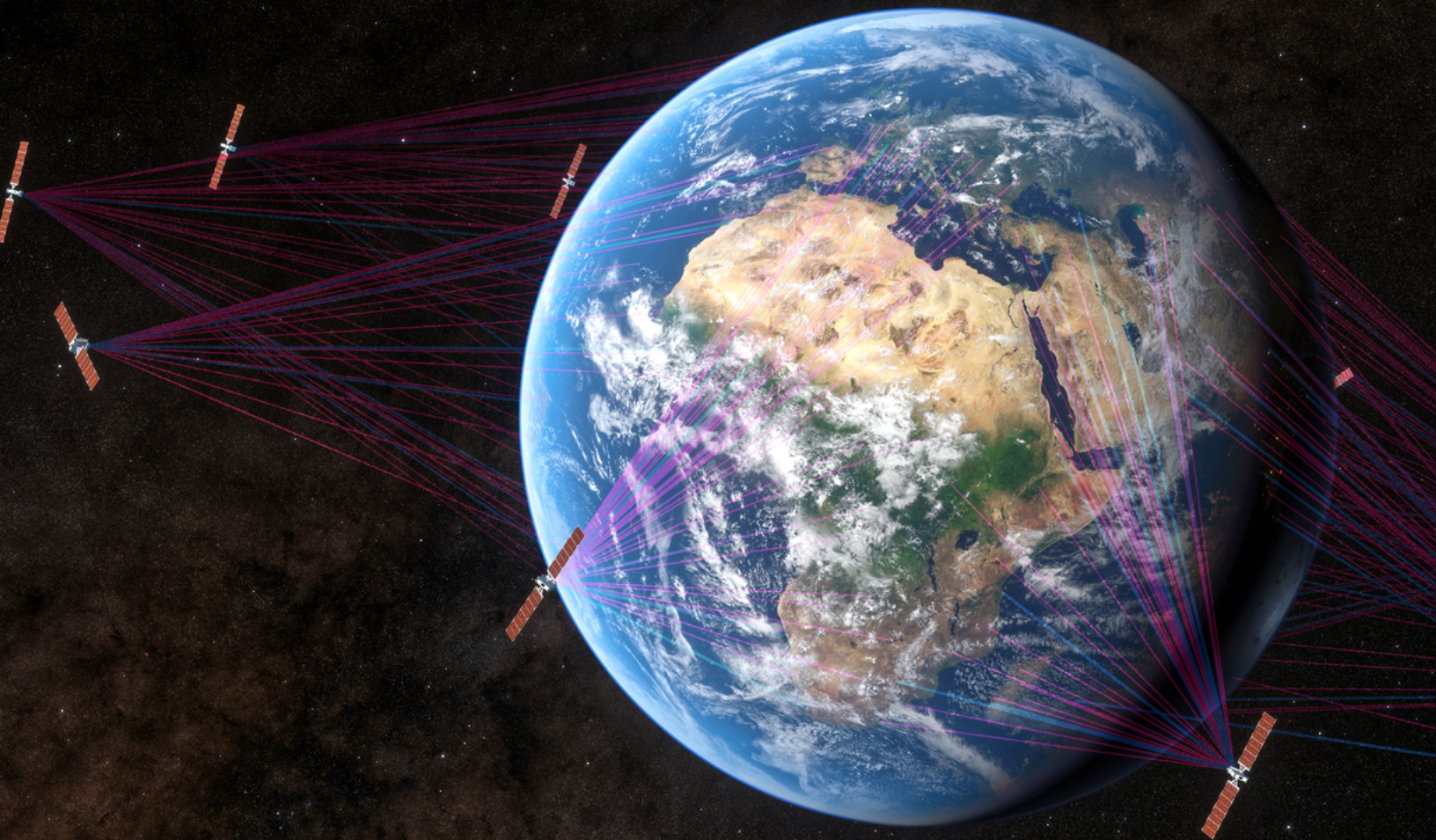


Worldwide Satellite Magazine

# ***SatMagazine***

May 2021



Artistic rendition of SES's O3b mPOWER MEO satellite constellation.  
Image is courtesy of SES.

