RTK and CORS

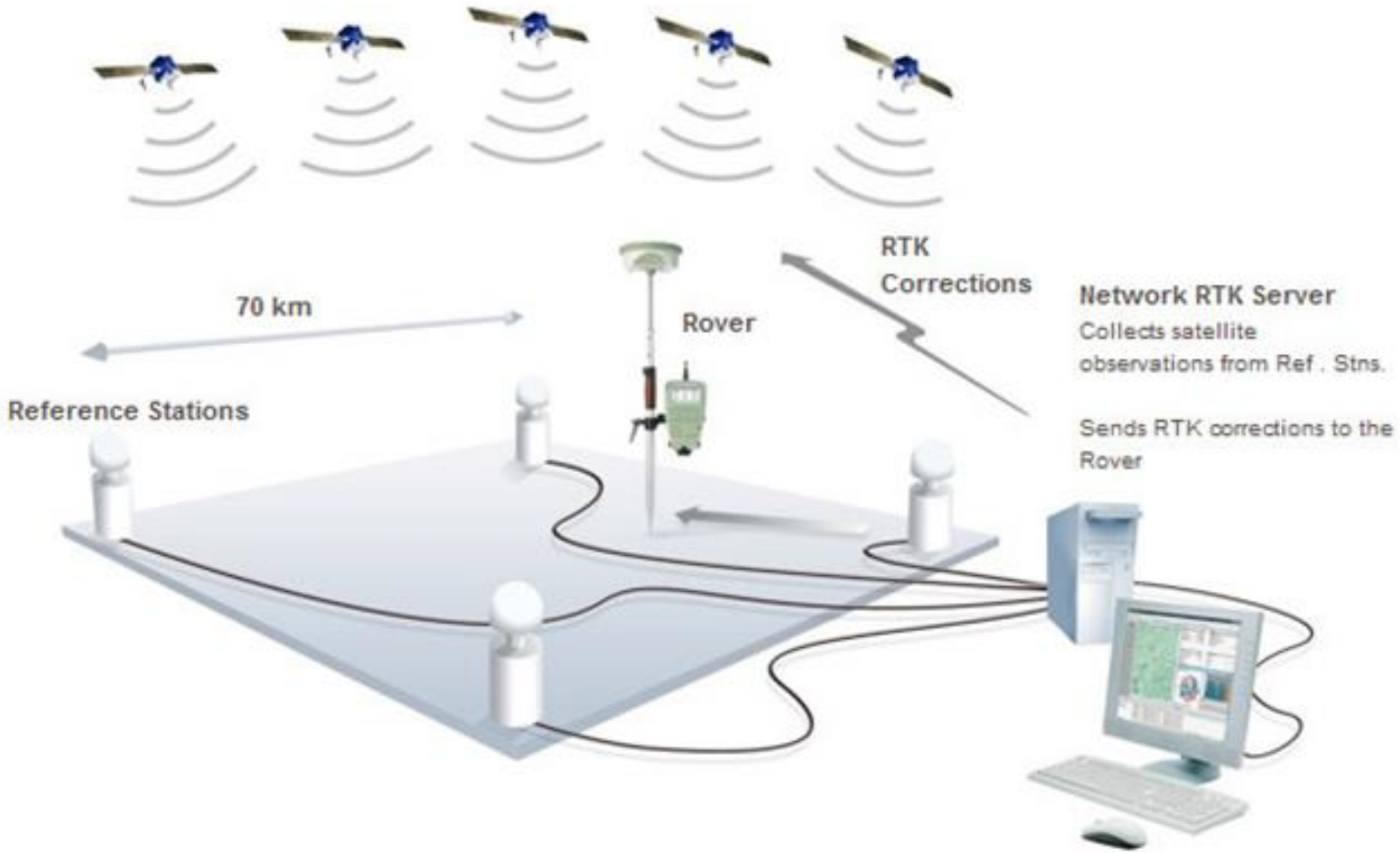
A Brief Overview

GNSS RTK definition

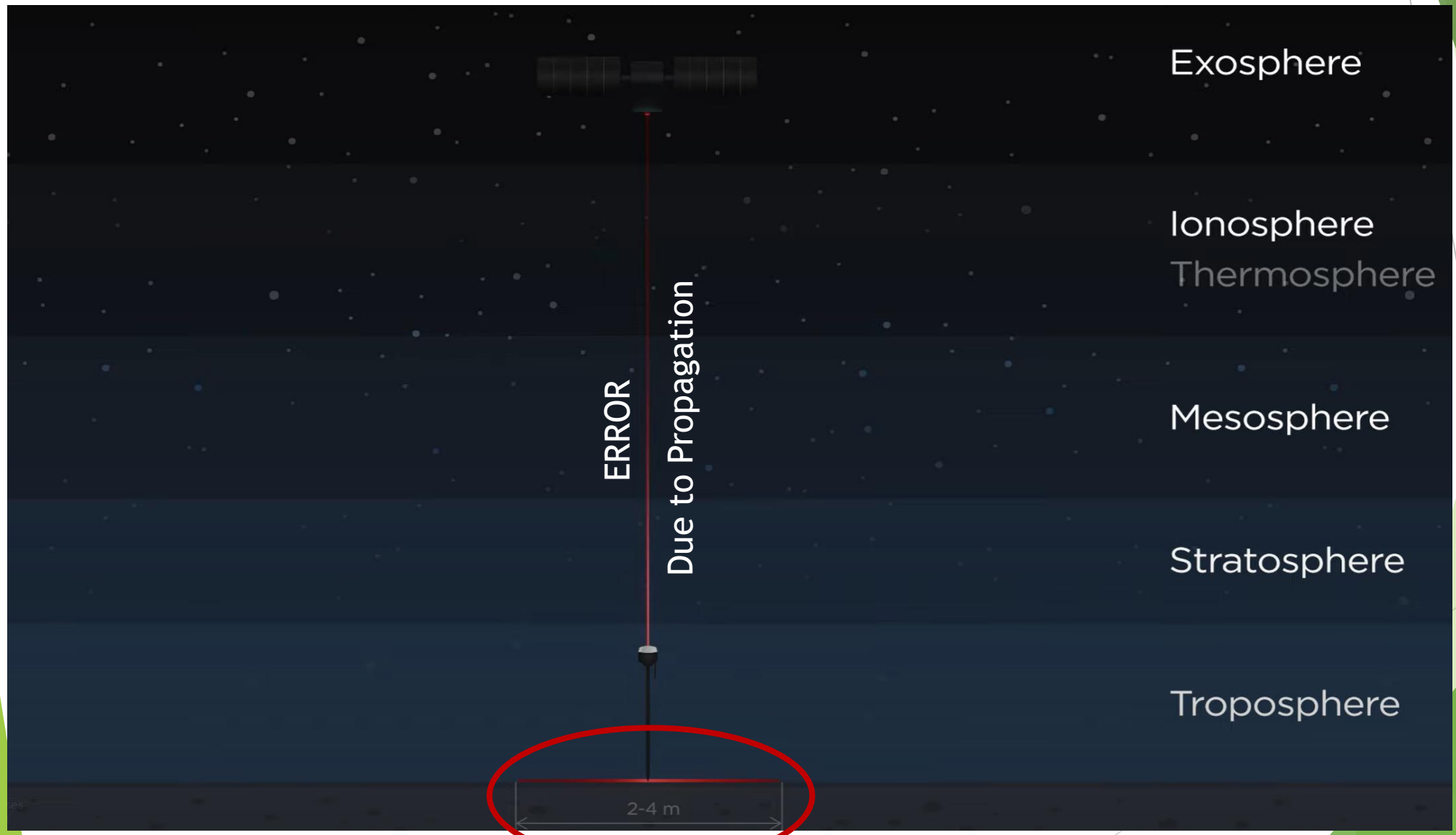
Real-time kinematic GPS is a type of GPS technology that uses a combination of GPS signals and a local base station to provide highly accurate positioning data.

Unlike traditional GPS systems, which rely on data from satellites alone, RTK GPS systems use additional data from a nearby base station to improve the accuracy of the GPS data.

This can provide positioning data that is accurate to within centimeters, making it ideal for a wide range of applications.


RTK
Corrections
70 km
Rover
Reference Stations
Network RTK Server
Collects satellite
observations from Ref . Stns.
Sends RTK corrections to the
Rover

How does it work?



