# GEOMATICS DEPARTMENT
# NWCCU Assessment Report
# 2008-09 Academic Year
**12 August 2009**

## SECTION I - DEPARTMENT OVERVIEW

## Program History

Geomatics education has been offered virtually since the university's inception, with an associate degree in Surveying initiated in 1951. The program was accredited by the Engineer's Council on Professional Development (ECPD) in 1953. ECPD is now recognized as ABET. A baccalaureate Surveying Technology degree was offered in 1966, and accredited by TAC-ABET in 1970. The program was one of the first two bachelors of science surveying programs in the nation to receive RAC-ABET accreditation in 1984. The geomatics program has enjoyed 57 years of continuous accreditation under ABET or its predecessor, ECPD. OIT can be proud of having the oldest BS Geomatics program in the nation! The program degree title was officially changed from Surveying to Geomatics in 2001, reflecting a global trend recognizing the broadening of the profession and the impact of a revolution in advanced technology. As of 2007 the department now offers the BS Surveying option (former BS Geomatics degree), and the new BS GIS option.

### Recent Staff Changes

Geomatics professor Dennis Findorff resigned in 2003 to join the ministry. Professor Mason Marker was hired to fill this position. Due to possible changes to the Public Employee Retirement System (PERS) Professor Mark Ager retired in 2003, and negotiated an agreement to teach half-time during the 2004-05 and 2005-06 academic years.

During the 2005-06 academic year, a successful search resulted in hiring Dr. Evelyn Kalb to fill Professor Mark Ager's position. Dr. Kalb joined the staff during the 2006-07 academic year. Emeritus professor Mark Ager will continue to teach half-time for the foreseeable future.

In the spring of 2008, Dr. Kalb announced her intent to leave OIT to resume a full-time partnership in the firm Chesebro-Kalb. This was a reluctant decision on Evelyn's part, and she intends to remain available as an adjunct faculty and develop geomatics distance education course offerings. Mr. Mitch Duryea has been hired to fill this position. He has extensive boundary surveying experience as the proprietor of Duryea and Associates.

### Endowed Faculty Position

Approximately 60% of the Bureau of Land Management (BLM) cadastral surveyors, many holding prominent positions, are Oregon Tech Surveying graduates. The BLM is facing a 50% loss in surveying staff in the next 5 years due to retirement. BLM has always heavily recruited at Oregon Tech, and in the spring quarter of 2005, a Memorandum of Understanding was signed with the Bureau of Land Management (BLM) to endow a geomatics faculty member for five years. This $750,000 agreement funds a 4$^{th}$ geomatics faculty position with approximately half-time release for geomatics recruiting and outreach activities. This agreement replaces an ongoing BLM assistance agreement providing $50,000 per year to enhance the geomatics program. Oregon Tech offers geomatics students who successfully complete a summer internship with BLM $2,000 scholarships. These scholarships have proven to be an effective

recruiting tool. Professor Tim Kent was hired to fill this position. After three years of service, he resigned for personal reasons. With department enrollment increasing, the decision was made to leave this position unfilled.

**Department Status**

Effective 1 July 2006, the department of Civil Engineering and Geomatics became two separate departments, the Department of Civil Engineering, and the Department of Geomatics. Professor Jack Walker has been appointed as the Geomatics Department Chair, receiving half-time release.

The geomatics profession is evolving rapidly in response to new technologies, and has less in common with the civil engineering profession than at any time in the past. The Geomatics program enjoys exceptionally strong support from constituents, and as an autonomous department has an opportunity to expand and grow.

## Enrollment Trends

Geomatics enrollment for the last 5 years is listed below. It was gratifying to see a 41% increase during the fall term or 2007, and a slight increase for 2008.

| Fall Terms | Year (2004-05) | Year (2005-06) | Year (2006-07) | Year (2007-08) | Year (2008-09) |
|---|---|---|---|---|---|
| Full-time Students | 39 | 46 | 46 | 65 | 67 |

Table IA Enrollment Trends for Past Five Academic Years

## Retention Rates

Retention rates are kept for full-time, first-time students only. Since a large percentage of geomatics students are transfer students, the data does not accurately reflect department retention. For example, about 20 new students enrolled in geomatics in the fall of 2007, yet only 5 are listed as “first-time students”.

| Fall Terms | Year (2003-04) | Year (2004-05) | Year (2005-06) | Year (2006-07) | Year (2007-08) |
|---|---|---|---|---|---|
| First-time Students | 2 | 0 | 5 | 6 | 5 |
| Changed major | 1 | 1 | 2 | 0 | 3 |

Table IB Retention Trends for Past Five Academic Years

## Degrees Awarded

A summary of the number of geomatics degrees (now the Surveying and GIS options) awarded for the last 5 years is shown below.

| Fall Terms | Year (2003-04) | Year (2004-05) | Year (2005-06) | Year (2006-07) | Year (2007-08) |
|---|---|---|---|---|---|
| First-time Students | 7 | 10 | 7 | 10 | 7 |

Table IC Retention Trends for Past Five Academic Years

## Program Graduate Data

Graduates are asked to report whether they have passed the NCEES Fundamentals of Land Surveying (FS) examination. Senior students are eligible to sit for the FS in April, and are not notified of exam results until July or August. The long delay resulted in many individuals neglecting to report whether they passed. NCEES is now providing exam results, which greatly enhances tracking statistics.

Historically, the number of graduates returning Career Services graduate survey forms has been low, for example only 2 responses from the 10 graduates of the class of 2006. Geomatics faculty attempt to contact graduates and assist Career Services to obtain significant placement and salary data for graduates. The 2007 employment rate was 100%, with an average starting salary of $56,595, and a high of $70,408. Graduates accepting employment with the federal government typically start at GS-5 or GS-7 wage grade, which is less than $40,000 annually. These graduates will eventually "catch up" with private sector salaries if they remain in government service. This tends to skew the starting salary data in years when significant numbers of graduates accept federal government positions. Private sector graduate salaries tend to be in the range of $45,000 to $65,000.

# SECTION II – DEPARTMENTAL ASSESSMENT SUMMARY

## Geomatics Industrial Advisory Committee

At the 17 October 2008 Geomatics Industrial Advisory Committee meeting, assessment topics discussed included:

- GIS Option update– Mason Marker and John Ritter
  Enrollment continues to grow in the GIS option, and the new degree option is being received very well in industry. Prof. John Ritter continues to attend professional meetings for program visibility and recruiting.
- Surveying Option curriculum review of "geodetic" course sequence including GME 425 Remote Sensing, GME 451 Geodesy, GME 452 Map Projections, and GME 444 Adjustment by Least Squares.
  These courses constitute much of the advanced mathematics and science component within both degree options. IAC members had positive comments on the content and quality of this course sequence.
- PLSO Student Chapter Update
  Student chapter officers provided an update on recruiting and community service projects.
- April, 2008 NCEES examination results for geomatics students were 3 of 5 (60%) passing for the FS exam. This is lower than the average, but sample size is small. For geomatics alumni, 4 of 5 (80%) passed for the PS exam.

At the 8 May 2009 Geomatics Industrial Advisory Committee meeting, assessment discussion focused on the appropriate depth of curriculum coverage of emerging and new technologies. The consensus was unanimous that students should be exposed to these technologies, and understand the theory behind them, but employers do not expect a high degree of proficiency.

## Student Learning Opportunities

Geomatics student professional learning opportunities include:

- American Congress on Surveying and Mapping (ACSM) national student surveying competition. Geomatics students organize each year, and begin a fundraising drive to supplement funding provided by professional organizations. Students volunteer as runners to assist with conference details, attend technical paper presentations, and staff the OIT Geomatics department booth.
- Professional Land Surveyors of Oregon (PLSO) annual conference. Students volunteer as runners to assist with conference details, attend technical paper presentations, and staff the OIT Geomatics department booth.
- GME 468 Geomatics Practicum. Students typically form a hypothetical corporation, and are responsible for completing a number of community service projects for city, county, state, and federal organizations and agencies. During fall quarter, GME 499 Geomatics Practicum was offered for students graduating in March. These students assisted with completion of a BLM cadastral survey, precise deformation monitoring of Ponderosa Junior High School, and planning for use of ODOT RTN GPS network to map City of Klamath Falls fire hydrants. During the academic year, a massive terrestrial, GPS, and hydrographic survey of the Lakeshore drive was completed. Students in GME 343 Boundary Surveys and GME 468 completed a cadastral survey under BLM authority.
- Industry speakers are invited to make presentations at the PLSO Student Chapter meetings.

