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# STAR WARS

## The LEO strikes back !

By: Dale Stacey

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# 120 second History of the Galaxy \!



First there was  
Sputnik  
-1960



Then there was the  
NASA Apollos  
late 1960's to 1972  
(17 over 10 or so  
years)



NASA Space  
Shuttles 1980's  
135 over 30  
years, (1981 to  
2011)



Satellite  
Launches  
1990's onwards



Now there is more  
launches than ever  
before  
(165 missions by  
SpaceX in 2025  
alone),  
~ every day  
including all users

# First there was the .....GEO STATIONARY SATELLITE ORBIT (GSSO)

- Satellite is stationary relative to earth
- Where centrepetal force=Gravitational
- Condition occurs at ~35,785 Km from equator

$$F_{\text{grav}} = \frac{G \cdot m_1 \cdot m_2}{d^2}$$

where G represents the universal gravitation constant  
( $G=6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$ )

- Condition occurs at ~35,785 Km from equator

Radius = 6430 Km



$$Mrw^2 = Gm_1m_2/R^2$$

$$F_c = mv^2/r$$


$$F_{\text{grav}} = \frac{G \cdot m_1 \cdot m_2}{d^2}$$

where G represents the universal gravitation constant  
( $G=6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$ )

## Geostationary gave birth to the first generations of GSSO's 1960-1970-1980

A diagram showing a central text box with four lines of text. From each line, a beam of light extends outwards to the left and right, converging towards the center. The beams are white and have a slight glow. The background is a dark blue space with faint white lines representing orbital paths and small white stars.

Inmarsat,  
Intelsat,  
Eutelsat,  
Raduga







 Initially analogue 'bent pipe' transponders.

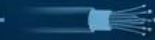


Second generation lead to digitalisation in the 1980's


Digitilisation of these gave 4.8 kbps/ 32 kbps / 64 kbps, IDSN and 1.5-2 Mbps services in the 80's

# Limitations of the GSSO

-  Limited Spectral Bandwidth (L, C, Ka Ku ) and spectral inefficiency
-  Frequency for reuse a few times only, (interference limited and have LOS to other satellites)
-  Usually 3-4 satellites only in a constellation meaning poor overall nbandwidth
-  Poor latency (laws of Physics round trip = 280 mS) **X, SOMETIMES DOUBLE THIS**
-  **X** Not conducive to voice comms **X**
-  **X** expensive (I remember working in Kazakhstan when Inmarsat C was \$5 US a minute) **X**