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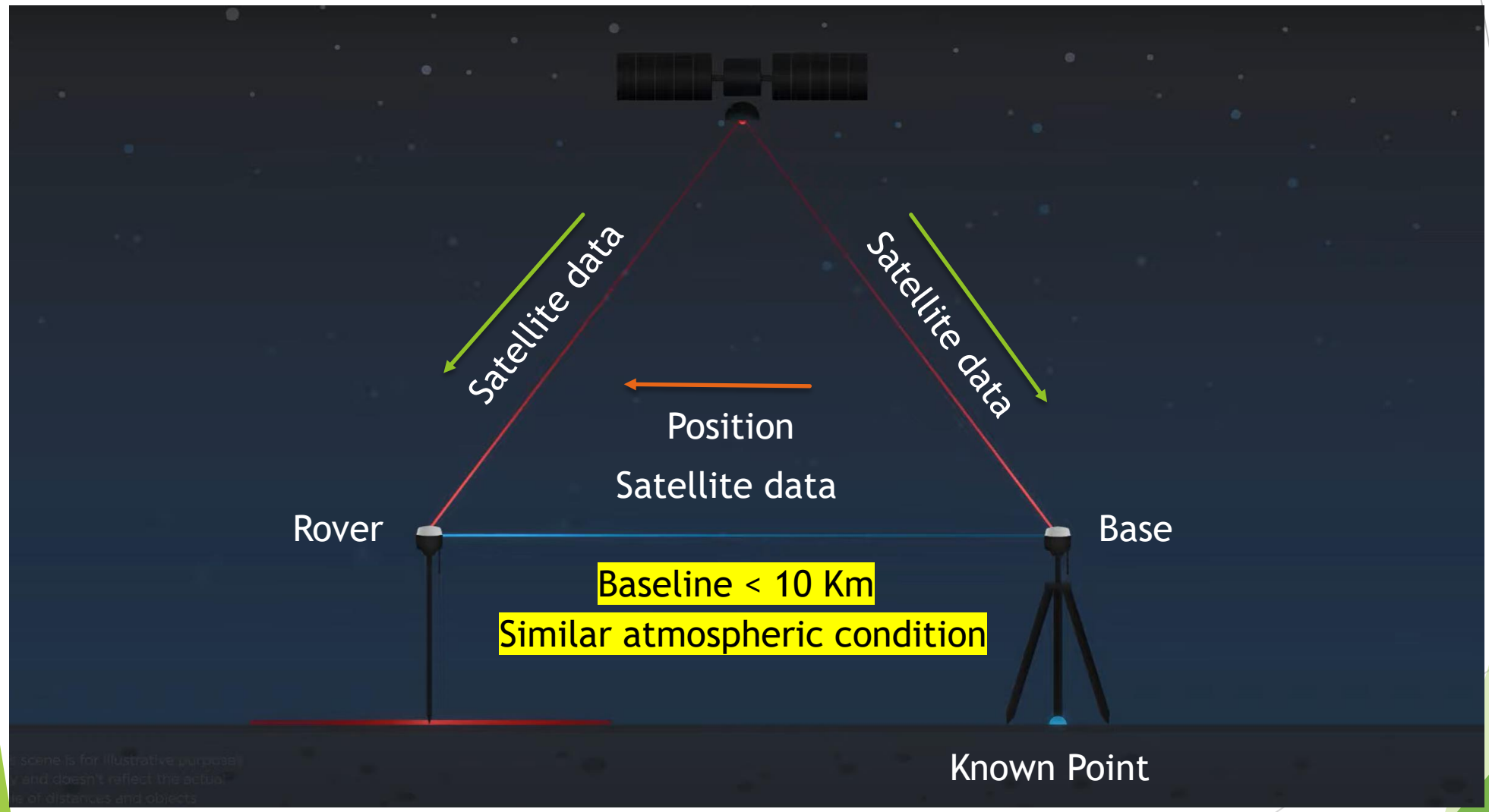

