al Yah satellites use the C-, Ku-, and Ka-bands to provide their services. For example, Al Yah-1 has eight C-band transponders, 25 Ku-band transponders, and 21 Ka-band transponders. Al Yah-2 has 25 Ku-band and 21 Ka-band transponders, and Al Yah-3 has 58 Ka-band transponders.<sup>23</sup>

SATELLITE	SPECTRUM BAND	DATE LAUNCHED
Thuraya-1	L-band, C-band	2000 (since retired)
Thuraya-2	L-band, C-band	2003
Thuraya-3	L-band, C-band	2008
Thuraya-4	L-band, Ka-band	2024
Al Yah-1	C-, Ka-, and Ku-bands	2011
Al Yah-2	Ka-band	2012
Al Yah-3	Ka-band	2018
Al Yah-4	TBD	By 2026
Al Yah-5	TBD	By 2026

Table One: Past, current, and future Yahsat satellites. Source: AzurX.

The C-band is primarily used for satellite television broadcasting as well as communications of large amounts of data. C-band is ideal for usage in regions subject to tropical rainfall such as Africa, South America, and South and Southeast Asia. Ku-band is used for direct broadcasting as well as broadband internet communications. Ka-band is used for broadband internet communication as well as for secure communications by governments, militaries, and other users.

### What Does a Geostationary Satellite Communications System Look Like?

Putting these elements together creates a satellite system, comprising the satellite, the up and down links that utilize the spectrum bands, and the ground and user segments.

<sup>22</sup> See "Our Fleet," <https://www.yahsat.com/en/about-yahsat/our-fleet>. The information at this link is accurate at the date of publication of this white paper.

<sup>23</sup> See "Our Fleet," <https://www.yahsat.com/en/about-yahsat/our-fleet>. The information at this link is accurate at the date of publication of this white paper.



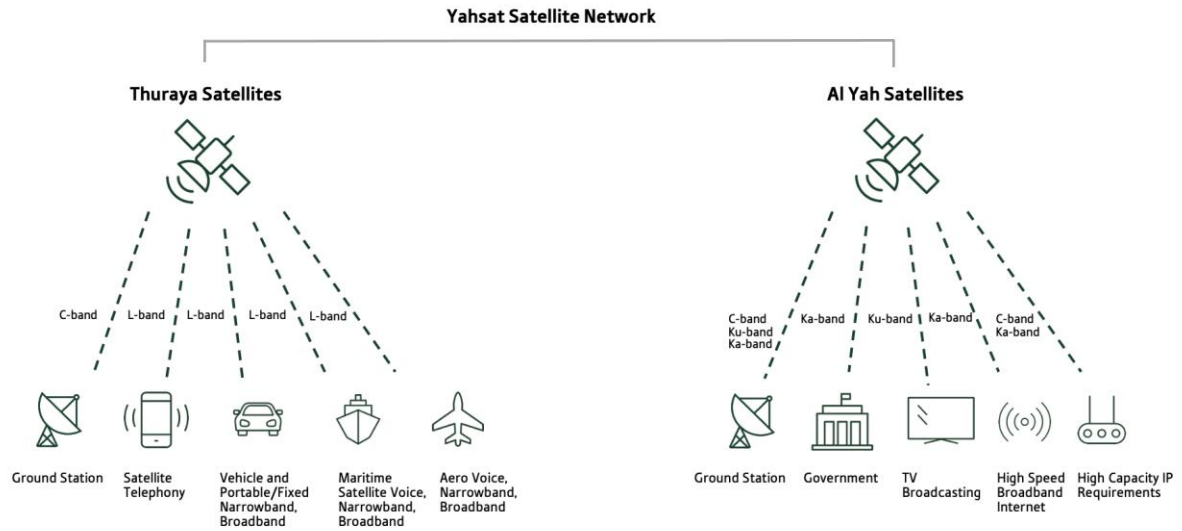


Figure Seven: Depiction of Yahsat’s satellite communications system. Source: AzurX.