# ***Cellular Backhauling Over Satellites***

**NOT FOR YOU? WELL,  
THINK AGAIN!**

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## CELLULAR BACKHAUL OVER SATELLITE (CBH) THE PROMISE OF BRIDGING THE DIGITAL DIVIDE

The need to bridge the digital divide is now stronger than ever before and has been exasperated by the COVID-19 pandemic that has caused a significant rise in demand for connectivity and especially in the surge of demand on cellular networks.

We see a record need for video streaming and bandwidth hungry applications that are coming about due to work and study from home, social distancing that is increasing the reliance on communication from home, as well as additional connectivity requirements to support users during this global crisis.

As not everyone in the developing world can afford computers but do possess 4G smart phones, internet via those crucial devices backhauling over satellite is the fastest solution for bridging the digital divide. There is a need to reach underserved areas quickly with a satellite alternative to terrestrial networks that do not provide an adequate solution or are altogether nonexistent.

The adoption of *cellular backhaul (CBH)* over satellite has increased substantially over the past years and is expected to continue to do so, according to various industry analysts. In a recent report published by research firm **NSR**, CBH was singled out as the key vertical expected to drive growth in the satellite communications market.

Satellite backhauling has become an economically viable solution that can answer the strictest *Service Level Agreements (SLAs)*, and for many *Mobile Network Operators (MNOs)*, is no longer a niche play. In the past, the satellite option for CBH was often used only as a fallback for hard to reach rural areas, such as islands, mountains and deserts, where terrestrial infrastructure, such as fiber, next-generation copper or microwave, were either too expensive or unfeasible. Today, Gilat sees that the increasing need for high-throughput data networks together with improved economics and advancements in technology, in both satellite capacity and the ground-segment, are causing MNOs to rethink old habits.

Furthermore, the advantages of satellite communication are particularly relevant during this pandemic, due to record-time deployment as well as being able to reach anyone, anywhere. In addition, MNOs are increasingly focused on their core business and outsourcing non-core competencies, thereby opening the opportunity for satellite communication as a managed service.

Gilat is recognized as the world leader in CBH over satellite, reaching 44 percent market-share in modem shipments according to a report by industry analyst NSR in 2020. Gilat, with its **SkyEdge II-c** platform and **Capricorn** family of VSATs, has deployments of large networks worldwide that consist of tens of thousands of sites that are being connected with satellite backhaul, providing a major impact in narrowing the digital divide and promoting equal opportunity.

Additionally, these network extensions over satellite are a significant source of revenue generation to the MNOs, indicating that, indeed, satellite backhaul has moved into the mainstream.



### Dispelling the Myths About CBH Over Satellite

While the business case for satellite backhaul has never been stronger, there still remains one major barrier to widespread deployment, and that is — **perception**. Common, negative misperceptions of satellite backhaul revolve around three myths: **inadequate performance**, **high cost** and **unmanageable complexity**. One of the main reasons for these misperceptions is a lack of familiarity with satellite technology. Often, decision makers are unaware of the recent innovations in satellite technology, leading to their apprehension about its suitability for cellular backhaul.

The best way to alleviate these false impressions is to examine the common myths one by one.

#### => Myth 1

#### **4G/5G Performance Cannot be Met with Satellite Backhaul**

With the large amounts of required data communication, MNOs raise concerns that VSATs are not able to deliver the required LTE performance to the handset and will not be able to support the high throughput required for the 5G network architecture.

