Satelliet communicatie en effecten voor de Hydrografie

Programma

16:00-16:30 Starlink Satelliet communicatie status (Oigen Blankert, Fugro)

16:30-17:00 Onbemande vaartuigen en communicatie bij Fugro (Igor Dorrestijn, Fugro)

17:00-17:30 Pauze

17:30-18:00 USVs: technical and organizational impact (Dieuwertje Smallenburg en Erik Fijlstra, Deep BV)

18:00-18:30 Sociale aspecten van werken op afstand (Peter Aarts, Fugro)

19:00 Lichte maaltijd

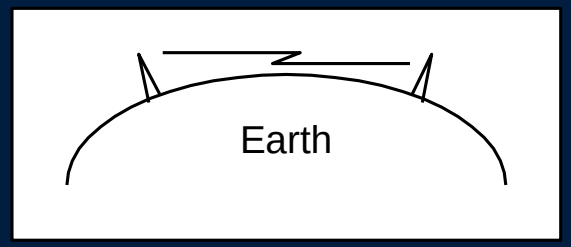
Dagvoorzitters Marleen ten Napel en Hans Visser.

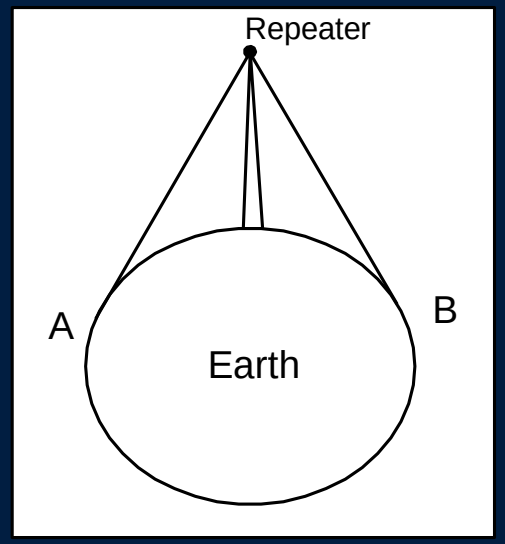
Satellite communication status

Oigen Blankert,
o.blankert@fugro.com

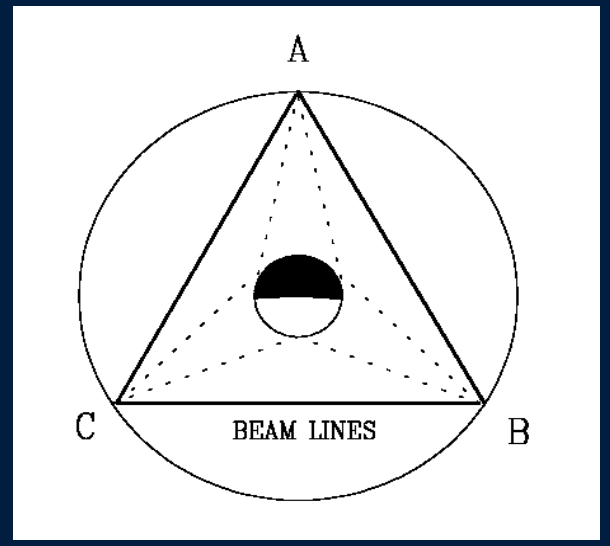
7th September2023

Why satellite?





- Terrestrial radios are limited to approx. 80km
- Repeater in the sky
- GEO satellite covers 1/3 of the globe on a Global Beam
- GEO provides global coverage, except polar regions
- LEO provides pole to pole coverage