## Mission Statement

The mission of the Geomatics Department is to provide students with fundamental knowledge and skills in the geomatics and GIS disciplines. The Surveying Option prepares students to pass the Fundamentals of Surveying (FS) examination and pursue licensure as a registered Professional Land Surveyor (PLS). The GIS Option prepares students to become certified GIS Professionals. All students learn the professional responsibility of protecting the health, safety and welfare of the public, and become aware of global and cultural issues.

## Program Educational Objectives

Program educational objectives are statements that describe the expected accomplishments of graduates during the first few years after graduation—usually 3-5 years. These objectives are consistent with the mission of the program and the institution**.**

Geomatics Department Program Educational Objectives

- Prepare graduates to enter into professional practice
- Provide students with a broad foundation in major geomatics and GIS disciplines
- Prepare students to function effectively on multidisciplinary teams
- Prepare graduates to become licensed or certified professionals.

## Program Outcomes

Student learning outcomes are statements that describe what students are expected to know and/or be able to do by the time of graduation. It is anticipated that if students achieve these outcomes, they will be able to achieve the educational objectives after graduation.

## Surveying option Program Outcomes

(a) an ability to apply knowledge of mathematics, science, and applied sciences
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to formulate or design a system, process or program to meet desired needs
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify and solve applied science problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of solutions in a global and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.

## GIS Option Program Outcomes

1. Ability to work effectively in teams
2. An understanding of professional and ethical responsibility
3. Demonstrate critical thinking skills in solving geospatial problems
4. Ability to devise database schema required for addressing geospatial problems
5. Ability to develop customized user interfaces appropriate for geospatial investigations.
6. Ability to appropriately incorporate GPS, CAD, and historical paper-based record data into a GIS framework.
7. Ability to identify geospatial problems and the requisite method, or set of procedures needed to address the issue.
8. Ability to construct a clear, presentable cartographic product that addresses a geospatial issue
9. Understand the software/hardware requirements for implementing a scalable GIS.

## SECTION III - SUMMARY OF PROGRAM OUTCOME ASSESSMENT

Geomatics technology is changing at an incredible rate, even faster than computer technology in many cases. This is reflected by ongoing changes in content of the NCEES Fundamentals of Surveying (FS) licensing examination. These ongoing changes are reflected by continually-evolving technology and workflow processes encountered by graduates. Since the cost of new technology is very high and changing continually, it is beyond the capability of the university to be a leader in implementing new technology. The geomatics department successfully partners with industry and equipment vendors to revise the curriculum and determine the most effective methods to incorporate evolving technologies. The department's Industrial Advisory Committee (IAC) is exceptionally valuable in providing this input.

Monitoring performance of seniors taking the FS examination, now reported by NCEES twice each year, is crucial to assessing the surveying option curriculum. The same is true regarding input from employers and alumni, as the industry has the funding to adopt and pioneer new technologies, not the university. University geomatics programs often find themselves playing "catch-up" with the state-of-the industry.

The geomatics department program outcomes assessment cycles for the surveying option are summarized below. The GIS option, approved for the 2007-08 catalog, is in its second year of existence. Assessment processes are being designed and implemented, and will parallel those used by the surveying option when possible.

| Constituent/Measure | Frequency |
|---|---|
| Geomatics faculty | ongoing |
| IAC | biannual |
| FS Examination | biannual |
| Employers | 3 year |
| Alumni | annual |
| Student Focus Groups | varies |

Table IIIA Geomatics Constituents

The Geomatics Department Surveying option is designed to ensure students satisfy ASAC-ABET program outcomes. The GIS option currently offers ESRI Certification, and will seek appropriate accreditation as it evolves.

The Surveying option curriculum was carefully designed, and monitored by faculty with the goals of 1) Designing course content with optimum coverage and overlap. 2) Designing course prerequisite knowledge students need to succeed in each course. 3) Ensuring that from a holistic view of the curriculum, the ABET program outcomes have redundant coverage. Unlike some departments, geomatics faculty do not have the freedom to teach course content as they see fit. Faculty are expected to adhere to the curriculum design. This concept that the "whole is more than the sum of the parts" has resulted in a curriculum that is copied (and envied) by other geomatics programs.

Course outcomes which phrase the ABET criteria in discipline-specific statements students can understand are published in each course syllabus. A number of graded requirements such as homework assignments, examinations, team peer evaluations, written and oral reports, laboratory exercises and reports, and field projects are used to measure and evaluate course outcome competencies. As students progress through geomatics course sequences, faculty monitor the degree to which students were prepared by prerequisite geomatics courses.

A summary of the mapping of course outcomes to ABET program outcomes are shown in appendix A. Course content was designed to provide appropriate overlap, breadth and depth in outcomes competencies throughout the surveying option curriculum. This holistic overview of the curriculum has proven to be quite valuable.

Alumni and employer surveys, and supervisor reports for students completing summer internships, are also used to measure outcome competencies. The FS examination pass rate is a key measure of program outcomes, since examination topics are mapped to ABET program outcomes. Feedback from the biannual Industrial Advisory Committee meetings is also used to analyze program outcome data.

At the annual geomatics faculty retreat, and at department meetings, assessment results are analyzed, and corrective actions formulated. Significant course changes are made with discussion and input from

program constituents. Changes to the program curriculum map require formal approval of the university Curriculum Planning Commission, which typically requires a one-year cycle.

# SECTION IV 2008-09 GEOMATICS DEPARTMENT ASSESSMENT SUMMARY

## 1. Geomatics Department Assessment Meeting

Geomatics faculty discussed and refined program outcome assessment cycles for both degree options. Program outcome assessment cycles are summarized in Appendix C.

## 2. Surveying Option Assessment, Fall Quarter 2008

During the Fall Quarter of 2008 the Surveying Option within the Geomatics Department scheduled two program outcomes for assessment. These assessments were conducted in GME 451 Geodesy, and GME 163 Route Surveying as shown below.

**Surveying Option Program Outcomes Assessed Fall Quarter 2008**

a) An ability to apply knowledge of mathematics, science, and applied science – GME 451 Geodesy (Examination questions)
d) An ability to function on multi-disciplinary teams – GME 163 (Faculty and Peer Evaluation)

**Program Outcome a) An ability to apply knowledge of mathematics, science, and applied science**

GME 451 Geodesy examination problems were assessed for this outcome. Computation of the 2-dimensional coordinate transformation problem was used to assess the student's ability to perform a standard computation. Students were asked to explain the gravitational potential effect referred to as the "orthometric correction" as a measure of comprehension of applied science knowledge. Students were asked to complete a mathematical proof to assess understanding of computed results.

| a) An ability to apply knowledge of mathematics, science, and applied science | | | | |
|---|---|---|---|---|
| Performance Criteria | Assessment Method | Measurement Scale | Minimum Acceptable Performance | Total Class Percent |
| Computation | Exam Problem | Percent completion | 70% | 73% |
| Comprehension of Applied Science Knowledge | Exam Problem | Percent completion | 70% | 80% |
| Understanding of computed results and/or theoretical concepts | Exam Problem | Percent completion | 70% | 74% |

**Note: The minimum acceptable achievement value is 70%**

**Evaluation of results:** While the class performance is just above the expected benchmark of 70%, it should be noted that this particular course has a reputation for being exceptionally challenging.

**Actions:** No formal action is planned at this time.

**Program Outcome d) An ability to function on multi-disciplinary teams – GME 163 (Faculty and Peer Evaluation)**

Geomatics professionals must often work on multi-disciplinary teams with other professionals such as architects, builders, engineers, lawyers, and planners. Part of working on a team is learning to assess both your work and the work of other team members. In GME 163 (Route Surveying), students are asked to complete a term-long design project in teams. This project requires both field work and office computations. It involves a significant amount of team effort on the part of the students in order to complete the project. As part of the final project wrap-up, students are asked to complete peer evaluations. Each student evaluates themselves and their team members. The scores are then averaged in order to create the composite scores shown below.

| **Student #** | **Criteria(1)** | | | | **Achievement Level % (2)** |
|---|---|---|---|---|---|
| | **Quality** | **Quantity** | **Timeliness** | **Level** | |
| **1** | 5 | 5 | 5 | 5 | 100% |
| **2** | 3.5 | 2.5 | 2.5 | 3.5 | 60% |
| **3** | 3 | 1 | 1.5 | 2 | 38% |
| **4** | 5 | 5 | 5 | 5 | 100% |
| **5** | 4 | 5 | 4 | 5 | 90% |
| **6** | 5 | 5 | 5 | 5 | 100% |
| **7** | 4 | 5 | 5 | 5 | 95% |
| **8** | 5 | 5 | 5 | 4 | 95% |
| **9** | 4 | 3 | 5 | 5 | 85% |
| **10** | 5 | 5 | 5 | 5 | 100% |
| **11** | 2 | 2 | 2 | 2 | 40% |
| **12** | 4 | 5 | 5 | 5 | 95% |
| **13** | 5 | 5 | 5 | 5 | 100% |
| **14** | 5 | 5 | 5 | 5 | 100% |
| **15** | 3 | 1 | 1 | 2 | 35% |
| **16** | 5 | 5 | 5 | 5 | 100% |
| **17** | 4 | 5 | 5 | 5 | 95% |
| **18** | 3 | 4 | 1 | 2 | 50% |
| **19** | 4 | 4 | 5 | 4 | 85% |
| **20** | 4 | 5 | 5 | 5 | 95% |
| **21** | 5 | 5 | 5 | 5 | 100% |
| **22** | 4 | 5 | 5 | 4 | 90% |
| **23** | 5 | 5 | 5 | 5 | 100% |
| **24** | 5 | 5 | 4 | 5 | 95% |
| **25** | 4 | 3 | 4 | 4 | 75% |
| **Average** | 4.2 | 4.2 | 4.2 | 4.3 | 85% |

