

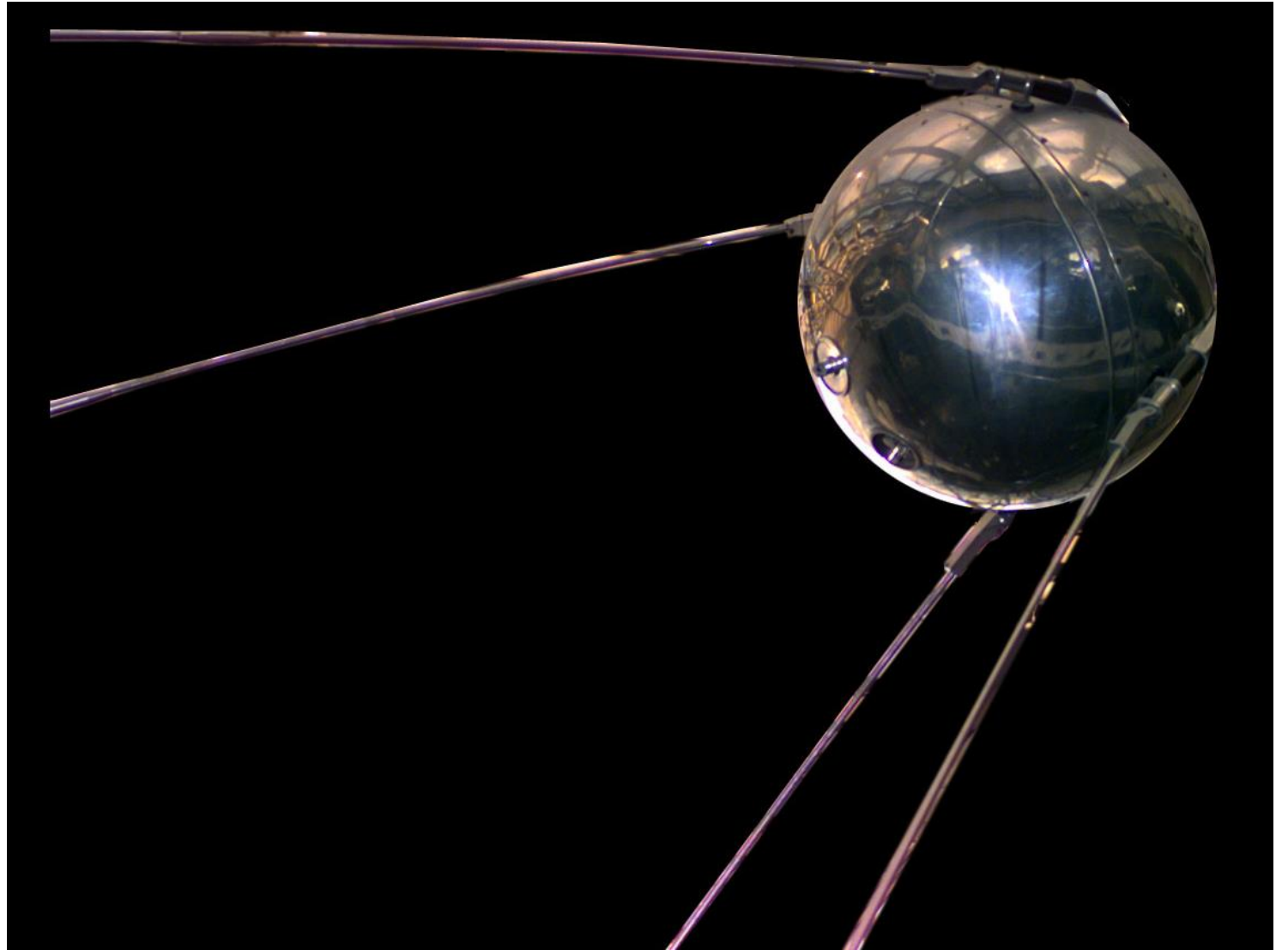
Brief Summary of Satellite Internet

Jupiter II



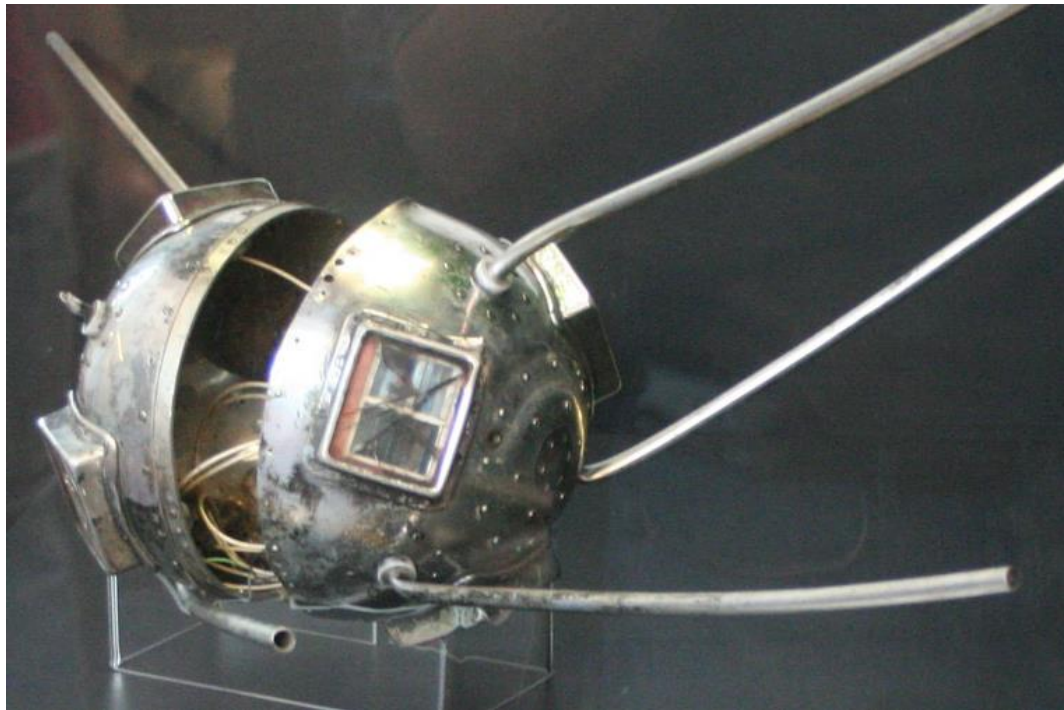
Sputnik 1 (184#, 1W), Sputnik 2 (1120#)

- Sputnik 1 Oct. 4, 1957
- Sputnik 2 Nov. 3, 1957
“Liaka”



Vanguard TV3 (3#)

Dec. 6, 1957



Explorer 1 (31#, 60W)

Dec. 31, 1957



Vanguard (3.2#, 10 mW, 6.4" Dia.)

- March 17, 1958



Satellite Distance from the Earth

- LEO (Low Earth Orbit) 100-1240 miles up
- MEO (Medium Earth Orbit) 1240 miles to below GEO (GPS, O3B)
- GEO (Geosynchronous Orbit 22,300 miles up (Clark Belt)
- HEO (Highly Elliptical Orbit)



Satellite Phones for Alaska: Iridium

LEO

64 satellites,

Text and Phone,

International phone numbers,

Heavy voice compression,

Relays from ground to satellite to satellite to ground station,

Alaska Plan, \$200/6 months, 200 minutes, minutes roll over if current

Availability: 24-7, everywhere

Satellite Phones for Alaska: Globalstar

LEO

Very clear audio

24 satellites (plus “extras”)

Text, VM, very slow Internet

Local Wasilla #s,

Relays from ground to satellite directly to ground station(s)

Free phones, unlimited use, \$1200/yr, \$780 1200 minutes/year

Availability, most land masses, more gaps in coverage toward poles

Coverage, 40 minutes/hour

Satellite Phones for Alaska: Inmarsat

GEO

Clear Audio

Doesn't work near poles

Earlier phones resembled laptops, and were manually pointed to Sat.

Not commonly seen in Alaska



Satellite tracking, locating & messaging in Alaska: Spot, Trace

LEO (Globalstar Network)

Originator of concept for inexpensive consumer devices

One-way communications only (Trace – tracking only)

Emergency Button (Spot only)

Pre-programmed messages (Spot only)

Simple operation, cheap to buy and purchase service for

No global coverage, especially over oceans

Weaker toward poles

Uses lithium batteries

Globalstar Phone, Spot, and Trace



Satellite tracking, locating & messaging in Alaska: Spidertracks

LEO (Iridium Network)

Aircraft Tracking – uses ship's power

Texting (some systems)

Global coverage

More expensive



Satellite tracking, locating & messaging in Alaska: inReach (Garmin)

LEO (Iridium Network)

Relatively inexpensive to purchase

Two-way communications, text and email

Emergency Button

Pre-programmed messages and custom messages

Relatively inexpensive service plans

Global coverage

Rechargeable battery



Satellite Internet for Alaska: General Considerations

Alaska is a challenging market for providers !!

