

GPS/GIS SYSTEMS ANALYSIS: RECOMMENDATIONS AND SUGGESTIONS FOR THE FUTURE

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Introduction

The first year of any operation is bound to have struggles that are only smoothed out with time and experience. RMBL's new GPS/GIS department is no exception to this rule. Despite this, the department was still able to offer an incredible number of services in its first year, and has provided a solid base to continue delivering accurate results.

Overall the GPS/GIS department began the summer prepared to give researchers access to all available GPS and GIS technology at the research station. Hard work and good planning allowed this summer to run fairly smoothly making the job of giving recommendations and suggestions somewhat challenging. In addition, many of these suggestions are currently being solved and may be fixed before summer's end. The most important recommendations are for better organization and dissemination of information for GIS and GPS, as well as suggestions to smooth out the interactions between researchers and the department. The recommendations and suggestions have been divided into sections: GPS units, online work, and overall recommendations. The first two sections are further divided into introductions, problems, and solutions.

GPS UNITS

GeoXT Introduction

The use of the GeoXT this summer was a huge success. The two units were signed out almost everyday, and everyone from the novice GPS user to the most advanced were able to use the units with little confusion or hassle. The GeoXT was capable of a sufficient accuracy as to lend itself to a variety of uses for the least amount

of training and maximum mobility. Because of this, it is recommended that a third GeoXT be purchased for the next season.

In general, the GeoXT system appeared to run fairly well. Users signed up outside the GPS lab, received a brief training session, and then were free to take the units (and a help manual) out by themselves into the field. This system, however, could still use some changes to make it more organized.

GeoXT Problems

To begin with, the check out system should be clearer and easier to use. Thus far, one would check out a unit on one of two clipboards outside the GPS office, where numerous pieces of paper explaining the rules for check-out were posted. Users were often confused about the terms and rules of checking out. For example, how many days they needed to check out a unit, when they needed to return them, and how they could get the information off the machines when they were finished. All these questions and more were answered by the posted notes above the clipboards, however, the notes were often overlooked and department personnel were frequently needed to help in the check out process, leaving less time to do other work.

Another issue involved organization of data return. Currently, department personnel differentially correct and email data back to the researcher. Then later, they let the other personnel know what has been completed. In the future, as more and more researchers begin to take advantage of the GPS units, there will be much more data coming through the office. It will become immensely important to have some way of

instantly knowing what data has been downloaded, corrected, and e-mailed to avoid forgetting, and to make sure that it gets done in a timely fashion.

GeoXT Solutions

An online check-out would help increase the clarity and organization of the check out system. Similar to the metadata page, an online check out would force users to sign up properly, and in a clear and organized fashion. A page dedicated to signups would also include the rules and important information so that many of the basic questions would be answered. To help clarify the problem with returning metadata to researchers a solution could be found in a check system linked to the check-out system.

Hiper Pro Introduction

The Hiper Pro was a great unit this season, and has impressed the department with its accuracy. In the future, researchers should be able to take the unit out by themselves after only a few training sessions. The data collector was the most complicated part of the operation, but a brief field manual should answer most questions.

Hiper Pro Problems

There were a few problems with the unit, but for the most part they did not inhibit users from collecting data. Some of the problems included being unable to connect to Bluetooth in the field, which is important for base station and rover communication, as well as antenna malfunctions, which is also important for base station and rover communication. It was also difficult to transfer files from one data collector to the other.

So far we have been unable to understand why Bluetooth and the antennas occasionally malfunctioned. The department is working with TopCon to figure out how to transfer data from one collector to another.

The biggest hurdle for the Hiper Pro was fixing and maintaining enough satellites to record positions. Our experience using the unit has been that satellites were the best in the morning, but by afternoon, the unit was rendered nearly useless regardless of mission planning.

Another potential problem could be the radio connection between base station and rover. The maximum distance that the radios will maintain connection is three miles which could be limiting depending on how much the localizations grow. It is important to note that the millimeter accuracy of the Hiper Pro is only feasible within a localization, and since there are only two localizations thus far, the unit is limited in its usefulness for researchers.