**Notes:**

**(1) The Criteria are defined as follows:**

a. **Quality** of Work – Value and quality of contributions, suggestions, opinions, and ideas.
b. **Quantity** of participation – Sharing of responsibility, willingness to do his/her share of the work, prepared for work at scheduled times.
c. **Timeliness** – Attendance at meetings, classes, and work sessions. Met deadlines, had work finished and ready on time.
d. **Level** of Work – Final work was professional and ready to be used by the group and/or turned in to the instructor.

**(2) The minimum acceptable achievement value is 70%**

**Evaluation of Results:** Analysis of the results shows that the twenty five students in GME 163 (Fall 2008) performed above the departmentally established 70% floor. The average achievement level for the class was 85%. Only three students failed to meet the 70% established floor. The area most in need of improvement is in the category of timeliness. Additional reminders from the instructor regarding due dates may improve the score. However, students may be better served with additional instruction in time management strategies.

**Actions:** As this is the first assessment of this particular exercise in GME 163, no formal action will be taken at this time.

## 3. GIS Option Assessment, Fall Quarter 2008

During the Fall Term of 2008 the GIS Option within the Geomatics Department scheduled assessment of three program outcomes. Two of these assessments were to be conducted within the context of GIS 446 GIS Database Development, and the third in GIS 306 Geospatial Raster Analysis, as shown below. GIS 306 was cancelled due to low enrollment, and since assessment of program outcome #3 (critical thinking) was assessed during the 2007-08 academic year, it will be assessed during the next assessment cycle.

**GIS Option Program Outcomes Assessed Fall Quarter 2008**

Outcomes assessed for the GIS option during the fall quarter were:

1. Ability to work effectively in teams (Peer & Faculty Evaluation) – GIS 446 GIS Database Development
4. Ability to devise database schema required for addressing geospatial problems (Project Evaluation) – GIS 446 GIS Database Development

**Program Outcome #1 – Ability to work effectively in teams**
The last two and one-half weeks of the term were devoted to individual student projects. Each student in the class was given a research topic with the goal of making a presentation on this topic to the rest of the class. The other class members, however were to aid this person in the process of gathering and assimilating the necessary information as well as providing any assistance necessary in the construction of the presentation. As a result, each student was able to participate both as a group leader and as a group member at various times throughout the duration of the assignment. The numerical results for this assessment are shown below, note that there were only three students enrolled in the course and that the scale ranges from 1 (low) to 4 (high) achievement.

| 1. Ability to work effectively in teams | | | | |
|---|---|---|---|---|
| | Student # | | | % Achievement |
| | #1 | #2 | #3 | |
| Attends team meetings and work sessions, works effectively with others | 3 | 4 | 4 | 92 |
| Is prepared for meetings and contributes their fair share to the project workload | 2 | 4 | 4 | 83 |
| Courteous group member, non-judgmental when disagreeing with others and seeks conflict resolution | 4 | 4 | 4 | 100 |
| Shares credit for success and accountability for team results | 4 | 4 | 4 | 100 |

**Note: The minimum acceptable achievement value is 70%**

**Evaluation of Results:** The conclusion from this effort indicates that, for the most part, students in this class were able to effectively work in a team format. Some improvement could, however, be seen in the area of individual preparation/contribution to the project.

**Actions:** No formal action is proposed at this time.

**Program Outcome #4 – Ability to devise database schema required for addressing geospatial problems**

One of the laboratory projects undertaken during this term was the analysis and construction of a database. Detailed laboratory instructions guided students through the process of identifying the various pieces of information that were to be cataloged, their grouping into thematic tables, the assignment of cardinalities to the tabular relationships, and finally, the use of ArcGIS software to create the desired relationship classes. During an element of their final lab assignment, students were given another set of data for which they were to construct a database. The results were mixed as the following numerics for this assessment indicate:

| 4. Ability to devise database schema required for addressing geospatial problems | | | | |
|---|---|---|---|---|
| | Student # | | | % Achievement |
| | #1 | #2 | #3 | |
| Ability to follow a scripted example | 4 | 4 | 4 | 100 |
| Ability to group data elements into separate tables based on themes | 1 | 4 | 4 | 75 |
| Ability to discern appropriate cardinality between tables for process to be modeled | 1 | 3 | 2 | 50 |
| Ability to use software to appropriately construct the database | 1 | 4 | 3 | 67 |

**Note: The minimum acceptable achievement value is 70%**

**Evaluation of Results:** Due to the small class size of 3 students, it is difficult to draw valid conclusions. The results indicate that although everyone was able to follow the scripted example well, only one of the three students was able to use this knowledge in the solution of a new problem. One of the other remaining students was able to make some correlation between the scripted example and the new problem, but the remaining student showed no ability to transfer this knowledge to the original problem.

**Actions:** No action will be taken until future assessment validates these findings.

## 4. Surveying Option Assessment, Winter Quarter 2009

During the Winter Quarter of 2009 the Surveying Option within the Geomatics Department scheduled eight program outcomes for assessment. These assessments were conducted in GME 452 Map Projections, GME 454 GPS Surveying, GME 434 Advanced GIS, and GME 466 Boundary Law II.

**Program Outcome b) An ability to design and conduct experiments, as well as to analyze and interpret data - GME 454 (project evaluation)**

A critical skill for geomatics professionals is the ability to design control surveys that meet project specifications, execute the survey using the appropriate tools and techniques, and then analyze the results to determine the success of the survey. Students in GME 454 (GNSS Applications) course are expected to demonstrate these skills in a laboratory exercise where they are charged with designing a control survey that meets Federal Geodetic Control Committee specifications, and then executing the survey. Once the students have collected field data, they are expected to analyze it for completeness and decide if their survey has attained the accuracy requirements outlined in the project specifications.

| Criteria | Student Number | | | | | % Achievement (1) |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | |
| 1. Correctly identify specifications required to complete project | 3 | 3.5 | 4 | 4 | 4 | 93% |
| 2. Designs field survey protocols to selected project specifications | 3 | 3 | 4 | 4 | 3 | 85% |
| 3. Collects data in field utilizing protocol design | 4 | 4 | 4 | 4 | 4 | 100% |
| 4. Final data is analyzed utilizing mathematically and statistically valid techniques | 2 | 3 | 4 | 4 | 3 | 80% |

**Note: The minimum acceptable achievement value is 70%**

**Evaluation of Results:** Analysis of the results shows that the five students in GME 454 (Winter 2009) performed substantially above the departmentally established 70% floor. The area most in need of improvement is in the student's ability to determine if a dataset will meet the requirements of the project, and if not, what must be done to correct the shortfalls. Additional instruction in this area may assist the students in obtaining a better score, but the ability to identify appropriate corrective action after analyzing field data is somewhat dependent on experience.

**Actions:** As this is the first assessment of this particular exercise in GME 454, no formal action will be taken at this time.

**Program Outcome c) an ability to formulate or design a system, process or program to meet desired needs – GME 452 student project**

Students in GME 452 Map Projections were required to design a map projection for a medium-sized city, and evaluate the feasibility of the design. This was an open-ended scenario with no "correct" answer.