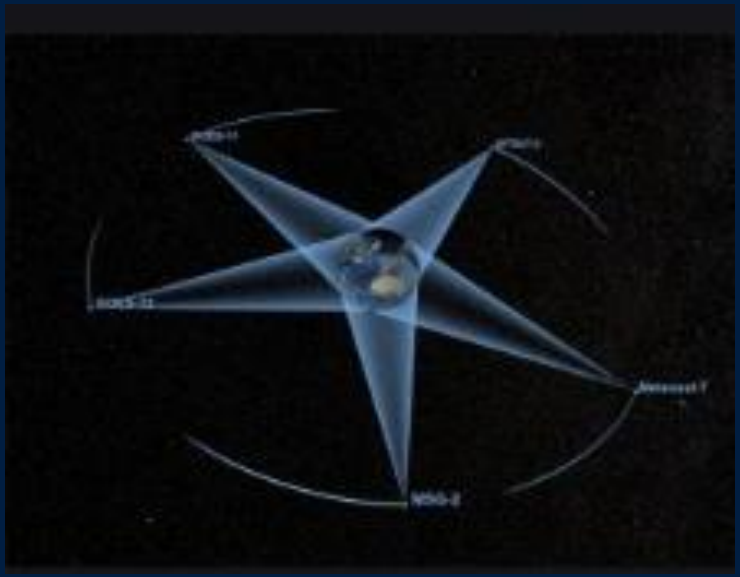
Satellite major events

- 1945: - The idea – Second world war – radar/rocketry
- 1955: - The plans
- 1957: - The Space race winners Sputnik 1
- 1962: - First telephone communication & TV broadcast via satellite: Echo 1
- 1964: - The Olympic games first major event broadcast live via satellite
- 1974: - First 3 axis stabilized: Symphonie 1
- 1978: - First GPS satellite launched
- 1997: - Inmarsat I3 launched
- 2001: – Iridium satellite launched
- 2013: - Inmarsat GX launched
- 2013: - O3B MEO launched
- 2019: - Starlink and One Web LEO launched
- 2020: - Iridium Certus constellation complete
- 2022: - Starlink commercially available for marine use
- 2025: - Kuiper constellation expected to be commercially available

Types of orbit - GEO

- Circular Equatorial – 24hr Orbit
- 35,800km above equator
- Pros:
  - Satellite appears stationary from fixed point on earth
  - One satellite can cover 42% of earth's surface

- Cons:
  - No polar region coverage
  - High signal loss and delay – 550ms round trip



Types of orbit - MEO

- Between 2,000km – 35,800km
- O3B is 8063 km from equator
- Approximately 5 hour orbit
- 20 satellites

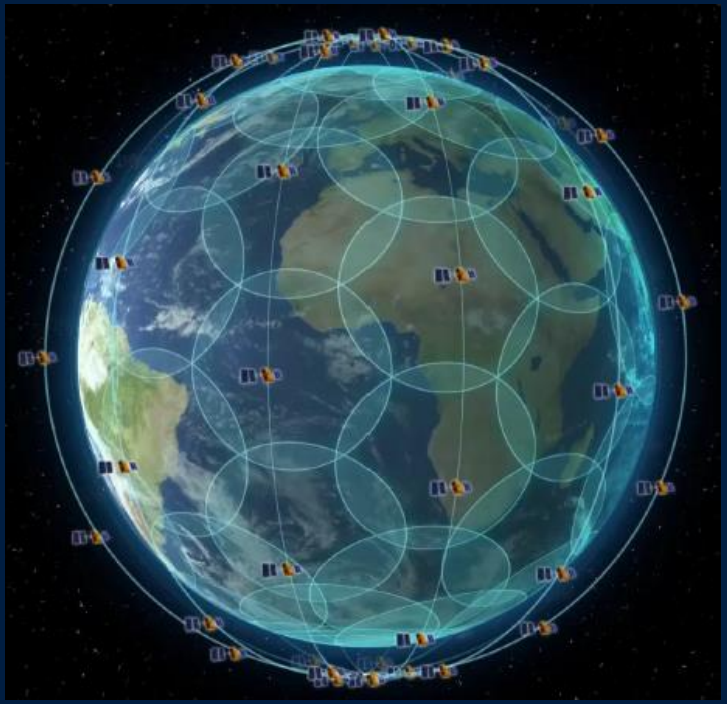
- Pros:
  - Low latency ~ 150ms
  - High throughput max 800Mbps per beam/per direction
  - Ideal for satellite backhaul
- Cons:
  - Multiple antennas required
  - Minimum capacity purchase
  - Spot beam 700km wide
  - +/- 45 deg coverage

Types of orbit – LEO (Iridium)

