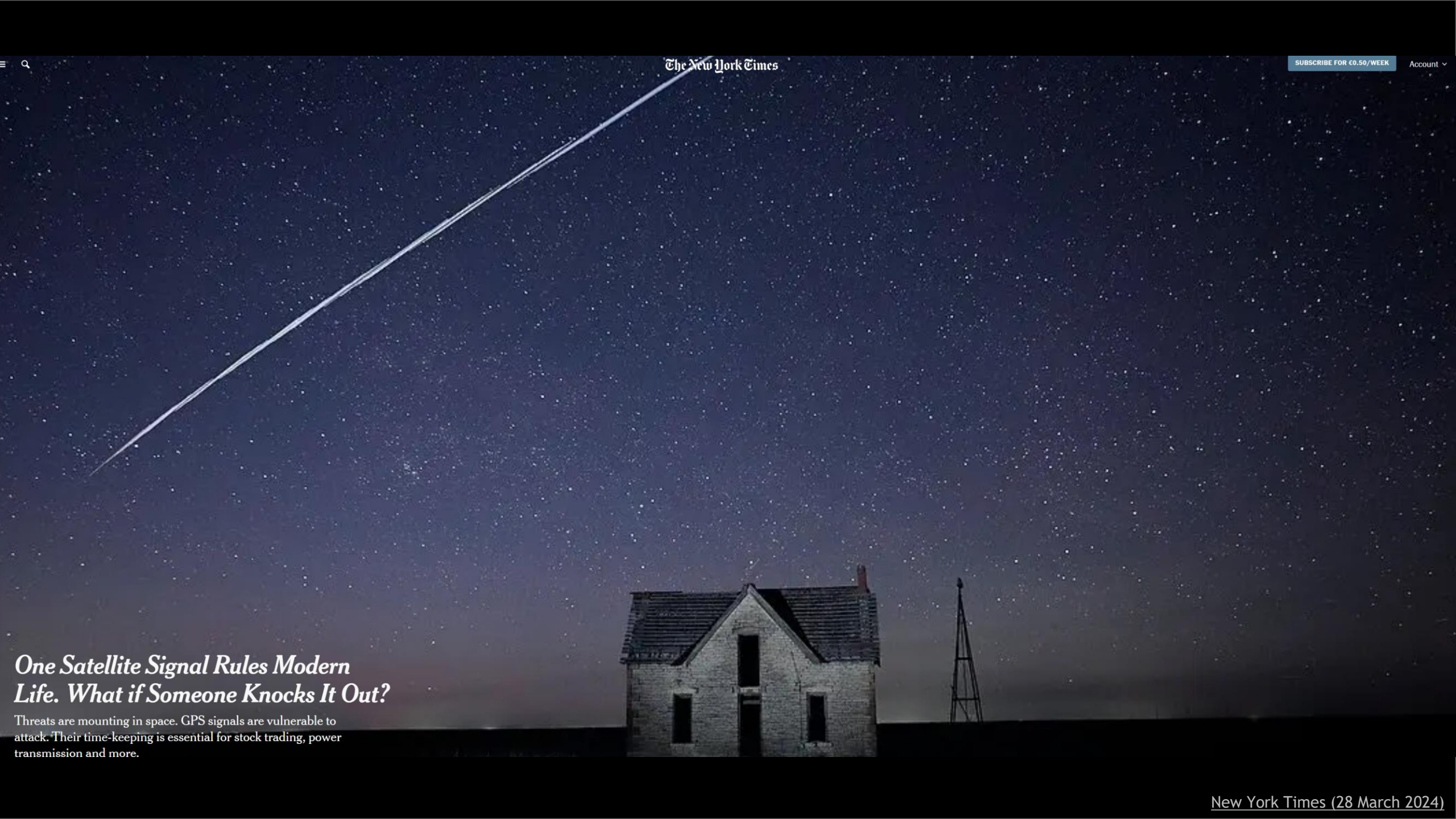
United Nations
Global Geodetic Centre of Excellence

Hidden risk to critical Infrastructure and the economy

Nicholas Brown
UN-GGCE Head of Office



One Satellite Signal Rules Modern Life. What if Someone Knocks It Out?