## Assessment Rubric: Low-Distortion Map Projection Design

| Outcome element | Unacceptable (1) | Marginal (2) | Acceptable (3) | Exceptional (4) |
|---|---|---|---|---|
| Clear understanding of the need addressed by the design. | No need is indicated. | Need stated incompletely or ambiguously. | Statement of need is made, but some improvement is possible. | Clearly articulated statement of need. |
| Does the proposed design meet the need? | The proposed design will not meet the stated need. | Reader must infer how the design will meet the need. | It is apparent that the design will meet the stated need, but could be presented better. | The utility of the design in meeting the stated need is well communicated as part of the presentation. |
| Logical and practical design proposal | The proposed design cannot achieve the intended result. | The proposed design will likely work, but has significant shortcomings. | The proposed design appears to be a reasonable approach to accomplishing the intended task. | The proposed design sequence exhibits a high degree of innovation. |
| Has the design been clearly presented? | The report is difficult to comprehend, poorly written, or fails to communicate clearly. | The report is adequate; however it could be substantially improved. | The technical features of the proposed design are well presented. | The proposed design is presented in a way that is both technically correct and highly readable. |

Summary of Student Performance

| Student | Understanding of Need | Design Meets Need | Logical Design | Design Communication | Percent |
|---|---|---|---|---|---|
| 1 | 4 | 3 | 4 | 4 | 94% |
| 2 | 4 | 4 | 4 | 4 | 100% |
| 3 | 3 | 3 | 3 | 2 | 69% |
| 4 | 3 | 3 | 3 | 3 | 75% |

**Note: The minimum acceptable achievement value is 70%**

**Evaluation of Results:** While the sample size is small, all students essentially performed at or above the departmentally established 70% floor. The area most in need of improvement is in the student's ability to determine if a design will meet project requirements. This is a professional practice decision, and students do not have the industry experience to make this decision. In that light, all students performed quite well.

**Actions:** As this is the first assessment of this particular exercise in GME 452, no formal action will be taken at this time.

**Program Outcome f) An understanding of professional and ethical responsibility – GME 466 (Exam Questions)**

Students in GME 466 Boundary Law II submitted a required paper using eight legal cases or other primary legal sources. A minimum of four other sources was required. The last assignment included questions on professional code of ethics and knowledge of lifelong learning opportunities.

***f. an understanding of professional and ethical responsibility***

| 1. | 2. | 3. | 4. | Percent |
|---|---|---|---|---|
| **Using code of ethics, describes ethical issue(s)** | **Describes stakeholders and discusses their points of view** | **Describes and analyses alternative approaches** | **Chooses an approach and explains the benefits and problems** | |
| 4 | 1.25 | 2.5 | 2.5 | 64% |
| 4 | 2 | 2.5 | 3 | 72% |
| 4 | 4 | 3 | 4 | 94% |
| 2.5 | 3 | 4 | 4 | 84% |
| 2 | 3 | 2.5 | 3 | 66% |
| 4 | 4 | 4 | 4 | 100% |
| 4 | 4 | 4 | 4 | 100% |
| 4 | 3.5 | 4 | 4 | 97% |
| 3.75 | 4 | 4 | 4 | 98% |
| 3.5 | 4 | 2.5 | 2.5 | 78% |
| 4 | 4 | 4 | 4 | 100% |
| 3 | 4 | 3.5 | 2 | 78% |
| 4 | 4 | 4 | 4 | 100% |
| 3 | 4 | 4 | 4 | 94% |

**Note: The minimum acceptable achievement value is 70%**

**Analysis**

The area where students as a whole encountered difficulties was in item three. They tended to identify the current method or technology as "the best" and not consider or focus on alternatives. All students met the minimum achievement level for this assessment.

**Program Outcome g) An ability to communicate effectively – GME 434 and GME 466 (Research Papers)**

Students in the GME 434 (Advanced Geographic Information Systems) course are required to write a critical thinking paper as part of their regular course work. The purpose of the paper is for the student to take a current subject of controversy in the field of GIS, select a side to the controversy, and then defend their position. The student is required to clearly identify the problem, recognize stakeholders, evaluate assumptions, evaluate evidence, and draw conclusions from their analysis. The goal of this exercise is for

students to be able to identify conflicts within their profession and clearly evaluate the evidence supporting both sides of the conflict. The paper is evaluated using a rubric where each evaluated category is given a numerical score from 1 to 4. A 1 indicates no proficiency with the task and a 4, high proficiency.

| **Criteria** | **Student Number** | | | | **% Achievement (1)** |
|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | |
| 5. Identify and explain problem | 2 | 4 | 3.5 | 4 | 84% |
| 6. Recognize stakeholders and context | 3 | 4 | 4 | 4 | 94% |
| 7. Acknowledges other perspectives | 3 | 4 | 4 | 3 | 87% |
| 8. Evaluates assumptions | 3 | 4 | 3.5 | 4 | 91% |
| 9. Evaluates evidence | 3 | 4 | 3.5 | 4 | 91% |
| 10. Evaluates implications, conclusions, and consequences | 3 | 4 | 3.5 | 4 | 91% |

**Note: The minimum acceptable achievement value is 70%**

**Evaluation of Results:** Analysis of the results shows that the four students in GME 434 (Winter 2009) performed substantially above the departmentally established 70% floor. The area most in need of improvement is in the student's ability to clearly identify and explain a problem. The results in this area are biased by the small sample size and the fact that one student performed particularly poorly in this area (50%).

**Actions:** While efforts will be made in the future to help students better understand how to clarify their problem statement, no formal action is proposed at this time.

Students in GME 466 Boundary Law II submitted a required paper using eight legal cases or other primary legal sources. A minimum of four other sources was required. This formal senior research paper was used to assess the ability to communicate.

| **1.** | **2.** | **3.** | **4.** | **Percent** |
|---|---|---|---|---|
| **Grammar/ Mechanics** | **Purpose** | **Development** | **Organization** | |
| 3.6 | 3.5 | 3.75 | 3.6 | 90% |
| 2.4 | 3.5 | 2 | 2.8 | 67% |
| 2.4 | 2.5 | 2 | 2.8 | 61% |
| 3.6 | 3 | 3.5 | 3.4 | 84% |
| 4 | 3.5 | 4 | 3.4 | 93% |
| 3.6 | 3 | 3.5 | 3 | 82% |

| | | | | |
|---|---|---|---|---|
| 3.2 | 4 | 3 | 3 | 83% |
| 3.6 | 3.5 | 3.75 | 3.6 | 90% |
| 4 | 3.5 | 3.5 | 3.6 | 91% |
| 4 | 3 | 4 | 3.5 | 91% |
| 4 | 3 | 3 | 3 | 81% |
| 4 | 4 | 4 | 4 | 100% |
| 2.4 | 2.5 | 2 | 3 | 62% |
| | | | | |

**Note: The minimum acceptable achievement value is 70%**

**Analysis**

The majority of the students did well on this item, however three students fell below the 70% achievement goal. Analysis revealed these students had altered their registration after meeting with their advisor, and had not completed WRI 327 (Advanced Technical Writing). The OIT registrar is implementing automated prerequisite checking, which will enforce this prerequisite in the near future. The department should consider recommending students with low writing scores not take a heavy class load during the term they take GME 466. The geomatics department anticipates automated prerequisite checking will be implemented during the 2009-10 academic year.

**Program Outcome h) The broad education necessary to understand the impact of solutions in a global and societal context – GME 434 (Project Evaluation) and GME 466 (Research Paper)**

One of the goals of the GME 434 (Advanced Geographic Information Systems) course is to provide students with a broad prospective of how the application of GIS technology can impact the users of the technology. This understanding is critically important in the design of cadastral GIS systems that will be created from many different data sources and will be utilized by many different users, each with different goals. Geomatics students must fully understand how cadastral GIS systems are used by society so that they can insure the systems that they will develop and maintain will be of the highest quality and cost efficiency.

GME 434 students develop a cadastral GIS project over during the quarter. During this project they are evaluated on their understanding of how their project would fit within the context of the society for which they are developing it.

| **Criteria** | **Student Number** | | | | **% Achievement (1)** |
|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | |
| 11. Identify and critique source of data used in system | 3 | 4 | 4 | 4 | 94% |
| 12. Identify methodologies used in data transformations that could compromise integrity of data (ie. NAD27 to NAD83 conversions) | 4 | 2 | 4 | 4 | 88% |
| 13. Insures that each theme in project has proper metadata associated with it and that metadata is current | 3 | 3 | 3 | 3 | 75% |

| | | | | | |
|---|---|---|---|---|---|
| 14. Identifies end users of cadastral GIS and potential conflicts between design intentions and use | 3 | 3.5 | 3.5 | 4 | 88% |
| 15. Identifies potential security issues (unauthorized use, privacy issues, unwanted modification of data, etc) | 3 | 4 | 2 | 4 | 81% |
| 16. Evaluates potential future uses of system | 3 | 3 | 3 | 3 | 75% |

**Note: The minimum acceptable achievement value is 70%**

**Evaluation of Results:** Analysis of the results shows that the four students in GME 434 (Winter 2009) performed above the departmentally established 70% floor. These results are biased by the fact that the group of students that were evaluated for this year was small. In criterion (2) and (5), one student in each category scored a two. Although only one student had this low score, the average was reduced significantly because of the small population.

**Actions:** As this is the first assessment of this particular exercise in GME 434, no formal action will be taken at this time.