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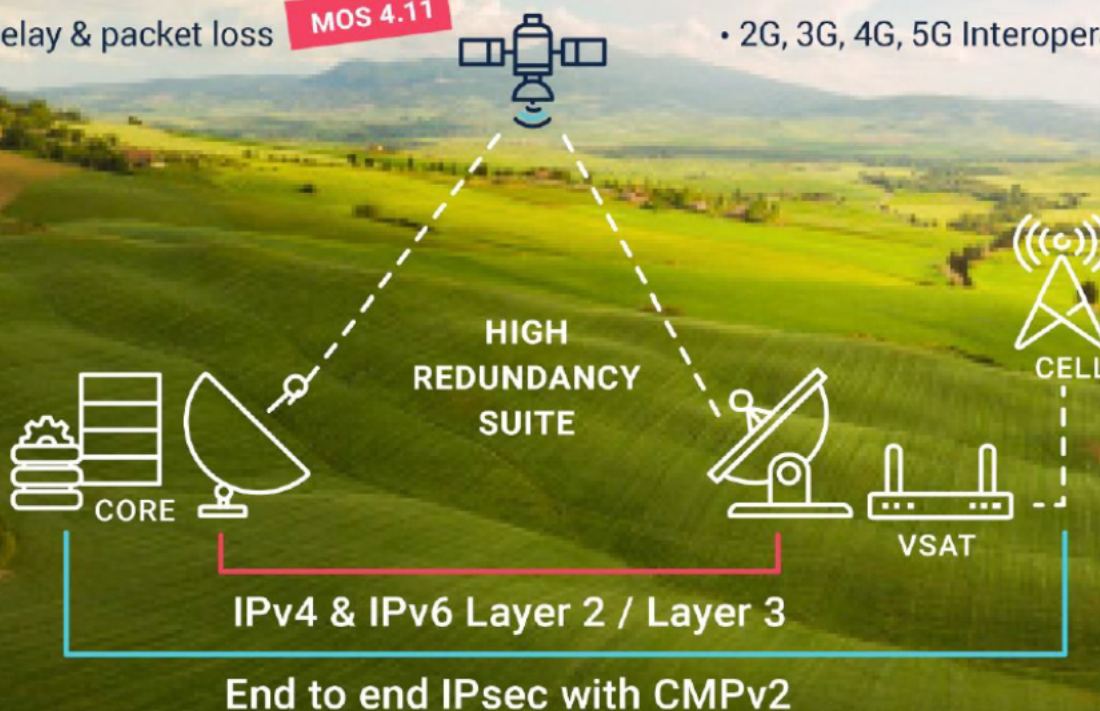
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## SEAMLESS INTEGRATION AND FUTURE PROOF

In addition, as satellite communication has an inherent delay, a concern is raised that this will result in poor backhaul performance and consequentially a poor user experience.

### => Fact

#### **Acceleration Technology and High-Performance Modems Mitigates Latency Effects**

The inherent satellite delay can be overcome by using acceleration technology that addresses the latency effects. Mitigating the latency effect, makes it possible to achieve high throughput which requires high performance modems to accommodate the traffic and provide the required high-quality user-experience. Such a solution is especially critical when high bandwidth is required, like in 4G/5G deployments.

An outstanding solution was jointly developed and patented by Gilat and SoftBank. The innovative technology enables true high speeds, through acceleration of traffic inside the GTP tunnel. This acceleration technique has been embedded in Gilat's Capricorn VSAT and was implemented initially in Japan.

Now this achievement of enabling true LTE performance is deployed in Tier-1 mobile networks around the globe including in North America, South America, Asia, Europe and Australia. Furthermore, this acceleration technique and the Gilat 5G ready system architecture, in combination with high throughput

VSATs, allow operators to start deploying 5G Standalone (SA) and Non-Standalone Architecture (NSA) networks over satellite.

In addition, as the satellite industry evolves to **Non-Geostationary Satellite (NGSO)** constellations, the satellite latency concern is further mitigated with **medium and low orbit (MEO/LEO)** constellations, significantly reducing the satellite distance from the earth.

### => Myth 2

#### **Satellite Connectivity is Expensive**

In the past, the cost of satellite bandwidth capacity and management of the satellite backhaul often caused satellite-based communications to be prohibitively expensive for providers of broadband services, such as MNOs.

