

INSIGHTS

Issue TWO

Looking Back, Leaning Forward - The Future of Broadband from the Sky

Many factors are contributing to the latest space race to fill the skies with broadband satellites, primarily poor coverage for key industries + billions of people without access combined with the exponential growth of Internet and data traffic from existing sources.

As reported in the Issue One of Avealto INSIGHTS, the world's Internet capacity has become the new Moore's law, with a forecasted increase of 50% to 70% over the coming five years, which does not even factor in the Covid-19 crises which some have feared would overload and break the Internet.

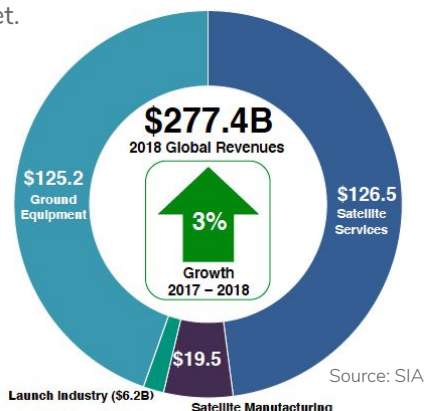
So let's break this down: The hundreds of Geostationary Satellites (GeoSats) in orbit (see chart on Page Three) around the equator produced US\$ 126.5B of revenue in 2018 (source: Satellite Industry Association). GeoSats are the incumbents of the market & have been launched and used for decades - they are very expensive to launch (US\$ 300M+ each), sit high in the atmosphere and thus have a high latency of more than 500ms but cover up to 1/3rd of the planet at a time.

The existing satellite market is estimated to be growing at 3% per year and 80% of that market is currently related to TV and radio broadcasts, "one to many". Because traditional / existing satellite services are so expensive, satellites do not provide much if any capacity to mobile phone operators for backhaul to their switching centers.

Even a mobile operator, like Indosat in Indonesia (260M people on 17K islands), who owns their own satellites, cannot afford to use their own satellite capacity to link to mobile tower sites. Mobile phone service plans have competitive pricing and many areas of the world do not have mobile service because the cost is too high for the mobile operator to provide service in those areas.

Starting in the late 1980s and early 1990s, Low Earth Orbit Satellites (LEOSats) first appeared on the scene, with early players like Iridium (subsequently filing one of the largest bankruptcies in U.S. history at that point in 1992), and Orbital Sciences, LEOSats require constellations of hundreds or thousands of satellites to provide seamless service around the world.

LEOSats orbits are closer to the to the ground than GeoSats, but they still have a fair amount of latency by today's standards (30-110ms), are expensive (US\$ 6M to 8M each). Like GeoSats, once they are launched they cannot be modified or upgraded. Early movers were met with low market demand and, even though...



(Continued on Next Page)

issue two FOCUS

Avealto's Mission: Avealto is developing lighter-than-air, solar-powered, uncrewed High Altitude Platforms (HAPs) to provide telecommunications infrastructure around the world.

Avealto will provide connectivity to unserved and underserved regions, mobile operators and the maritime industry. Each of Avealto's HAP vehicles will remain in a stationary position at an altitude of 20 km to 22 km (65,000 to 80,000 feet).

Issue Two focuses on the market, players and near term future with respect to the latest development and trends in the world.

As with all Editions of Avealto INSIGHTS, we will be recording more in depth interviews and summaries via the Avealto INSIGHTS Podcast. Thank you for joining us on our INSIGHTS journey and we look forward to your feedback and input.



“COVID-19 is taxing global networks to the limit. Operators and platforms are reporting huge, huge surges in traffic as the world has transitioned almost overnight to online working, schooling, shopping, and socializing,

We heard during a high-level dialogue yesterday organized by The World Bank, ITU, WEF and GSMA that some providers are reporting demand spikes as high as 800%.

It is an enormous credit to the global digital community that they are able to continue to make these networks and services available but also at the same time that so many operators are working to expand services to people who now need it more than ever."