Threats are mounting in space. GPS signals are vulnerable to attack. Their time-keeping is essential for stock trading, power transmission and more.

New York Times (28 March 2024)

Imagine this scenario...

7:43 AM

1 

The alarm on your phone didn't wake you up

7:50 AM

2 

Telecommunications satellites providing television signals, and GNSS systems have stopped working.

9:03 AM

3 

Since the GNSS and telecommunication satellites stopped working, land, sea and air travel has ceased.

10:18 AM

4 

The traffic light systems have either stopped working or become highly erratic because they rely on GNSS synchronization information.

11:47 AM

5 

All stock exchanges around the world have stopped operating.

12:34 PM

6 

There is panic on the streets and a run on the banks as people try to withdrawal cash.

14:02 PM

7 

Satellite failure cripples communication, military units stranded, global leaders struggle amid rising tensions.

17:12 PM

8 

Satellite failure disrupts backup timing, causing global issues in communication and infrastructure.

23:30 PM

9 

Global crisis: GNSS failure triggers widespread state of emergency.

23:58 PM

10 

Severely disrupted global systems; business halted, governments struggle, order breakdown feared.

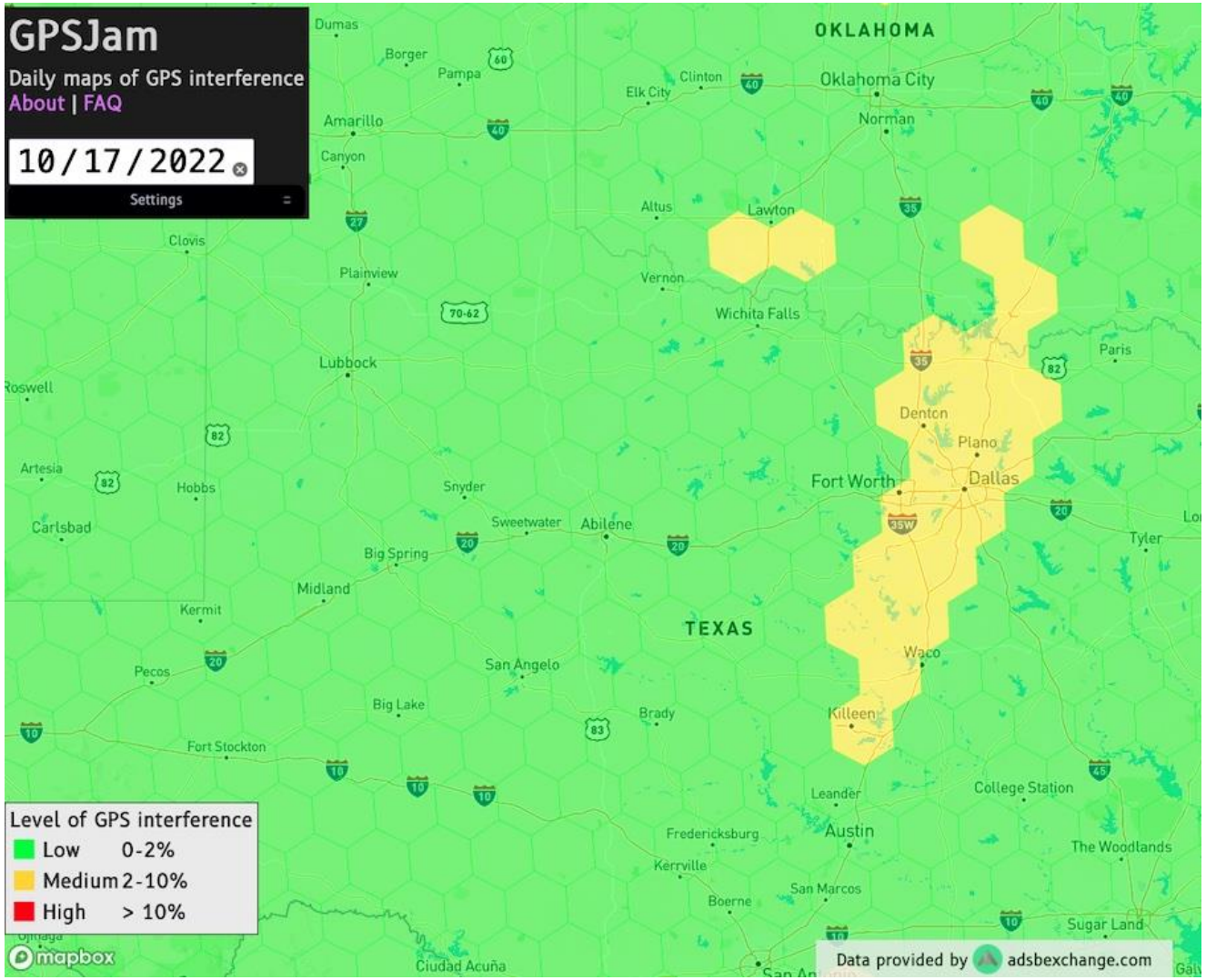
Reliance on satellites

- We have an ever-increasing reliance on satellites
- ‘A single point of failure’ for some national economies and operation of critical infrastructure
- **Critical Infrastructure operation:**
  - A 2012 report from the U.S. Department of Homeland Security found that 15 of 18 critical infrastructure and key resources sectors relied on the global positioning system (GPS).
- **Economic benefits:**
  - Over the next decade, revenue from GNSS, Earth Observation and satellite telecommunications (80% of the space industry market revenue) has growth rate of ~9%
  - Reaching a total of almost €800 billion.
- This is why countries are investing in GNSS, Earth Observation and satellite telecommunications and want sovereign capability

Back to our scenario – could it happen?

- Yes – but it’s unlikely
  - solar storm; a coordinated cyber-attack; space debris (‘Gravity’).
- Space agencies and satellite operators implement rigorous safety measures and redundancy systems to minimize the impact of potential failures.

Risk



More likely scenario? Subset of localized impacts

- Outages, degradation of satellite services for a period of time, or in a specific region
- Jamming, Spoofing, space weather events (e.g. intense solar activity) or satellite malfunction.