## Yahsat: The Region's Leading Satellite Communications Provider

Yahsat provides customers with L-, C-, Ku-, and Ka-band satellite communication services. Other providers in the region either focus on television broadcasting services, broadband internet, or a mixture of both.

COMPANY	COUNTRY	FLEET SIZE	PLANNED SATELLITES	SPECTRUM BANDS
Yahsat	UAE	5	3	L-, C-, Ka-, & Ku-bands
ARABSAT	Pan-Arab organization, headquartered in Saudi Arabia	6	2	C-, Ka-, & Ku-bands
Es'hailSat	Qatar	2	N/A	Ka- & Ku-bands
NileSat	Egypt	4	N/A	C-, Ka-, and Ku-bands
TurkSat	Turkey	5	1	Ka- & Ku-bands
AzerCosmos	Azerbaijan	2	N/A	C-, Ka-, & Ku-bands
OmanSat	Oman	0	1 (2024)	Ka-band

**Table Two: Comparison of regional satellite operator fleet size, planned satellites, and spectrum bands used (excluding military satellites). Source: AzurX.**

Moreover, Yahsat provides its services across five continents, whereas other regional providers focus on the immediate region and parts of Europe, Africa, and Asia.

COMPANY	MENA	EUROPE	AFRICA	CENTRAL & SOUTH ASIA	SOUTHEAST ASIA	AUSTRALIA & NEW ZEALAND	SOUTH AMERICA	NORTH AMERICA
Yahsat	√	√	√	√	√	√	√	X
ARABSAT	√	√	√	√	X	X	X	X
Es'hailSat	√	√	√	X	X	X	X	X
NileSat	√	X	√	X	X	X	X	X
TurkSat	√	√	√	√	X	X	X	X
AzerCosmos	√	√	√	√	X	X	X	X
OmanSat	√	√	√	√	√	X	X	X

**Table Three: Comparison of geographic coverage of regional satellite operators. Source: AzurX.**

## Yahsat's Businesses

“Yahsat has delivered another excellent performance with third quarter revenue and EBITDA growth accelerating compared to the first half of 2022. Our core Government business has performed particularly well with quarterly revenues in our Managed Solutions business more than doubling year-on-year. Through the procurement of the T4-NGS satellite, which we expect to launch in the first half of 2024 and enter operations in the first half of 2025, we remain well positioned to meet the UAE Government’s increasing demand for advanced satellite communication solutions.”<sup>24</sup>

Ali Al Hashemi, Group CEO, Yahsat

To provide its range of services over much of the planet, Yahsat operates five distinct business units. As well as being one of the largest satellite communications companies in the region, Yahsat also provides the widest range of services.

COMPANY	TV BROADCASTING	BROADBAND INTERNET	L-BAND VOICE/DATA	SECURE COMMUNICATIONS	DIRECT -TO- DEVICE	INTERNET OF THINGS	SATELLITE BACKHAUL
Yahsat	√	√	√	√	√	√	√
ARABSAT	√	√	X	√	X	X	X
Es'hailSat	√	√	X	√	X	X	X
NileSat	√	√	X	X	X	X	X
TurkSat	√	√	X	√	X	X	√
AzerCosmos	√	√	X	X	X	X	√
OmanSat	√	√	X	√	X	X	√

Table Four: Comparison of SATCOM services provided by regional satellite operators. Source: AzurX.

## Yahsat Government Services

Many users of satellite communications require secure services using encryption and technical capabilities that prevent jamming. Militaries and governments are by far the biggest users of such services, but so do energy companies, financial institutions, law enforcement, and infrastructure operators. Securing data is essential for these users in order to maintain continuity of essential and sensitive operations as well as for national security purposes. Yahsat Government Services (YGS) provides Ka-band satellite communications for secure connectivity. The main clients of Yahsat Government Services are the UAE Armed Forces as well as the UAE Government, providing secure satellite communications for military units, ministries, and embassies around the world.<sup>25</sup>

<sup>24</sup> See “Yahsat Reports Double Digit Revenue and EBITDA Growth for the First Nine Months of 2022,” 8 November 2022, <https://www.yahsat.com/en/news-and-media/news/2022/yahsat-reports-double-digit-revenue-and-ebitda-growth>. The information at this link is accurate at the date of publication of this white paper.