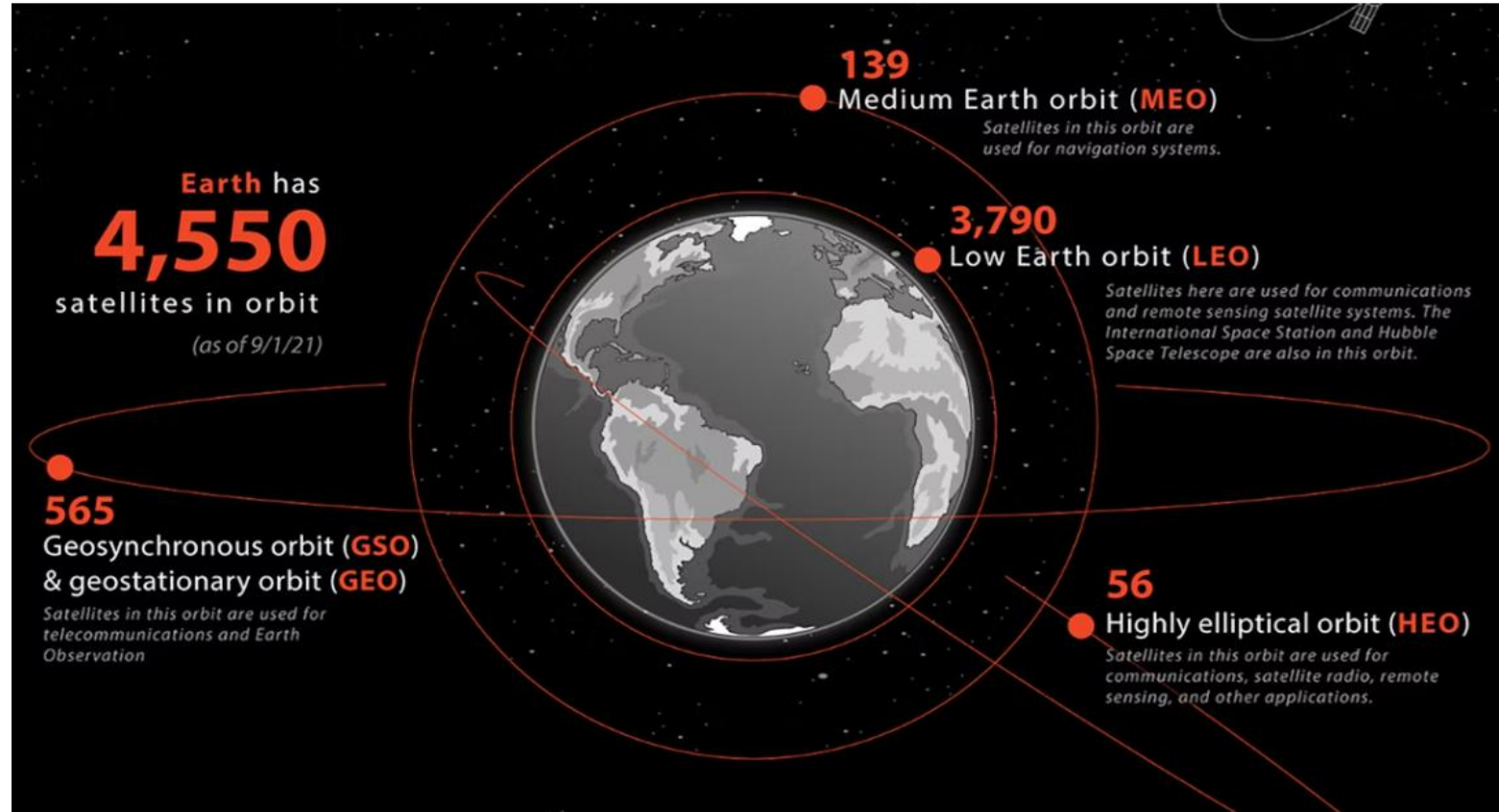


Consequently back in the 1980's everyone said Satellite and radio was dead as fibre optic has 1000000 times the bandwidth and arrives in 10's of milliseconds