### => Fact

#### **Satellite Capacity Pricing at Times Rivals Terrestrial Bandwidth Costs**

With the continued launch of **High Throughput Satellites (HTS)** and **Very HTS (VHTS)** satellites, as well as the promise of NGSO constellations, industry analysts are expecting a further decline in bandwidth prices due to the abundance of satellite capacity, propelling satellite solutions into the mainstream. Based on these trends, it is expected the cost for satellite backhaul networks will

# TIER-1 MNOS CHOOSE GILAT



compete with those of terrestrial backhaul networks for many use cases.

## => Fact

### **Bandwidth Sharing for Efficient Resource Allocation Reduces Costs Even Further**

Gilat implements access schemes such as TDM/TDMA that do not waste bandwidth when not needed and provide sufficient capacity to meet peak usage. Gilat's SkyEdge II-c platform ensures that bandwidth is adjusted according to usage, for better cost efficiency.

## => Myth 3

### **Satellite Connectivity is Too Complex**

A third common misperception is that satellite technology is too complex for cellular backhaul networks. MNOs already have their hands full with their rapidly evolving mobile networks, and the last thing they want is added complexity for backhaul.

## => Fact

### **Accelerated Layer-2 Support Facilitates Satellite Network Integration**

A factor contributing to satellite backhaul complexity relates to the **OSI** network layer, which is where the integration of the satellite and terrestrial cellular networks occurs. Satellite networks traditionally operate at **Layer-3 (network layer)** to be able to accelerate the user data, while MNO networks, in some cases, operate at **Layer-2 (data link layer)**. Gilat's SkyEdge II-c has the advantage of supporting accelerated data while operating at a carrier-grade Layer-2, thus easing MNOs satellite integration while extending traditional terrestrial networks.

## => Fact

### **Global Network Management Reduces Complexity**

Another way to reduce satellite backhaul complexity is to use a sophisticated global **network management system (NMS)**. Gilat's **TotalNMS** enables full provisioning, configuration, control and monitoring of all satellite hub elements, as well as remote terminals, regardless of their physical location. This is crucial for streamlining the management, allowing MNOs easily and cost-effectively scale to support any network size and enabling them to start small and add sites as needed.

## => Fact

### **Managed Service Reduces Costs**

Significant savings in cost can be achieved by regarding satellite backhaul as a managed service. The MNO specifies the requirements, the SLA and key performance indicators, as well as the required site locations and the schedule. Considering the managed service as a black box and giving end-to-end responsibility to Gilat, enables the MNO to focus on their core competency and promote their business.

To conclude, these presented facts dispel the myths:

- *As satellite technology has evolved to deliver speed, performance and terrestrial-grade user experience, inadequate performance is negated.*
- *Today's satellite TCO rivals' terrestrial solutions, in many cases, resulting in high costs dispelled.*
- *Since comprehensive suites of services simplify deployment, integration and operation, unmanageable complexity is dispelled.*

## ***Gilat Holds More Than 80 Percent Market-Share Of Satellite 4G CBH Market***

Both the economics, as well as overcoming technical challenges, have brought 4G/LTE satellite backhauling to the forefront in the more established markets as well as in the developing world. Clearly, the traditional markets of Asia, Africa, and Latin America are prime candidates for connectivity due to their lack of terrestrial infrastructure. However, at Gilat, we see significant growth and need in the developed world, including North America, Japan and Australia.

Gilat's achievement of holding more than 80 percent market-share in satellite backhaul for 4G/LTE installations worldwide, is due to both technological capabilities as well as global expertise, local presence, outstanding support and superior delivery capabilities.

The use cases vary greatly and have changed worldwide over the years to serve a variety of applications such as emergency response and Internet of Things (IoT). In addition, today's applications require high throughput just as much for upload, as well as for download. End-users want to share data such as videos and photos over social media, shifting from a download centric traffic profile to a growing need for data upload. To meet these needs, Gilat is continually evolving its VSATs to address the changing requirements.