Logistics (shipping & installer travel) Issues

Large area to cover, relatively few customers

FCC and providers require certified installers

Ground movement, wind, and cold temperatures

Demanding environment for outdoor electronics and cables

Off grid and remote power sometimes unstable

Low look angles – trees, hills, power lines cannot block signal path

Existing MEO network (O3B) limited to middle latitudes.

TV dealers sometimes “bundle” with satellite Internet (Exede and Hughes)

Satellite Internet for Alaska: Starband

Starband was first consumer service in Alaska

No longer operates consumer services in Alaska

Current owner does still provide enterprise services to USPOs in Alaska

Recovery Act participant, provided Internet to remote customers

Antennas still in use today for other satellite services

Difficult history, with bankruptcy, satellite failures, satellite changes.

Consumer Satellite Internet for Alaska: HughesNet Gen2

Made possible by Horizons 1 satellite at 127 degrees west

Gen2 is first 2-way (satellite return) HughesNet service (DirecWay)

Started operating in State 2004

Satellite expected to operate through 2023

Satellite is relatively high in sky, strong signals in Alaska

Ku band, “bent pipe construction”

Network Operations Centers for Alaska: Germantown, MD, Las Vegas

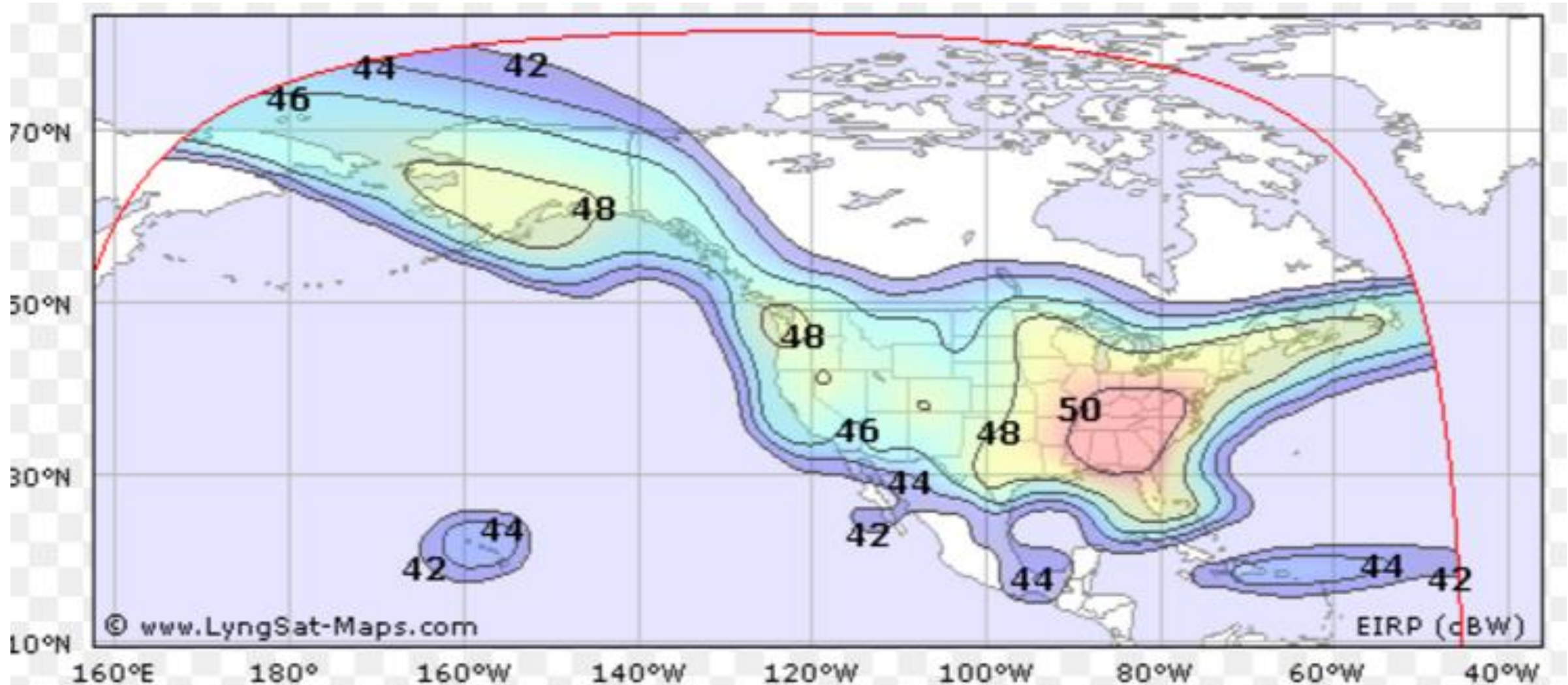
Consumer speeds up to 2 mbps, prices \$60-200/month

