

UNITED NATIONS UNIVERSITY

Institute for Environment & Human Security (UNU-EHS) Bonn, Germany

Introduction to GPS technology

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Introduction to GPS technology

Why is it important?

Who knows What?



Artist Interpretation of GPS satellite; image courtesy of NASA Source: http://www.navcen.uscg.gov/ftp/gps/ggeninfo/gps-iif.tif Team Alpha: Map of EE assessment (field sites and tracks) Slovenia, 19/09/2017 Upper left: 46° 19' 26.82" N; 14° 10' 37.93" E





Content:

- 1. Basic GPS functions for field missions
- 2. Uploading current map data to the GPS
- 3. Downloading data from GPS and Rapid Mapping in
 - Google Earth

Why bother?





https://grapevinecenter.files.wordpress.com/2014/04/questions.png



https://i.pinimg.com/736x/59/bb/ed/59bbede 838404b669cb4b6e614f22f98--wh-questions-social-stories.jpg

GPS applications during field missions and SimEx





UNOSAT staff (Einar Bjorgo) plots GPS points during an emergency in Côte d'Ivoire. Image credit: United Nations. http://cerncourier.com/cws/article/cern/40423 Master students during SimEx in Bonn, 2016 (photo: J. Szarzynski).

Differential GPS in land survey mapping





http://www.archaeologyse.co.uk/03-Our-Services/Excavation%2BFieldwork/Survey%2 BGeomatics/Survey%2BGeomatics.htm



http://www.trimble.com/co nstruction/buildingconstruction/TS-series-Total-Stations.aspx



http://trimblenewcoloradooffices.blogspot.com/2012/0 4/trimble-s6-in-action.html

Global Positioning System - GPS







http://en.wikipedia.org/wiki/Global_Positioning_System

Strex 20

19

GARMIN



U.S. Air Force Senior Airman runs through a checklist during Global Positioning System satellite operations.

Global Positioning System - GPS

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Home > About GPS > What is GPS?

What is GPS?

Source:http://www8.garmin.com/aboutGPS/index.html

What is GPS?
Applications
Glossary
What is WAAS?
Geocaching

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS.



Q

How it works

GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can determine the user's position and display it on the unit's electronic map.





 The Global Positioning System (GPS) was initially developed by the U.S. Department of Defense for military applications and it was made available for civilian use in the 1980's.

 System based on a network of satellites available around the globe 24h/24 and controlled by the U.S.
 Department of Defense.

Allow orientation everywhere and everytime

GPS satellite constellation



Temporal revolution: 12 hours

Clocks with high atomic accuracy and transmitting a radio signal recognizable by a specific code



GPS Nominal Constellation 24 Satellites in 6 Orbital Planes 4 Satellites in each Plane 20,200 km Altitudes, 55 Degree Inclination

Global Positioning System - GPS





How it works

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GPS Triangulation System





Position (X,Y,Z) of a satellite is recorded at the same time (T): 4 dimensions

GPS Garmin Etrex 20 Description





Main functions for assessment missions:











Major statistics of trips

Main functions for assessment missions:





Waypoints





Main functions for assessment missions:







Tracks

What does it cost?



Varianten



Basiskarte



ab 155,98 Westeueropa



ab 189,64 Osteueropa

(too...) simple basemap





What does data cost?



GARMIN. Preprogrammed data card • Vorprogrammierte Speicherkarte Carte mémoire préprogrammée • Scheda dati preprogrammata • Tarjeta de datos preprogramada • Cartão de dados pré-programado



City Navigator® NT

Displays turn-by-turn directions, searchable POIs, addresses and s

Anzeige von Abbiegehinweisen, durchsuchbaren POIs, Adressen detaillierten Straßenkarten

Donne des instructions précises, affiche des cartes détaillées et ind une fonction de recherche par adresse et par point d'intérêt.

Visualizza indicazioni delle svolte, POI ricercabili, indirizzi e dettagli a livello stradale

Muestra direcciones giro a giro, puntos de interés para busquedas rápidas, direcciones y detalles de calles

Apresenta indicações de mudança de direcção, Pesquisa de POIs, endereços e detalhes de ruas





GARMIN.

Garmin Datenkarte City Navigator Europa NT

Artikel-Nr. : 130046

GARMIN

Garmin TOPO Deutschland V7 PRO MicroSD

Artikel-Nr. : 288031

119,95€

sofort lieferbar



Teilen 🔞 f 🍠 🖇

Auch in deiner Filiale erhältlich? (j)

In München Vorrätig, knapper Bestand

Abholen in der Filiale So funktioniert's

Verfügbarkeit in anderen Filialen V

What does data cost?