Tier-1 MNOs worldwide have implemented Gilat's solution. Some examples include:

*In the US: TMobile and Sprint*

*In the UK: BT/EE*

*In Australia: Telstra and Optus*

*In the Philippines: Globe Telecom*

*In South America: Telefonica and TIM*

*In Japan: Gilat dominates the satellite backhaul market with Softbank, NTT Docomo and KDDI, among others.*

In all of these situations, and more, satellite backhauling is a quick solution that can be deployed anywhere. In many circumstances the costs and time involved in setting up a terrestrial infrastructure, if even feasible, would not be cost effective.

Extending cellular networks outside of crowded urban areas is the primary reason for MNOs to adopt a satellite backhaul solution. At times the requirement comes from the government that is looking to include the rural population in the country's economy, with a sincere desire to narrow the digital divide. Often in these cases, it is mandatory for the mobile operator to supply such connectivity to the underserved or unserved areas. At other times, competition between MNOs in increasing their subscriber base drives MNOs to extend networks, so as not to be required to pay roaming costs to a competitor when their subscriber moves out of their current coverage area. In other cases, there are areas where an opportunity arises to support tourist attractions such as hiking trails, scenic travel routes and ski resorts, that require connectivity.

Another example of a CBH application is within the agriculture **Internet of Things (IoT)** business. As an example, Gilat provides 4G services to TIM Brasil's IoT agribusiness from the coastline into the country. Gilat's 4G network expansion allows to connect machines and operators to real-time control and monitoring of harvesters and agricultural tractors.

This enables cost-effective decisions, and quick and effective crop management and further productivity in the production flow. Finally, likely the fastest growing application for cellular backhaul is for emergency response and backup. Satellite backhauling is the solution of choice when terrestrial infrastructures collapse. In the next section this topic is further discussed.

## ***Emergency Response & Backup — A Growing Application***

Whether dealing with a natural disaster or a terrorist attack, reliable communications and access to information are critical for enabling effective emergency response. Climate change and its impact on natural disasters are causing MNOs and regulators to rethink their emergency preparedness and emergency response strategies.

To meet the public's ever-growing reliance on mobile communications, there is a growing interest in broadband communication that is not dependent on the risk-prone terrestrial infrastructure. Therefore, we are seeing more local governments, MNOs and emergency organizations adopting alternative solutions, such as satellite communications, for emergency response and disaster recovery.

Independent from terrestrial and wireless infrastructure, satellite communications provide a secure and reliable solution that can be deployed quickly for disaster response or national emergencies. CBH over satellite solutions enables MNOs to extend network coverage to remote areas beyond the reach of terrestrial infrastructure, enabling emergency services to operate seamlessly in virtually any location. In other cases, satellite backhaul can serve as a backup solution should the terrestrial network go offline due to a disaster or malfunction. This means that precisely when communication is most important for saving lives, it is all-too-often not available due to network breakdown.

When lives are on the line and every second counts, first responders require advanced technologies that can be rapidly deployed anywhere to support voice, video and data applications. Satellite backhauling is the technology that supports effective real-time communications and continuous situational awareness, as they are critical for making high-pressure decisions in the toughest imaginable circumstances.

Gilat is involved in numerous real-world emergency response and backup deployments. A particularly massive implementation is going on in the UK with EE/BT, one of Europe's largest 4G networks. EE/BT is working with Gilat to build out the world's largest 4G **Emergency Services Network (ESN)** to provide network resilience and backup for the UK population.

EE/BT was commissioned by the UK's *Home Office* to deliver emergency service coverage for the entirety of the UK over their 4G nationwide network. The ESN runs over EE/BT's commercial network, which automatically grants priority use to emergency services. EE/BT is using Gilat's field-proven cellular backhaul solution to extend ESN's coverage to remote areas without terrestrial infrastructure, enabling emergency services to operate seamlessly in any location throughout the UK.

Moreover, Gilat is in the process of deploying about 1,000 LTE satellite backhaul sites, including weather-proof VSATs in outdoor locations. These sites will enable service in areas without terrestrial infrastructure or in other cases serving as a backup solution.