Usage limits, but unlimited at night

Normal antenna sizes for Alaska: .74M and .98M (larger available if needed)

Covers all of Alaska except Pribilof and Aleutian Islands

Horizons 1 Footprint



Consumer Satellite Internet for Alaska: Exede

ViaSat 1 satellite first Ka spot beam consumer service in Alaska.

Relatively good orbital slot for Alaska at 115 degrees west

Band of coverage from Prince William Sound to Kotzebue

Good performance as compared to Ku services, more usage and speed

12 mbps download and 3 mbps upload, prices \$60-100/month

Soon will have speed increase to 25 mbps download

Relatively easy to install and service, but certified installer required.

.74M antennas in beam, larger, 1.2M and 1.8M antennas outside beam

Lease only

Exede Spot Beam 357



Consumer Satellite Internet for Alaska: HughesNet Gen5

Most powerful broadband communications satellite to date

Speed 25 mbps download, 3 mbps upload, \$50-130/month

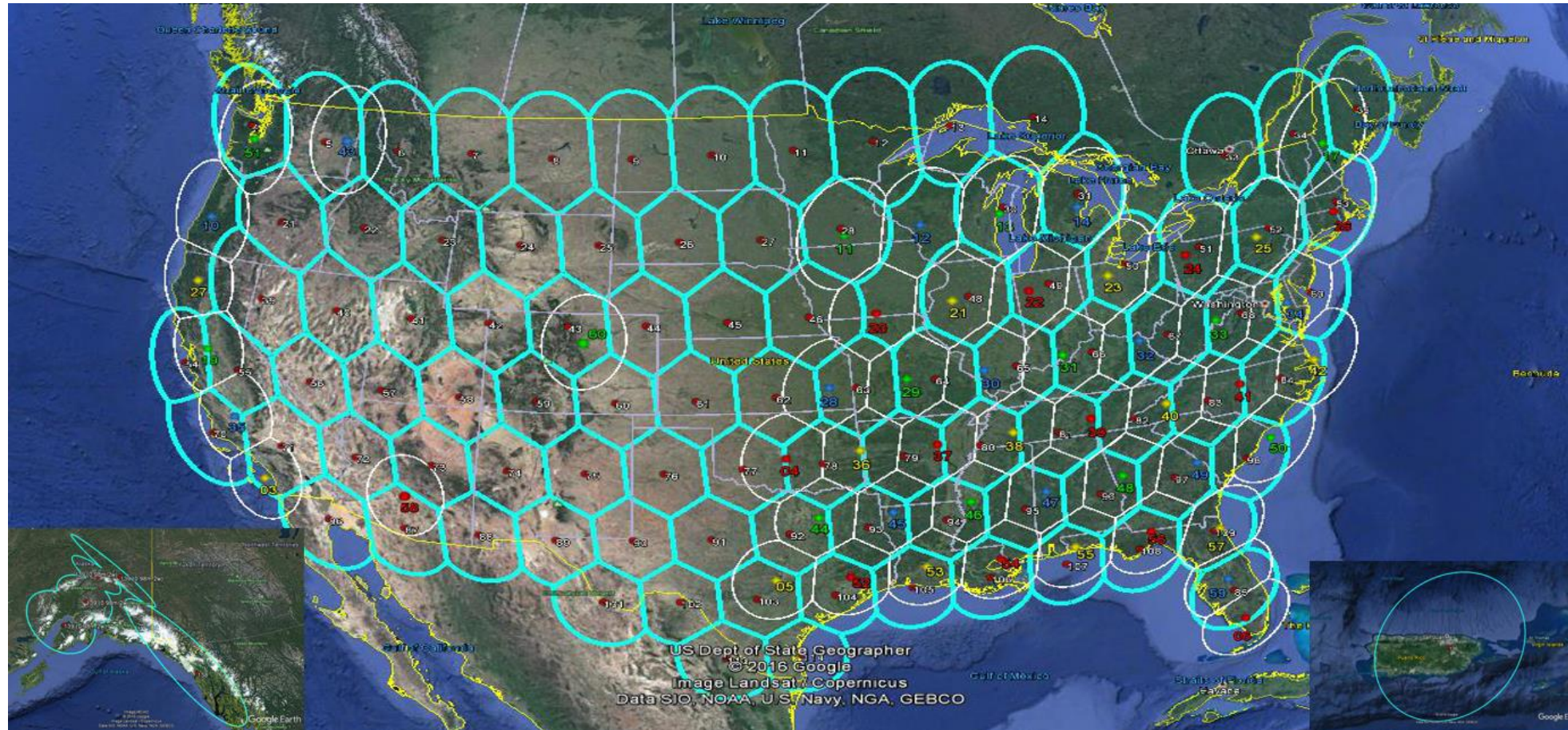
Orbital slot: 97 degrees west

Two spot beams: 138 (SE) and 139 (Mainland- East and South-Central)