## Difference between GSS, HEO, MEO, LEO

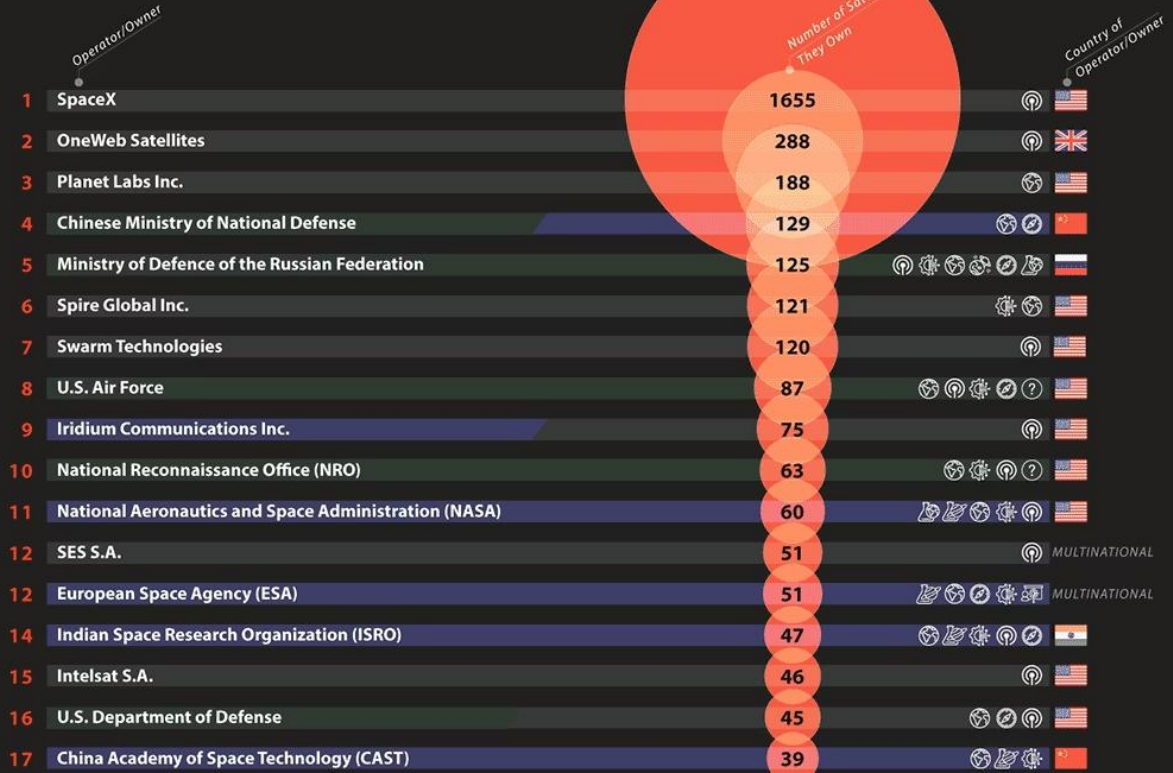


# THE 50 OPERATOR/OWNERS

## of the Most Satellites Orbiting Earth



USERS		PURPOSE					
	Commercial		Communications		Earth Science		Technology Demonstration
	Military		Earth Observation		Space Science		Navigation/Global Positioning
	Government		Space Observation		Technology Development		Unknown
	Civil						



# Estimates from Various sources

<https://www.pixalytics.com/sats-orbiting-earth-2016/>



## ACTIVE SATELLITES IN SPACE



## SATELLITES LAUNCHED PER YEAR



## TOTAL OBJECTS (ACTIVE + INACTIVE + DEBRIS)



Estimates from Various sources

<https://www.pixalytics.com/sats-orbiting-earth-2016/>



## STARSHIP V3 LAUNCH - LATEST AND GREATEST MAY 12th 2026

- More Mass than ever before > 200 Metric Tonnes payload (150-200% increase over V2)
- Suitcase satellites (60 per launch)
- Triple Payload



## 3 horse race



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Starlink (SpaceX)  
Oneweb (Eutelsat)

Project Kuiper now Amazon Leo since Dec 2025

	Starlink	Oneweb	Amazon Leo
Started launching satellites	May 2019	Feb 27th 2019	April 2025
Commercial launch	2021	2025	Still Pending
Satellite in service today (March 2026)	10020	654	27+27+24+24+27+24+27+32+X= 212+
Ambition	50,000		3000+
Affiliates	Telstra / Optus /Hypha		NBN



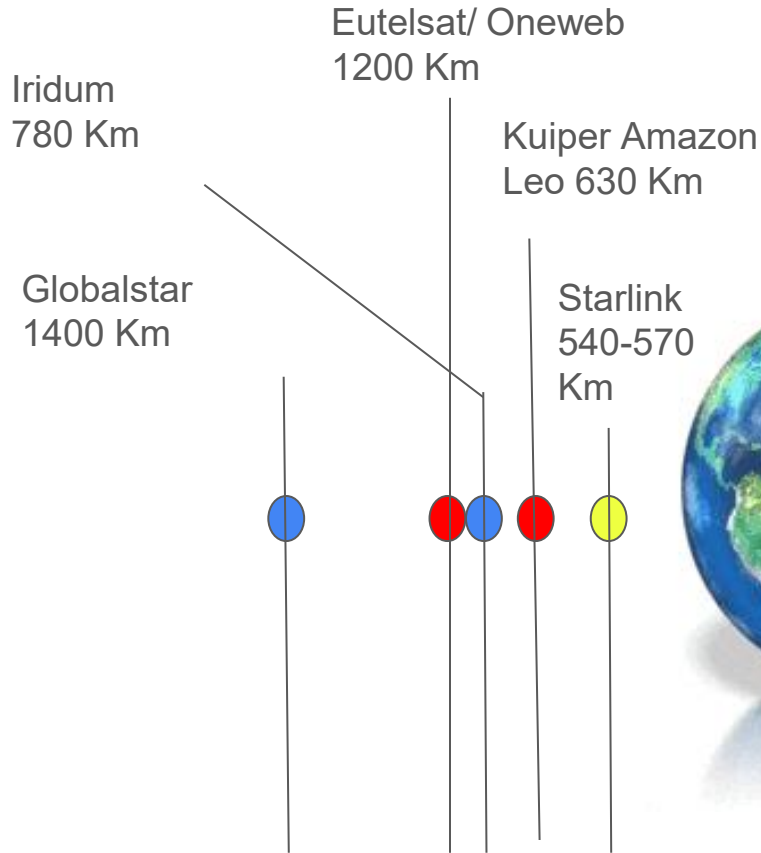
APRIL 2026: BEEN THERE GOT THE POSTCODE !