Sport & Freizeit Sportbekleidung * Sportschuhe * Camping & Outdoor * Fitness * Fußball * Radsport * Rucksäcke & Taschen * Running * Spor

Curück zu den Suchergebnissen für "datenkarte garmin afrika"



Für größere Ansicht Maus über das Bild ziehen

Datenkarte, microSD/SD,CN NT Osteuropa, (Österreich/Tschechen/Kroatien/Ungarn/Polen/Slovenien /Slovakei von Garmin

🛨

Preis: EUR 39,27 GRATIS Premiumversand Langstrecke für Prime-Mitglieder Details

Alle Preisangaben inkl. USt

Hinweis: Dieser Artikel ist zu einem günstigeren Preis bei anderen Verkäufern erhältlich, die nicht Amazon Prime anbieten.

Nur noch 6 auf Lager

Verkauf und Versand durch Amazon.

5 neu ab EUR 38,90 1 gebraucht ab EUR 34,95

• 010-11037-00

C Falsche Produktinformationen melden



http://garmin.openstreetmap.nl/

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	None		
Other Garmin maps	Ochoose a predefined country:		
OpenStreetMap OpenFietsMap	Africa Asia Europe North America Coceania South America		
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Donate	Wequest your map or download it directly: (Make a selection first)		
Bitcoin:			+m









Free maps for Garmin brand GPS devices

from OpenStreetMap





Free worldwide Garmin maps from 🗙	Index of /garmin/generic/02-09-2 × +	
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Free maps for Garmin brand GPS devices

from OpenStreetMap

country: Slovenia version: 02-09-2017

	Name Size	Description
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N	osm generic windows.exe 118M	Map installer for BaseCamp / MapSource on the Windows platform.
Q	osm generic tiles.zip 119M	Compressed file containing the tiles and overview map. This is useful for applications like Qlandkarte and Linux
S	osm monthe maccounting 117M	Map installer for BaseCamp / Mac OSX platform.
Mgr	osm generic gmapsupp.zip 1151	Compressed file containing a single image that can be placed directly onto the SD-card of the GPS. Unzip first!

Map data © openstreetmap.org and contributors

Copy the data file to your GPS device





(too...) simple basemap





















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👗 Garmin Oregon 600 (F:)		Track_2017-06-08 053705.gpx	08.06.2017 05:37	GPX File			
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🌗 Current		Waypoints_05-JUN-16.gpx	05.06.2016 12:44	GPX File			
🐌 Nav		Waypoints_05-NOV-16.gpx	05.11.2016 06:35	GPX File		BE/ENERAL	
퉬 help		Waypoints_06-AUG-17.gpx	06.08.2017 13:47	GPX File			
🌗 Profiles		Waypoints_06-FEB-15.gpx	06.02.2015 13:56	GPX File			
🌗 Shortcuts		Waypoints_06-JUN-16.gpx	06.06.2016 08:38	GPX File		HERE AN AV	
🐌 SQL		Waypoints_06-SEP-15.gpx	06.09.2015 10:54	GPX File		La Alla	
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"There are no passengers on Spaceship Earth. We are all crew!" Marshall McLuhan



What is GPS?

The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense.

GPS was originally intended for military applications, but in the 1980s, the government made the system available for civilian use. GPS works in any weather conditions, anywhere in the world, 24 hours a day. There are no subscription fees or setup charges to use GPS.



How it works

A GPS receiver must be locked on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3D position (latitude, longitude and altitude).

Once the user's position has been determined, the GPS unit can calculate other information, such as speed, bearing, track, trip distance, distance to destination, sunrise and sunset time and more.

GPS Triangulation System



Triangulation



Gemma Frisius's 1533 diagram introducing the idea of triangulation into the science of surveying. Having established a baseline, eg the cities of Brussels and Antwerp, the location of other cities, eg Middelburg, can be found by taking its compass direction at each end of the baseline, and plotting where the two directions cross. Note that this was only a theoretical presentation of the concept -- because of hills etc, it is in fact actually impossible to see Middelburg from either Brussels or Antwerp! Nevertheless, the figure soon became well known all across Europe.

Global Positioning System - GPS

The GPS satellite system

The 24 satellites that make up the GPS space segment are orbiting the earth about 12,000 miles above us. They are constantly moving, making two complete orbits in less than 24 hours. These satellites are travelling at speeds of roughly 7,000 miles an hour.

GPS satellites are powered by solar energy. They have backup batteries onboard to keep them running in the event of a solar eclipse, when there's no solar power. Small rocket boosters on each satellite keep them flying in the correct path.

Source:http://www8.garmin.com/aboutGPS/index.html



The GPS satellite system - 2

Here are some other interesting facts about the GPS satellites (also called NAVSTAR, the official U.S. Department of Defense name for GPS):

- •The first GPS satellite was launched in 1978.
- •A full constellation of 24 satellites was achieved in 1994.
- •Each satellite is built to last about 10 years. Replacements are constantly being built and launched into orbit.
- •A GPS satellite weighs approximately 2,000 pounds and is about 17 feet across with the solar panels extended.
- •Transmitter power is only 50 watts or less.



How accurate is GPS? - 2

Newer Garmin GPS receivers with <u>WAAS</u> (Wide Area Augmentation System) capability can improve accuracy to less than three meters on average. No additional equipment or fees are required to take advantage of WAAS. Users can also get better accuracy with **Differential GPS** (DGPS), which corrects GPS signals to within an average of three to five meters.

