SPACE FOR FINANCE

Olivier Smeyers

29-04-2021

Noordwijk

SPACE FOR FINACE - SUMMARY

1. Introduction and Objectives
2. What space can do
3. A need of Finance: TIME
4. What Global Navigation Satellite Systems (GNSS) can do for finance
5. What ESA can do for finance

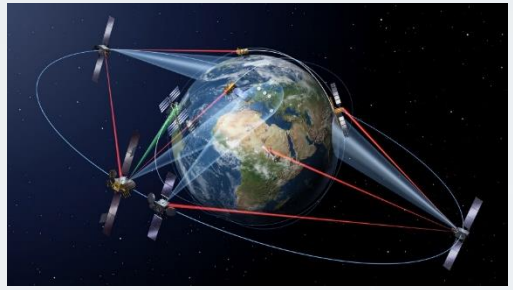
…ESA's involvements in Fintech: Introduction and Objectives

1. Introduction and Objectives
   - What space can do
   - Overview on financial needs
   - How space can fulfil financial needs
   - What ESA can do
2. What space can do
3. A need of Finance: TIME
4. What Global Navigation Satellite Systems (GNSS) can do for finance
5. What ESA can do for finance

SPACE FOR FINACE - SUMMARY

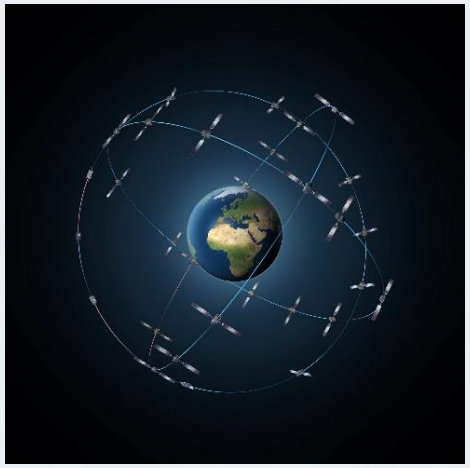
1. Introduction and Objectives
2. What space can do
   - A vision from Above
3. A need of Finance: TIME
4. What Global Navigation Satellite Systems (GNSS) can do for finance
5. What ESA can do for finance: NAVISP Programme

…ESA's involvements in Fintech: What Space can do



What can space do?

Why space can do things in a unique way?



A vision from above:

- ✓ Everywhere: Target is earth, satellite signals can reach everywhere at virtually the same time.
- ✓ Unique technologies and capabilities:
  - ➢ Telecommunications; voice and data communication at a global scale, for one and for many.
  - ➢ Monitoring and surveying; of large areas of earth that can have an impact on economical activities.
  - ➢ Location; and precise positioning information (position, velocity and time) for assets and people.
- ✓ Space can provide high quality local, regional and global services enabling **innovative new applications**

We will focus on what **Global Navigation Satellite Systems (GNSS)** can offer: **Position, Navigation and Time**

- Where I am? How I go there? What time is it? Many needs and **commercial opportunities around that ..**

SPACE FOR FINACE - SUMMARY

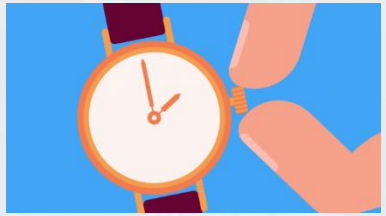
1. Introduction and Objectives
2. What space can do
3. A need of Finance: TIME
   - Synchronisation and traceability
4. What Global Navigation Satellite Systems (GNSS) can do for finance
5. What ESA can do for finance

…ESA's involvements in Fintech: A need of Finance

A need of Finance .. TIME

Everything is relative in this world, it changes, evolves so …

- ✓ To understand this world we need to find **absolute references** to relate the changes to them and one of these fundamental references is **TIME**.
- ✓ We know that things change and evolve with TIME and “events” happen relative to TIME.