The ESN enables network resilience in the event of a cell site failure, as well as providing immediate high-speed voice and data connectivity to emergency response teams in the field. Gilat's Capricorn VSAT answered the requirement of delivering true LTE speeds to 4G handsets and fully supporting encrypted data. The ESN deployment comprises of both fixed and portable on-the-pause cell sites, which use a vehicle-mounted solution containing both the cell node and the Gilat VSAT that handles the backhaul.

### 5G: The Future is Knocking on the Door

As the world moves into the future, there is no doubt that satellite communication is essential to materialize the upcoming technologies such as 5G. The 5G vision, of ubiquitous connectivity, is dependent on satellite backhauling as an essential enabler to provide the scale and scope for connectivity everywhere. Gilat is making significant headway in the evolving 5G ecosystem that will directly influence the way people live and work.

Gilat has proven in numerous demonstrations that the company's SkyEdge II-c platform is 5G ready. As an example, a recent demonstration of carrying 5G traffic with outstanding performance took place in Thailand over **Thaicom's IPSTAR** GEO HTS Satellite.

These tests with 5G handsets, demonstrated unique speeds, of 400 Mbps download and 100 Mbps upload, while running a large number of applications including: *Browsing, Speedtest, Youtube 4K, VoLTE, ViLTE, Virtual Reality, Augmented Reality* and even communication with a drone providing a live video stream. The tests were completed with several 5G architecture options, including *Standalone (SA)* and *Non-Standalone (NSA)*, using Gilat's Capricorn PLUS VSAT with the adaptation of its patented GTP acceleration.

As the requirement for coverage anywhere/anytime continues to expand, the technology roadmap must keep in synch, thus demanding more bandwidth at higher speeds and lower latency. In addition, the technology roadmap must support technologies that will reduce cost and complexity to ensure the most efficient solution.

As such, Gilat recently launched the next generation family of VSATs, **Aquarius**, supporting 5G Networks in both GEO and NGSO constellations. Gilat's Aquarius family of ultra-high-performance, multi-orbit VSATs provides more than 2 Gbps of concurrent speeds and supports seamless satellite handover.

As 5G networks are deployed and customer demands continue to exponentially grow, Gilat's Aquarius VSATs are designed to serve, with maximum efficiency, data and media intensive applications. This new family of VSATs is designed to provide uninterrupted service, ultra-high-performance and support for next generation software defined satellite constellations. Further, the high-throughput with a Multi Access Edge Computing (MEC) infrastructure, enables deployment and orchestration of

3rd party virtualized network functions on the VSAT, simplifying remote site management and operations for next generation 5G services, such as video caching and IoT gateways. These and other Aquarius VSAT capabilities, coupled with Gilat's long-time experience and patented cellular backhaul technology, make it the solution of choice for enabling MNOs to deliver their customers a true 5G experience over satellite.

5G adoption is expected initially in the cities, which will drive additional 4G over satellite deployments into suburban and rural areas, where terrestrial coverage is less feasible. At a second stage, 5G deployment over satellite will spread to rural areas, as well, answering the promise of universal coverage. Gilat with its 80 percent market share in 4G/LTE satellite backhauling is continuing to address the 4G market and is more than ready to answer the 5G challenge.

The unique attributes of satellite communication and its proven value in numerous applications make it an essential component of cellular networks to enable reach to people wherever they are, thus supporting the narrowing of the digital divide. Furthermore, the dropping prices of satellite capacity are making satellite communication the feasible solution to solve today's communication needs.

Not only does satellite enable connecting remote locations, it strengthens the resiliency of communications networks, and directly contributes to saving lives. Gilat has proven its superior satellite backhauling technology worldwide and is diligently at work for next generation solutions to meet the challenges still ahead.

[www.gilat.com/solution/cellular-backhaul/](http://www.gilat.com/solution/cellular-backhaul/)



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Oren has more than 20 years of industry experience, and has held management positions in R&D, product management and product marketing, for international high-tech companies. In this capacity she contributed to next generation product definition and was responsible for delivering the company's vision to the media and analyst community.

Doreet has published thought leadership articles in renowned international journals, and has spoken at numerous industry conferences worldwide. Oren received a BSc in Computer Science from George Washington University.

