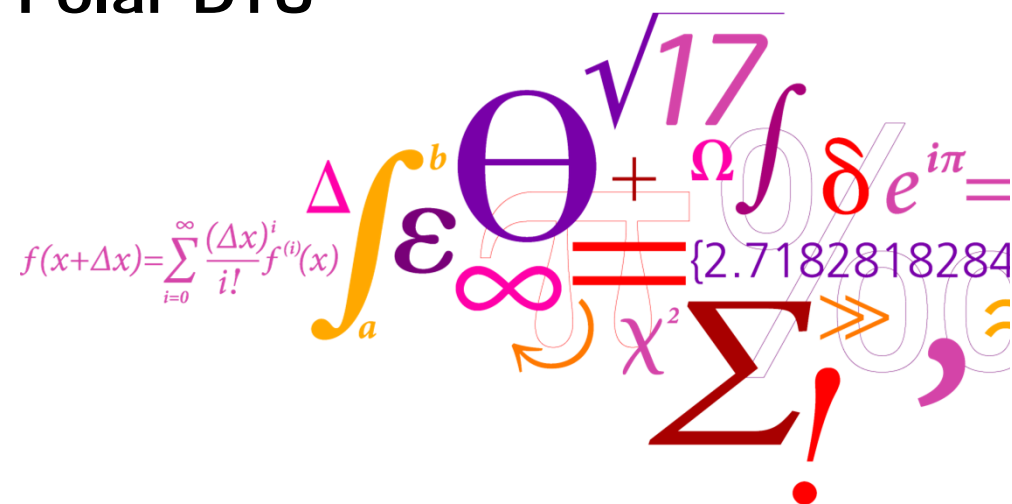


# Synergies in military and civilian use of satellites for communication, navigation and surveillance

Jens Olaf Pepke Pedersen  
DTU Space & Polar DTU

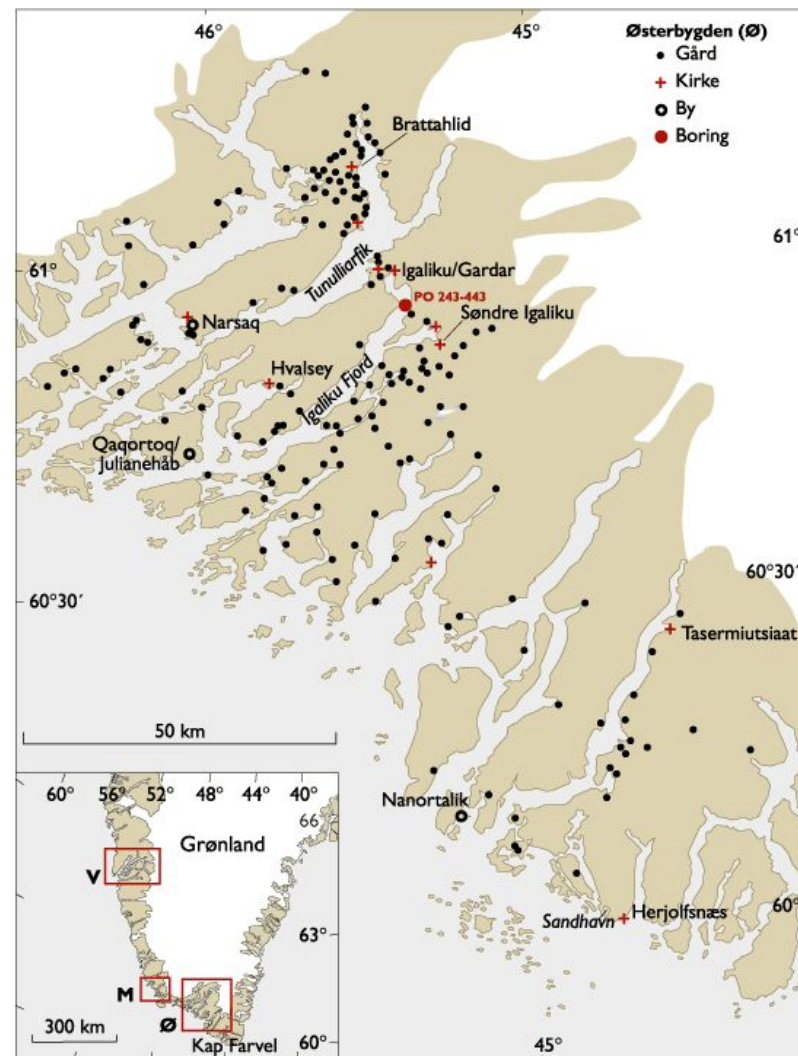




985



1408





# The Arctic as a short cut: Search for the North West passage

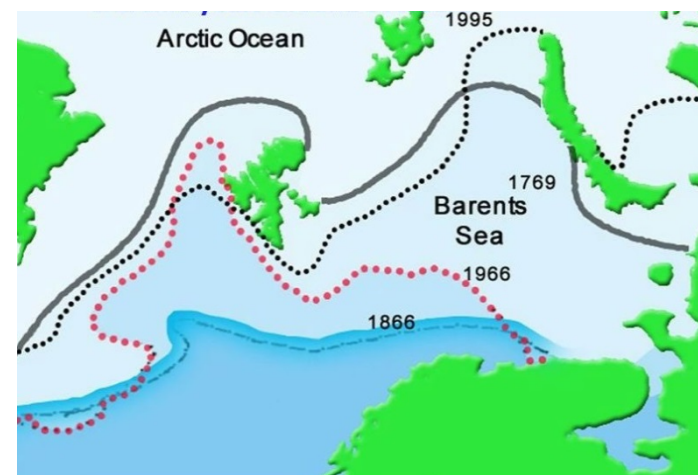


Jens Munk (1619-20)

# The Arctic as a short cut: Search for the North East passage



Westall (1806) 'Nelson and the Bear'



John Phipps (1773)