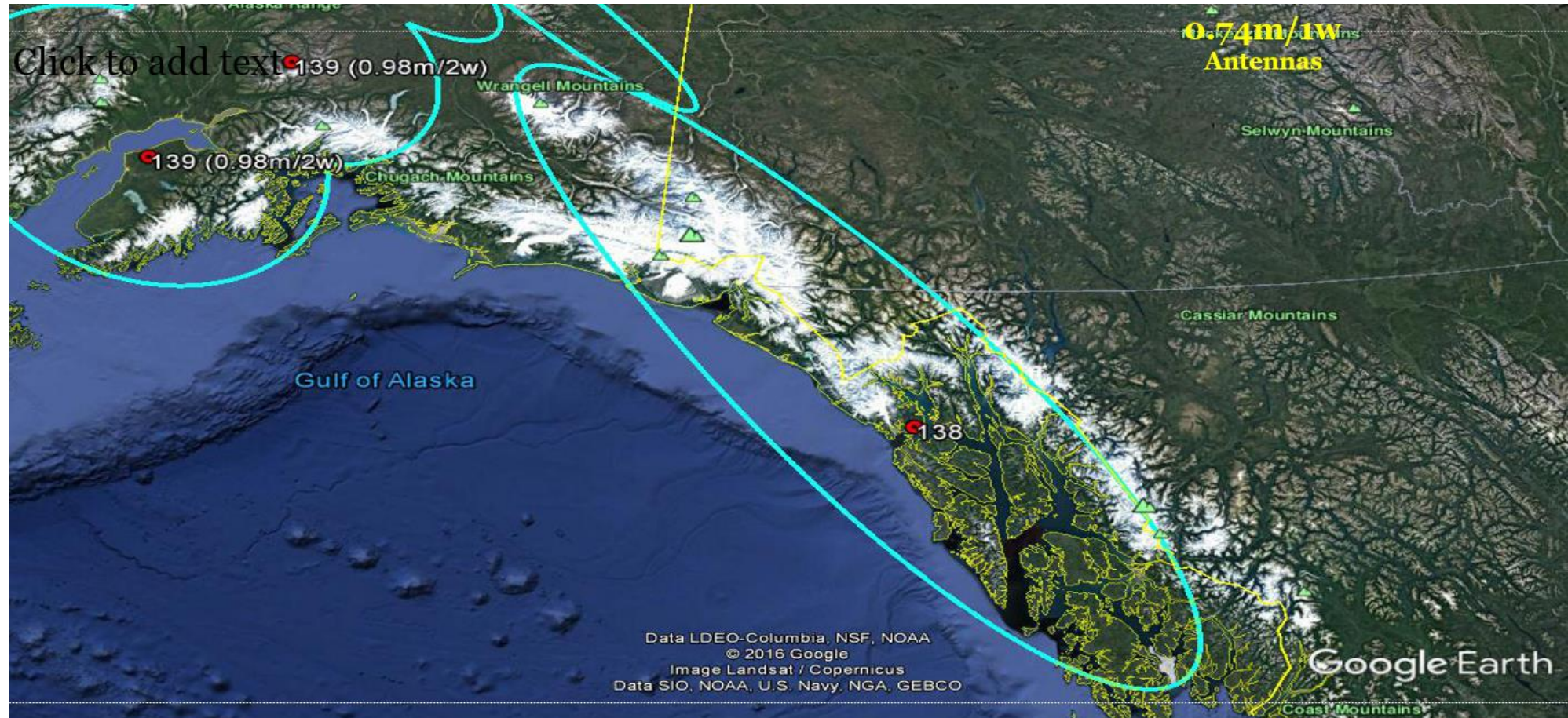
.98M antenna, lease or purchase

Experimenting with larger antennas to work somewhat outside of beams

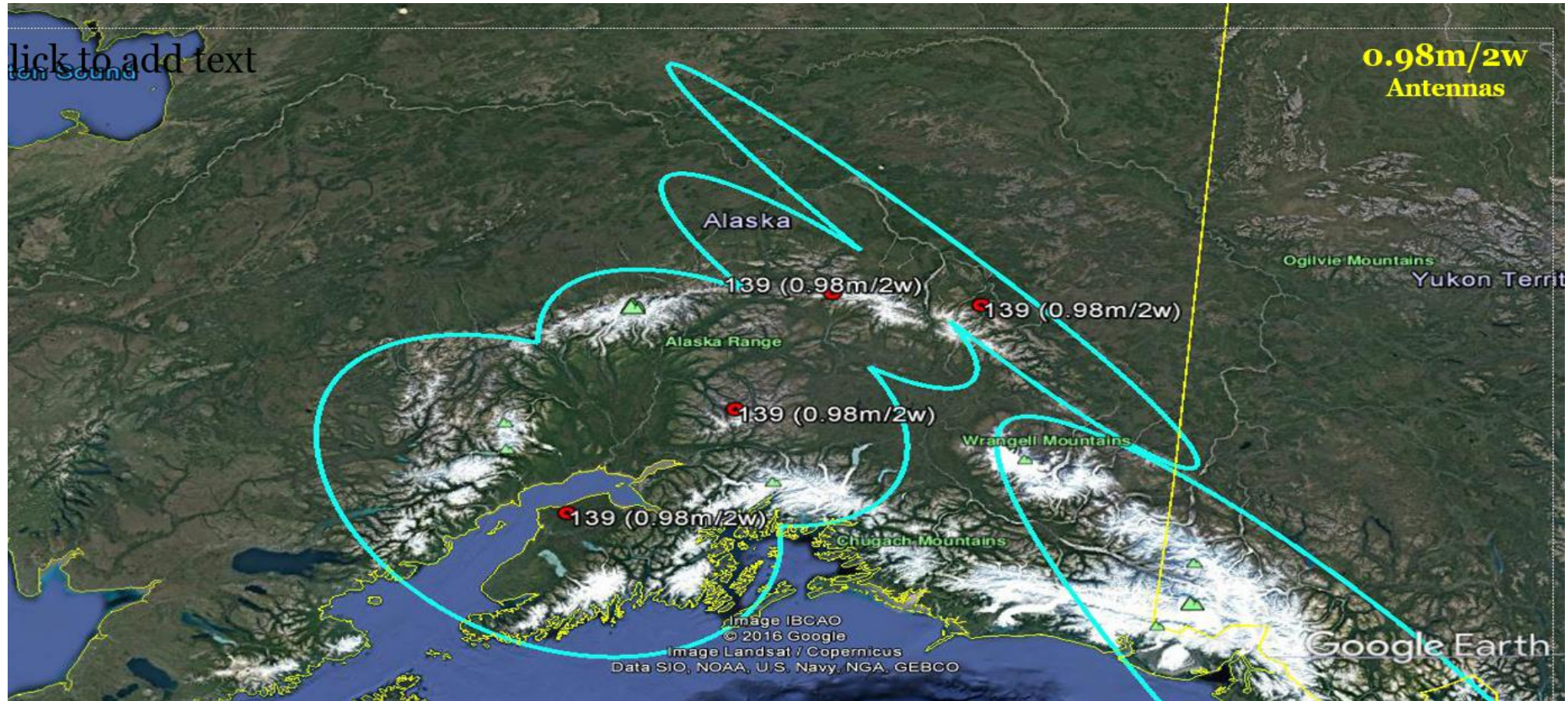
Hughes Jupiter 1 and Jupiter 2 Ka Spot Beams



Jupiter 2 Ka Band Alaska 138 Spot Beam



Jupiter 2 Alaska Spot Beam 139



Satellite Internet for Alaska: Ku band Enterprise Services

Intended for larger entities when consumer services aren't adequate

Lower contention ratios

More expensive equipment: antennas, radios, and modems

Larger antennas more expensive to transport and install

Speeds .2 – 5 mbps

Service ranges from \$300-3000/month

Unlimited plans available, sometimes at extra cost

More specialized options (static IP, ACL, etc.), higher level tech support

Satellite Internet for Alaska: Enterprise Service Providers

Hughes HX (Ku and Ka Band)

Switch (Ku and C Band)

Galaxy (Ku and Ka Band)

iDirect (Ku Band)

Exede Business (Ka band)

Starband (Ku Band, USPO only, under new ownership)

Network Innovations (Ku band)

Enterprise satellite Internet can sometimes provide a competitive alternative to services provided by local telecom providers.