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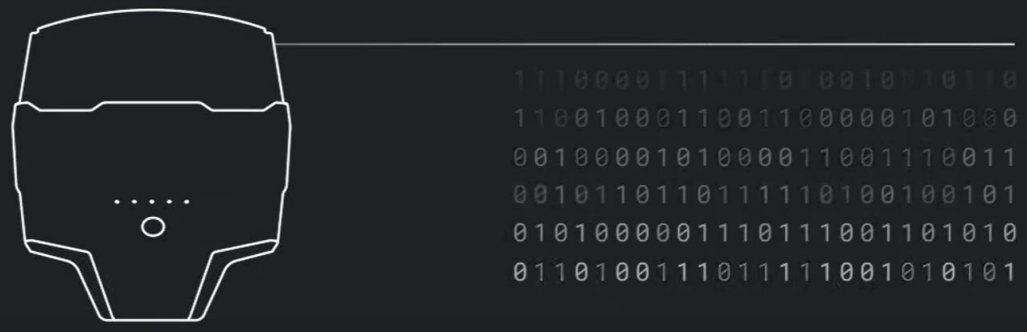
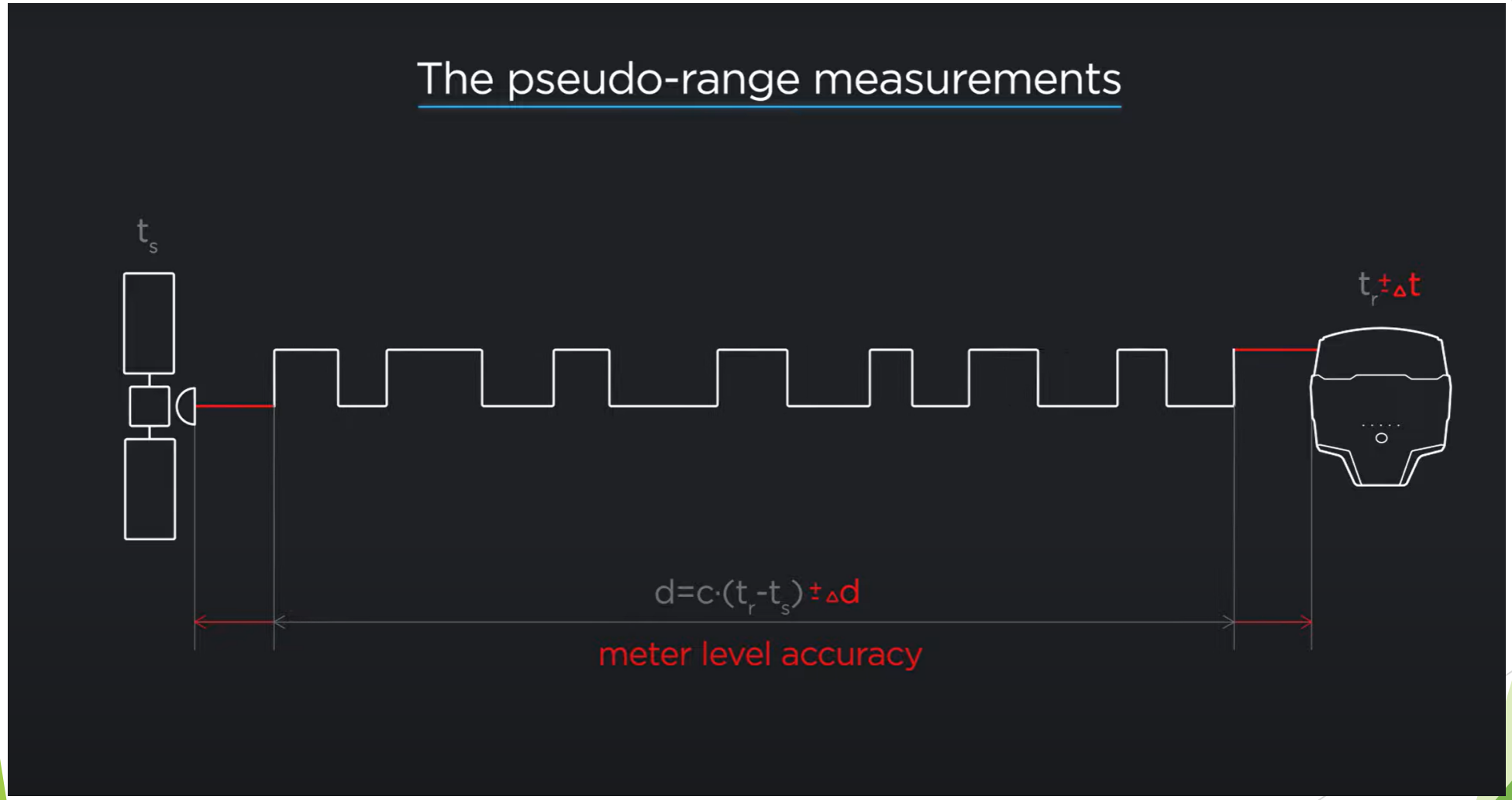