- Doreen Bogdan-Martin, Dir. of the Telecommunication Development Bureau of the ITU in TechRepublic

The Future of Broadband from the Sky

(Continued from Page One)

...some companies are still in business, most entrants went out of business or faced bankruptcy. As hundreds of LEOsats have been or are being launched recently by the likes of SpaceX, OneWeb and Blue Origin, and Kuiper, this segment is by far seeing the most activity today and getting the most funding and attention (see LEO Satellites Fuel New Space Race on Page Three). However, the casualties are already starting to mount with the recent news of Softbank-backed (US\$ 2B) OneWeb filing bankruptcy, when it had only launched 74 of a planned 648 LEOsats.

OneWeb is blaming the Coronavirus for not being able to secure additional financing, but their issues and headwinds will surely be felt by other LEOsat operators. Starlink from SpaceX is furthest ahead of the pack of recent market entrants, with hundreds of LEOsats launched and has promised to start offering service by the end of 2020.

So far, the moral of this story is that GeoSats and LEOsats rely on CAPEX-intensive business models, have differing levels of service and potential, with inflexible operating models that require outright replacement of satellites to upgrade. Their one-size-fits-all business models have merit but will not, in their current form come close to assuaging the global Internet demand, which is doubling roughly every two years (probably faster post-Coronavirus). These solutions fill in part of the puzzle but a great opportunity remains.

Enter High Altitude Platforms (HAPs) - Unlike GeoSats and LEOsats, HAPs provide a proven demand / success-driven solution, supplying broadband capacity exactly where it is needed at a much lower cost with higher quality. In addition, HAPs can also serve remote areas that traditional ground-based infrastructure cannot easily reach. Avealto is targeting the non-broadcasting segment of the Global Satellite Services market, roughly 20% of the total, is currently US\$ 25B in annual revenue (broken down on the chart to the right). This segment of The market growing at a clip between 3% and 12%, but is likely to grow much faster due to the lower price point of HAP services.

Unlike LEOsats, which spend most of the orbit over areas with few of now customers, HAPs can be placed into service in areas which already have significant customer demand. Each HAP vehicle brought into service will be profitable immediately. Our estimate is that the potential broadband market for sector to be north of USD\$ 100B.

The primary markets that are ripe for HAPs and where we have seen the most demand include:

- Maritime communications
- Mobile backhaul
- Aeronautical communications
- High Speed Trading Links
- Public Sector: Governments and NGOs

Timing is Everything -

The good news is that a mature market already exists for HAP services. Customers in most instances will be able to use their existing ground station equipment to link to the lower cost and higher quality HAP service.

Many areas of the world do not have mobile service because the cost is too high for the mobile operator to provide service in those areas. This is a business opportunity to generate new revenue in a market that can be served only by HAPS.

Avealto's cost to produce transmission capacity will be extremely low. In addition, Avealto will be able to enjoy extremely high margins and still offer substantial discounts below the market prices in each region.

from the HEADLINES

Coronavirus freezing funding for space companies and more than half may not make it, analyst says

(CNBC) Years of private funding flowing into young and growing space companies has ground to a halt during the coronavirus pandemic, in what one firm describes as a "culling" of space companies backed by venture capital.

Investment in private space companies had seen a golden age in recent years, including a record nearly \$6 billion last year. But that's ended due to the coming "COVID-19-induced recession," a report by Quilty Analytics on Monday said, in a shakeout the firm expects will last about two years. Quilty Analytics is a boutique research and investment firm focused on the satellite and broader space industry.

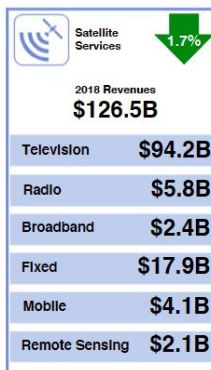


"High vulnerability segments will see a higher level of business failures, but the survivors may be more-handsomely rewarded due to less competition down the road," Quilty Analytics said.