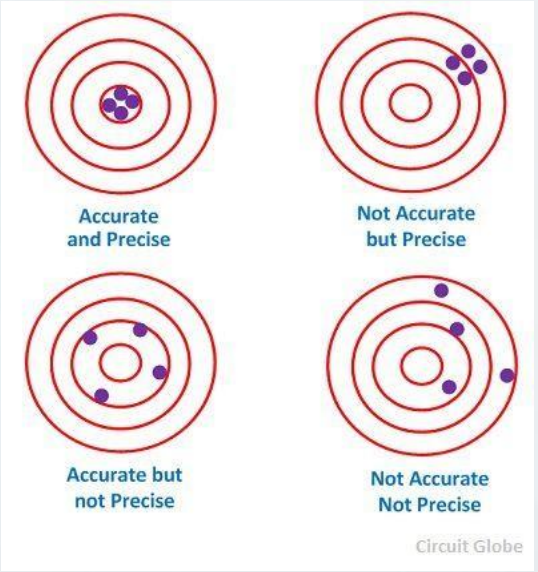


However we cannot see or touch TIME so .. **How can we use it?**

- ✓ With the pass of time .. we have developed different ways to **measure** .. the pass of time.
- ✓ We have defined precise and accurate time references and from them we can measure time intervals. And this is important because:
  - ➢ We can identify things that happen within specific time intervals.
  - ➢ We can identify which events have happened before or later or consider them simultaneous.

...ESA's involvements in Fintech: A need of Finance

Finance needs .. TIME

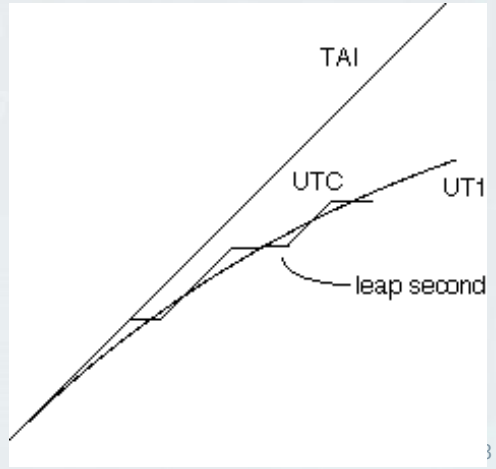


We perceive time because things happen around us at different “moments” but we need more and we use “things” that naturally repeat along time that is, oscillates:

- ✓ A pendulum in a clock, vibrations of quartz driven by an electric field
- ✓ Resonation properties of atoms e.g. Hydrogen or Caesium

But individual “clocks” are not enough so we have developed three major time frames:

- ✓ **Universal Time (UT)**: Natural, based on the rotation of earth, but it is not so precise nor accurate since earth does not maintain an exact rotation period.
- ✓ **International Atomic Time (TAI)**: Atomic clocks, extremely accurate but not always practical, UT and TAI are no aligned.
- ✓ **Coordinated Universal Time (UTC)**: Accurate but flexible 37 (leap) seconds behind TAI so far ..



…ESA's involvements in Fintech: A need of Finance

Now, what all this have to do with finance?

As a very broad definition of finance we can say that it is the management of funds. The specific amount of money is actually relative ..

Any management is relative to time, therefore **financial elements and transactions are relative to time**.

- ✓ Markets opening and closure, transactions, accounting, investments, revenue and profit calculation, depreciation, amortization … all are done, assessed or analysed along a timeline with a more or less precise relation with time.