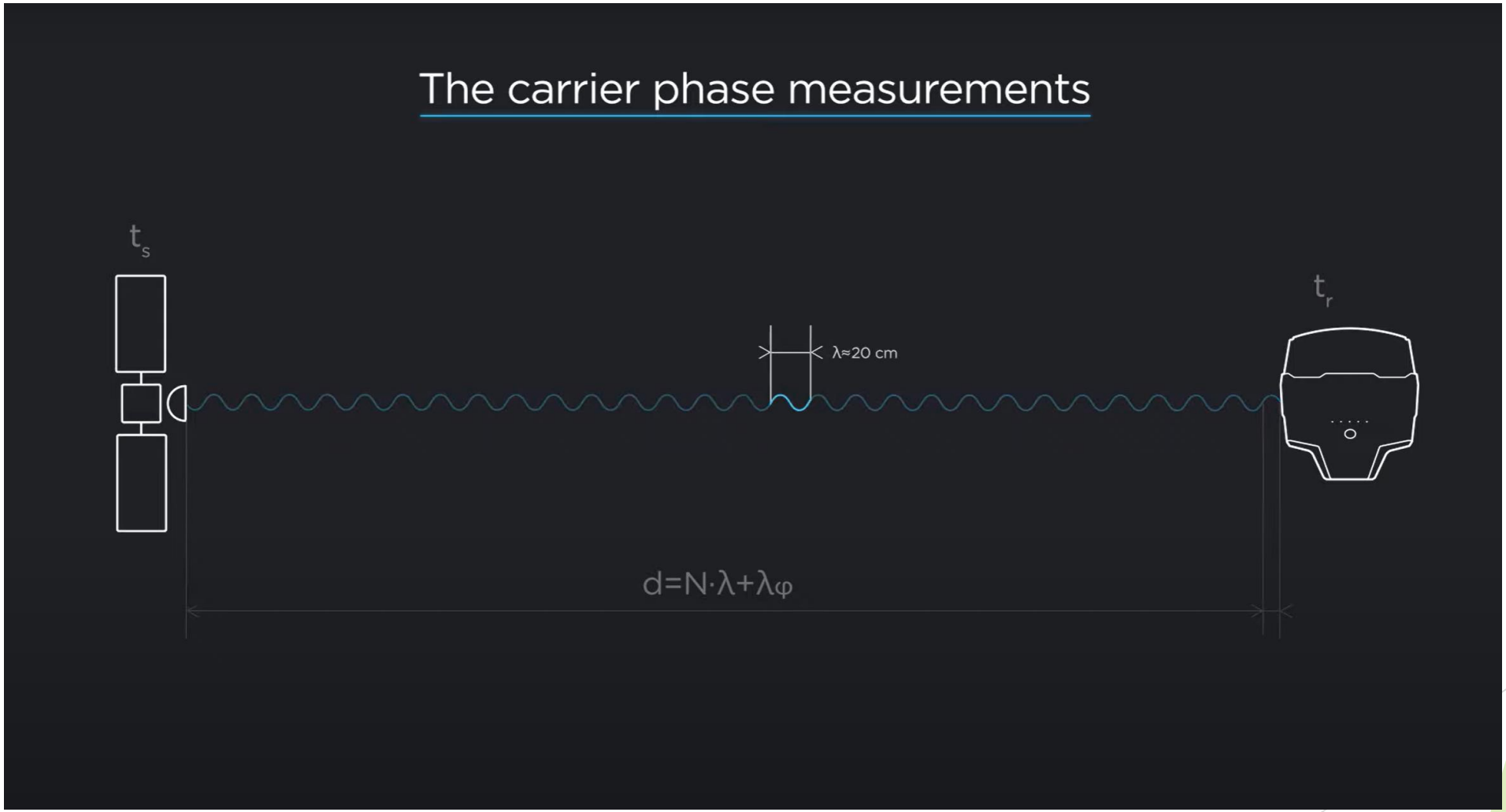


Complex GNSS data and algorithm

How does it work?