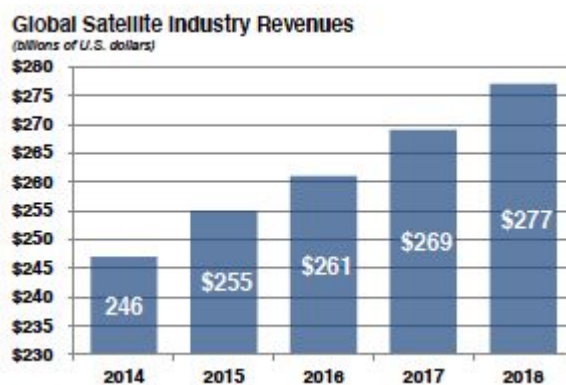
The first "very high" risk sector is low Earth orbit satellite internet networks. The report emphasized that these "LEO Broadband systems" are the most capital intensive of all the 13 space sectors and that, already, two of the five contenders – OneWeb and Leosat – have dropped out. Quilty Analytics expects one or two of the remaining contenders – SpaceX's Starlink, Amazon's Project Kuiper and Telesat – will succeed in offering service.

While the short-term outlook has soured for VC-backed space companies, Quilty Analytics said it is still bullish on the space industry's growth over the long-term.

"The Space opportunity is exciting despite its immaturity," Quilty Analytics said. "Despite having immaterial revenue impact on the broader Space industry today, the opportunities (and threats) arising from Venture Space are anything but inconsequential to the large, traditional Satellite & Space incumbents."



Source SIA



Steady Growth Market 2014 - 2018: Source SIA

LEO Satellites Fuel New Space Race- Plagued by Limitations and Concerns

(Statista excerpts + Avealto editorial) “Start-up rocket and satellite companies are springing up across the globe with the promise of providing many different space services and endeavors. One of the leading markets these companies are looking to fill is the production and launching of small low-Earth orbit satellites, or LEOs, and they’re already taking up most of the satellite space.

As of September 30, 2019, there were over 2,200 satellites orbiting Earth, most of which are LEO. These satellites operate fairly close to the surface of the Earth, between 500 and 2000 kilometers. Companies like SpaceX and Blue Origin are investing heavily in the production of LEO satellites as an alternative to higher latency GEOSats. These companies hope to create a satellite constellation network for data distribution and broadcasting, with plans to launch thousands of LEOSats in the near future.

Other satellites—including medium-Earth orbit (MEO), elliptical and geostationary orbit—are less common but fulfill different roles. These satellites get further and further away from Earth while covering a wider surface area, giving more sustained coverage but taking longer to fully orbit. Geostationary orbit satellites are the second-most common, and it only takes three to provide full coverage of the planet. However, latency is especially high since they’re generally over 36,000 kilometers above the Earth’s surface.”

The surplus of new LEOSats may help provide high-speed data and broadband to every area of the globe, opponents point to three downsides of LEOSats:

First, each LEOSat has a limited broadband capacity and when over even a moderately populated area, will not be able to support the amount of capacity needed. LEOSats will be useful to provide some coverage everywhere in the world but they can only provide a portion of the capacity needed.

Second, LEOSats move rapidly over their coverage area. Ground terminals will need “tracking” antennas which will significantly increase the cost as many thousands of terminals will be needed.

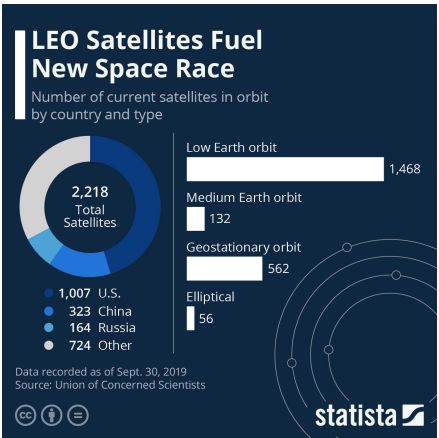
Third, each LEOSat passes over multiple countries every few hours. Much of the time there are no potential customers in the coverage area that is sweeping across the ground. Also, regulatory approval is needed in each country the LEOSat operator wants to serve. Many countries are not interested in giving United States-based satellite operators permission to serve their territories as they are concerned with the well documented privacy violations of US companies and the US government. This regulatory barrier will further reduce the efficiency and profitability of LEOSat networks.