- LEO orbits ~ 160km – 2000km
- 781km above earth
- 101 minute orbit
- 66 satellites

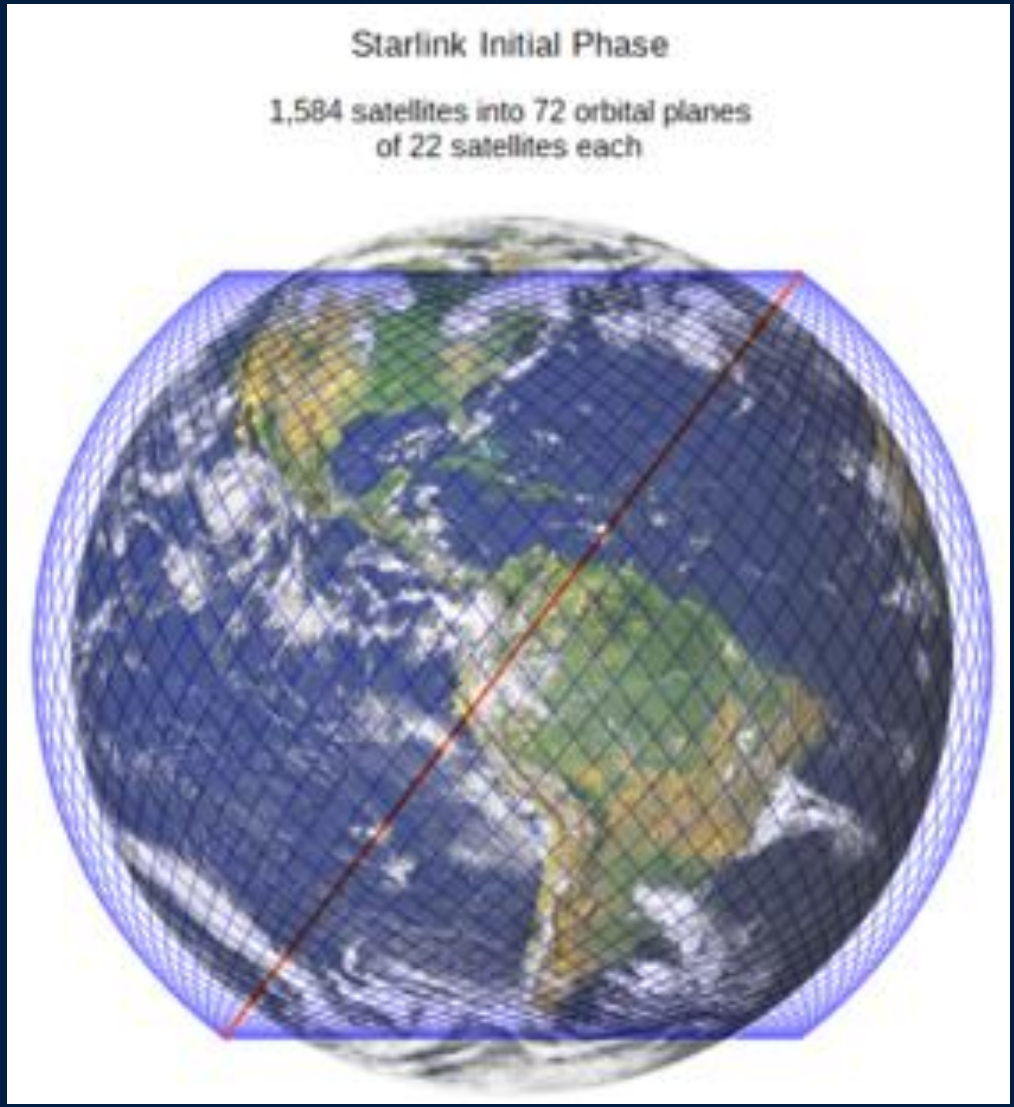
- Pros:
  - Operates on L band
  - Pole to pole connectivity
  - Minimal setup and hardware

- Cons
  - Limited bandwidth 768/348
  - Expensive
  - Not necessarily low latency
  - Limited gateways