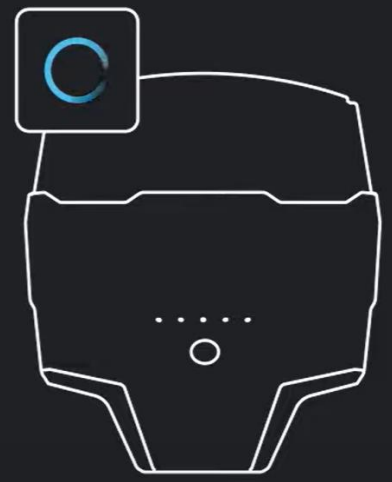
How does it work?

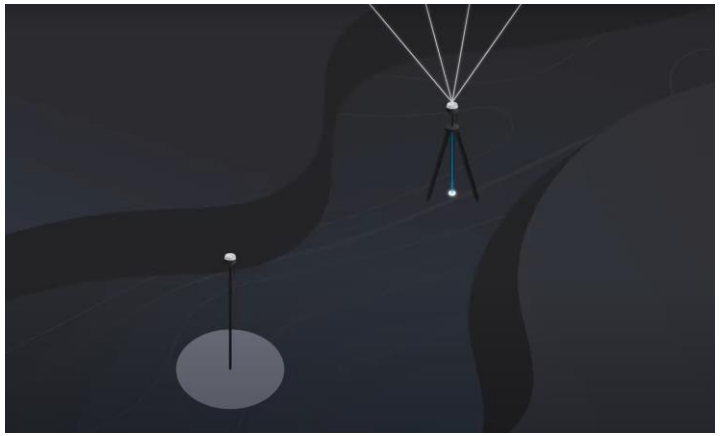


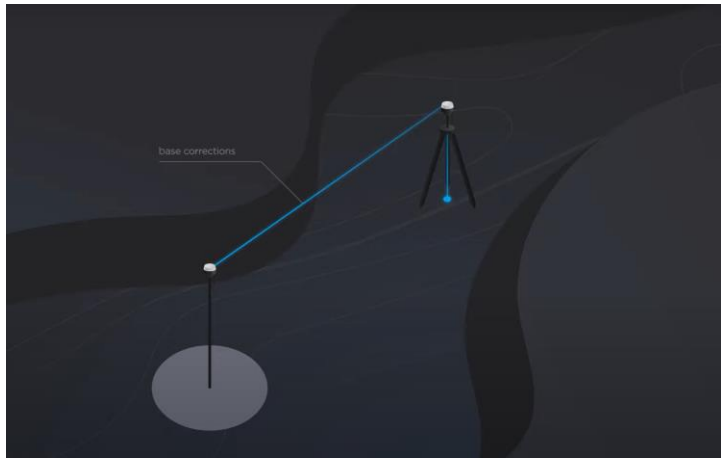
How does it work?