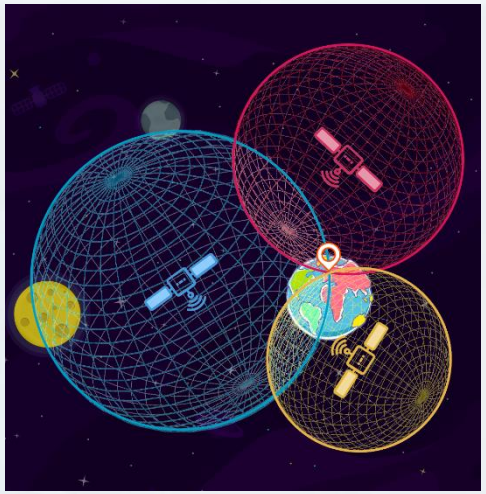
Therefore, **time synchronisation is capital**!. And transactions need to be **legally traceable over time (MiFID II).**

SPACE FOR FINACE - SUMMARY

1. Introduction and Objectives
2. What space can do
3. A need of Finance: TIME
4. What Global Navigation Satellite Systems (GNSS) can do for finance
   - Time-as-a-service
5. What ESA can do for finance: NAVISP Programme

…ESA's involvements in Fintech: What GNSS can do

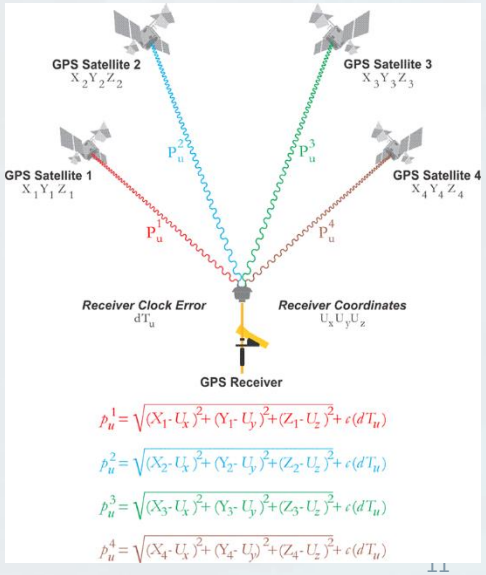
What Global Navigation Satellite Systems (GNSS) can do for finance



GNSS can provide time and synchronisation means .. but why, how?

The determination of the position done by a GNSS receiver rely on the precise **time synchronisation of the system**.

- ✓ GNSS systems have a very precise and accurate time framework (e. g. **Galileo System Time**) to operate that are also based on Atomic Clocks.
- ✓ So let's go further and relate the System Times scales to a universal reference, the Coordinated Universal Time UTC.



Now we have **time-as-a-service**, provided by GNSS

SPACE FOR FINACE - SUMMARY

1. Introduction and Objectives
2. What space can do
3. A need of Finance: TIME
4. What Global Navigation Satellite Systems (GNSS) can do for finance
5. What ESA can do for finance
   - NAVISP Programme

…ESA's involvements in Fintech: NAVISP

NAVigation Innovation and Support Programme NAVISP

ESA programme designed to foster innovation & competitiveness of the European PNT sector

Things that evolve: New technology

More GNSS satellites

More GNSS signals

Communications

WiFi / RFID

UWB, Sparse Band

Digital broadcasting

Pseudolites, Locatalites

Smaller, cheaper inertial sensors

Digital mapping (outdoor & indoor)