# The Arctic as the destination

## Still a region with many challenges

- Communication
- Situational and Domain Awareness
- Navigation
- Charting

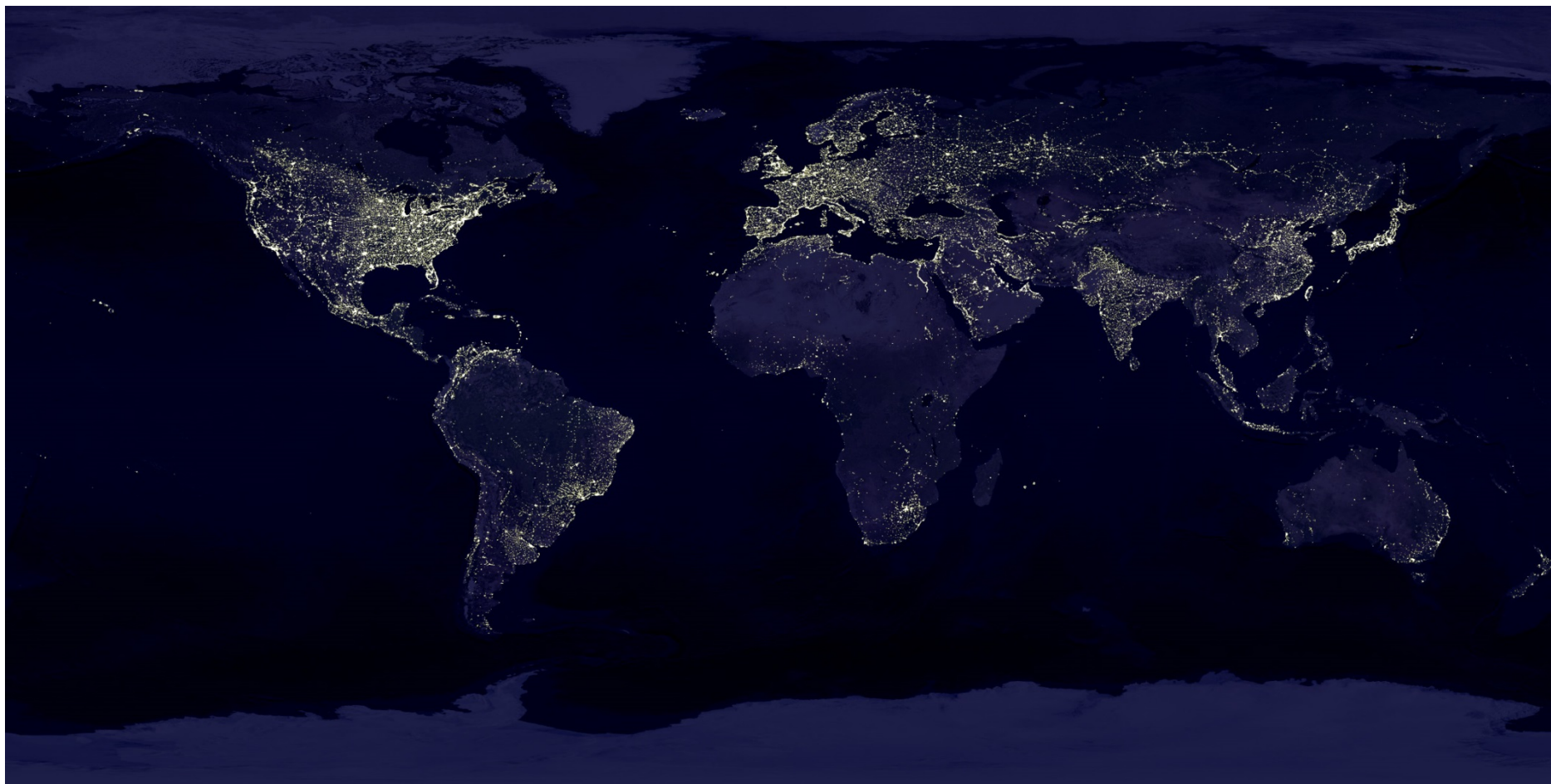
## Dual Use Aspects



# Challenges

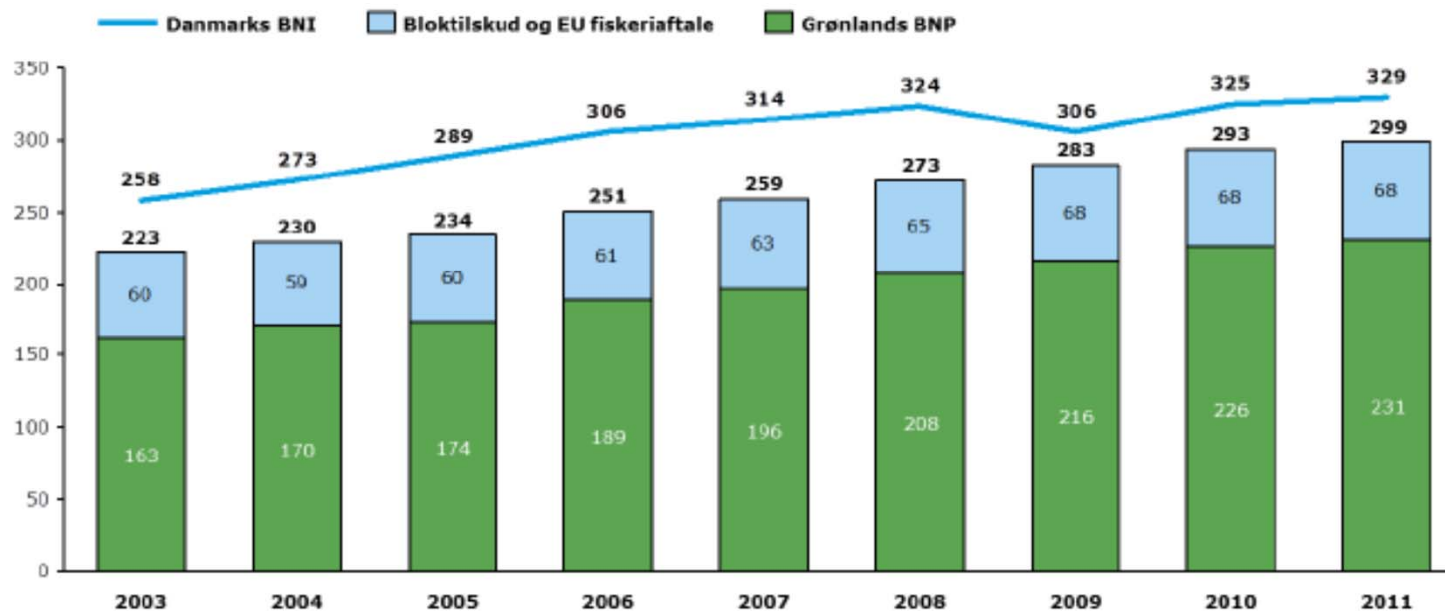


# Challenges



# Challenges

Figur 5: Udvikling i BNI per indbygger for Grønland og Danmark, i 1.000 kr., 2003-2011