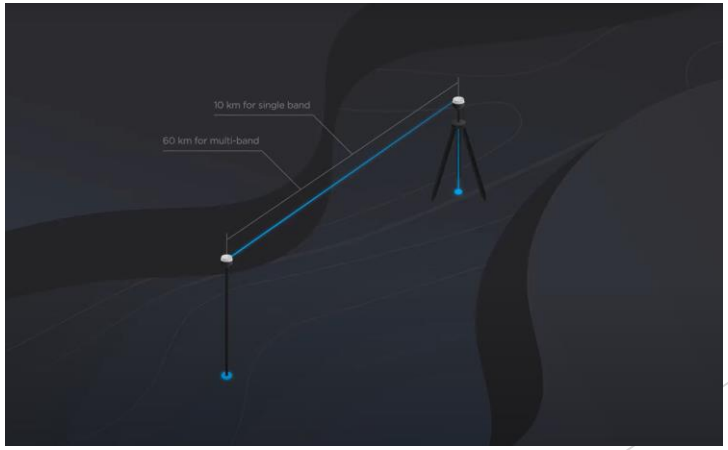
The pseudo-range measurements

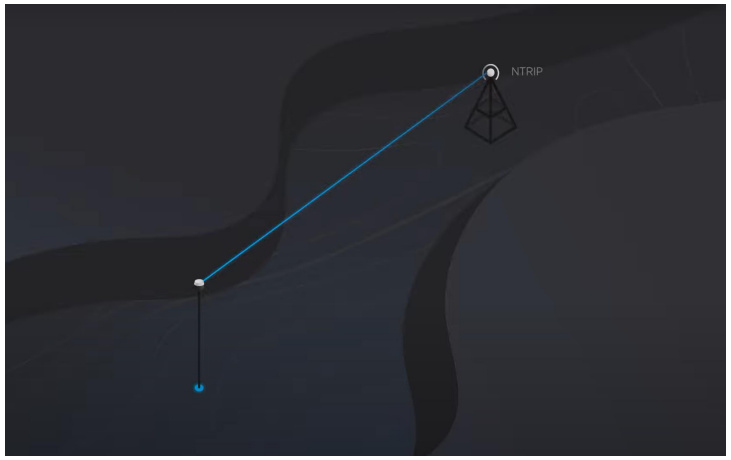
The carrier phase measurements

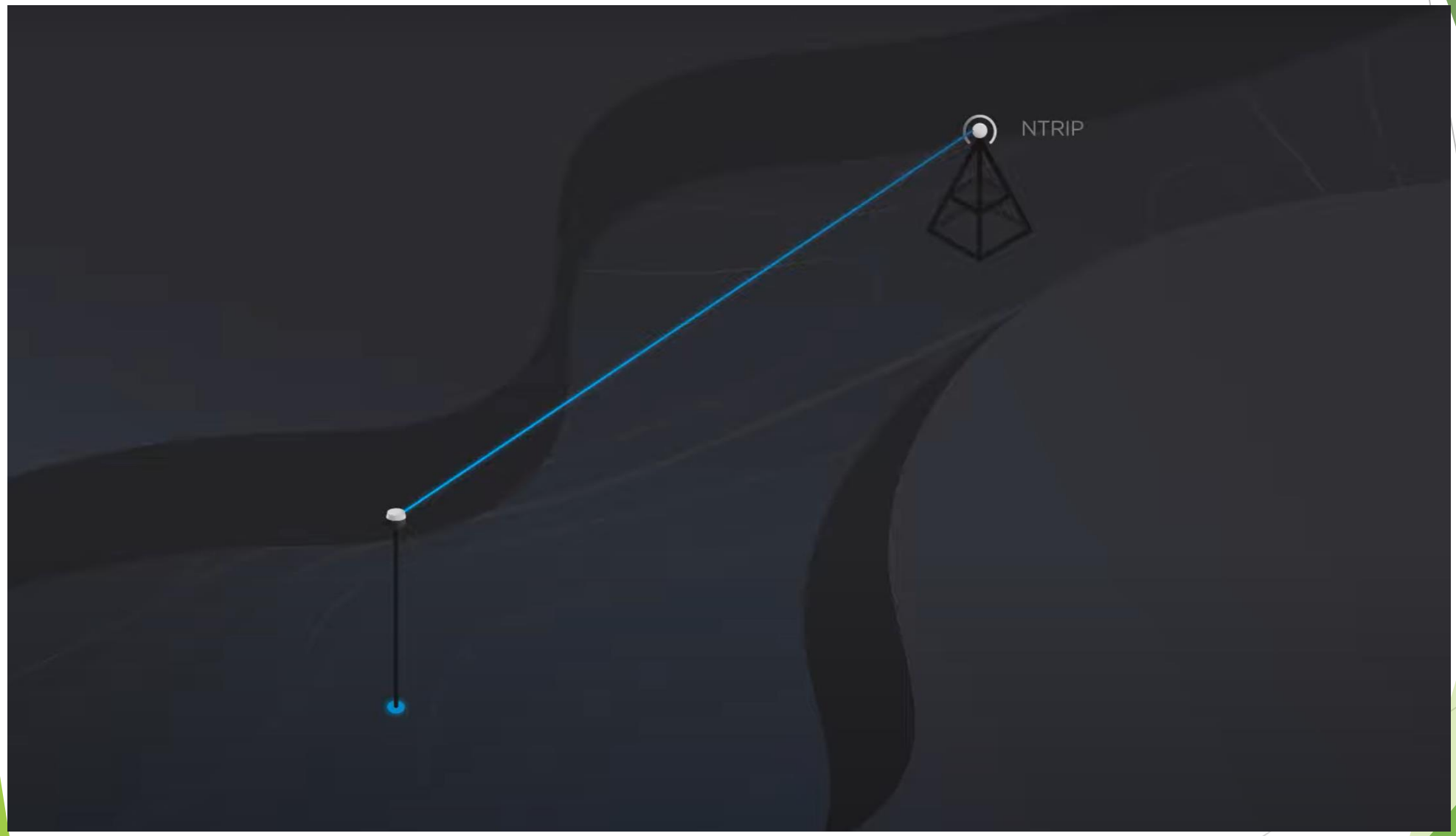





base corrections


10 km for single band
60 km for multi-band


NTRIP


NTRIP

Brief History on RTK – Part 1

1978

- Charles Counselman of MIT developed the first GNSS receiver called Macrometer after the launch of GPS satellites in the same year.

1979

- Benjamin Remondi ''Father of Real time Kinematic Survey''

1980s

- Steve Deloach with other scientist and engineers, developed improved vertical precision for tidal measurement and hydrographic surveying

1984

- Trimble launched its first product 4000A GPS locator, a C/A code receiver.