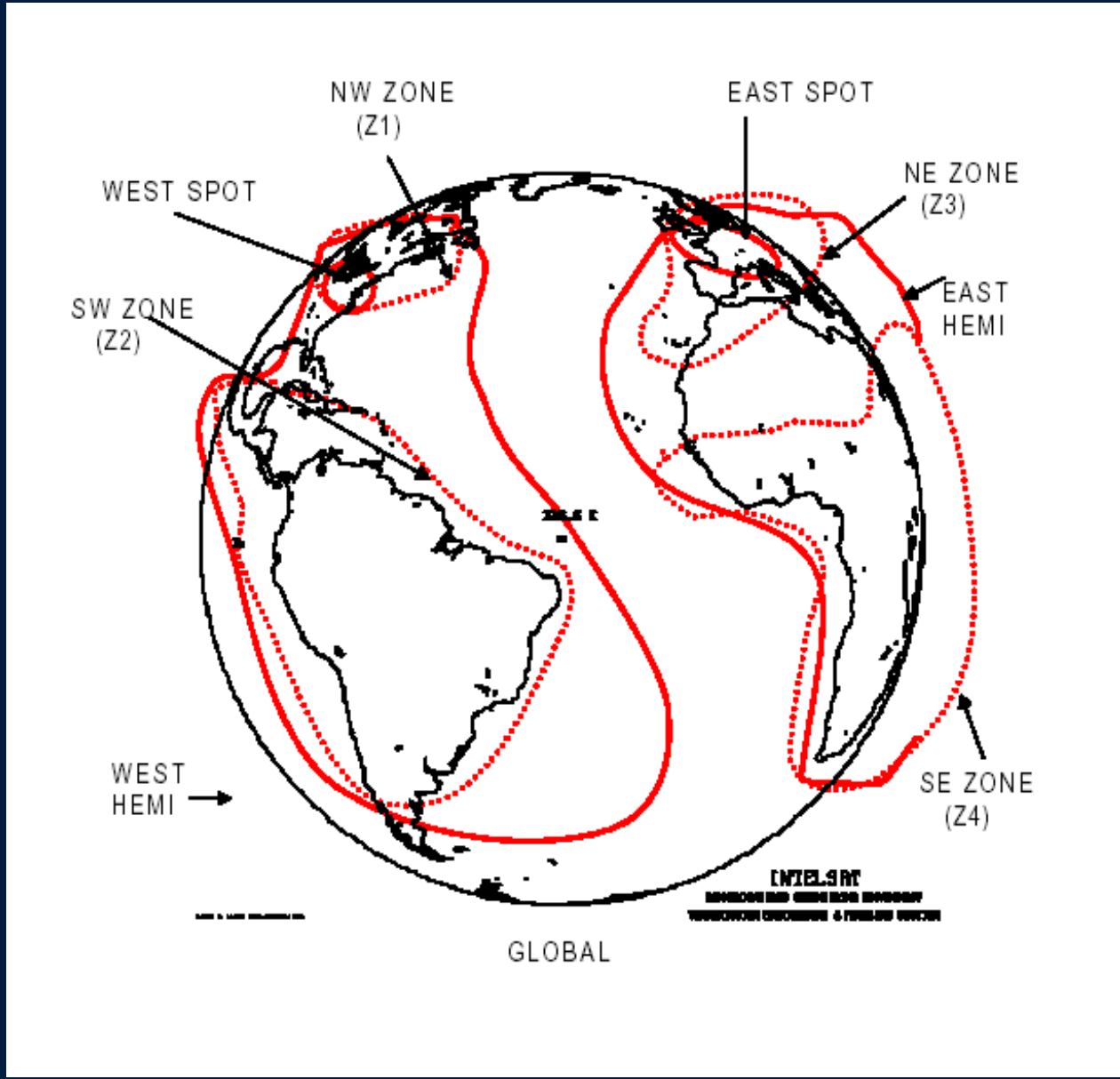
Types of orbit – LEO (Star Link/ One Web)

- 550 km above earth
- Thousands of small satellites (approved for 7000)
- Claimed latency of 35ms