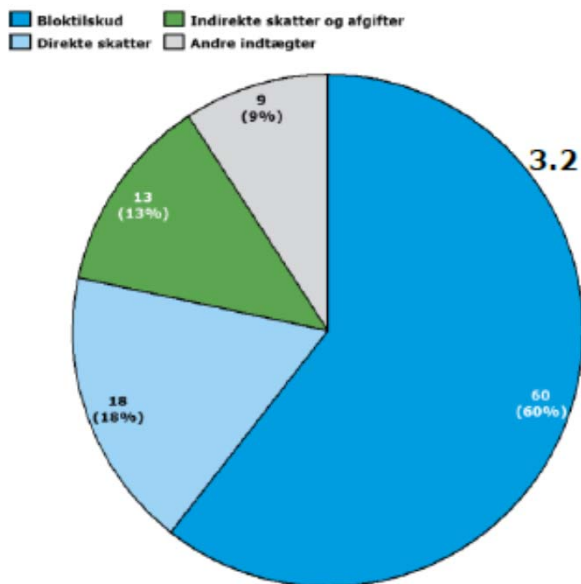


Kilde: Grønlands Statistik og Danmarks Statistik.

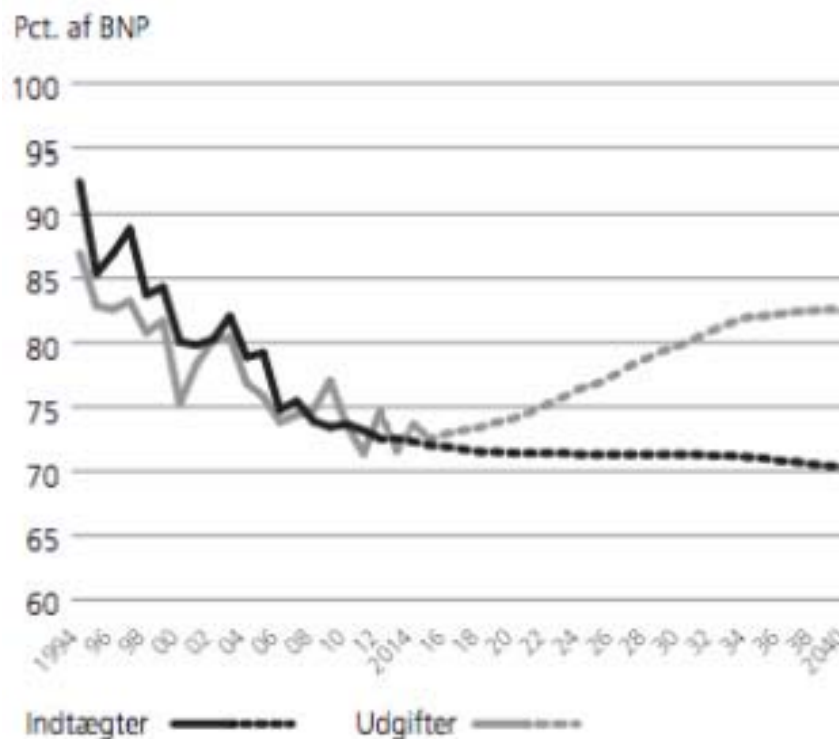


# Challenges

Figur 6: Selvstyrets indtægter i mio. kr., 2011



Kilde: Grønlands Finanslov for 2013.

