Understanding the Operation and Accuracy
Of the Global Positioning Unit

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ABSTRACT

Thorough investigation was conducted through surveys and comparisons of maps and coordinates of various sites. These results suggest that the Global Positioning Unit is not only precise but accurate when utilizing their numerous navigational tools.

INTRODUCTION

The Global Positioning System (GPS) is a unit that is used to provide people with various navigational tools for a number of situations. It uses satellites to help you find information on coordinates, elevation, temperature and tracking of certain specified positions. Although the system is used by people around the world, it is funded and controlled by the United States Department of Defense (DOD) and operated by the United States military (Magellan 1998). A GPS system uses three satellites to find positions and a fourth to compute the time offset of the internal clock of each unit (Magellan 1998). GPS started in 1978 by the Department of Defense with 11 satellites orbiting the world. Since 1995 there have been 24 satellites orbiting the world on six different orbits (Magellan 1998). These satellites provide readings and data obtained from each GPS system. Another satellite navigation system currently being used is the Global Navigational Satellite System (GLONASS) which is operated by Russia (Magellan 1998). Both of these systems provide navigational tools for civilian and military use.

MATERIALS AND METHODS

For this experiment two GPS units were compared. The first model was a Magellan GPS Tracker, model number 22-10335-00. This system was the most recent model of the two units, made in 1998. The second model used in this study, was a

Magellan GPS ColorTRAK Satellite Navigator, model number 22-10303-00. The ColorTRAK unit was made in 1997 and had the same functions as the Tracker unit except that it had a color screen. Another difference was that the ColorTRAK unit had more problems finding satellite signals than the newer Tracker unit.

In order to perform navigational functions with the GPS unit, it was important to read and understand the instructions manual for each model. This helped perform the basic functions of the system. The manual explained how to customize readings and deal with questions or problems that may occur while using the system. There was also customer service contact information in case the manual does not answer all the questions.

Before use, both systems had to first be initialized in order to receive correct coordinates (Magellan 1998). To obtain accurate readings, the initialization of the two units was made at Batali Beach on the west coast of the island of Dominica. This made it easier to set the elevation accurately at zero, rather than guessing the altitude. It was important to find an area with the least amount of coverage as possible in order to find a signal to obtain a position reading. If a position could not be found due to interference or poor satellite positions, walking around the selected site helped in receiving data.

Most of the study was performed at Springfield Plantation in the mountains of Dominica (Table 1). Readings were also taken near Fort Shirley in Cabrits National Park on the north side of the island. Data were taken on the dates of 29 and 30 May, and 1, 4-6 June of 2005. Seven position readings were recorded and compared between the GPS Tracker and ColorTRAK units (Table 1). Other comparisons of altitude and position coordinates were also tested between the Tracker model and a new 2005 GPS unit.

Previous studies performed at Springfield, using the GPS systems, were used for comparison (Koehler 2003).

RESULTS

The first position taken, by the Tracker model, at Springfield was 15° 20.43'N latitude and 61° 22.08'W longitude. The altitude was 1081ft. These data were collected before initializing the unit with a 0ft elevation at Batali Beach. The position from Springfield changed to 15° 20.79'N latitude, 61° 22.11'W longitude with an elevation at 1158ft.

The following survey compared the GPS Tracker model to the GPS ColorTRAK model. From this comparison, there seemed to be a similarity in the data collected (Table 1). The largest difference in position coordinates was by only one minute in latitude and longitude. However there was a contrast in the temperatures and elevations between the two units. The largest temperature variation was ±5° F and in elevation there was a 53ft discrepancy.

From observations of previous studies, there seemed to be no differences in the GPS positions or site elevations recorded (Koehler 2003). There was also little differentiation from the readings recorded with the 2005 model during the observations. All the positions were precise down to the ±0.05 minutes of latitude and longitude.

DISCUSSION

After collecting and recording data the resulting coordinates were located on a map. Comparing the coordinates from the survey sites, to the latitude and longitude on the maps, illustrates that the GPS units are not only precise but also nearly accurate.

The main discrepancies were found in elevation. There were numerous times when elevation was not recorded primarily due to imprecision. For example the readings recorded at Cabrits National Park displayed a decrease in elevation when the user was clearly moving up in elevation on a hillside.

There were various reasons why a reading may not have been accurate. The manuals stated that each unit will have an accuracy of 100 meters horizontal and 150 meters vertical (Magellan 1998). There was also a probability of receiving data outside of these horizontal or vertical boundaries. Overhead coverage from trees or buildings played a large factor in receiving correct readings from satellite signals also. When readings were taken from under a thick canopy it was always difficult to find satellite signals. Each unit used for this survey needed at least three satellites to get a position reading. It was difficult to receive any data from the GPS units if there was any interference from mountains, closed canopies or buildings.

Another important reason the GPS units may have been less accurate was that the satellites are controlled by the Department of Defense (DOD) (Magellan 1998). Since the United States is in a war there may be more probability of a less accurate reading. This could be to ensure the safety of everyone around the world.

After observing the data collected from the surveys and comparisons, it is obvious that a GPS unit can be helpful in many ways. Some of the navigational tools that can be helpful consist of mapping routes and landmarks and finding positions, distance, speed, and many other readings. GPS units could be used in various types of research, such as finding elevations for different species of plants, temperature for anole habitats, or saving routes for trees or other landmarks being observed. All of the different tools can be

utilized for research, military intelligence, topography, and recreational use. Although there may be some interference at times, the data was precise and accurate.

Figure 1. Map of Dominica displaying area of coordinates measures.

- Springfield Plantation

X- Fort Shirley (Cabrits National Park)

O – Batali Beach

Figure 2. Map of Dominica displaying latitude and longitude.

Table 1. Comparison of coordinates at Springfield Plantation.

	Area	Latitude	Longitude	Elevation	Temperature
Tracker					
1	Stream house	15°N 20.77	61°W 22.11	1140 ft	81°
2	Stream house	15°N 20.77	61°W 22.11	1147 ft	82°
3	Stream house	15°N 20.77	61°W 22.11	1180 ft	80°
4	Stream house	15°N 20.77	61°W 22.11	1139 ft	76°
5	Main house	15°N 20.80	61°W 22.14	1105 ft	77°
6	Stream house	15°N 20.77	61°W 22.11	1177 ft	77°
7	Court yard	15°N 20.81	61°W 22.11	x	70°
ColorTRAK					
1	Stream house	15°N 20.77	61°W 22.11	1149 ft	76°
2	Stream house	15°N 20.77	61°W 22.11	1156 ft	78°
3	Stream house	15°N 20.77	61°W 22.11	1170 ft	77°
4	Stream house	15°N 20.77	61°W 22.11	1140 ft	73°
5	Main house	15°N 20.79	61°W 22.13	1158 ft	73°
6	Stream house	15°N 20.77	61°W 22.11	1133 ft	74°
7	Court yard	15°N 20.81	61°W 22.11	x	74°

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