Students in GME 466 Boundary Law II submitted a required paper using eight legal cases or other primary legal sources. A minimum of four other sources was required. This formal senior research paper was used to assess student understanding of how boundary surveys which delineate title lines affect society, and the importance of possessing a sound understanding of is the foundation of professional licensure.

| 1. | 2. | Percent |
|---|---|---|
| **Awareness of how land boundaries and the practice of land surveying impacts society, locally and globally** | **Understands the impact of decisions made by courts, legislatures, and professional societies to society from the local level to the global level** | |
| 4 | 4 | 100% |
| 4 | 4 | 100% |
| 4 | 4 | 100% |
| 4 | 4 | 100% |
| 4 | 4 | 100% |
| 4 | 4 | 100% |
| 4 | 4 | 100% |
| 4 | 4 | 100% |
| 4 | 4 | 100% |
| 4 | 4 | 100% |
| 4 | 4 | 100% |
| 4 | 4 | 100% |
| 4 | 4 | 100% |

**Note: The minimum acceptable achievement value is 70%**

**Analysis**

The students did very well on this item. This may reflect the extensive discussion of how legal statutes affect the public which accompanies discussion of the various statutes and administrative rules themselves. No formal action is planned at this time.

**Actions:** No formal action will be taken at this time. Department faculty will discuss methods to strengthen presentation of this outcome in the curriculum.

**Program Outcome i) A recognition of the need for, and an ability to engage in life-long learning – GME 466 (Research Paper)**

Students in GME 466 Boundary Law II submitted a required paper using eight legal cases or other primary legal sources. A minimum of four other sources was required. This formal senior research paper was used to assess student understanding of the importance of life-long learning in the rapidly-changing geomatics profession.

| 1. | 2. | Percent |
|---|---|---|
| **Research/gathering information** | **Ability to recognize the need for and be able to pursue life-long learning** | |
| 3.4 | 4 | 93% |
| 3.2 | 1.6 | 60% |
| 3 | 3.2 | 78% |
| 4 | 4 | 100% |
| 4 | 2 | 75% |
| 4 | 2 | 75% |
| 4 | 2 | 75% |
| 4 | 3.2 | 90% |
| 3.6 | 3.2 | 85% |
| 4 | 3.2 | 90% |
| 3.4 | 2.8 | 78% |
| 4 | 3.2 | 90% |
| 3 | 2 | 63% |

**Note: The minimum acceptable achievement value is 70%**

**Analysis**

This item was split between the two sub items. The students did quite well in the research sub item. This was most likely because the research requirements were explicitly stated. (They were required to use 8 primary law sources (cases and statutes) and 4 secondary sources.) While there was some complaints about the depth of the required research, the students all eventually did the required research.

The students appeared to not do as well with regards to the second sub item, lifelong learning. This may have been because the question presented to the students did not explicitly state what was required in the answer. The question presented a scenario where the surveyor was lacking experience in a specific area of geomatics required for a project. The students concentrated their answers on not pursuing the project or hiring another qualified surveying instead of indentifying the option of having the surveyor learn the

necessary skills through professional development. While the students had correct answers, the answers did not specifically cover the area we were trying to evaluate.

**Actions:** No formal action will be taken at this time. The explanation provided to students will be further refined for life-long learning.

**Program Outcome j) A knowledge of contemporary issues GME 452 (Project Evaluation)**

This outcome was assessed in GME 452 Map Projections. Each student was required to design a Low Distortion Map projection (LDP) for a medium sized city in Oregon, and write a technical report describing the distortion properties and feasibility of their design. Each student then presented their design as if they were responding to an RFP, in a competitive bidding process. The assessment reveals that students are able to effectively research, design, and summarize current geomatics issues related to LDP design

| | 1 | 2 | 3 | Percent |
|---|---|---|---|---|
| Student | Demonstrate an of understanding current map projection applications | Effective technical report presentation to target audience | Effective technical presentation | |
| 1 | 3 | 3.5 | 4 | 88% |
| 2 | 3 | 3 | 3.5 | 79% |
| 3 | 4 | 4 | 4 | 100% |
| 4 | 3.5 | 4 | 4 | 96% |

**Note: The minimum acceptable achievement value is 70%**

**Actions:** There were only four students who completed the final project, so the results are marginally reliable. No formal action will be taken at this time.

**Program Outcome k) An ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice – GME 454 GPS Surveying**

A critical skill for the geomatics professional is the ability to properly utilize the techniques and tools of professional practice. Throughout the quarter, GME 454 (GNSS Applications) students are evaluated on their ability to utilize the hardware and software required to perform GPS surveys. While each of the criteria is evaluated as part of lab exercises generally performed in a group, each student is also individually evaluated on their ability to perform each criterion. The matrix below summarizes each student's ability to perform the given criteria.

| **Criteria** | **Student Number** | | | | | **% Achievement (1)** |
|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | |
| Correctly design a GPS static survey utilizing FGCC Specifications | 2 | 2 | 4 | 4 | 4 | 80% |
| Configure GPS unit for static data | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| collection | 4 | 4 | 4 | 4 | 4 | 100% |
| Collect data in field with GPS in static mode | 3 | 3 | 4 | 4 | 4 | 90% |
| Download data to computer from GPS units or data collector | 4 | 4 | 4 | 4 | 4 | 100% |
| Process static data using OPUS | 3 | 2 | 4 | 4 | 4 | 85% |
| Process static data with commercial processing software | 4 | 3 | 4 | 4 | 4 | 95% |
| Configure GPS units for RTK survey | 4 | 4 | 4 | 4 | 4 | 100% |
| Perform site calibration | 3 | 3 | 4 | 4 | 3 | 85% |
| Collect topographic data with GPS in RTK mode | 4 | 4 | 4 | 4 | 4 | 100% |
| Perform point stakeout with GPS in RTK mode | 3 | 4 | 4 | 4 | 3 | 90% |

**Note: (1) The minimum acceptable achievement value is 70%**

**Evaluation of Results:** Analysis of the results shows that the five students in GME 454 (Winter 2009) performed substantially above the departmentally established 70% floor. These results are biased by the fact that the group of students that were evaluated for this year were, in general, high achieving students with a particular interest in the hands-on aspects of GPS surveying. These results will needed to be compared with a larger group in order to properly ascertain the instructional methods used in this course.

**Actions:** As this is the first assessment of this particular exercise in GME 454, no formal action will be taken at this time.

## 5. GIS Option Assessment, Winter Quarter 2009

During the Winter term of 2009 two program assessments were conducted for the Geomatics/GIS degree option. The first assessment monitored program outcome #2: *An understanding of professional and ethical responsibility* and was conducted within the context of GIS 456. The second assessment was conducted within the context of GIS 316 for Program Outcome #7: *Ability to identify geospatial problems and the requisite method, or set of procedures needed to address the issue*.

**Program Outcome #2 – An understanding of professional and ethical responsibility**

During the first eight weeks of the term students worked together in a team to discern the main thrust of an assigned chapter from the textbook regarding the development of an enterprise GIS program. For each chapter, one student was designated as the team leader. The role of the team leader was to direct the discussion and assign to each team member relevant topics to be researched prior to the next meeting. For each chapter in the textbook the role of team leader would rotate from student to student. As a result, each student was able to participate both as a group leader and as a group member at various times throughout the duration of the term. For each chapter, the assigned leader was responsible for giving an oral presentation on the chapter material as well as on any material researched by the team members. Following the chapter presentation the class instructor held a one-on-one discussion with the team leader with regard to both the presentation and also with respect to how they conducted the discussion sessions. Particular attention was paid to how (professionally/ethically) they handled disagreements and took responsibility for their action/inaction.

The last two weeks of the term were devoted to individual student projects. Each student found a county or other government agency that had initiated a comprehensive GIS program. Each student then prepared both a written and an oral report on their evaluation of the agency's GIS program. The numerical results for this assessment are shown below. Note that there were only three students enrolled in the course and that the scale ranges from 1 (low) to 4 (high) achievement. The scores shown below are derived from a combination of the final, written report as well as in-class student-student evaluations and the verbal critique of each team leader following their presentation.

**Evaluation of Results:** The conclusion from this effort indicates that, for the most part, students in this class had a good grasp of their professional and ethical responsibility.

| 2. An understanding of professional and ethical responsibity | | | | |
|---|---|---|---|---|
| | Student # | | | % Achievement |
| | #1 | #2 | #3 | |
| Student understands and abides by the professional Code of Ethics and OIT Students Code of Conduct | 4 | 4 | 4 | 100% |
| Evaluates a situation in practice or as a case study, using facts and a profesional code of ethics | 3 | 4 | 3 | 83% |
| Demonstrates ethical behavior among peers and faculty | 3 | 3 | 4 | 83% |
| Student takes personal responsibility for their actions | 4 | 4 | 4 | 100% |

**Actions:** No formal action will be taken at this time.

**Program Outcome #7 – Ability to identify geospatial problems and the requisite method, or set of procedures needed to address the issue**.

