FIELD MAPPING

Instructor: Ev Wingert, Saunders 445B, 956-3510, everett@hawaii.edu

Place: The class will meet promptly at 8:30 AM Saturday mornings in Physical Science Building 310 unless prior arrangements have been made. The Saturday sessions will be mostly conducted off campus, after an on-campus introduction, and will vary in length depending upon the student’s field efficiency. It is not uncommon to be in the field until 4 to 5 PM, but on other occasions, field work may be done by noon, leaving time for afternoon data analysis and plotting! There will be no formal work in the lab after field time, but it can be useful for teams to get together after field time to clean and check equipment, exchange data, and make plans for plotting during the week. However, it may be necessary for teams to meet sometime during the week and work out materials that will need to be turned in the following week.

Course Synopsis: This is NOT a course in GIS and we will not employ GIS software. Geographic Information Systems or Science is a technology for managing and analyzing data not collecting it. Field Mapping is about collecting data from primary methods in a field setting for the express purpose of mapping usually localized large-scale sites. At some point field data will likely be entered in a GIS but we are mainly concerned about the characteristics of the data we will collect, not how it might be used in different contexts.

By mapping a site [miniaturizing it] it is possible to study and measure it in a context some distance from the field. People have been mapping from primary data almost from the beginning of cartography around 6000BP. Early mapping developed into an elementary body of geometric techniques which, over the years, grew and evolved into the more specialized fields of surveying, photogrammetry and the other engineering-oriented technical fields that are now disciplines in their own right. However, many of the original techniques remain useful and are still appropriate for many applications today. The first method to be explored in this class, compass and pacing, existed in the 9th and 10th centuries. Plane table mapping was used extensively by George Washington and Thomas Jefferson, surveyors, and in almost all topographic mapping before 1955. And plane table mapping is still the best method for many types of very large scale archeo-
logical and other types of site mapping and is gaining a new resurgence among some archeological professionals.

New techniques are continuously becoming available. Global Positioning Systems have totally changed how we map many subjects, but the method does not have the same impact on the field of legal mapping and surveying that it has on resource mapping. GPS is inherently a low precision mapping or positioning system however, high resolution systems are available but can be very expensive. High resolution systems that are appropriate for legal and control work can cost over $40,000 compared to other "resource and recreational grade" GPS units available for under $100. However, there are methods to increase GPS accuracy of the lower cost equipment, but the methods also slow the data acquisition rate. There are some situations where low precision GPS is much better than anything we have now. However, in dense vegetation and rugged terrain GPS simply will not work for any mapping functions.

As many of the early but relatively low-tech methods were superseded by better equipment and higher degrees of technology and precision, specialized fields grew and much higher levels of precision became possible, but at a price. A commonly accepted tenet of all mapping is that we always take pains to make the most accurate maps possible. However, there is also a conflicting tenet: a lower accuracy map, carefully done, is almost always better than no map. While it is highly desirable to survey the trail from Maui’s Haleakala Crater to Seven Pools with the best electronic surveying equipment available, one is just as likely to reach the destination with a carefully prepared sketch map from memory.

The distinction between a surveyed map and field mapped data is usually clear but there are many cases when a map compiled from low precision methods is used inappropriately, far beyond its accuracy intent, causing poor decisions and/or legal liability situations to arise. The person using any map must be cognizant of how a map was made and the limits to its confidence.

Cost is a constant factor in field work. To hire a licensed surveying team to survey the Manoa Falls trail will cost a couple of thousand dollars, while compass and pacing might be done by a careful individual on a pleasure hike. Which is better, more accurate, more expeditious, more useful, more cost-effective? There are very few, if any, hard and fast answers or rules of procedure when it comes to mapping from field data. One always does the most careful and consistent work possible within the technological limits imposed by equipment available. One always produces maps that reflect, not exaggerate, the characteristics of the data used to make the map.
Objectives: This course will attempt to accomplish several interrelated objectives.

First, it will expose the student to a range of useful technologies and methods for mapping at large scales. Associated with each exercise will be abundant opportunities for monitoring the map’s accuracy. It is expected that the student will be constantly monitoring the accuracy potential of equipment and method and be drawing conclusions about situations where the method represents a good match to the problem at hand or just not adequate.

Second, in field situations we will be paying close attention to the subject of our mapping, as it relates to technique. When we are mapping a vegetation 'boundary', its precision is limited by the nature of the boundary. It makes no sense to map a boundary that grades between two plant species groups over 10 meters, with an instrument that has a potential precision of 2 centimeters. However, it is necessary to map that boundary with a method that has a consistent error factor so that the mapped boundary line falls within the transition zone.

The third aspect of the course is almost a side effect, but important to all cartographers and those who conduct fieldwork. I never really understood scale and generalization before I started to collect data in the field. These central aspects of all mapping give the concepts of accuracy and precision meaning in a very real analytical sense, and may be the most important outcome of this course for many.

In summary, this course is designed to link the often abstract concepts embedded in maps to the real world. It will give the student a practical sense of how maps for many different purposes can be made. And it will provide an understanding of the confidence that can be ascribed to the maps that field scientists use, and often rely on with a misdirected sense of accuracy.

Student Learning outcomes:

1. To gain experience in the use of a range of field measurement equipment and use methodologies in field situations.
2. To understand the accuracy characteristics of large scale maps.
3. To evaluate field methods appropriate for the measurement of different classes of environmental and cultural data.
Readings: At the present there is no single affordable introductory field mapping text to supplement what I think is necessary lecture and field material.