Brief History on RTK – Part 2

1988

- U.S. Army corps of engineers launched its high priority, multi-year project to develop a complete operational porotype RTK system with the goal of vastly improving the economies, accuracies and timeliness of dredging and hydrographic surveying

Late 1980s and early 1990s

- Mark Nichols and team solved integer ambiguity resolution more precisely and developed algorithms to solve it on the fly.

1993

- The U.S. Army Corps of Engineers had completed a successful multi-year project to develop a complete operational prototype RTK system to vastly improve the economies, accuracies and timeliness of dredging and hydrographic surveying.

1994

- Trimble released its first commercial RTK receiver with OTF capabilities, described in patent "Centimeter accurate global positioning system receiver for on-the-fly real-time kinematic measurement and control," at the International Federation of Surveyors (FIG) conference in Melbourne, Australia.

Brief History on RTK – Part 1

Late 1990s

- Trimble and other manufacturers supported the effort to develop a common interface, which was widely used from the late 1990s, with revisions for new satellite systems and signals coming along over the next decades.

1995

- Trimble started developing a hardware product suitable for machine mounting.
- "The user interface provided the machine operator with a video-game-like experience that allowed them to grade to the design, free from string lines or survey stakes," Talbot said.

1999

- Trimble acquired Terrasat facility.
- errasat pioneered Virtual Reference Station (VRS) technology, which involved installation of a permanent network of reference GNSS equipment across regions, states, and countries, typically by government or large organizations.
- NTRIP is a form of VRS technology

2000s and today

- New GNSS constellations launched- Galileo and BeiDou.
- In 2005, PPP services introduced.
- Today RTK, enabled by the centimeter-accuracy global correction services

Network RTK or NRTK

- The usage of network of CORS stations (Continuously Operating Reference Station) for RTK positioning is called NRTK.
- A network of permanent stations for real-time positioning is an infrastructure consisting of three parts:

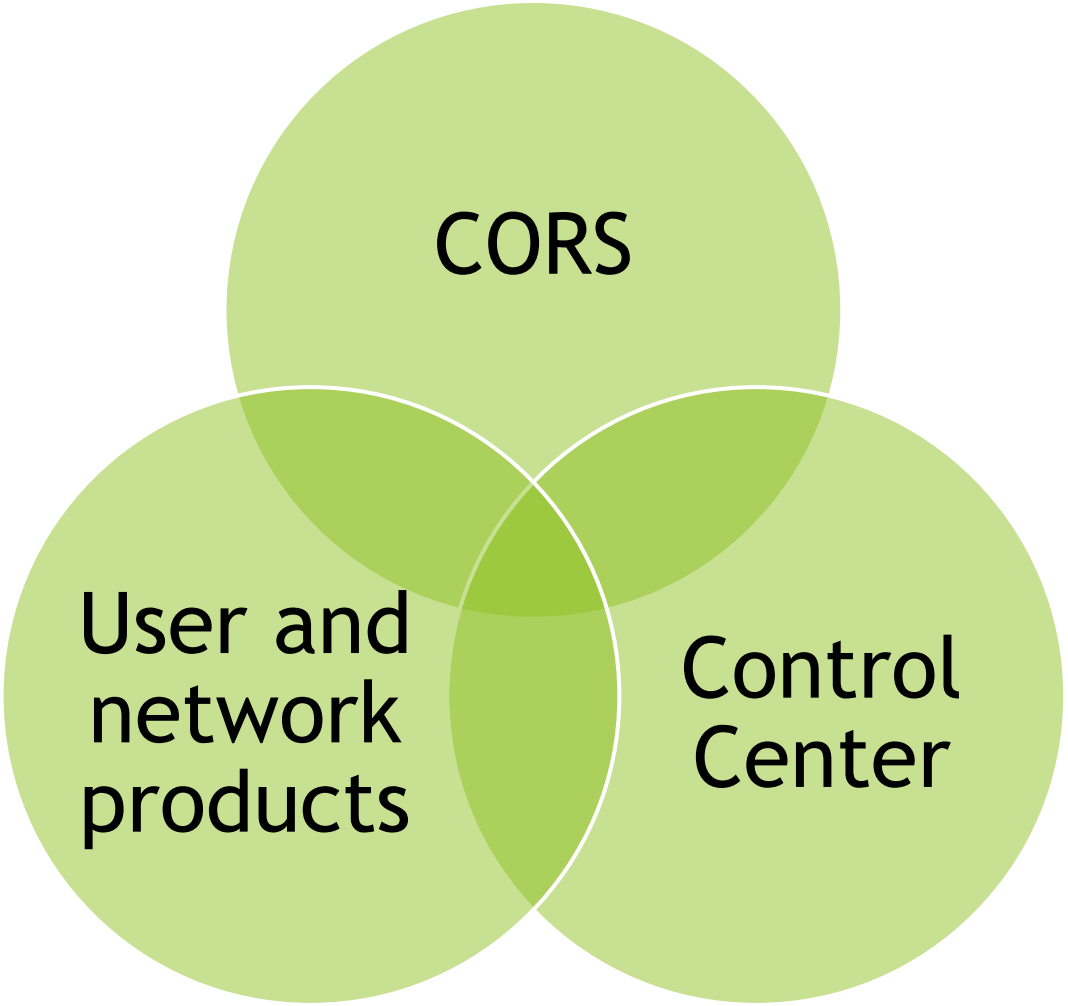
1. One part consists of all CORSs (more or less extended), with accurately known position, that transmit their data to a control center in real-time.