**Evaluation of Results:** One of the projects undertaken during this term was to produce a map, either in terms of a simple cartographic representation or as the result of researching a geospatial topic. The results were quite pleasing, as the following results indicate. Although the class size was small, the results indicate that everyone had high achievement in all areas of the program outcome. Everyone was apparently able to transfer the theoretical concepts into appropriate solutions and seek the appropriate resources

needed at a sufficiently high level. It was fascinating to observe the incredible variety in the range of topics addressed.

| 7. Ability to identify geospatial problems and the requisite method, or set of procedures needed to address the issue | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Student # | | | | | | | |
| | #1 | #2 | #3 | #4 | #5 | #6 | #7 | % Achievement |
| Can relate theoretical concepts to practical, appropriate solutions | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 96% |
| Demonstrates understanding of how various pieces of the problem relate to each other and the whole | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 100% |
| Correct solution that is checked for validity if possible | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 100% |
| Use of appropriate resources to locate needed information; effectively integrate information to develop a solution | 4 | 3 | 4 | 3 | 4 | 4 | 4 | 93% |

**Actions:** No formal action will be taken at this time.

**Student Map Competition**

The geomatics department attended the Intermountain GIS Conference in Coeur d'Alene, Idaho and the GIS In Action conference in Vancouver, WA for the first time ever. Students entered the map competitions and took first place at both conferences. Over 40 entries were submitted at each conference, some of them designed as graduate student projects, and others submitted by student teams. This served as an indirect measure of the GIS option rigor and program quality. Numerous employers stated they were unaware of OIT geomatics and GIS offerings, but were very impressed with the curriculum. Several students stated they would have attended OIT had they been aware of our GIS option.

## 6. Surveying Option Assessment, Spring Quarter 2009

During the Spring Quarter of 2009 the Surveying Option within the Geomatics Department scheduled two program outcomes for assessment. These assessments are shown below.

d) An ability to function on multi-disciplinary teams – GME 468 (Faculty Evaluation)
j) A knowledge of contemporary issues GME 372 (examination results)

**Program Outcome d) An ability to function on multi-disciplinary teams – GME 468 (Faculty Evaluation)**

Class: GME 468 Senior Practicum

Description of Activity: Seniors acted as crew chiefs on various projects. They were responsible for organizing and utilizing not only their own skills, but also those of students enrolled in GME 299 and various volunteers.

***Assessment item: Ability to function on multi-disciplinary teams***

| Student | 1. | 2. | 3. | Percent |
|---|---|---|---|---|
| | **Contribution to the team project/work** | **Taking responsibility** | **Valuing other team members both inside and outside of Geomatics** | |
| 1 | 5 | 5 | 5 | 100% |
| 2 | 3 | 5 | 5 | 87% |
| 3 | 5 | 5 | 5 | 100% |
| | | | | |

**Note: (1) The minimum acceptable achievement value is 70%**

**Evaluation of Results:** Only 3 students were in this year's practicum. This low number makes the numeric averages unreliable, however performance appears to be very good.

**Actions:** No formal action will be taken at this time.

**Program Outcome j) A knowledge of contemporary issues - GME 372 (examination results)**

As with any profession, geomatics students must have an understanding of contemporary issues that are pertinent to their profession. Not only must the students understand how contemporary issues directly affect their profession, but they must also understand how the issues impact other professions and society in general. The students in GME 372 Subdivision Planning and Platting explore contemporary issues in surveying and subdivision planning through a series of reading assignments during the quarter. At the end of the quarter, the students are given a test on these readings to assess their understanding of the issues presented. The table below summarizes the performance for the GME 372 class in spring of 2009 identifying four important elements in contemporary issues.

| Student # | Criteria(1) | | | | Achievement Level % (2) |
|---|---|---|---|---|---|
| | **Extent** | **Stakeholders** | **Context** | **Implications & Consequences** | |
| **1** | 15 | 14 | 15 | 16 | 94% |
| **2** | 13 | 12 | 13 | 15 | 83% |
| **3** | 14 | 15 | 15 | 14 | 91% |
| **4** | 16 | 16 | 16 | 15 | 98% |
| **5** | 16 | 15 | 16 | 16 | 98% |
| **6** | 13 | 12 | 11 | 12 | 75% |

| | | | | | |
|---|---|---|---|---|---|
| **7** | 13 | 14 | 12 | 12 | 80% |
| **8** | 15 | 16 | 16 | 16 | 98% |
| **9** | 16 | 16 | 16 | 16 | 100% |
| **10** | 14 | 14 | 15 | 14 | 89% |
| **11** | 12 | 11 | 12 | 12 | 73% |
| **12** | 15 | 16 | 16 | 16 | 98% |
| **13** | 15 | 12 | 12 | 14 | 83% |
| **14** | 14 | 14 | 14 | 14 | 88% |
| **15** | 15 | 15 | 12 | 13 | 86% |
| **16** | 14 | 12 | 12 | 12 | 78% |
| **17** | 12 | 11 | 11 | 12 | 72% |
| **18** | 16 | 16 | 16 | 16 | 100% |
| **19** | 10 | 10 | 6 | 6 | 50% |
| **20** | 8 | 8 | 6 | 5 | 42% |
| **21** | 9 | 7 | 7 | 8 | 48% |
| **Average %** | 85% | 82% | 80% | 86% | 82.1% |

**Notes:**

**(1) The Criteria are defined as follows:**

a. **Extent** – This score indicates the students understanding of the issue in terms of local, national, or global setting.

b. **Stakeholders –** The stakeholders score indicates the student's ability to identify the individuals and organizations involved in a particular issue and their relationship o each other.

c. **Context -** The context score indicates the student's ability to connect the issue being discussed with other areas of knowledge such as economics, politics, society, and law.

d. **Implications –** This score measures the student's ability to understand the potential ramifications and consequences of the discussed issues. In particular, this score reflects the students ability to synthesize the other three criteria and draw

**(2) The minimum acceptable achievement value as established by the geomatics department is 70%.**

**Evaluation of Results:** Analysis of the results shows that the twenty one students in GME 372 (Spring 2009) performed above the departmentally established 70% floor. The average achievement level for the class was 82.1% with only three students not meeting the minimum 70%. The area most in need of improvement is in the category of identifying the context of the issue. While this category is ten percentage points above the established minimum, it will be an indicator that will need to be watched on the next assessment.

**Actions:** As this is the first assessment of this particular exercise in GME 372 and all criteria were above the mandated 70%, no formal action will be taken at this time.

## 7. Alumni Survey Assessment Data

An OIT Geomatics department alumni reunion was held at the 2009 PLSO Annual Conference. Those attending were asked to complete an alumni survey. 53 individuals attended this event, and 17 completed the survey for a response rate of over 30%. Since this was a social event serving food and alcohol, and many individuals were renewing old acquaintances, so completing a formal survey wasn't a high priority, however the response rate was good, and we took advantage of a "captive" audience.

**Curriculum Content Overview**

17 alumni who graduated between 1974 and 2008 were asked to "List in order of importance the geomatics disciplines you are regularly involved with. Use a range from 1 to 5, with "5" being Very Important and "1" being Not Important."

Established disciplines were rated as highly important by most alumni, while new and emerging technologies were rated lower by graduates nearing the end of their career and higher by recent graduates as would be expected. No broad discipline areas were identified for further analysis.

| CATEGORY | Average |
|---|---|
| Construction Surveying | 4.28 |
| GPS Surveying | 4.50 |
| GIS | 3.19 |
| Boundary Surveying | 4.88 |
| PE & RS | 2.87 |
| Urban Planning | 3.37 |
| Other | N/A |
| Not Engaged | N/A |

**Curriculum Technology Content (Surveying Option)**

In an attempt to identify the importance of specific technologies in the curriculum, alumni were asked to rate the relevance of specialized technologies in the geomatics program to the types of work they perform as "Highly Relevant, Somewhat Relevant, or Not Relevant. If a topic is not applicable, do not check a box for that item."