Avealto will only place vehicles in areas where we have the regulatory approval and can fully utilize our network capacity. Avealto will only operate in the areas of the world where we are welcome and, as a UK company, we do not have the negative reputation for privacy violations attached to US-based operators.

Space scientists have larger concerns as LEOSat constellations contain many thousands of small satellites - the first is known as the Kessler Effect. No one knows for sure how many LEOs there can be before the risk of collision within low earth orbit grows significantly. Once a collision happens, it can set off a cascade or chain-reaction which will increase the risk of future collisions.

The second reason opponents are skeptical of increased LEOs is that many astronomers believe they will interfere with the observation of space, as the sun has been shown to reflect off a few test satellites already launched by SpaceX, which have already disrupted astronomical tests and observation.

avealto development IN ACTION



Low Hanging Fruit: A Deep Dive on Markets Ripe for HAPs

MARITIME COMMUNICATIONS

The amount of voice and data service provided to cargo ships, passenger ships and private vessels is increasing rapidly. Cargo vessels are increasingly using broadband communications to coordinate their activities and as an incentive to on-board employees. Private vessels, including offshore fishing vessels, increasingly are installing small satellite transceivers to maintain communications while at sea. Passenger vessels now find that their customers expect to remain connected while on board.

The provision of maritime communications is a fragmented business with many different Maritime Telecommunication Operators controlling portions of the market. A single HAP can cover a circular area around 480 kilometers (300 miles) in diameter over water where there are no obstructions. A HAP vehicle can transparently replace existing satellite services with a higher quality service at a much lower cost.

MOBILE BACKHAUL

Mobile phone service has grown quickly with almost every town or village in the world now served by some level of mobile phone service. Mobile phone users are rapidly increasing the amount of bandwidth that they use. A HAP can instantly connect cell towers back to the central switching facility.

This is not only useful for remote areas but can be used to rapidly expand a network or provide additional coverage on a temporary basis by connecting portable towers to the switching facility.

KU BAND CAPACITY REPLACEMENT

Retail establishments all over the world rely on VSAT terminals to provide very small bandwidth communications as backup for their point of sale (credit card) transactions. Almost every major retail establishment (Kmart, Walmart, Staples, gas stations, etc.) has a VSAT dish on the rooftop of every location.

A retailer may switch to HAP service solely based on price but will benefit from a higher level of service which is not affected by disruptions on the ground. Other organizations requiring continuous communications can benefit from HAP backup.



the space ECONOMY

Commerce Department to develop new estimate of the size of the space economy

(SpaceNews) "An agency of the U.S. Department of Commerce is developing its own estimate of the size of the space industry, the most authoritative effort to date to measure space's role in the broader economy. Secretary Wilbur Ross has been among those **projecting the space economy to grow to at least US\$ 1T by 2040.**

In an article published in the December issue of its journal, the Survey of Current Business, the Bureau of Economic Analysis (BEA) said it's starting development of a Space Economy Satellite Account to measure the size of the space industry in the United States.

SPACENEWS

A number of estimates exist on the size of the space economy, which vary depending on what is included. A May 2019 report prepared for the Satellite Industry Association (SIA) by Bryce Space and Technology estimated the global space economy to be \$360 billion, of which the satellite industry accounted for \$277 billion and the rest primarily by government space budgets. The Space Foundation, in its annual Space Report published in July 2019, estimated the global space economy to be nearly \$415 billion in 2018. The two reports also differed in estimated growth: the SIA report saw growth of 3% in 2018, versus 8% in the Space Foundation report.

Those estimates, and projections for future growth, have led some to predict the space economy, however it is defined, to be worth at least \$1 trillion within 20 years. U.S. government officials, including Commerce Secretary Wilbur Ross, have frequently talked about efforts to create a trillion-dollar space economy."

- Excerpts from SpaceNews feature,
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5 St. John's Lane
London
EC1M 4BH
United Kingdom

(P) UK +44 203 2909542
(P) US +1 202 4671199
(W) Avealto.com
(E) enquiries@avealto.com