More processing power

Taking advantage: New applications

Seamless indoor-outdoor personal navigation

Intelligent Transport Systems

Rail signalling & control

Precision aircraft landing

Ships in harbours

Location-dependent billing

Virtual security fences

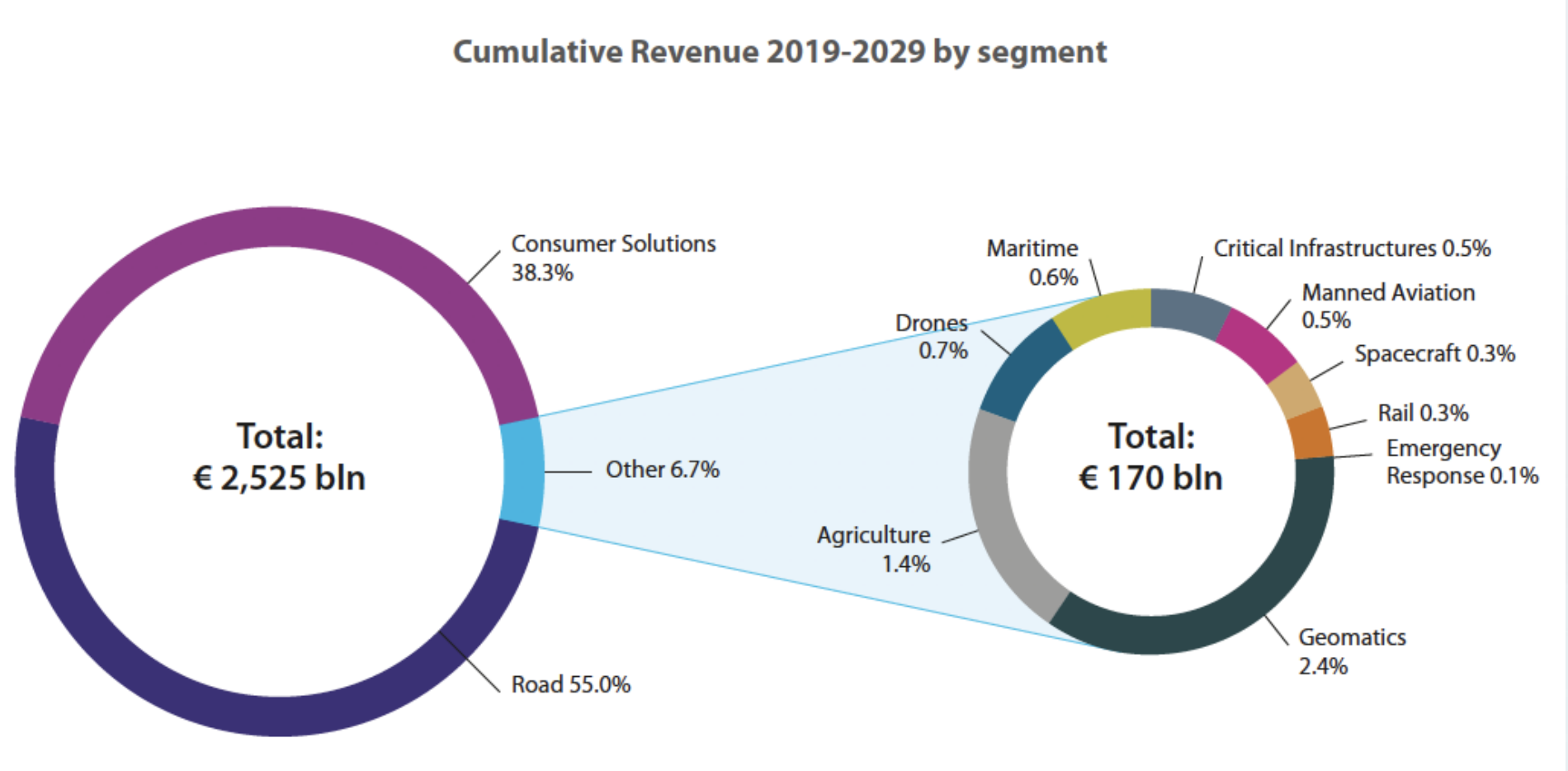
Tracking people/animals/assets

Social inclusion

Drives new applications

Creates new challenges

The context - Financial Indicators



source: GNSS Market Report, issue 6, GSA

...ESA's involvements in Fintech: NAVISP

NAVISP Programme Structure

	ELEMENT 1 [Innovation in Satellite Navigation]	ELEMENT 2 [Competitiveness]	ELEMENT 3 [Support to Member States]
Content	Analyses and developments linked to new and emerging design and operational concepts, techniques and technologies related to satellite navigation systems	Ad hoc technological & product developments and pre-operational activities along the whole satellite navigation value chain in support of the competitiveness of the industrial sector in the participating Member States	Support to MS national Programmes & Activities in satellite navigation and along the whole value chain
General principles for implementation of the activities	Competitive tender, 100% ESA funding on the basis of yearly work-plan adopted by PB NAV	Continuous open call, unsolicited proposals, ESA co-funding (level of support to vary according to the nature of the companies 100% - 80% - 50%, MS support letter	On request by MS, ad-hoc mechanism to be established on a case-by-case basis that ensures ESA's full costs are met (100% ESA funding)
Lead for the definition of the activities	**ESA**	**Industry**	**Member States**