# LEO's -

Not Geostationary

Closer to earth advantage:-

- Reuse of frequency like a cellular network
- low latency
- Scalability (50,000 satellites)



32	648	66	212	~10,000	Present Qty
?	?	?	3236	50,000	futures




# Generic LEO SWOT



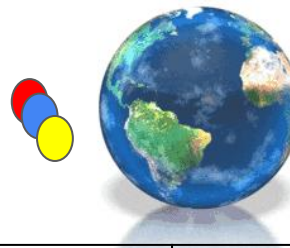
Strengths	Ubiquitous Low latency Bandwidth (today) / spectral reuse Affordability (today)
Weakness	Ultimately Bandwidth limited / Spectrum Sovereignty
Opportunities	Change user requirements (supply and demand) Competition
Threats	Saturation* /Contention Weaponsisation * Space Garbage* Sabotage*

# 3 HORSE RACE

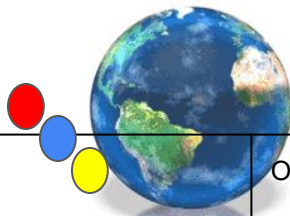


-  Starlink (SpaceX)
-  OneWeb (Eutelsat)
-  Project Kuiper now Amazon Leo

- Typically 500-2000 Km above the earths surface
- Not Geostationary
- Reuse of frequency like a cellular network
- Scalability (50,000)



	Older generations Iridium, Globalstar	STARLINK	ONEWEB	KUIPER AMAZON LEO
Strengths	<p>Established</p> <p>Earlier generational foibles resolved.</p> <p>Been through the bankrupting process and now restructured</p>	<p>Latest technology</p> <p>Not inhibited by backward compatibility</p> <p>10,100+ satellites up (May 2026), planning 50K</p> <p>2 years ahead of competition</p> <p>Lowest Latency</p> <p>In house launch capability</p>	<p>Latest technology</p> <p>Not inhibited by backward compatibility</p>	<p>Latest technology</p> <p>Not inhibited by backward compatibility</p>
Weakness	<p>Traditionally expensive and limited bandwidth</p> <p>Limited in business agility, retaining backward compatibility</p>	<p>Starting to see capacity issues.</p> <p>Consumer costs</p>	<p>Development 2 years behind Starlink</p>	<p>Development 2 years behind Starlink</p> <p>Reliance on 3rd Party rocket launch provider</p>



	STARLINK	ONEWEB -EUTELSAT	KUIPER AMAZON LEO
Strengths	<ul style="list-style-type: none"> <li>• Latest technology</li> <li>• Not inhibited by backward compatibility</li> <li>• 10,000+ satellites up, planning 50K</li> <li>• 2 years ahead of competition</li> <li>• Lowest Latency</li> <li>• Resources / In house launch capability</li> </ul>	<ul style="list-style-type: none"> <li>• Latest technology</li> <li>• Not inhibited by backward compatibility</li> <li>• Financial resources of Eutelsat</li> </ul>	<ul style="list-style-type: none"> <li>• Latest technology</li> <li>• Not inhibited by backward compatibility</li> <li>• Financial Resources of Amazon</li> <li>• Boeing /Viatel connection</li> <li>• Beta launch 8 April 2026</li> </ul>
Weakness	<ul style="list-style-type: none"> <li>• Starting to see capacity issues.</li> <li>• Consumer costs rising</li> </ul>	<ul style="list-style-type: none"> <li>• Development 2 years behind Starlink</li> <li>• Worst latency</li> </ul>	<ul style="list-style-type: none"> <li>• Development 2 years behind Starlink</li> <li>• Reliance on 3rd Party rocket launch provider</li> <li>• Second worst latency</li> <li>• Full launch not expected to mid 2026</li> </ul>
Opportunity	<ul style="list-style-type: none"> <li>• To build a whole new generation of LEO from the top down</li> </ul>	<ul style="list-style-type: none"> <li>• To build a whole new generation of LEO from the top down</li> </ul>	<ul style="list-style-type: none"> <li>• To build a whole new generation of LEO from the top down</li> </ul>
Threat	<ul style="list-style-type: none"> <li>• Rationalisation of networks (Not space for 10 players)</li> <li>• Spectrum availability and geospatial space</li> </ul>	<ul style="list-style-type: none"> <li>• Rationalisation of networks (Not space for 10 players)</li> <li>• Spectrum availability and geospatial space</li> </ul>	<ul style="list-style-type: none"> <li>• Rationalisation of networks (Not space for 10 players)</li> <li>• Spectrum availability and geospatial space</li> </ul>