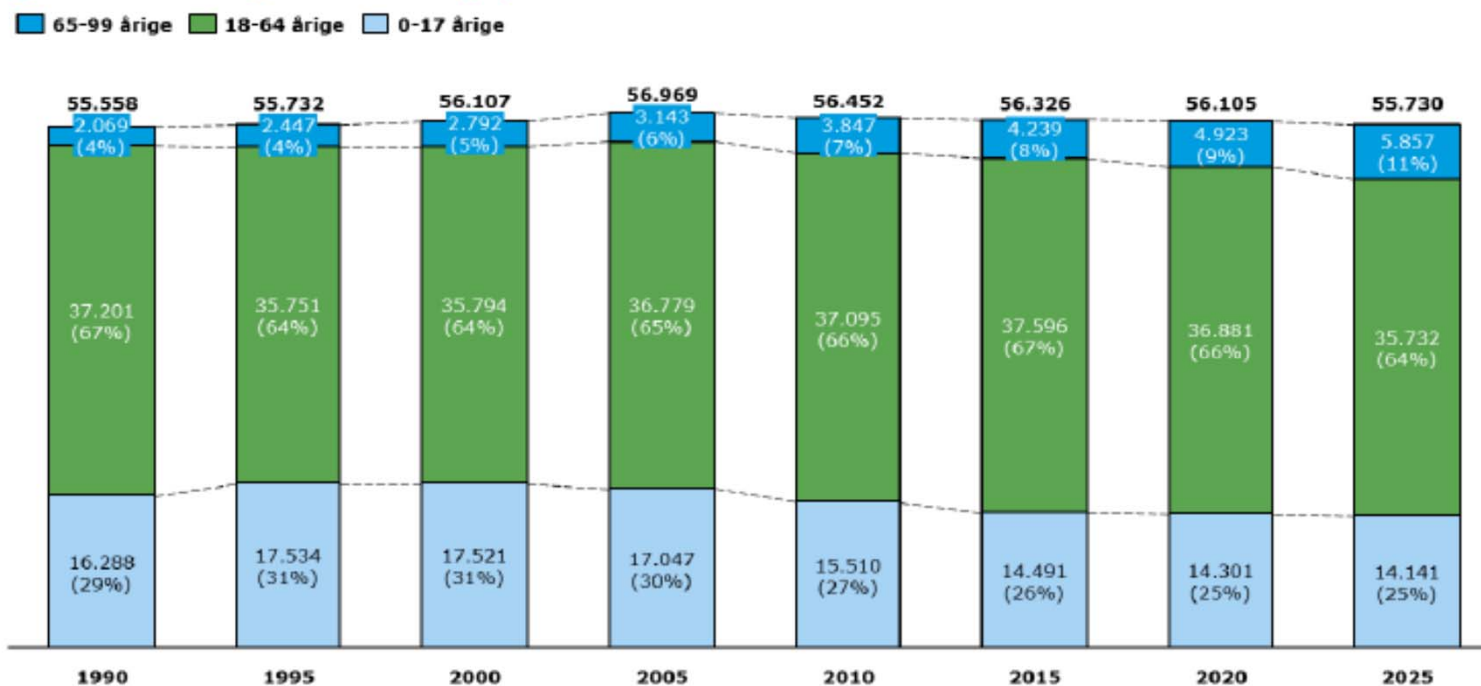


Prognose for Grønlands økonomi til år 2040.

Kilde: Grønlands Statistik og Grønlands Økonomiske Råd

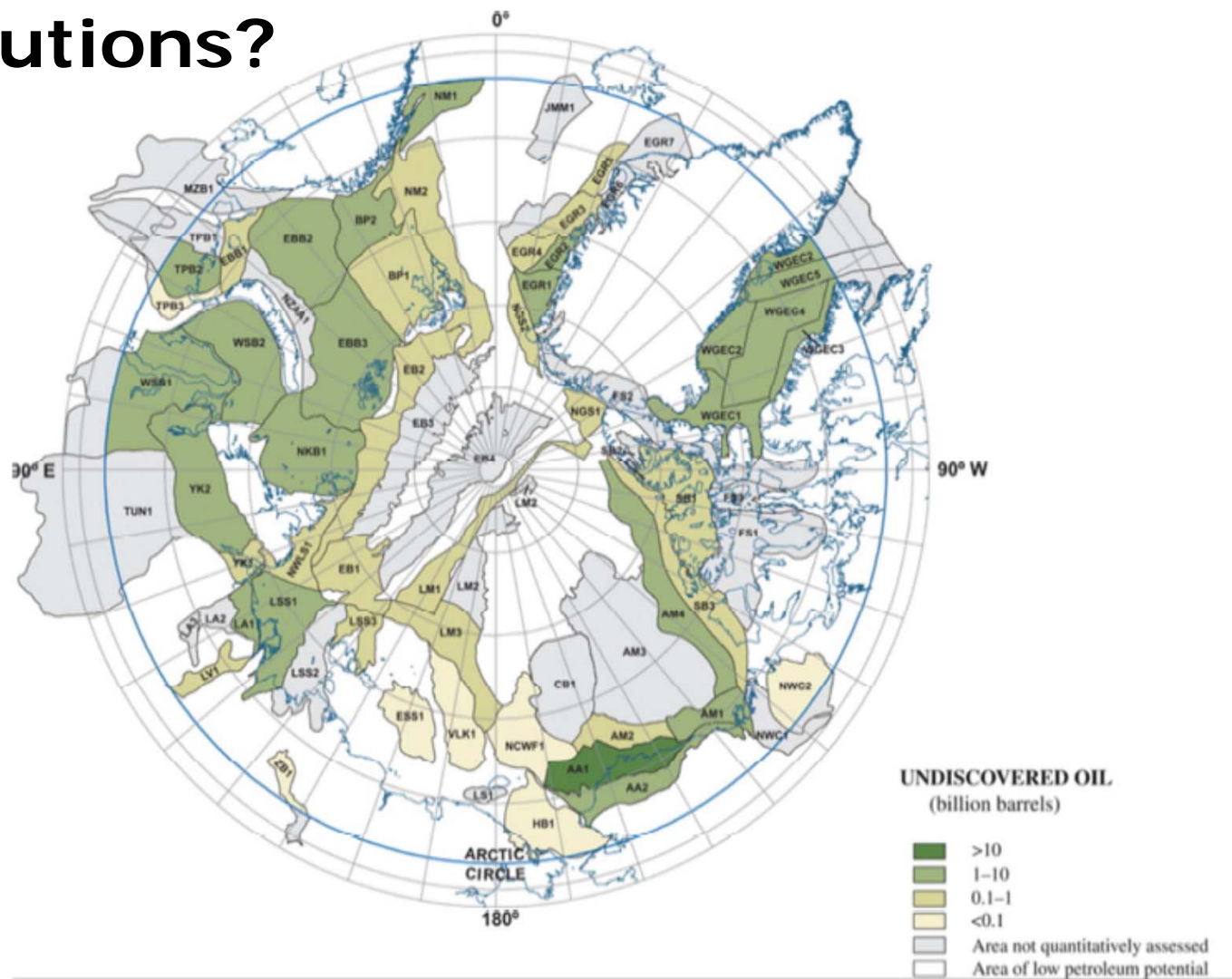
# Challenges

Figur 9: Udvikling i Grønlands population, antal mennesker



Kilde: Grønlands Statistik.