<sup>25</sup> See <https://www.yahsat.com/en/about-yahsat/government-solutions>. The information at this link is accurate at the date of publication of this white paper.

## Thuraya

“Mobility Solutions...achieved double digit revenue growth during the first nine months of the year.”<sup>26</sup>

Ali Al Hashemi, Group CEO, Yahsat

Another important segment of satellite communications users are the shipping industry, remote facilities such as oil platforms and mines, humanitarian aid organisations, news media, and militaries and governments. These users require mobile communications services where normal mobile telephone services are unavailable. Using satellite telephones that provide voice and messaging communications, these users can maintain connectivity no matter where they might be. Thuraya provides mobile-satellite services to customers in over 150 countries.

L-band mobile-satellite services include Direct-to-Device (D2D) connectivity such as satellite telephone communications at sea, on land, or in the air as well as data exchanges for Internet of Things (IoT) networks for customers such as infrastructure operators or logistics companies that need to remotely operate and track assets, containers, and infrastructure in real-time and over vast geographical distances.<sup>27</sup>

## YahClick

Access to reliable internet services in remote parts of the world, or in areas that are underserved by regular telecommunications infrastructure, is another important segment served by satellite communications. Reliable access to the internet is essential for social and economic development, education, and local commerce in such parts of the world. YahClick is Yahsat’s premier satellite broadband service with coverage across Africa, Middle East, Southwest Asia, and Brazil through its Ka-band satellites. The Al Yah 2 and Al Yah 3 satellites were launched primarily for commercial purposes to offer secure and reliable broadband data via YahClick, to provide coverage for underserved and unserved communities. Today, YahClick’s footprint covers one billion people in high-growth, emerging markets, who benefit from affordable broadband solutions to individual consumers, enterprises, mobile network operators, and governments.<sup>28</sup>

## YahLink

Satellite communications are also essential for connecting individual mobile telephone users to the world. Mobile telephone or internet users that need to make a call to another part of the world or access another network in another country rely on their local telecommunications or internet service provider for connectivity. What is not known by most users is that connecting a local network to another network overseas or across a vast geographical area relies on

<sup>26</sup> See “Yahsat Reports Double Digit Revenue and EBITDA Growth for the First Nine Months of 2022,” 8 November 2022, <https://www.yahsat.com/en/news-and-media/news/2022/yahsat-reports-double-digit-revenue-and-ebitda-growth>. The information at this link is accurate at the date of publication of this white paper.

<sup>27</sup> See <https://www.thuraya.com/en/services>. The information provided at this link is accurate at the date of publication of this white paper.

<sup>28</sup> See <https://www.yahclick.com>. The information provided at this link is accurate at the date of publication of this white paper.

satellite communications. This kind of satellite service is called satellite backhaul and ensures global connectivity for individual users. Today mobile network operators and fibre optic cable providers actively invest in 4G and 5G networks and new fibre optic cables. For rural and remote users, and underserved, and unserved communities, these terrestrial services cannot be provided because of either geographical challenges or the expensive cost of laying fibre optic cables. In these circumstances, satellite communications provides the required data and mobile satellite data solutions. YahLink is a business-to-business service that supports internet service providers and telecommunication companies by extending the reach of their networks.