# THE FUTURE SPACE VERSUS TERRESTRIAL



## STARLINK

### Strengths



- Relative market share increasing
- Ubiquitous coverage Reduced need on Ground infrastructure
- Supply chain independent (in house engineering/fabrication, launch rockets etc)

### Weakness



- Ultimately a limited Bandwidth
- Susceptibility to jamming, sabotage

### Opportunities



- To take over the world in comms

### Threats



- 

## TELSTRA

- Established
- Market share of Comms and mobile market
- Fibre optic and Ground Infrastructure
- Security
- Sovereignty

- Cant compete with ubiquitous
- Ultimately needs backhaul and supply chains

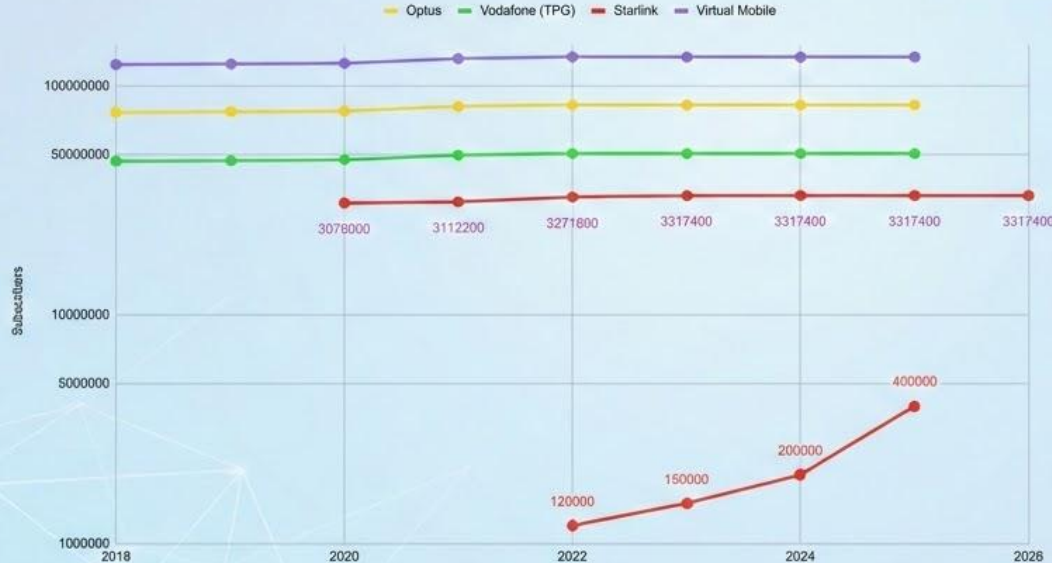
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- Starlink and other LEOs threaten

# Market share (Growth LEO)

Mobile Network Subscribers (Growth last 8 years) Same slide logarithmic scale

SUBSCRIBERS



Note: Doesn't show other LEO's

Doesn't show international registrations (Maritime, Aeronautical etc)



# Competition with Terrestrial lines www.satpty.com

- Previous models only show competition to national mobiles.
- There is also the costs of Terrestrial land lines to remote place. Arguably this is even bigger
- Remember 5-10 years ago NBN was in the news putting ½ dollar Microwave last mile connections to farms etc
- Telcos will never fulfil the last 2% of coverage by population (over 80% of area of Australian outback)

Not forgetting international aspects not included (ie airlines, maritime, etc)

# Cost Model



- Starlink Costs have changed 3-4 times since May 2025 as its moved from Startup to BAU.
- Whispers of Capacity constraints (in USA) driving this,
- Why wouldn't they do this in the supply/demand model now demand has been established and in the short term they have a monopoly.



# Opex Cost Model (Costs per month shown)



www.satpty.com

	<b>Starlink</b>	<b>OneWeb Eutelsat</b>	<b>Kuiper LEO</b>	<b>Landline</b>	<b>Terrestrial Mobile</b>
Market Entry	A\$69 per month personal, <b>100 Mbps unlimited in UK?</b>	Starter 50 GB 50/10 US\$ 110	4K video streaming (8Mbps) NOT AVAIL YET	~\$20	\$5-10 PAYG
Medium Level product (Government contracts)	\$108 National priority (50GB) \$408 Global priority (50 GB)	100 GB 50/10 US\$355	100 Mbps NOT AVAIL YET	\$70 median plan	\$70 median plan
High usage	Global Priority 2 TB \$3870	1.5 TB US\$5183	400 Mbps NOT AVAIL YET	Unlimited use \$150	Unlimited use \$150