Hiper Pro Solutions

One consideration on the satellite problem is that this could be a time period of reduced satellite availability for this area. There has been a steady decrease in good mission planning time over the summer. Perhaps if GLONASS satellites were utilized there would be fewer problems as well. As it stands currently, being able to use the Hiper Pro only in the morning may become unacceptable if demand increases. As the localizations are expanded up and down the East River Valley, the Hiper Pro will become more useful, and most likely more utilized by researchers.

Total Station Introduction

The Total station seems to be a much more complicated system to master. At least initially, the researchers will need department personnel to accompany them in the field to make sure that all settings and setup are perfect. It will take many more training sessions than the Hiper Pro. There appears to be less interest in the Total Station than the Hiper Pro or GeoXT, however, this may change as researchers come up with projects needing millimeter accuracy.

Total Station Problems

Some of the problems that have been encountered include general setting procedures (adjusting the barometric and temperature gauges), adjusting the tilt and leveling bubbles accurately, and accommodating for the earth's curvature. There were also field related problems, such as like setting up the tripods on uneven terrain, and working in harsh conditions such as early morning cold and bright sun that hindered our abilities to function and work productively at times. We also found that it was vital to have a person manning each tripod separately instead of one person running from backsight to foresight. With three people, the accuracy of gun shots was better maintained, and there was less possibility of error due to tripod set up and wind movement on the prism. It is also important to note that seeing shots thru the gun at distances of greater than 300m becomes difficult and a large single prism is necessary.

Total Station Solutions

Most of the problems listed above have been solved as the department gained more experience with the Total Station. After correspondence with TopCon, several

problems associated with barometric, temperature, and earth curvature issues have been resolved, and will hopefully greatly reduce future error by allowing fewer shots in the localizations. While field conditions are tough, with practice it has become possible to identify trouble spots and find solutions. For instance, long shots make it difficult to see the prism, therefore, we use the largest prism and use a light or dark background behind it, to make it easier to pick out the prism from vegetation and rock.

ONLINE WORK

Metadata Introduction

After some initial trial runs with the metadata form and procedure, the process ran fairly smoothly. Differentially correcting and emailing data to researchers has run well from the GIS department's perspective. There have been no complaints about the form itself, either about the options that are available (no spatial data, map research site, and spatial data for research project) or the process of filling it out. The REU's have stated that the form takes minimal time, and is easy to fill out. The file return process wherein researchers cannot receive their data until the form has been submitted, worked well. It is important for the metadata to get submitted and filled out in a timely fashion, and the current setup provides for this.

Metadata Problems and Solutions

One problem encountered was that for those people who had never used GPS, or had never filled out a metadata form (or who had no clue what metadata was), there was confusion as to which metadata form they needed to fill out. Occasionally the department received forms that were not appropriate for the data that was sent. It would be clearer if there was a brief summary beneath the options. As it stands now, the same checklist is

provided beneath each option. The check list is a great way to get people thinking about their metadata form before they go into the field to take the data, and some additional information about the different metadata forms could help to clarify to the user exactly what sort of data they are going to be collecting.

Another problem that should be addressed involves keeping track of which metadata form corresponds to which set of GPS data. Researchers may take many sets of data over the course of a summer, and currently are required to fill out a single metadata form. This could potentially be a problem if they collect different types of GPS data, and also it is problematic because there is not a form for each GPS data set. As a solution, the online metadata form could be adjusted so that it would track past forms that researchers fill out. If a researcher took more data on the same plot or area, they would select their name and the GPS files from automated pull down menu's. Each GPS data set would have a corresponding metadata form.

As one final note, the "upload data" button at the bottom of the form should either be removed or there needs to be some explanation of when to use it.

Helpdesk Introduction

Overall, there was an impressive amount of information incorporated into the helpdesk. It provided more than enough information for the majority of the users, spanning from the most basic background information to very specific troubleshooting. There will, of course, be those who that will want or need more or less information depending on their level of involvement and/or interest. For the first year the helpdesk was a good site that generally provided adequate information for even the most novice GPS/GIS user.