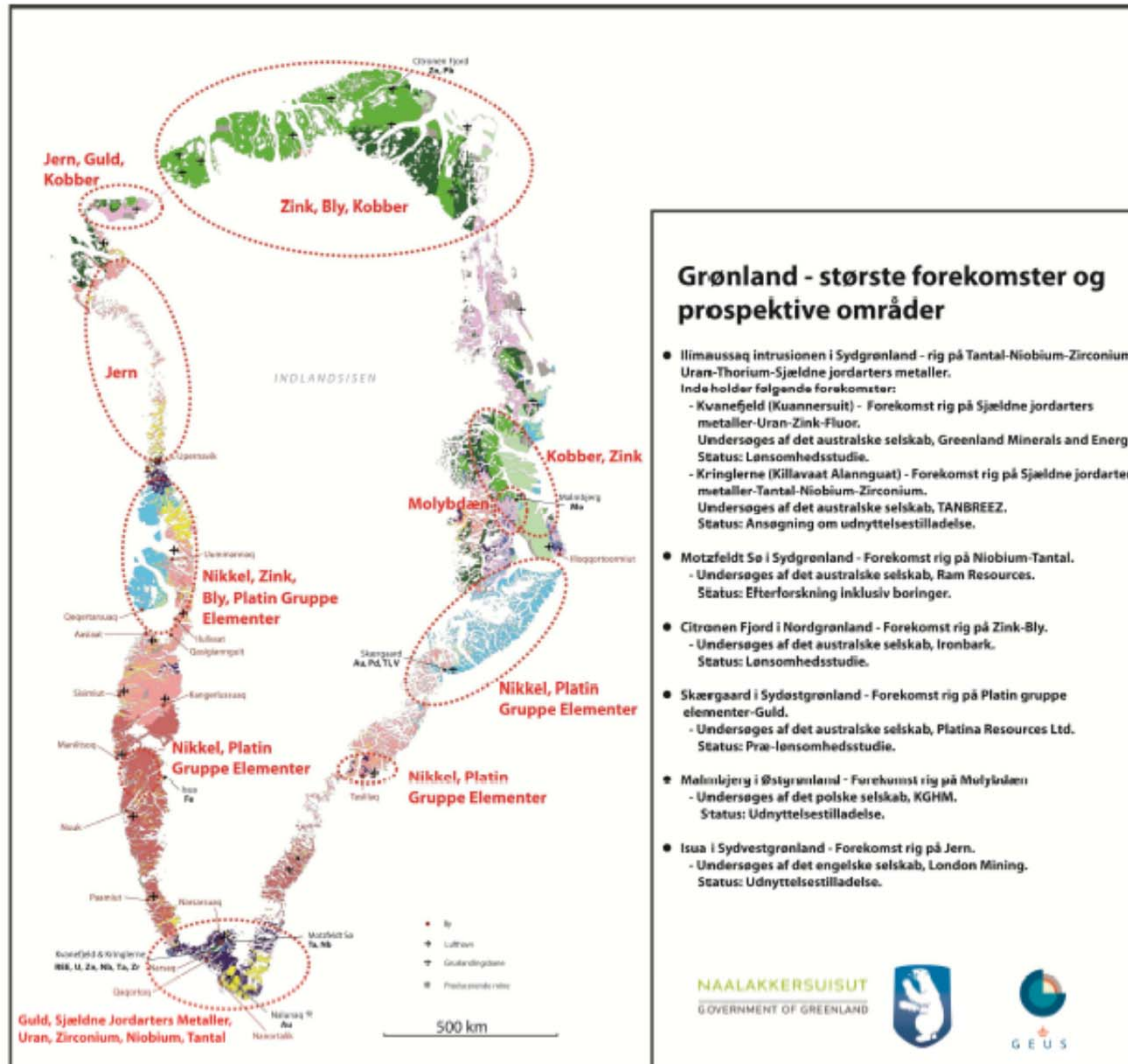
# Solutions?



Figur 6: Den arktiske region opdelt i geologiske enheder med henblik på vurdering af potentialet for olie. (Kilde U.S. Geological Survey)