Source each company Website. (published ratecard), ignoring hardware

# RISKS

# Spectrum Saturation Model by Starlink

## LEO Spectrum Presence

- **Traditional Bands:**  
L (~1.5 GHz), C (4/6 GHz), and Ku (12/14 GHz)
- **Satellite to Phone:**  
Global allocations for 3.7 GHz
- **Ka Band (Gateways):**  
28 GHz uplink / 18 GHz downlink (LASER)
- **E Band (70-80 GHz):**  
Coordinating with Terrestrial
- **W Band:**  
105-115 GHz

### KEY CLAIM

**Starlink's Inter-Satellite  
Laser Links are setting  
new records**

**42M**

GB Per Day



# Spectrum Saturation Model by SAT Pty



www.satpty.com

## Historical SAT Estimates

- 7,855 satellites up: 157,100 Gbps total capacity
- ~77% of Global commercial capacity
- **6M Subscribers: 26 Mbps @ 100% utilisation**
- **5% Utilisation cap: 523 Mbps per consumer**

## Comparative Analysis

Our figures were **50% lower** than Starlink's predictions.

The discrepancy (within 3 dB) was likely due to Starlink's **Laser Links**, which weren't in our initial model.

## Future Saturation Risk

The system is predicted to saturate within a few years. At 50,000 satellites, self-interference becomes the primary capacity bottleneck.

**Strategic Response: Price increases to manage demand against fixed supply.**



# SPACE DEBRIS BY THE NUMBERS

**~7,210**

Launches since 1957

**~25,920**

Satellites placed in orbit  
(17,610 in space, ~15,200 functional)

**~44,870**

Objects being tracked

## Debris Size Classification

**1mm to 1cm**

~ 140 Million space debris elements

**1cm to 10cm**

~ 1.2 Million space debris objects

**>10 cm**

~ 35,400 objects (including active payloads)

Speed of Starlink satellites ~ 28,800 Km per hour (relative to earth), not all constellations moving the same way.

# WEAPONIZATION

## Strategic Landscape

- **Military satellites:** Deployed by more than 20 nations
- **Sabotage risks:** Emerging in both space and terrestrial environments
- **Cyberwar:** Rapidly increasing threat vector

## Case Study

### Chinese Satellite TEE-01B

A critical recent example highlighting shifting alliances and dual-use technology in space.

Operational context: Currently utilized by **Iran**.

# FURTHER ANALYSIS



## LEO Growth Plateau?

Will growth level out at 400,000 consumers in Australia (Starlink only)? Equates to 1.5% of Australian Public Mobile market.



## The Terrestrial Gap

Don't forget the 2% of Terrestrial population that services can never reach economically.



## Spectrum Saturation Risk

Will saturation occur for LEOs, or will they continue to challenge Terrestrial services?



## Pricing Model Shift

Will unit bandwidth prices continue to rise now that the network startup 'honeymoon' is over?



## Competition & Rationalization

Will Kuiper and OneWeb catch up?  
Expect further network rationalization or corrections.

# Conclusions.



1. There is a revolution going on in comms presently solving the last conundrum of ubiquitous coverage and truly augmenting 5G.



2. Technically this is a positive thing. Can leverage to expand delivery to user requirements and augment existing networks (example VAAN)



3. The risk is a monopoly in this market for the next 2 years.



4. Further risk increasing reliance on Global supply chains and sovereignty of the solution, ever evolving Cyber vulnerability



5. A Star Wars quite literally in the LEO and undersea fibre space, between sovereign nations is emerging. (Cyber now, Kinetic tomorrow)



6. Conventional Telcos as they were and we see them today are predicted by some to disappear over the next 5-10 years.



7. It makes for a volatile, long term unpredictable future



8. Our jobs as ever are secured to help society navigate this

# Open Questions.



## 1. Regulation & Investment

The takeover from Space, how will it be regulated in Australia?

Seeing no protection of traditional Mobiles investment by Federal Government, is it considered too small a threat?



## 2. Telco Future

Will the Telcos survive this and all the other changes or will they become Landowner Estate Agents?



## 3. Starlink & Spectrum

FCC are regulating Starlink and potentially limiting number of satellites. Their ambitions are to put up 50,000 satellites.

**i)** Is it dangerous that US Federal Government ultimately controls Starlink destiny, isn't this a conflict? and volatile?

**ii)** It seems inevitable that we will run into spectrum saturation issues in 2 or so years at current growth (self interference and limited resource), how to deal with this or will Starlink (and others flatline at this point)?