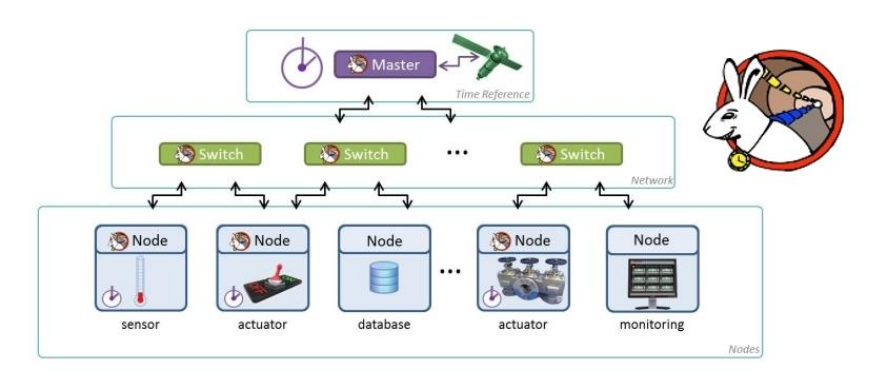
…ESA's involvements in Fintech: NAVISP

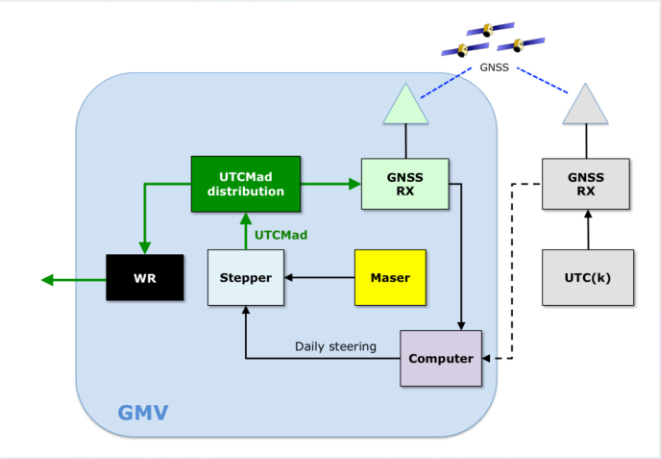
Fintech through examples of NAVISP activities

Time provision and distribution

TOWER: Towards a Robust, Autonomous, and GPS-Independent Precise Timing Facility (PTF) for the Future Galileo

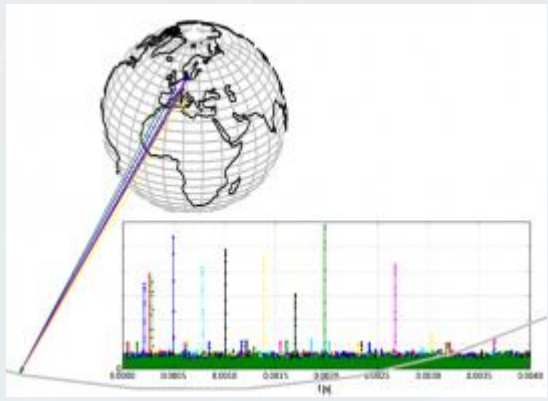
- ✓ The project aimed at the provision of accurate and precise time reference to Madrid stock market.
- ✓ Main technological aspects: Galileo and GPS time, time transfer Precise Time Protocol and White Rabbit.