Types of coverage

- Global
- Hemi
- Regional
- Spot



The old days….VSAT

- Constellation of satellites orbit at an altitude of 35.800km above the equator
  - Typical latency : >600ms
  - Download : Peak 100Mbps
  - Upload : Peak 40Mbps

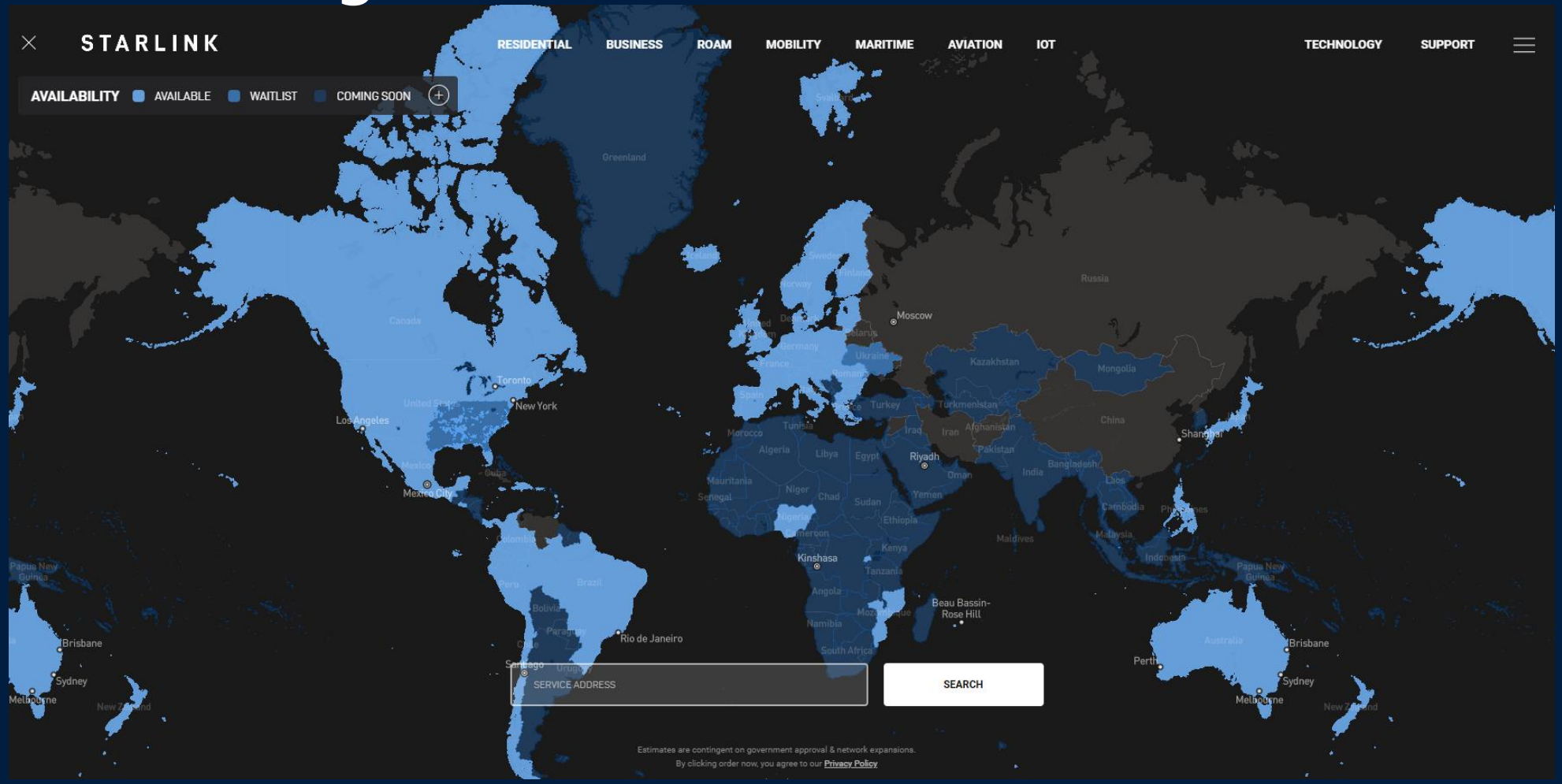
- Commitment on service
- Service Level Agreement
- Quality of Service and/or link management
- Long term commitment
- All you can eat