Other than internet service providers and telecommunication carriers, YahLink's customers include oil and gas exploration teams, oil and gas rigs, remote facilities and military bases, broadcast media, as well as back-up services for when undersea cables are disabled.<sup>29</sup>

### **Yahlive**

Finally, one of the largest uses of satellite communications is television broadcasting. More and more households across the world are now able to watch multiple channels in their native languages, catch up on the latest news, or watch a live sports event taking place on the other side of the planet, thanks to satellite communications. Yahlive is Yahsat's satellite television broadcast service that provides coverage for over 114 million viewers across the Middle East, Europe, North Africa, and Southwest Asia.<sup>30</sup>

### **Emerging Services**

In October 2021, Yahsat announced that it has been appointed by the UAE government to complete detailed analysis, assessment and recommendation for two new satellites, Al Yah 4 and Al Yah 5, to expand its government services capacity and support the UAE Government's and UAE Armed Forces growing satellite communications requirements. These two satellites are targeted for launch in 2026.<sup>31</sup>

The planned launch in 2024 of Thuraya 4-NGS will enable Yahsat to address the growing Direct-to-Device (D2D) market across its extensive coverage area, as well as better serve the Internet of Things (IoT), maritime and government market segments. L-band data services are now transforming into D2D and IoT services that are the result of Fourth Industrial Revolution technological trends.

D2D communications allow mobile telephone, as opposed to satellite telephone users to communicate with each other via satellite. Instead of mobile telephone signals going through a nearby cell tower or base station, the signal is transmitted up to a satellite and then down to

<sup>29</sup> See <https://www.yahsat.com/en/about-yahsat/yahlink>. The information at this link is accurate at the date of publication of this white paper.

<sup>30</sup> See <https://www.yahlive.com>. The information provided at this link is accurate at the date of publication of this white paper.

<sup>31</sup> See "Yahsat appointed by UAE Government to assess expansion of existing fleet with two new satellites," 5 October 2021, <https://www.yahsat.com/en/news-and-media/news/2021/yahsat-appointed-by-uae-government-to-assess-expansion-of-existing-fleet-with-two-new-satellites>. The information provided at this link is accurate at the date of publication of this white paper.

the intended recipient. D2D service will truly revolutionize connectivity, as it will allow individuals to communicate globally at affordable prices via satellite using a regular mobile phone.<sup>32</sup>

IoT is the convergence of several technological trends such as ubiquitous computing and small sensors that can connect numerous objects such as physical assets, vehicles and other objects across large geographical areas. Small sensors placed on or embedded in these objects communicate with each other with minimal human intervention (or even none). Satellite-based Internet of Things can extend the reach of these capabilities as well as provide connectivity to objects in remote locations, or for ships and other vehicles on the move.<sup>33</sup>

In October 2022, Yahsat acquired a minority stake in eSAT, Inc., an American Internet of Things satellite company, that will help expand its offering in the growing D2D and IoT markets.<sup>34</sup>

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<sup>32</sup> See Ali Al Hashemi, "How direct satellite-to-device connectivity can transform the SATCOM sector," *Gulf Business*, November 7, 2022, <https://gulfbusiness.com/how-direct-satellite-to-device-connectivity-can-transform-the-satcom-sector/>

<sup>33</sup> See <https://www.thuraya.com/en/services/m2m-iot>. The information provided at this link is accurate at the date of publication of this white paper.

<sup>34</sup> See "Yahsat Acquires a Minority Stake in eSat Global," 11 October 2022, <https://www.yahsat.com/en/news-and-media/news/2022/yahsat-acquires-a-minority-stake-in-esat-global>. The information provided at this link is accurate at the date of publication of this white paper.

## Yahsat Shapes the Future: Driving the UAE's Space Economy

Yahsat is a UAE space pioneer as well as a provider of satellite communications services at the cutting edge of technology and customer service.

Yahsat is supporting the future of the UAE's space programme and emerging space economy. This support includes former employees of Thuraya and Yahsat going on to fill senior positions in the UAE's space and satellite institutions and other companies. Yahsat also supports and enables the development of satellite manufacturing in the UAE through the Space Technology and Innovation Centre and the Yahsat Space Laboratory at Khalifa University. Yahsat provides the facilities and opportunities for new engineers and entrepreneurs in the UAE to develop their own space and satellite systems and applications. Through its partnership with Khalifa University, Yahsat is also helping produce the next generation of UAE satellite engineers who will be the future leaders and entrepreneurs to sustain the UAE's space programme. More importantly, the amount of investment Yahsat makes in new satellite technology, job creation and knowledge transfer drives the UAE space sector forward.