DIGITAL MODEM FOR TWO-WAY SATELLITE TIME TRANSFER

- ✓ Precise time centres get precise synchronisation transmitting at the same defined time signals between them. The time of arrival difference is the misalignment. International Atomic Time (TAI) centres use this technique.



…ESA's involvements in Fintech: NAVISP

Fintech through examples of NAVISP activities

Making time delivery robust

- ✓ Propagation of the signals through the atmosphere causes reception errors
- ✓ System can have malfunctions
- ✓ Blockage or reflexion of direct signals causes reception errors
- ✓ Unwanted signals can interfere or spoof the receivers of GNSS signals
- ✓ **Monitoring the system, provision of corrections to receivers, special antennas and receiver algorithms** can detect, protect and mitigate these effects.

MAGICGNSS BACK-END
SAFETY MAGICBESAFE Integrity and corrections

GNSS INTERFERENCE MONITORING AND DETECTION SYSTEM (GIMAD)

VANTIGE Beam forming antenna (CRPA)

…ESA's involvements in Fintech: NAVISP

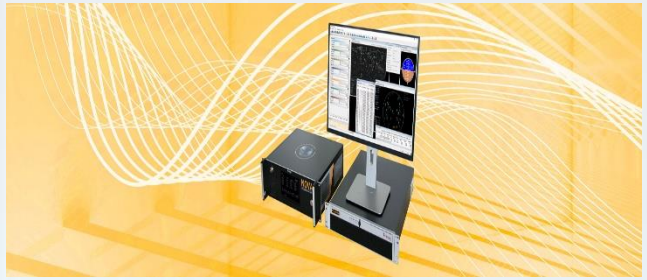
Fintech through examples of NAVISP activities

Making time delivery robust and looking at Future

EPIC

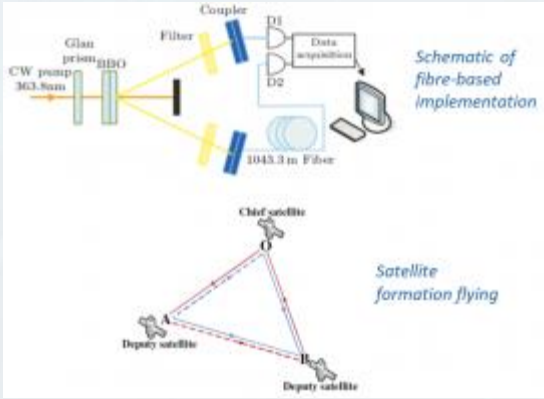
ePRTC standard as backup for GNSS time

STX2G Signal Authentication



The future: Galileo signals authentication

QUANTUM METROLOGY FOR SECURE PNT

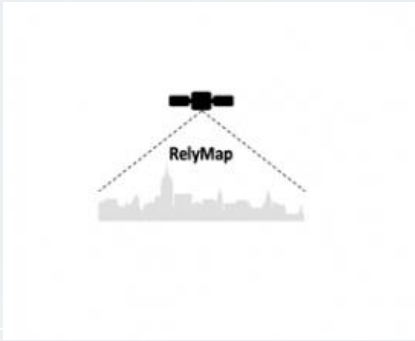


The future: Quantum Technology

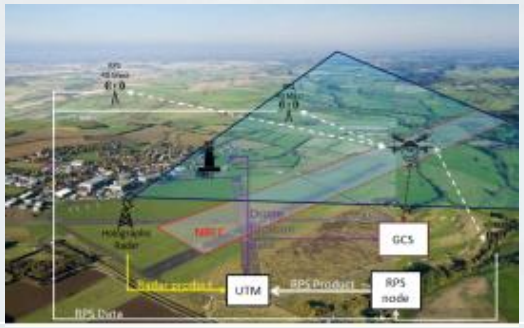
Quick vision on GNSS support to Green Finance an enabler for green activities.

Energy (synchronisation) ENERSYN

Mobility (efficient routes) RelyMap



Green Mobility REAL WORLD A-PNT



SPACE FOR FINACE - SUMMARY

Thank you!