Today….Starlink

- Constellation of thousands of satellites orbit at an altitude of 550km
  - Typical latency : <100ms
  - Download : Peak 350Mbps
    Expected 60 – 250 Mbps
  - Upload : Peak 40Mbps
    Expected 10 – 30 Mbps
- Frequencies: 10-13 GHz to terminals. 18, 37 GHz to gateways.
- 1.5+ mio subscribers
- No commitment on service
- No Service Level Agreement
- No Quality of Service and/or link management
- Month-by-month subscription
- 1TB plan / 5TB plan (maritime)
- Additional data plans available, Opt in vs Opt out

FUGRO

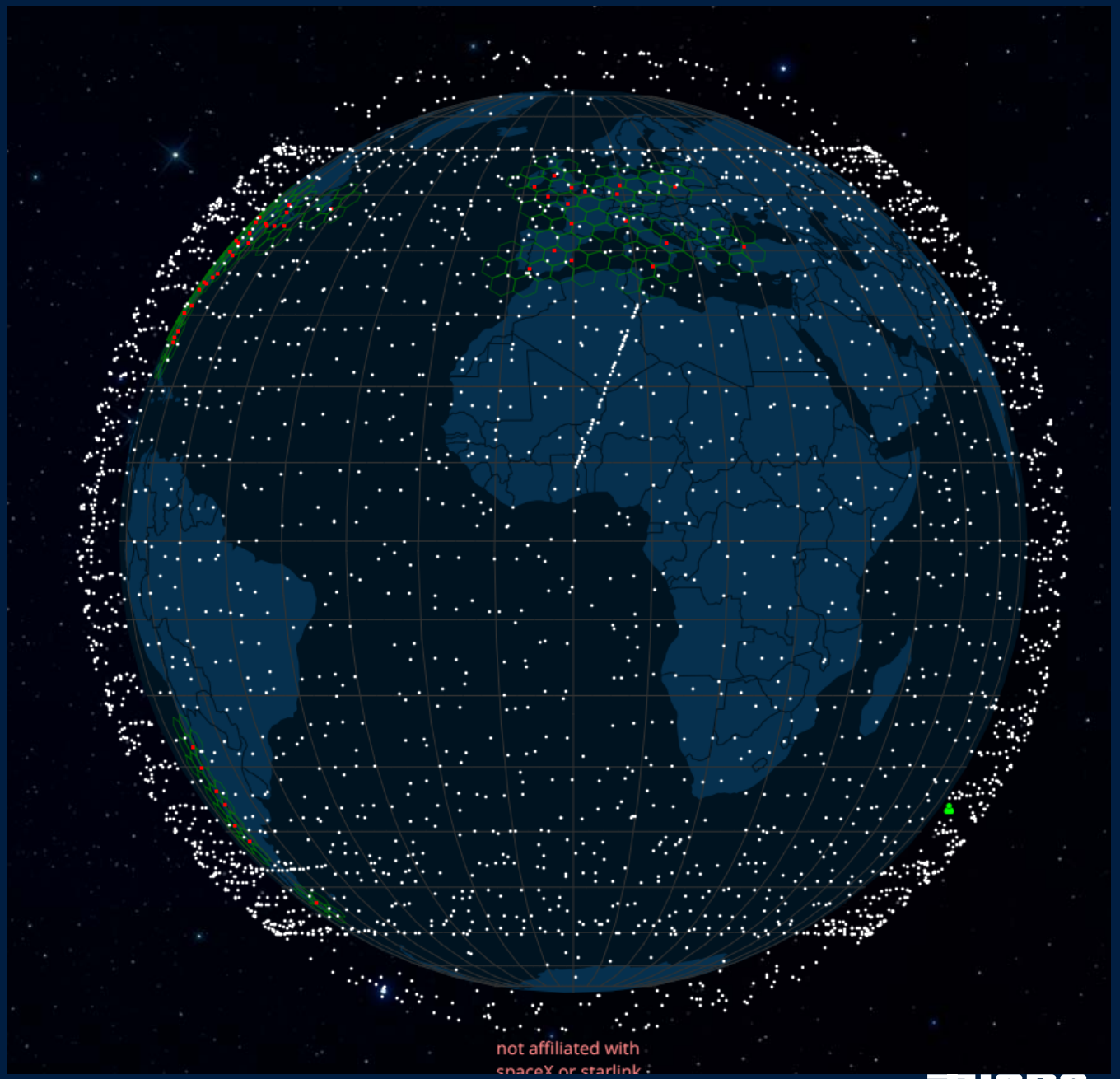
Starlink coverage



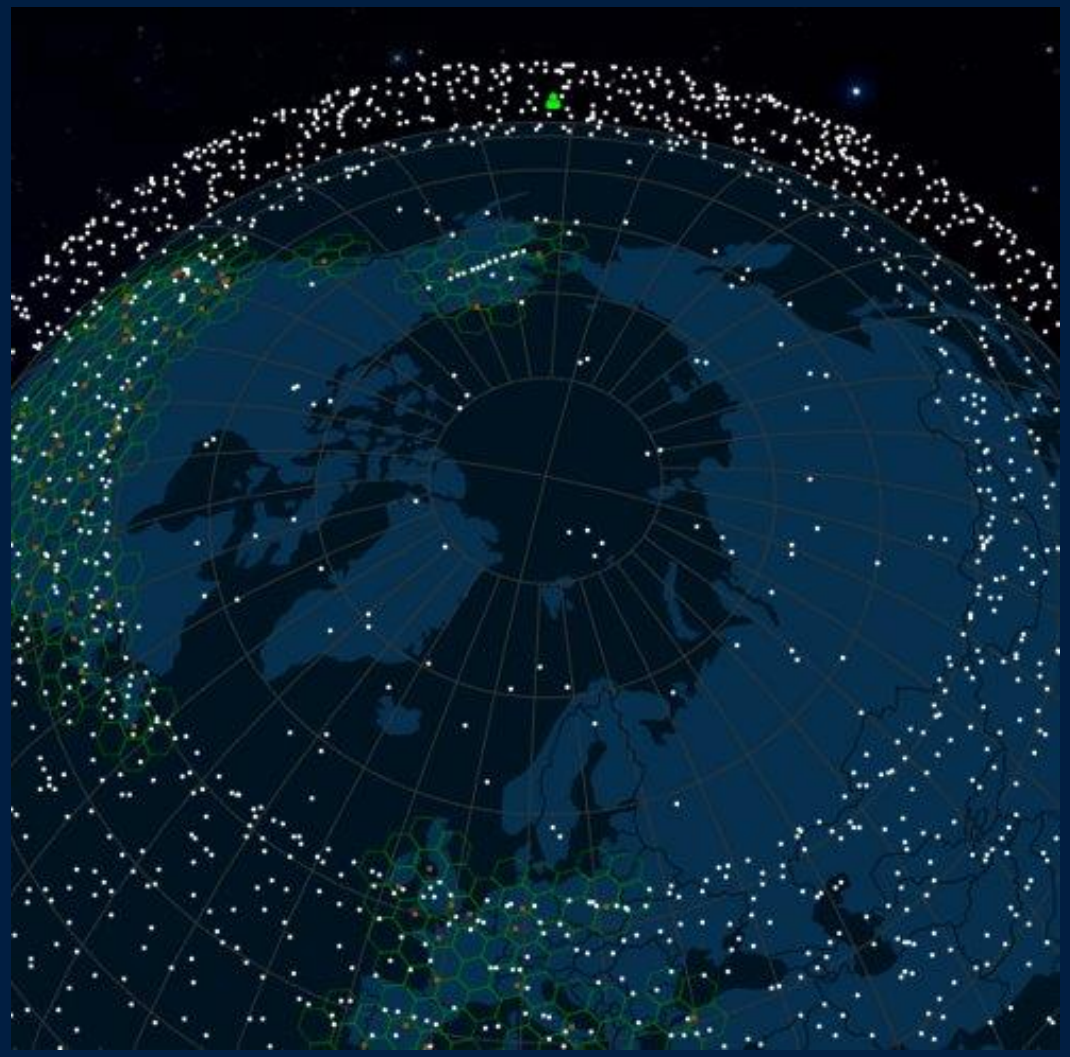
For most recent updates pls check www.starlink.com/map