Satellite Internet for Alaska: The Future

Flat plate, phased array antennas – may not need installer - automatic alignment (Toyota and Kymeta have LCD holographic flat plate technology)

LEOs and GEOs working together

LEOs for low latency and “everywhere” connectivity, GEOs for “heavy lifting” where latency isn’t a factor

Big names and big money behind projects (several thousand satellites overhead soon?)

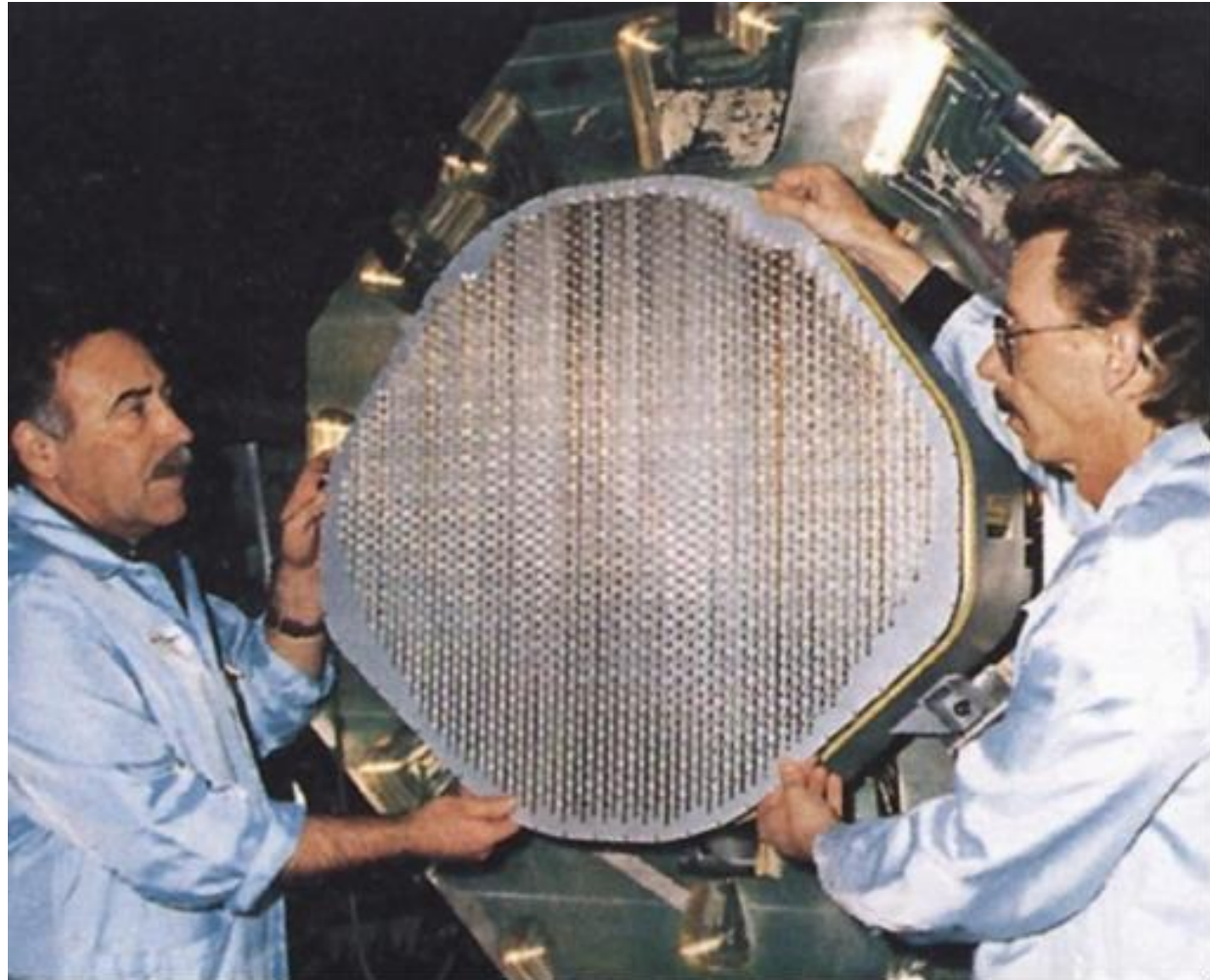
Coming soon – some launches perhaps as early as 2018