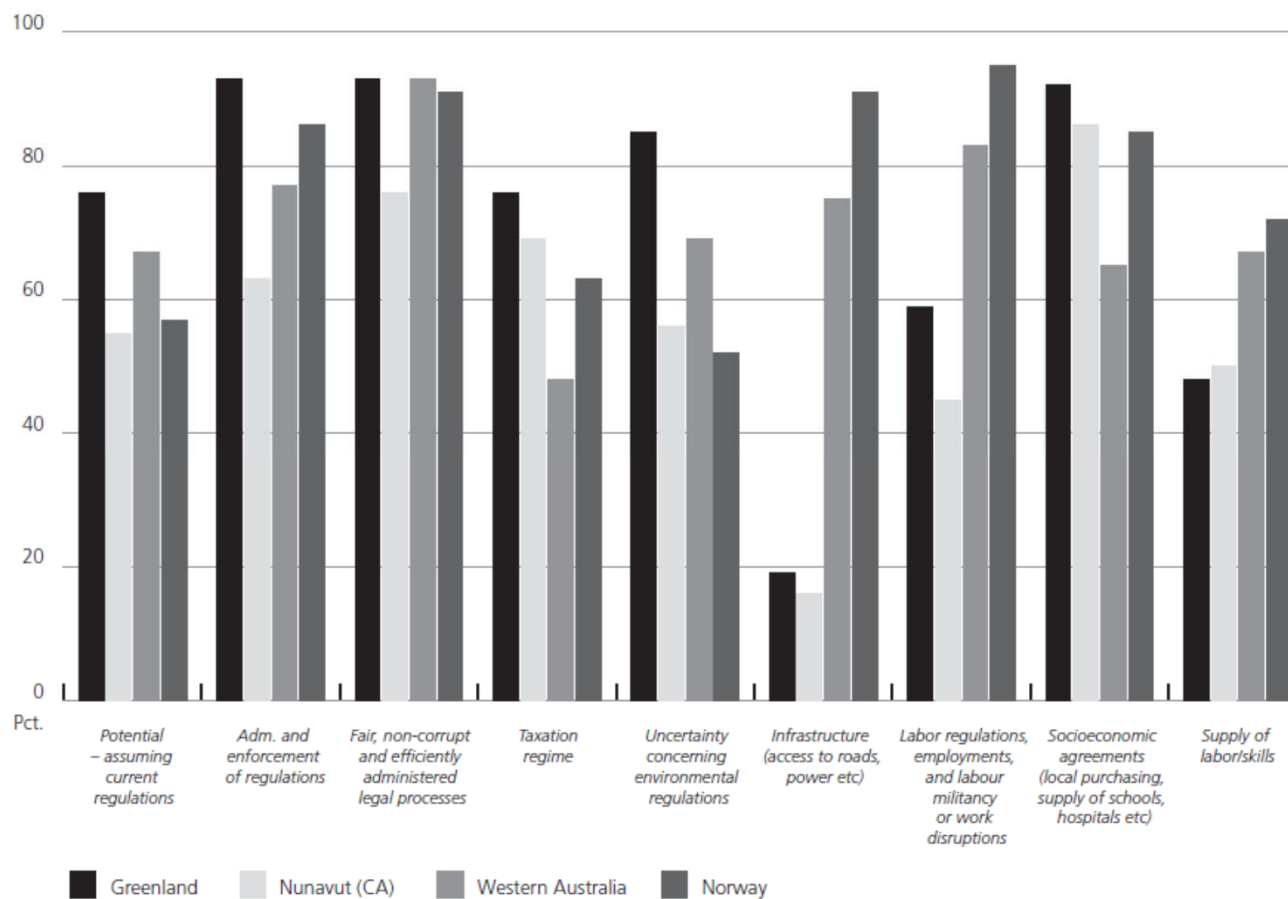


# Solutions?



Figur 8: Konkrete mineralforekomster med stort potentiale for udvikling af minedrift.

# Solutions?



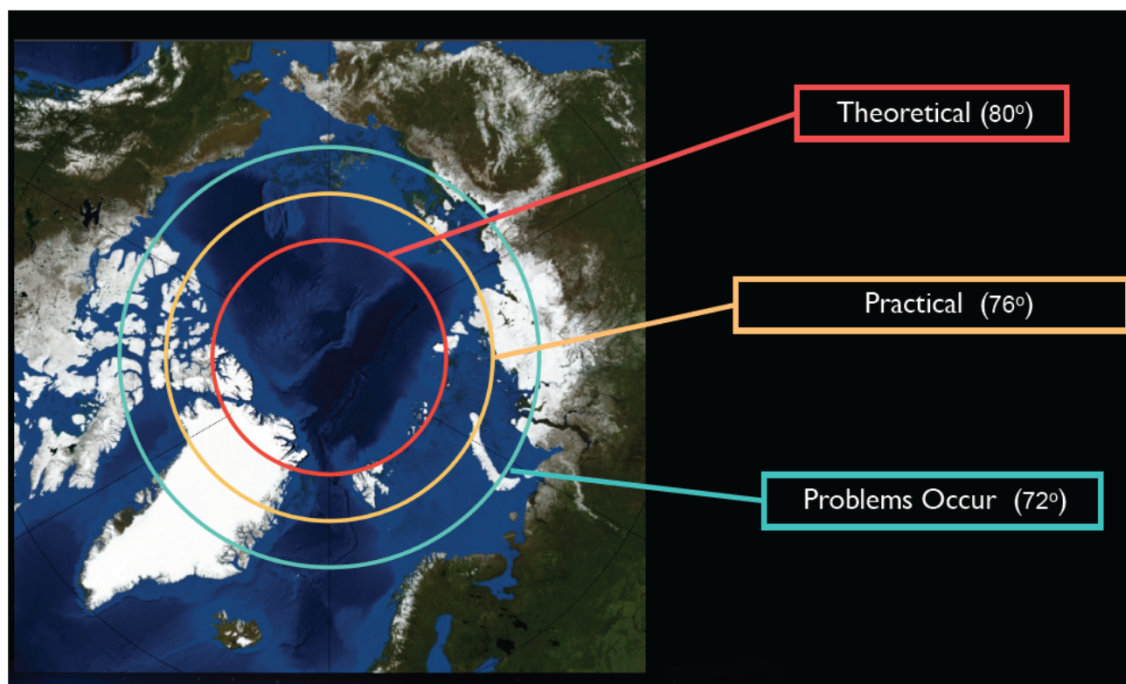
# Communication



Greenland: communication service provided by satellite, cables, and microwave radio relay



# Communication



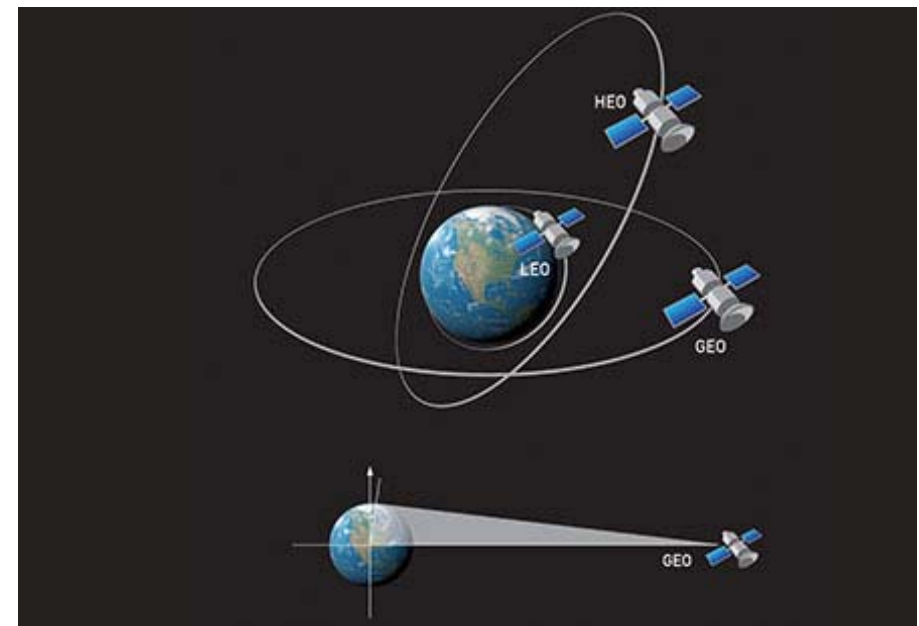
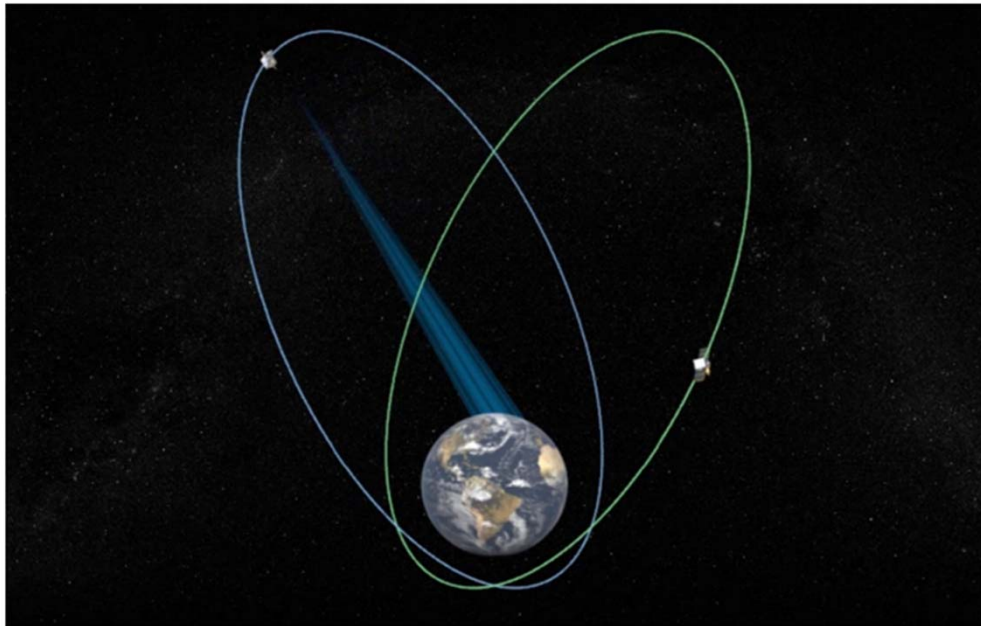
Existing satellite systems have little or no coverage North of 75 deg