Importantly, in November 2021, Yahsat and the UAE's Tawazun Economic Council announced the creation of Star Technologies.<sup>35</sup> This new venture will harness future satellite engineering talent and facilities already being developed by Yahsat's other initiatives with the aim of creating a satellite communications manufacturing capability in the UAE, further enhancing the nation's growing space industrial base.

The U.S. investment bank Morgan Stanley forecasts that the global space economy will be worth one trillion dollars by 2040.<sup>36</sup> This space economy is largely based on satellite communications that provide the foundation for activities on Earth, and Yahsat is well-placed to capture a significant portion of market share with its advanced satellite technology, geographical reach, visionary yet focused business units, and a discerning eye on future business opportunities.

Yet it is not just satellite communications that will build the future space economy. As Yahsat helps develop the next generation of satellite engineers and entrepreneurs, along with the UAE's achievements in Mars orbit, on the lunar surface, and beyond, it is possible that the nation will play its part in the space economy on the Moon, Mars, and the Asteroid Belt in the decades to come.

What is abundantly clear is that Yahsat is unique in the region as it prioritises new sectors that drive further growth for the company, its investors, and the nation.

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<sup>35</sup> See Tawazun and Yahsat launch Star Technologies to develop and manufacture satellite communications technology," 16 November 2021, <https://www.yahsat.com/en/news-and-media/news/2021/yahsat-tawazun-star-technologies>. The information provided at this link is accurate at the date of publication of this white paper.

<sup>36</sup> See Morgan Stanley, "The Space Economy's Next Giant Leap," <https://www.morganstanley.com/Themes/global-space-economy>

## Glossary

4G	The fourth generation of broadband cellular network technology.
5G	The fifth generation of broadband cellular network technology.
Backhaul	The use of communication satellites to connect cellular networks to other cellular networks.
Broadband	High-speed Internet access.
Direct-to-Device (D2D)	Using a mobile phone to connect directly with a satellite rather than through a satellite ground station gateway.
Earth Observation Satellite	A satellite with a camera, imaging radar, or other type of sensor that takes pictures and images of the Earth's surface.
Electromagnetic Spectrum (EMS)	The naturally occurring range of frequencies that are exploited by technology to either communicate or observe.
Frequency	A particular section of the EMS that is measured in the number of waves that pass a fixed point in time.
Gateway	A ground station that transmits data to/from the satellite to a local area network, such as a mobile telephone network.
Geostationary Orbit (GEO)	An orbit over the Earth's Equator at 36,000 km altitude. Used by many communication and meteorological satellites.
Internet-of-Things (IoT)	A network of interconnected objects and even people and animals using small sensors, computers, and means of communication such as satellite communications. With regard to objects IoT is sometimes known as a Machine-to-Machine (M2M) network.
Low-Earth Orbit (LEO)	An orbit located between 150 km and 2,000 km altitude used by many communications and Earth observation satellites as well as the International Space Station and China's Tiangong space station.



Medium Earth Orbit (MEO)	An orbit located anywhere between 2,000 km and 36,000 km altitude, but many communications and positioning, navigation, and timing (PNT) satellites operate at an altitude of about 12,200 km altitude.
Positioning, Navigation, and Timing (PNT) Satellite	A satellite that can provide positioning and navigation data to a person or object on Earth and provide highly accurate timing services. The most commonly known example of a PNT satellite is the U.S. Global Positioning System (GPS).
Satellite	A machine that is made up of computers, communications equipment, or a camera or sensor, as well as solar panels and small amount of fuel that orbits the Earth in LEO, MEO, or GEO.

Want to know more? Please visit [www.yahsat.com](http://www.yahsat.com)

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