Required Materials: (all available in the University bookstore)
1. **Waterproof field notebook.** These items have become outrageously expensive and in most cases a clipboard with notebook paper will suffice, however after working for several hours in a difficult field site trying to write on rain softened notebook paper will make you appreciate waterproof field books.
2. **A hand calculator with trigonometric functions.** All of our lab computers have trigonometric functions on them, but on a few occasions, it will very useful to be able to compute sines and cosines in the field. Most of the least expensive calculators have them so its not worth spending a lot of money on a high end calculator that you will need to use in the rain and probably occasionally drop in the mud.

Recommended Materials:
3. Daypack or map bag.
4. Hand compass with sighting line and declination adjustment. (We will supply field compasses for all class members if you do not have your own. **But if you anticipate future field work involving a good compass, it is better to develop experience on your own unit.** However, you might want to consult with me before spending a lot of money on a less than totally satisfactory model.)

Highly Recommended Supplies:
5. Clipboard, masking tape, large zip-lock plastic bags for waterproofing lunches, cameras, spare clothes, etc.
6. Shoes and clothes that you don’t mind getting muddy. There will be times when slippers will be inadequate or at least very uncomfortable footwear.
7. Canteen or water bottle!!!
8. Light rain gear or a good poncho! **(Unfortunately because of the short time available for class meetings, we will work outside in all)**
weather conditions that will not damage the instruments.
9. Hat or some headgear to protect you from the tropical sun.
10. A small collection of the usual first aid gear, lots of Band-Aids, aspirin, chocolate, snacks, etc. as your personal needs dictate.

COURSE OUTLINE ---------------------------------------

NOTE: The sites that are used as subjects for the field labs are quite fluid and may change or remain to be established as this outline is written [????]. In every case possible, you will receive the exercise handout a week in advance. The handout will incorporate information on methodology and the actual field conditions at the site so that you can prepare for contingencies such as clothing, shoes, rain gear, and food. In all cases if you miss the handout or I am late getting one out, please plan for the worst condition. Eg. Bring food, water, hat, and good shoes!

---------------------------  UNIT A - Reconnaissance Mapping  ---------------------------

1st week: [August 25] COMPASS AND PACING - pace calibration, closed traverse, basic compass use, plotting. CAMPUS * or ** (ASTERISKS INDICATE THE NUMBER OF PEOPLE IN A TEAM FOR EXERCISES)

2nd week: [Sept 1] COMPASS CALIBRATION AND ACCURACY - developing a compass card, compass adjustment, assessing map accuracy, wheel traverse. MANOA **
NOTE: We will work on this Saturday over Labor Day weekend so that we can take Thanksgiving weekend Saturday off to allow for holiday travel.

3rd week: [Sept 8] COMPASS AND TAPING - distance taping, planimetric traverse, compass use, AutoCad plotting, scales. LYON ARBORETUM***

4th week: [Sept 15] RESOURCE GRADE GPS FOR DATA PLOTTING - Compilation, data downloading, plotting data, accuracy evaluation. (Manoa* or **)
--- UNIT B - Plane Table Mapping ---

5th week: [Sept 22] **BASIC PLANE TABLE 1** - plane table, alidade, tape, leveling rods.  
**CAMPUS***

6th week: [Sept 29] **BASIC PLANE TABLE 2** - plane table, alidade, tape, range poles,  
leveling rods. **CAMPUS***

7th week: [Oct 15] **PLANE TABLE SITE MAPPING** - plane table, stadia rods, radiation,  
sketching. **Makiki Nature Center***

--- UNIT C - TOTAL STATION WORK ---

8th week: [Oct 6] **MID-TERM EXAMINATION [Take Home] TOTAL STATIONS** -  
total station setups, prism rod rods, plotting. **CAMPUS***

9th week: [Oct 13] **TOTAL STATION CLOSED TRAVERSE** - Total station, prism rod,  
data download, plotting. **CAMPUS***

10th week: [Oct 20] **CONTROL POINTS** - Total Stations, Survey grade GPS, data down-
loading, differential processing, data accuracy. **CAMPUS or ARBORETUM***

11th week: [Oct 27] **SOLOING ON THE TS's** - total station setups, traverse, point  
and line shots. ????? ***

12th week: [Nov 3] **MERGING DATA SETS** - total station setups, traverse, point  
and line shots. ????? ***

13th week [Nov 10] **TOPOGRAPHIC MAPPING** - total station setups, contouring.  
????? ***

14th week: [Nov 17] **TOPOGRAPHIC MAPPING Continued.**

15th week: [Nov 24] Thanksgiving weekend holiday

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16th week: [Dec 1] - Catchup. Usually by this time in the semester, we are behind because of the complexity of learning the Total Stations so this weekend is open for planning but will probably already be absorbed by the time we get here.

----------------------------- FINAL FIELD PROBLEM AND EXAM -----------------------------

17th week: [Dec 8] FINAL FIELD EXAMINATION - map accuracy

NOTE: The list of field exercises above will probably be modified as the course progresses. As interesting problems are encountered and weather problems arise during the semester, labs may be substituted or extended. It is quite common for requests for mapping help to come in during the semester. If they represent useful tasks in expanding equipment and methodological skill, I may substitute these for the planned labs. A couple of courses ago, we worked on a job, mapping a fishpond in Kaneohe that is being restored. Several years ago we were asked to do a topographic map of a site at the 5000 foot level of Mauna Loa on the Big Island. Class members have also participated in topographic mapping for Hawai`i State Parks on the NaPali Coast on Kauai. We have worked on Kahana Valley State Park grave mapping for several years. If anyone knows of other interesting projects that might profit from our help be sure to talk to me about it.

July 19, 2012