The U.S. Coast Guard operates the most common DGPS correction service. This system consists of a network of towers that receive GPS signals and transmit a corrected signal by beacon transmitters. In order to get the corrected signal, users must have a differential beacon receiver and beacon antenna in addition to their GPS.



Differential Global Positioning System (DGPS) is an enhancement to GPS that provides improved location accuracy, from the 15-meter nominal GPS accuracy to about 10 cm in case of the best implementations.

DGPS uses a network of fixed, ground-based reference stations to broadcast the difference between the positions indicated by the satellite systems and the known fixed positions. These stations broadcast the difference between the measured satellite pseudoranges and actual (internally computed) pseudoranges, and receiver stations may correct their pseudoranges by the same amount. The digital correction signal is typically broadcast locally over ground-based transmitters of shorter range.

http://en.wikipedia.org/wiki/Differential_GPS

Global Positioning System - GPS



How accurate is GPS?

3 Signal is Corrected and Broadcast to DGPS Receivers

Today's GPS receivers are extremely accurate, thanks to their parallel multi-channel design. Garmin's 12 parallel channel receivers are quick to lock onto satellites when first turned on and they maintain strong locks, even in dense foliage or urban settings with tall buildings.

Certain atmospheric factors and other sources of error can affect the accuracy of GPS receivers. Garmin® GPS receivers are accurate to within 15 meters on average.

Source:http://www8.garmin.com/aboutGPS/index.html



Differential GPS Explained

By Morag Chivers, Trimble Differential correction techniques are used to enhance the quality of location data gathered using GPS receivers. Differential correction can be applied in real-time directly in the field or when post-processing data in the office.





The underlying premise of DGPS requires that a GPS receiver, known as the base station, be set up on a precisely known location. The base station receiver calculates its position based on satellite signals and compares this location to the known location. The difference is applied to the GPS data recorded by the roving GPS receiver.

http://www.esri.com/news/arcuser/0103/differential1of2.html

Global Positioning System - GPS



What is WAAS?

WAAS - Wide Area Augmentation System is basically a system of satellites and ground stations that provide GPS signal corrections, giving you even better position accuracy, on average of up to five times better.

A WAAS-capable receiver can give you a position accuracy of better than 3 m, 95 percent of the time. And you don't have to purchase additional receiving equipment or pay service fees to use WAAS.

Source:http://www8.garmin.com/aboutGPS/index.html



WAAS - How it Works

WAAS consists of multiple ground reference stations positioned across the U.S. that monitor GPS satellite data. Two master stations, located on either coast, collect data from the reference stations and create a GPS correction message. This correction accounts for GPS satellite orbit and clock drift plus signal delays caused by the atmosphere and ionosphere.

The corrected differential message is then broadcast through 1 of 2 geostationary satellites, or satellites with a fixed position over the equator. The information is compatible with the basic GPS signal structure, which means any WAASenabled GPS receiver can read the signal.



Who benefits from WAAS?

Currently, WAAS satellite coverage is only available in North America. WAAS provides extended coverage both inland and offshore compared to the land-based DGPS (differential GPS) system. Another benefit of WAAS is that it does not require additional receiving equipment, while DGPS does.

Other governments are developing similar satellite-based differential systems. In Asia, it's the Japanese Multi-Functional Satellite Augmentation System (MSAS), while Europe has the Euro Geostationary Navigation Overlay Service (EGNOS). Eventually, GPS users around the world will have access to precise position data using these and other compatible systems.

Source:http://www8.garmin.com/aboutGPS/index.html



It just keeps getting better

100 m: Accuracy of the original GPS system, which was subject to accuracy degradation under the governmentimposed Selective Availability (SA) program.



Source:http://www8.garmin.com/aboutGPS/index.html

15 m: Typical GPS position accuracy without SA.

3-5 m: Typical differential GPS (DGPS) position accuracy.

< 3 m: Typical WAAS position accuracy.

GPS Control System



Peter H. Dana 5/27/95



Global Positioning System (GPS) Master Control and Monitor Station Network

GPS Components



- Receiver or transceiver
- A built-in antenna (and external antenna)
- A Central Memory Unit for storing
 information

GPS Common Uses



- Earth, Air and Marine Navigation
- Cars, planes and boast integrate GPS in navigation automatical device to optimize routes.
 Mapping: geodetic and georeferencing (refugees, IDPs, surveys, flood areas, corridors tracking, water sources...etc.)
- Optimize supplies delivery
- Ingrated to Early Warning System
- Now: mobile phone, PDA

PDA – GPS for Assessments support



- PDA Stands for Personal Digital Assistant
- A PDA is basically a computer that can fit into the palm of your hand.

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PDA – GPS nesting for Assessments support

- Coordinates (Latitude / Longitude)
- Accuracy of coordinates
- Date and Time







"There are no passengers on Spaceship Earth. We are all crew!" Marshall McLuhan