Helpdesk Problems and Solutions

Both overall and specific recommendations, are covered here. The specific recommendations are detailed under the headings to which they apply in the helpdesk. In terms of overall recommendations it is imperative that the spelling and grammatical errors be kept to a minimum. These sorts of errors decrease clarity and ease of understanding, as well as decrease user confidence in the information being given. Another suggestion to increase clarity of the helpdesk is to make sure that the organization of the tabs go from general to more specific. Often the most general information (GPS and GIS general information) is given as the last choice in the list. Listings from general to more specific would make the helpdesk easier to navigate. Specific suggestions are given as follows:

GPS

- In the section on Coordinate Systems, Ellipsoids and Datums, it should be made clearer the reason you need to correct ellipsoids and datums. Also, it would be useful if Gothic coordinates (Lat/Long, UTM etc.) were posted for general reference.
- In the section on Georeferencing, it would be useful to add something about changing projections. While researchers may not need to do this here, it is a background skill that could help on future projects.
- The section on Post Processing and Differential Correction is probably the most important for researchers to understand. Therefore, it would be beneficial to explain how post processing works.
- One final section under GPS-General Information could be added about GPS error. For example, why and how you might accumulate error.
- Under GPS software it would be good to include a section on data dictionaries and how they apply to any research that might be done. Data dictionaries are imperative for the researchers to use, so this could be helpful to explaining why they are important and make collecting data easier.
- Another basic definition that would be really helpful, would be to explain mission planning, what it means and how it applies to collecting data.

GIS

- One suggestion for this section would be to group all the file types together for better organization and clarity.

How To Section

- Add a section here on how to access GIS files because there is nothing on the helpdesk indicating that you have to go through database connections and click on the RMBLcoverages.sde.

Metadata

- Since there seems to be confusion about the metadata forms, either people filling out the wrong form or filling it out incorrectly, it would be good to have an explanation of the three different types of metadata forms that are used at the lab and when you would use them.

Maps

- If there is a map of all the current research sites it might be helpful to include the location of this on the helpdesk until a digital map is created.

OVERALL RECOMMENDATIONS

GPS Units

In terms of hardware, the GeoXT's had the most use this summer. They were easy to use, durable, and more mobile than the other units. While their accuracy was less than either the Hiper or the Total Station, many researchers would probably use a third GeoXT, especially during the crunch time when everyone is mapping plots or projects.

Online

The best thing that could be done to clarify the GPS/GIS system would be to create a section on the website. This website would include information on all the GPS units, including accuracy, availability, who can use them, online sign-outs, mission planning, and much more. In this way, anyone could easily find information on the units, and when they are free without going to the GPS/GIS lab or tracking down personnel. The website would also include GIS/GPS info on the helpdesk, a list of the available coverages, and the metadata forms. In this way, all the GPS/GIS information and services would be in one place.

This would be a much clearer and more organized way to provide information about the GPS/GIS department. Corrections and addendums to the system could also be posted rather than printed out on pieces of paper and taped up to the office door. It would seem a much more convenient way to convey information like mission planning and availability of the units for the researchers, enabling them to plan their upcoming work and sign out units from their cabin or office. This website would also conceivably cut down on the basic questions that come up and general confusion as the information would no longer be scattered. Having all the information about the GPS units, and the GIS coverages readily available would allow the researchers to be able to more thoroughly analyze how these tools could add or support their studies.

This summer has been a learning experience for all GPS/GIS personnel in terms of getting the GPS/GIS labs set up and running smoothly. Operations will become smoother in the future, however, the lab should anticipate more use of the GPS equipment by researchers. Very few people used the GIS tools to their full capacity this year, and in coming years there may be much more work involving the GIS side of the department. The GIS software is neither intuitive, nor easy to learn, so we should anticipate that in the future it may be necessary for someone to assist researchers to manipulate their data in the GIS environment. For these reasons I believe it will be necessary for there to be at least one person dedicated to GPS/GIS work in the future.

Conclusions

No new program is without problems. With these recommendations implemented the GPS/GIS lab will run much smoother. The single most important recommendation, that would do the most to help organize and clarify the GPS/GIS system, would be the

addition of a GPS/GIS section to the website. This would allow all the information about the department to be in one place that could be updated quickly and easily. There would also be the possibility of this website being used throughout the year for general GPS/GIS information.

Aiding researchers to map their sites using GPS, and to integrate their data into a GIS environment will greatly help them to see their work from new perspectives. These suggestions will hopefully make the GPS/GIS department more accessible and useful for researchers, students, and staff at RMBL.