| Highly Relevant Topics | Frequency | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Communications | 0 | 2 | 14 |
| Field measurement applications | 0 | 3 | 13 |
| Boundary Law | 1 | 2 | 13 |
| COGO | 0 | 2 | 13 |
| CAD Drafting | 0 | 2 | 13 |
| USPLSS | 1 | 1 | 13 |
| Digital data collection | 0 | 4 | 12 |
| Geometric Geodesy | 0 | 3 | 12 |
| Mathematics & Physics | 0 | 5 | 11 |
| Use of USGS & maps | 0 | 5 | 11 |
| Real Property Descriptions | 1 | 4 | 11 |
| Traverse Adjustment | 0 | 4 | 11 |
| Computer Applications | 0 | 5 | 10 |
| Satellite Geodesy & GPS | 2 | 4 | 10 |
| Leveling, vertical control | 0 | 7 | 9 |

| | | | |
|---|---|---|---|
| Least Squares & error theory | 2 | 6 | 8 |
| State Plane Coordinates | 2 | 5 | 8 |
| Route Surveying | 3 | 5 | 8 |
| Digital Terrain Models | 1 | 6 | 8 |

| Somewhat Relevant Topics | Frequency | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Orthophotos & digital imagery | 4 | 11 | 1 |
| Relational database design | 5 | 11 | 0 |
| Business & Accounting | 2 | 9 | 5 |
| Engineering economy | 4 | 9 | 2 |
| Urban Planning | 4 | 9 | 1 |
| GIS software | 6 | 8 | 2 |
| Subdivision Design | 3 | 7 | 6 |
| Physical Geodesy | 2 | 7 | 6 |
| Photogrammetry & products | 5 | 7 | 4 |
| Determining azimuth by solar or stellar | 4 | 6 | 6 |
| Site Design, earthwork | 4 | 6 | 5 |
| Humanities & Social Studies | 5 | 6 | 5 |

**Analysis of Results**: New and emerging technologies are increasing in importance, and some of the established technologies are decreasing in importance.

**Actions:** No technology was rated as Not Relevant, which validates the basic curriculum design. No specific curriculum content modifications are planned at this time.

## Geomatics Senior Exit Survey

Geomatics seniors are asked to complete an exit survey during the term before graduation. Seven students graduated during the 2008-09 academic year, however only one exit survey was returned by a surveying option student. Results are shown below.

ASAC of ABET criteria requires that accredited programs demonstrate that graduates meet the following outcomes:

(a) an ability to apply knowledge of mathematics, science, and applied sciences
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to formulate or design a system, process or program to meet desired needs
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify and solve applied science problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of solutions in a global and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning

(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.

Please rate the degree to which you feel the Surveying option has prepared you with the knowledge, skills and abilities listed above.

Rate each criteria as 1) Excellent, 2) Good 3) Average, 3) Below Average or 4) Poor

| Criteria | Rating |
|---|---|
| a | 1 |
| b | 1 |
| c | 2 |
| d | 1 |
| e | 1 |
| f | 1 |
| g | 2 |
| h | 1 |
| i | 1 |
| j | 2 |
| k | 1 |

ABET defines program educational objectives as statements that describe the expected accomplishments of graduates during the first few years after graduation—usually 3-5 years. Program objectives must be consistent with the mission of the department and the institution**.**

Geomatics Department objectives for the Surveying and GIS options are listed below.

a) Provide students with a broad foundation in major geomatics disciplines
b) Prepare students to function effectively on multidisciplinary teams
c) Prepare graduates to enter into professional practice
d) Prepare graduates to become licensed or certified professionals

Please rate the degree to which you feel the Geomatics Department has prepared you to meet the objectives listed above during your career.

Rate each criteria as 1) Excellent, 2) Good 3) Average, 3) Below Average or 4) Poor

| Objective | Rating |
|---|---|
| a) | 1 |
| b) | 1 |
| c) | 1 |
| d) | 1 |

Please list and describe what you consider are the main strengths of the Surveying option.

- Field work/practice

- Covering basic theories to complete FS exam
- Computing mass amounts of data

Please list and describe what you consider are main weaknesses of the Surveying option.

- When new software comes out, upper classmen may not know how to use new software.

Please list and describe how the Surveying option can be improved.

- Keep students constantly practicing CAD programs, if not sued regularly it's hard to recall

**Actions:** A sample size of one is too small to draw any significant conclusions from, however this particular student has passed the FS examination, and appears to be quite satisfied with their OIT education. No actions are planned at this time.

**NCEES National Examination Licensure Data**

Seven geomatics students took the April 2009 Fundamentals of Surveying (FS) examination. All individuals passed, for a 100% pass rate.

Five OIT alumni sat for the April 2009 Professional Surveying (PS) examination. Three individuals passed for a 60% passing rate.

Since NCEES began distributing FS examination results, we now have data from eight examination cycles. The makeup of examinations changes somewhat each year, and the number of senior students sitting for each examination cycle is small, so it is important to look for long term trends when analyzing results. The overall average passing rate for OIT geomatics students is 86%.

It was decided to identify significant outliers on the examinations. When the OIT percent for a topic differed from the national percent by 3 standard deviations or more, the topic was flagged as either "Possible Weakness" or "Possible Excellent Performance".

Topics flagged as Excellent Performance on the April 2009 examination.

- Higher Math
- Basic Sciences
- Geodetic Surveying, Astronomy & Geodetic Surveying Calculations
- Business Law – Management, Economics, Finance & Survey Planning
- Field Data Acquisition & Reduction
- Graphical communication – Mapping
- Plane Survey Calculation
- Geographic Information System – Concepts
- Land Development Principles

Topic flagged as Possible Weakness on the April 2009 examination.

- Probability and Statistics

The topic 'Written Communication" was flagged as a possible weakness on three successive examinations, but was satisfactory or excellent on the next four examinations. No long-term trend has emerged regarding this topic.

**Actions:** It was satisfying to see the number of topics listed as possible strengths, and that no long-term trends identifying possible weaknesses are emerging from examination analysis. At this time no actions are planned. The FS examination passing rate was excellent, and the PS examination results are acceptable, especially given the small sample size. No actions are planned at this time.

1. Assessment measures for the new GIS option are currently shared with the Surveying Option. A senior-year examination similar to the industry GIS Certified Professional exam appears to be an excellent set of direct measures. Access to examination questions is being investigated. A second possible set of direct measures to investigate is the ESRI GIS topic exams.

2. Spring 2007 GME 468 Geomatics Practicum assessment efforts identified 2 students who possessed only minimal competency with specific fundamental surveying technology applications. Technology proficiency requirements were implemented in GME 162 and GME 163 during the 2008-09 academic year. No individuals were identified as lacking proficiency in GME 468 during the spring of 2009.

## SECTION V – STUDENT LEARNING IMPROVEMENT PLAN

### Geomatics Department Strengths and Weaknesses

Geomatics department strengths include.

- National leader in merging GIS and Surveying into a common curriculum. This trend is gaining momentum with state licensing board actions and legislative action.
- Excellent FS examination passing rate for surveying option senior students, currently 86%
- Excellent feedback from employers and alumni for the surveying option.

Geomatics department weaknesses include.

- The topic Probability and Statistics was identified as a possible weakness on the April 2009 FS examination. This item will be tracked to see if a long-term trend emerges.

### Geomatics Department Program Improvements

The design of assessment processes and measures for the new GIS option was updated by Professors Marker and Ritter during the 2008 – 09 academic year.

## VI - Changes Resulting from Assessment

The topic ‘Written Communication” was flagged as a possible weakness on three successive examinations, but was satisfactory or excellent on the next four examinations. No long-term trend has emerged regarding this topic. When the PLSO Student Chapter schedules the annual FS examination review sessions, faculty suggest they include a review basic grammar and writing review. The assessment loop has been closed on this item.

All of the outcomes assessed in both the Surveying and GIS options met the required performance criteria. While this is only the first data point in assessing these outcomes, the faculty are satisfied that no significant weaknesses were identified, and that several possible strengths may be confirmed in future assessment cycles.