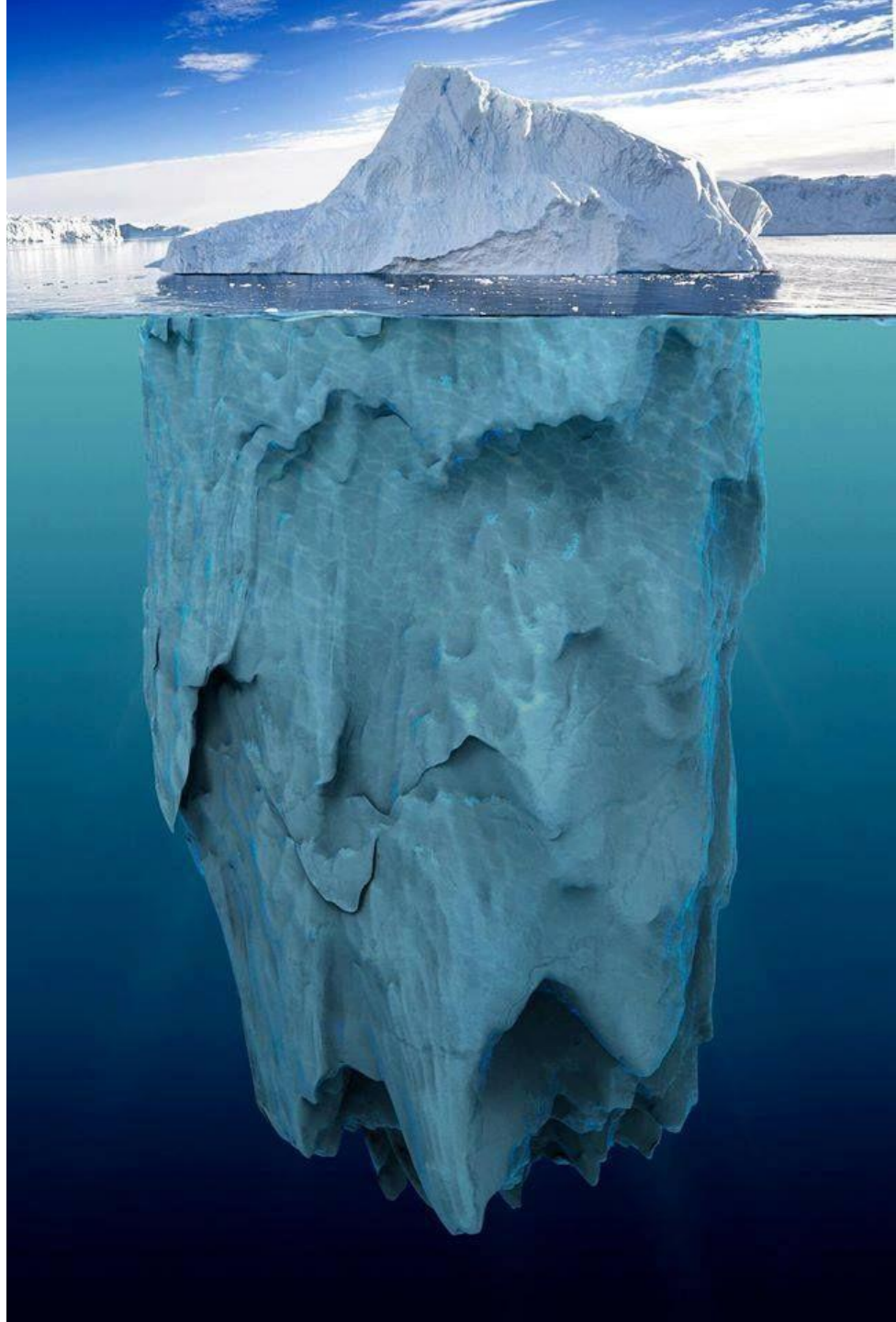
These risks are known by Member State governments

- Dallas Fort Worth airport (OCT 2022): “ATTN ALL AIRCRAFT. GPS REPORTED UNRELIABLE WITHIN 40 NM OF DFW.”
- Numerous reports recommend improve resilience.

https://arstechnica.com/information-technology/2022/10/cause-is-unknown-for-mysterious-gps-outage-that-rerouted-texas-air-traffic/

Hidden Risk

- What if I told you however that there is a risk that these reports don’t consider? A hidden risk.
- What if I told you representatives from Member States, space agencies and most satellite operators know about this risk which impacts the resilience and reliability of satellite services?
- What if I also told you these people are concerned about it, but it still isn’t being mitigated?