2. The second part consists of a control center which receives and processes the data of the stations in real-time, ambiguity fixing phase for all satellites of each permanent station and calculating ionospheric and tropospheric delays, clock biases etc.

3. The third part is the set of network products that can be provided from the control center to the user.

- Ambiguity resolution (AR) becomes short (15 – 20 s).

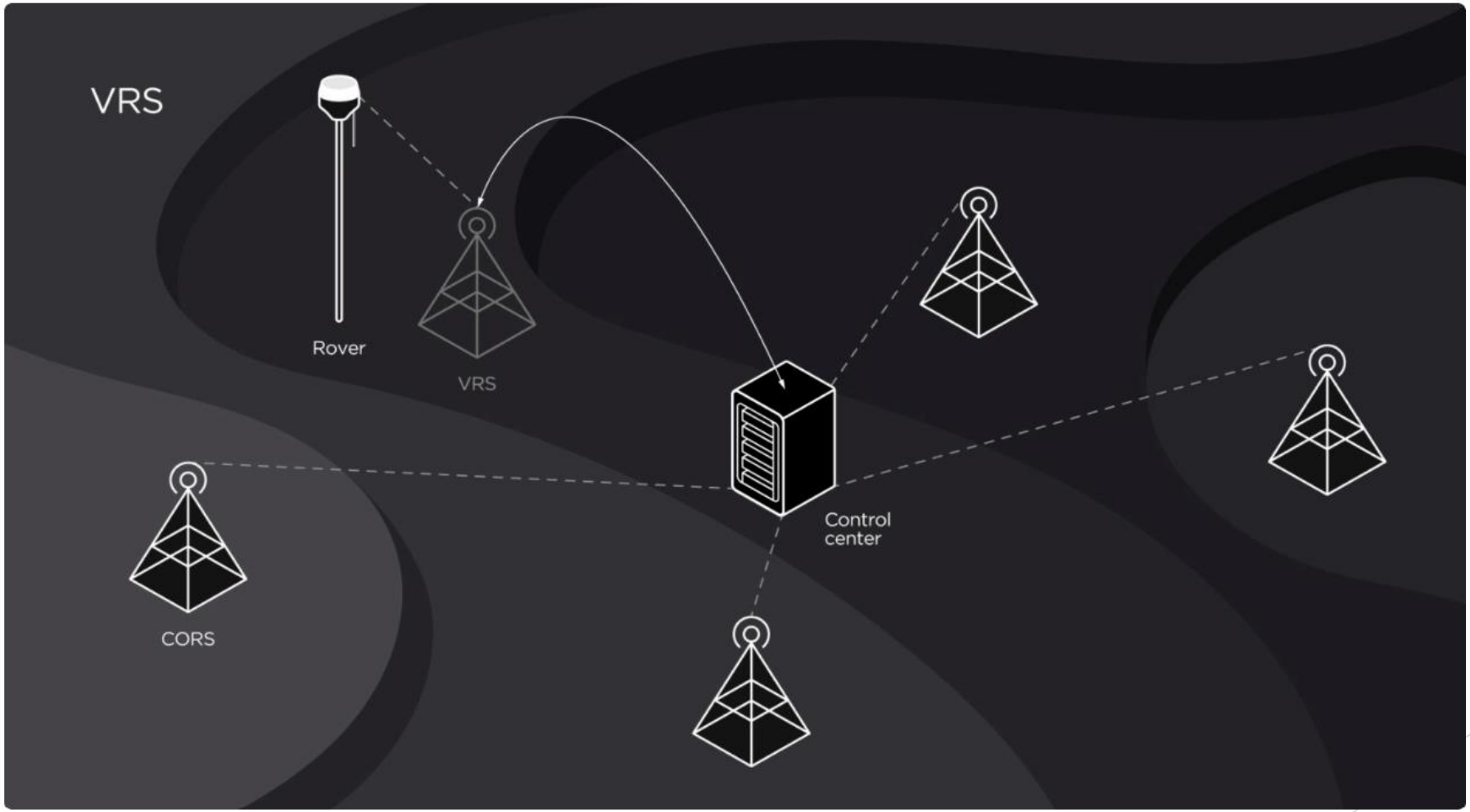
Network RTK or NRTK



NTRIP (Network Transport of RTCM via Internet Protocol)

- NTRIP works on the principle of VRS or Virtual Reference Station.
- Say, you are 30 km away from the nearest station.
- To create a VRS, your rover sends data back to the NTRIP caster.
- NTRIP allows the uniting of the data from your rover and the data from dense NTRIP bases and models a virtual base next to you.
- Thus, your baseline will go from 30 km to 0 km.
- The elimination of a baseline helps establish a fixed solution faster and keep it stable.
- In single base RT positioning, it is assumed both the base station, and the rover are experiencing nearly identical atmospheric conditions and there is minimal atmospheric modeling.
- Therefore, the baseline (base-rover distance) should not be too long to avoid making conditions from base to rover different.

NTRIP- Continued



The END

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