Small market for commercial broadband in Greenland:

- high rates and low speed

# Dual use : communication

Common infrastructure for both military and civil needs



Can cover full Arctic region – small amount of infrastructure – no harm to environment

Support businesses (large data transmission "potential game changer")

Support small villages: distant teaching / telemedicine

Safety & tourism – photo / film / maps

Transmit data from exploration surveys (seismic etc), weather & environmental data

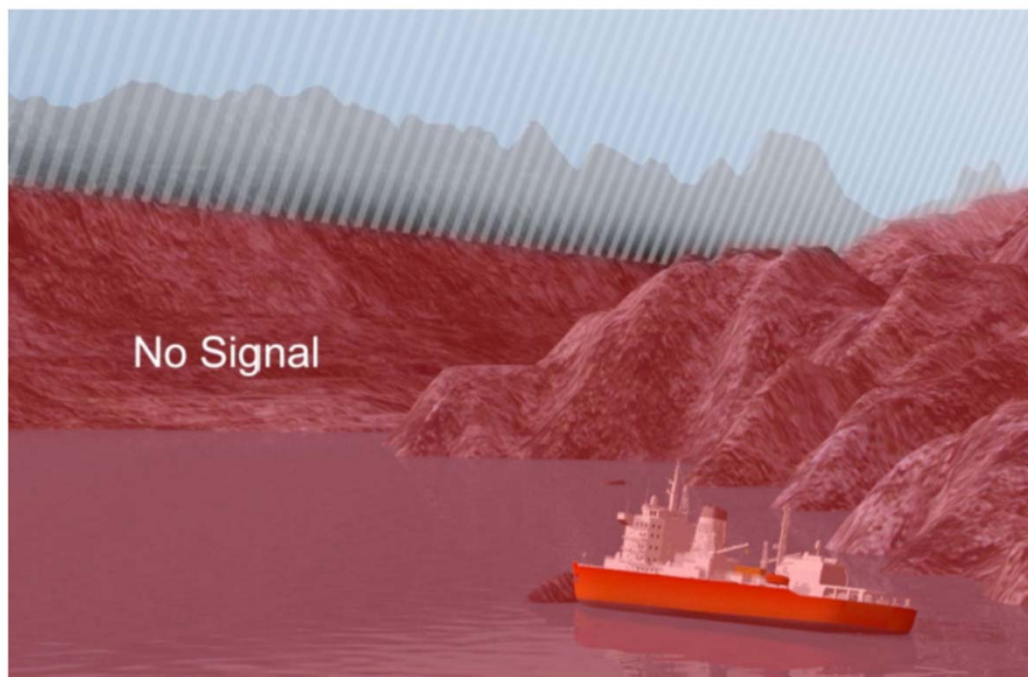
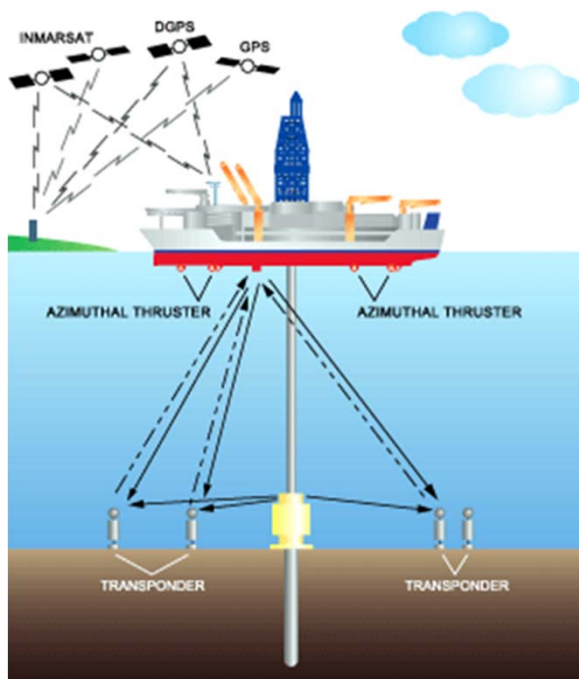
Drones as backup communication systems