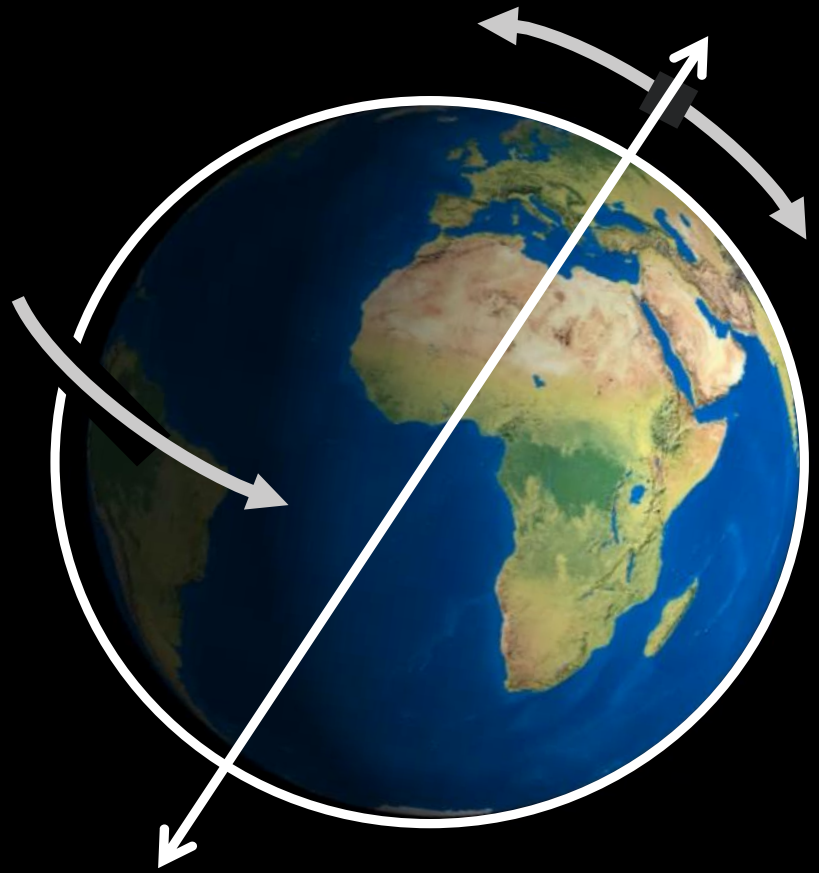


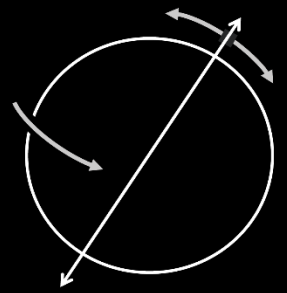
Geodesy Ground Stations Observations

Data Collection and Analysis

Satellite Intelligence

Space Based Delivery

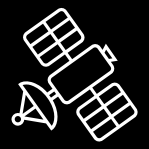


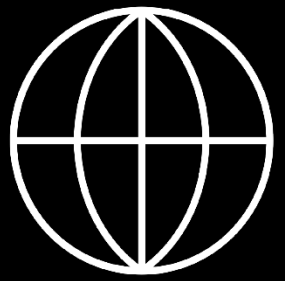


+

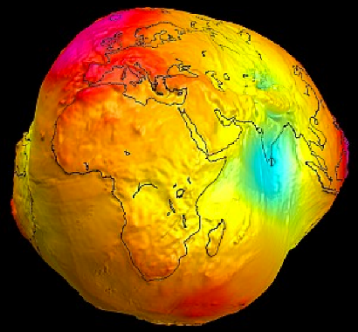
GNSS

Safety of life

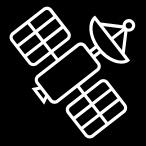




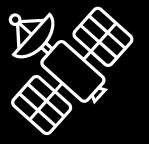
+



+



Communications



EO

Video source: Vecteezy.com

Deutsches Zentrum für Luft- und Raumfahrt (DLR)

Foundation

- The global geodesy supply chain is the foundation for national geospatial data integration and analysis
- Without the global coordinate reference frame:
  - You can’t integrate. This limits analysis capability
- Without accuracy and reliable satellite information:
  - You can’t collect data or monitor change using Earth observations, systems which use GNSS for data collection

Weaknesses

- **Evidence**
  - Little to no evidence which is written in a form decision makers can understand
  - Why it deserves investment of time, people, or money
  - Reports which describe the economic, environmental, and societal benefits don’t mention geodesy

- **Resources** dedicated people and funding
  - Reliance on old and aging infrastructure (and people)
  - Lack of observatories in some parts of world
  - Lack of analysis centres for some techniques

Weaknesses

- **Governance**
  - Lack of formal commitments
  - Reliance on in-kind contribution
  - Lack of global cooperation and coordination

- **Capacity**
  - Decrease in formal training options
  - Decreasing number of geodesists (‘Geodesy Crisis’)

- **Awareness**
  - No-one knows what geodesy is

Call to Action

Action 1: Improve evidence and raise awareness

Action 2: Joint Development Plan

Action 3: Member State actions