Mass produced, inexpensive satellites (One Web facility in Florida)

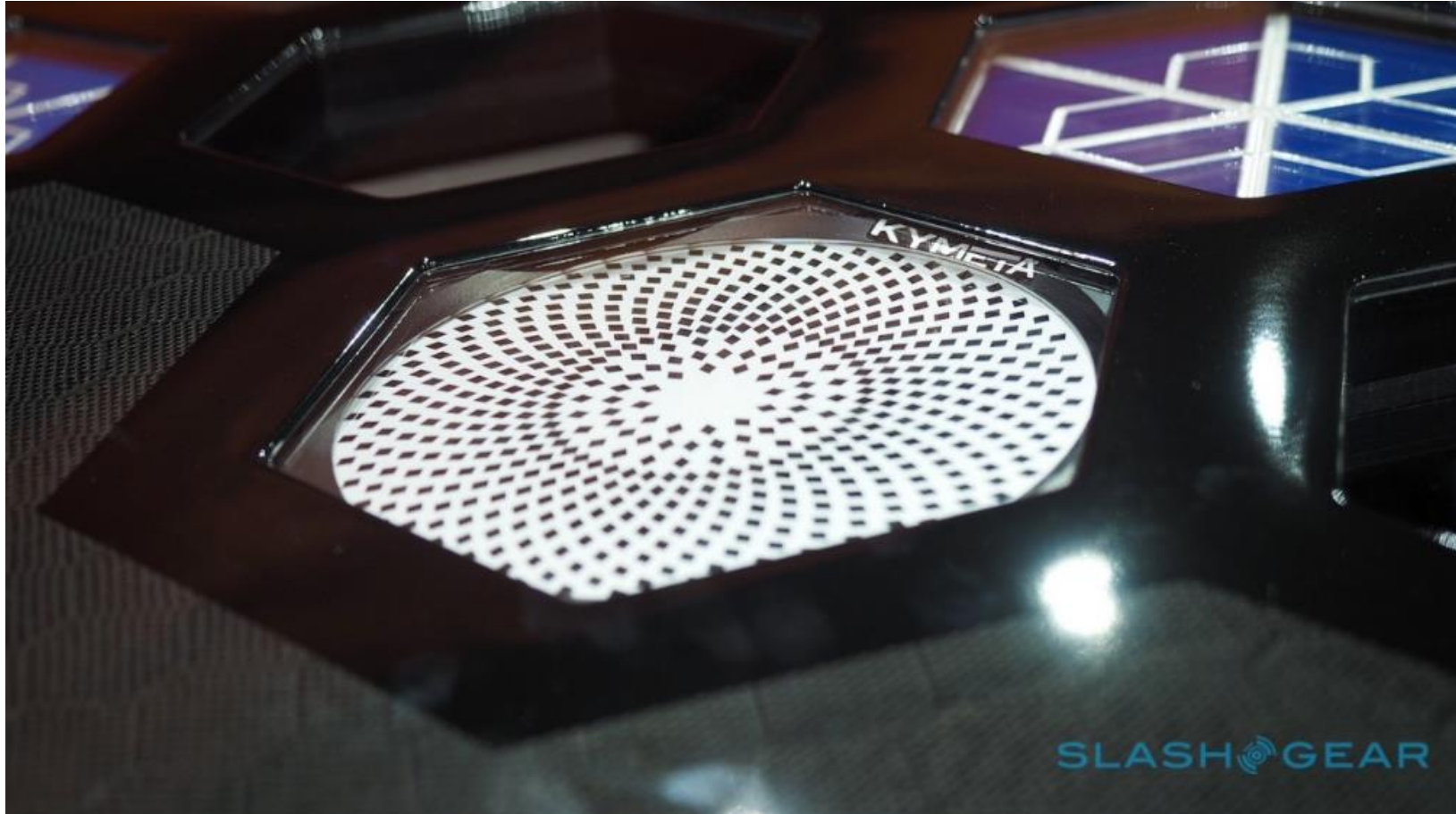
Could Alaska be a good place to launch from, since these are polar orbiting and do not need to go as high? (Kodiak Launch Facility)

Satellite enabled “cell” phones with Internet capability \$10/mo (disruptive?)

Aircraft Phased Array Antenna



Toyota – Kymeta Flat Plate Antenna



Satellite Internet for Alaska: LEO Providers

One Web Airbus, Hughes,
Coca-Cola, Bezos (900 LEOs)
B2C

SpaceX Musk(4425 LEOs)
B2C

Leosat (108 LEOs) B2B