# Dual use : situational and domain awareness





# Dual use : navigation



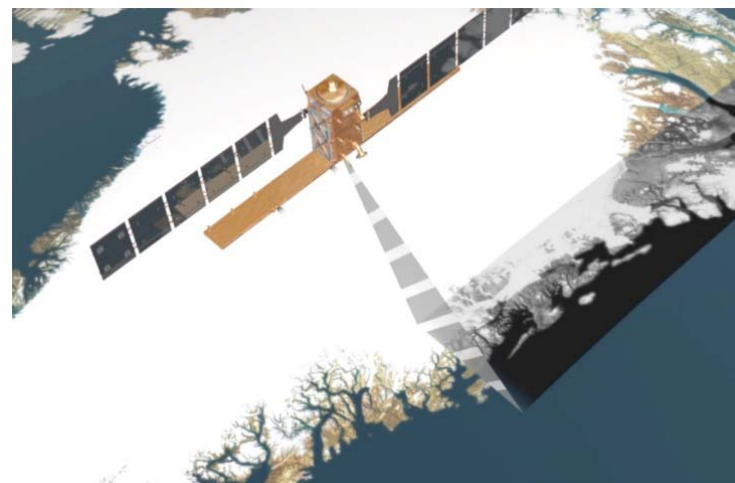
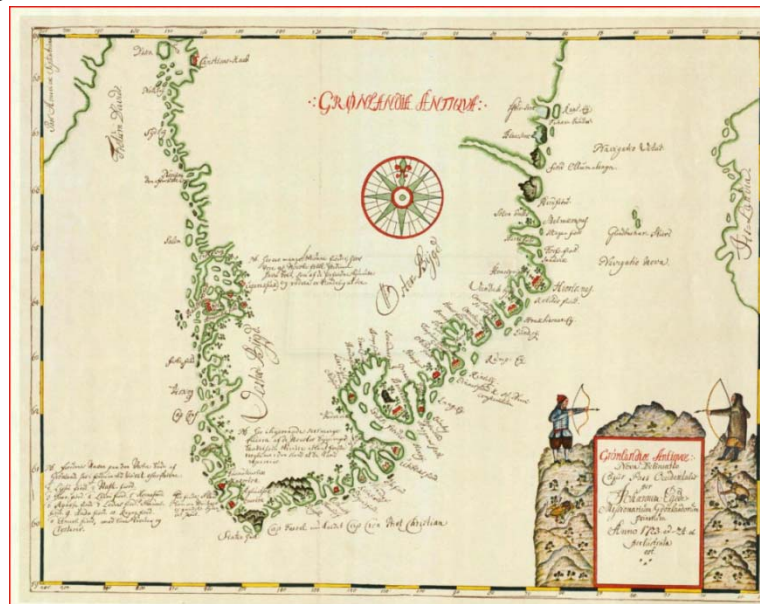
Navigation tæt på land og i fjorde kan være et problem, fordi signalet fra GPS-satellitterne står så lavt over horisonten, at signalet ikke når ned bag høje bjerge.

# Dual use : charting

Large need for updated maps  
(coast + inland)

Reduced sea ice opens new  
areas for traffic

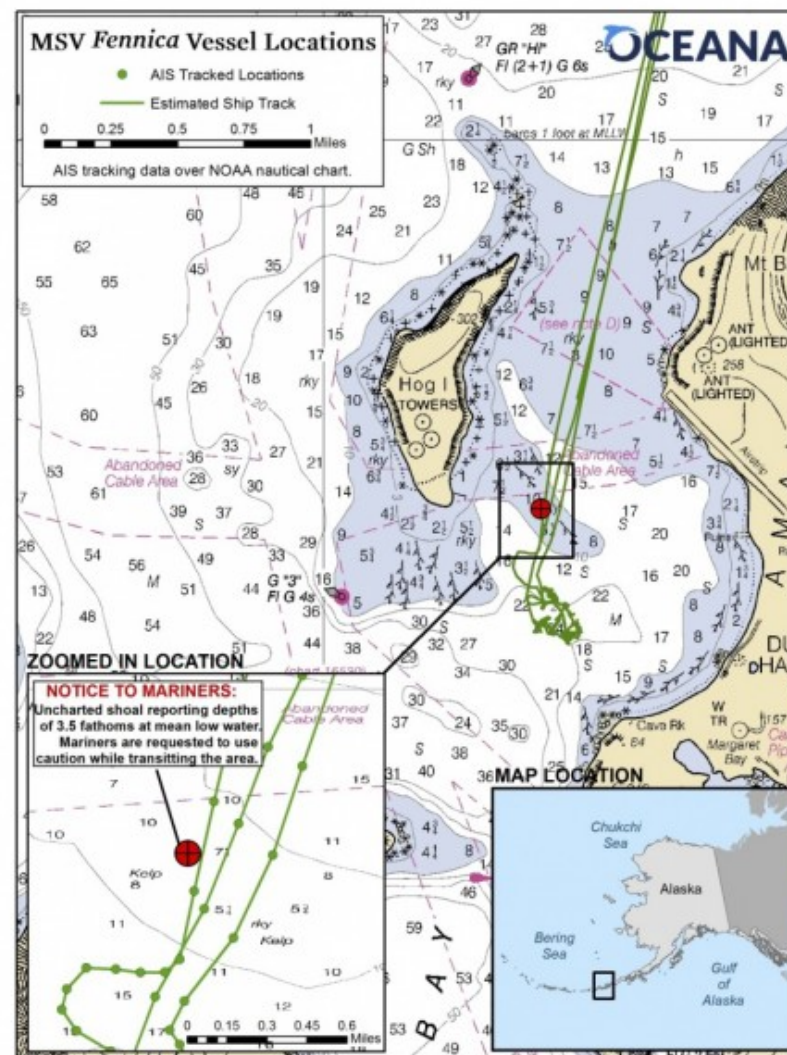
Drones relevant for collecting  
data



Satellitter, her Sentinel 1A kan levere overvågningsdata, der også kan bruges til kortlægning.



# Dual use : charting



# Space infrastructure in the Arctic

Earth observing  
satellites

Research  
satellites

Surveillance  
satellites

Weather  
satellites



Communication  
satellites



# Rapport fra Polar DTU:

- [www.polar.dtu.dk/Nyheder](http://www.polar.dtu.dk/Nyheder)
  - > [Satellitter og droner som rygrad i fremtidens Arktis](#)