Starlink grid

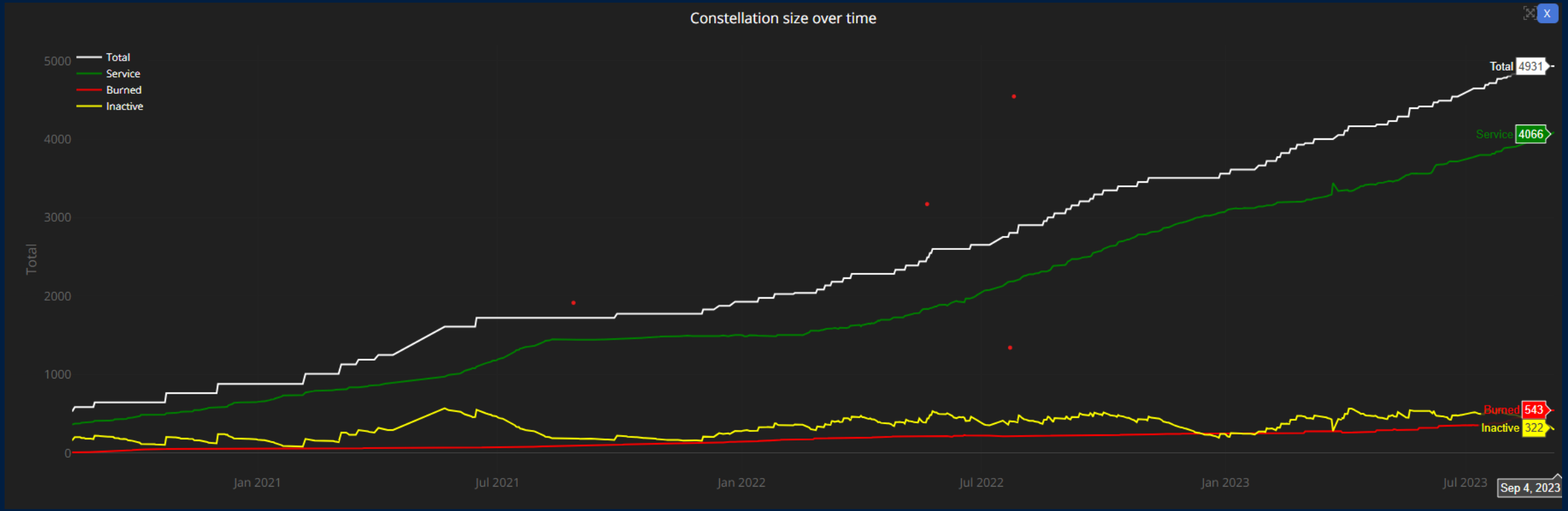
Train of satellites after launch



Licensing, coverage and usability



Total Starlink Satellites launched



Starlink incidents

- 4 Feb 2022 38 Starlink satellites lost by geomagnetic storm
- SpaceX Starlink satellites had 25,000 collision-avoidance maneuvers in just 6 months
- Light Pollution for Astronomers. (Improved by new Starlink design with dark coating)
- Radio interference for Astronomers (LOFAR) at 150.05 and 153 Mhz (Harmonics)
- 30 november 2022 worldwide Starlink outage during 15-20 Minutes

Hardware options

1. Residential; $120 - $ 50/month
   a) For residential use only
   b) Static location
   c) Standard antenna
2. Business; $250 - $1500/month
   a) For business use
   b) Static location
   c) High Performance antenna
   d) Priority traffic & support
3. ROAM; $150 - $250/month
   a) In motion use
   b) High Performance antenna
4. Mobility; $250 -$5000/month
   1. In motion use
   2. High Performance antenna
   3. Priority traffic & support
5. Aviation
   a) Not Available Yet

Hardware options

5. Maritime; $1000 - $5000/month
    1. Global offshore use
    2. Land use in licensed areas
    3. In motion use
    4. Dual antenna setup

Thank you