# Appendix A

# A Holistic View of Curriculum Design

# Mapping Course Performance Objectives to

# ABET Program Outcomes

To provide a holistic view of how the Surveying option curriculum meets ABET Program Outcomes, tables summarizing the mapping of surveying option course outcomes to ABET program outcomes are shown below. Course content was designed to provide appropriate overlap, breadth and depth in outcomes competencies throughout the surveying option curriculum. The level of prerequisite knowledge students should possess upon entering each class was established. Geomatics faculty must adhere to the departmentally-agreed upon syllabus, regardless of which courses they teach. This procedure has proven to be very effective in creating a curriculum in which "the sum of the parts is greater than the whole". Analyzing the performance of student performance as they advance through the curriculum allows the success of changes an a particular course to be assessed.

| Course & Credits: | GME 134 Geographic Information Systems, 3 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Mason Marker | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Provide the student with the GIS skills necessary to use ESRI software products to create simple maps and solve basic analysis problems. | X | X | | X | X | | X | X | X | | X |
| Provide a basic understanding of how to create, implement, and maintain a GIS. | X | X | X | X | X | | | X | X | | X |
| Develop a GIS vocabulary and understanding of GIS principles so that the student may clearly communicate GIS project needs and goals with other professionals | | | | | | X | X | | | X | |

| Course & Credits: | GME 161 Plane Surveying I, 5 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Mark Ager | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Understand the relevance of surveying to civil engineering and geomatics | | | | X | X | X | X | X | X | X | |
| Collect field data using standard surveying procedures | | | X | X | | | X | | | X | X |
| Analyze field measurements for conformance to accuracy standards | X | | | | X | | | | | X | |
| Understand how field data are used by civil engineers in the design process | | | X | X | X | X | X | X | X | X | |
| Compute and stake a highway curve | X | | | X | X | X | X | | | | X |
| Possess a background for further studies in transportation design and geomatics | | | | X | X | X | | X | X | X | X |

| Course & Credits: | GME 162 Plane Surveying II, 5 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Evelyn Kalb | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Develop an understanding of solar observations for azimuth | X | X | X | X | X | | X | | | X | X |
| Develop an understanding of instrument testing and adjustment | | X | X | | X | | | | | | X |
| Develop competence with standard surveying field practices | X | | | X | X | X | X | X | X | X | X |

| Course & Credits: | GME 163 Route Surveying I, 5 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Mason Marker | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Provide you with the theory necessary to solve route survey problems. This will include elements of route selection, calculation of horizontal and vertical curves, and earthwork calculations. | X | X | X | | X | X | | X | X | | X |
| Provide you with hands on experience in road design and layout. You will use Land Development Desktop (LDD) for the design of a road centerline and Total Stations for the collection of topographic data and alignment stakeout. | X | | X | X | X | | | | X | X | X |

| Course & Credits: | GME 175 Surveying Computations and Platting, 4 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Mason Marker | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Develop skills necessary to perform coordinate geometry calculations by hand and with survey software packages (Land Development Desktop). | X | X | | | X | | | | X | | X |
| Develop an understanding of statistical methods used in survey computations. | X | X | | | X | | | | X | | X |
| Perform least squares adjustment of survey data using software. | X | X | | | X | | | | X | | X |
| Learn the statutory requirements for the preparation of a survey plat. | | | | X | | X | X | X | X | X | X |
| Learn skills necessary to create survey plats using Land Development Desktop | X | X | | | X | | | | X | | X |

| Course & Credits: | GME 241 Boundary Law I, 3 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Evelyn Kalb | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Introduce the fundamentals of Law. | X | X | | | X | | | | X | | X |
| Provide the student with exposure to the Oregon Revised Statutes and Oregon Administrative Rules used by surveyors in professional practice. | X | X | | | X | | | | X | | X |
| Introduce the skills necessary to conduct legal research in a law library. | X | X | | | X | | | | X | | X |
| Examine case studies so that the student learns how the legal principles studied in class are applied in practice. | X | X | X | X | X | X | X | X | X | X | X |

| Course & Credits: | GME 242 Land Descriptions and Cadastre, 3 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Evelyn Kalb | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Be familiar with methods used to identify, describe, and locate real property interests | | | X | | | X | X | X | X | X | |
| Be able to write the descriptive portion of a land interest conveyance | X | | X | | X | X | X | X | X | X | X |
| Be able to accomplish research using the land information systems of Klamath County | | | | X | X | X | | X | X | X | X |
| Possess an overview of Land/Geographic Information Systems (LIS/GIS) | | | | | | | | X | X | X | |
| Understand the importance of written communication skills | | | | X | | | X | | | | |

| Course & Credits: | GME 264 Surveying Software Applications, 3 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Mark Ager | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Introduce students to residential subdivision design | X | X | X | X | X | X | X | X | X | X | X |
| Introduce students to site contours | X | | | | X | | | | | | X |
| Introduce students to reservoir placement and resultant earthwork | X | X | X | | X | | | | X | X | X |
| Introduce students to plan, profile and earthwork for a roadway | X | X | X | | X | | | | X | X | X |

| Course & Credits: | GME 372 Subdivision Planning and Platting, 4 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Mark Ager | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Introduce students to land development codes and processes | | X | X | X | X | X | X | X | X | X | |
| Introduce students to the subdivision design process | X | X | | X | X | X | | X | X | X | X |
| Introduce students to the platting and approval process | | | X | X | | | X | | X | X | X |
| Introduce students to the economics of land development | X | | | X | X | | | | X | X | X |

| Course & Credits: | GME 351 Engineering and Construction Surveys, 4 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Mason Marker | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| To understand basic elements of construction surveying and by using this understanding, develop the most practical and economical methods for construction surveys. | X | X | X | X | X | X | | | | X | X |
| To identify and eliminate common mistakes in construction layout. | X | | | X | | X | | | | X | X |
| To continue learning how to use total station instruments, data collectors, and real-time kinematic (RTK) global positioning system (GPS) instruments for site design projects. | X | X | X | | | | | | | | X |
| To develop note forms for various construction staking projects. | | X | X | X | | X | X | | | X | X |
| To learn how to organize and use a survey crew for better utilization of time and money. | X | | X | X | | X | X | | X | | X |
| To learn how to field stake several different types of projects. | X | X | X | | | | | | | | X |

| Course & Credits: | GME 415 Advanced Road Design, 4 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Mark Ager | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| To introduce the student to a complete road design project including "L" and "P" line locations, horizontal and vertical alignment calculations, earthwork and mass diagram calculations with consideration for drainage and road construction materials. | X | X | X | X | X | X | X | X | X | X | X |
| To introduce students to the economics of route design | X | X | X | X | X | X | X | X | X | X | X |

| Course & Credits: | GME 425 Remote Sensing, 4 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Jack Walker | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Correctly answer FLS examination photogrammetry questions! | X | | X | | X | | | | | | |
| Understand the geometry of vertical aerial photographs | X | | | | X | | | | | | |
| Understand the geometry of tilted aerial photographs | X | | | | X | | | | | | |
| Be able to compute ground coordinates from measured vertical photo coordinates | X | X | X | X | X | X | | X | X | X | X |
| Describe basic principles of digital image processing | X | | | | X | | | X | | | |
| Create an oriented stereomodel and orthorectify a photograph using Leica LPS software | X | X | X | X | X | X | | X | X | X | X |
| Understand image classification | X | | | | X | | | | | | |
| Understand image sources and data types | | | | X | X | X | X | X | X | X | |

| Course & Credits: | GME 434 Advanced GIS, 4 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Mason Marker | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Perform advanced analysis work using ArcGIS modules such as network analyst, spatial analyst, and 3D analyst. | X | X | X | | | | | | | X | X |
| Address management problems associated with the development and maintenance of a GIS. This includes system software and hardware specifications, cost-benefit analysis of GIS system, and determination of project costs. | X | | X | X | | X | X | X | X | X | X |
| Locate and identify digital data appropriate for use in specific GIS projects. This includes selecting a project coordinate system and insuring that all data is in the appropriate system. | X | X | X | | X | | | | | X | X |
| Customize the ArcGIS user interface. | X | X | X | X | | | X | | X | | X |
| Build a GIS to address a specific problem. | X | X | X | X | X | X | X | X | X | X | X |

| Course & Credits: | GME 444 Adjustment by Least Squares, 4 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Jack Walker | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| The concept of adjustment of random errors | X | | X | X | X | | X | X | X | X | |
| Two methods of least squares adjustment technique | X | X | X | | X | | | | | | |
| The propagation of variance-covariance matrices | X | X | X | | X | X | | | | X | |
| Error ellipses for points and lines | X | X | X | | X | X | | | | X | |
| The use of preanalysis | X | X | X | | X | X | | | | X | |
| The use of Star*Net software | | X | X | | X | X | X | | | X | X |

| Course & Credits: | GME 451 Geodesy, 4 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Jack Walker | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Recognize the relevance of geodesy to the surveying profession | X | | X | X | X | X | | X | X | X | |
| Analyze the effects of earth curvature on surveying measurements | X | X | X | | X | | | | | | X |
| Distinguish between physical and geometric geodetic concepts | X | X | X | | X | | | | | X | |
| Perform coordinate transformations and datum conversions | X | X | X | | X | | | | | X | X |
| Compose a discussion of results | | | | | | X | X | | | | |

| Course & Credits: | GME 452 Map Projections, 4 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Jack Walker | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Discuss the need for and usage of map projections in surveying | X | | X | X | X | X | | X | X | X | |
| Describe the distortions created by map projections | X | X | | X | | | X | X | | | |
| Analyze simple map projections to determine their properties | X | X | X | | X | | | | | | X |
| Utilize the state plane coordinate systems with proficiency and accuracy | X | | X | X | X | X | | | X | X | X |
| Design a local map projection for a specified project area | X | X | X | X | X | X | X | | X | X | X |

| Course & Credits: | GME 454 GPS Applications, 4 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Mason Marker | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | **k** |
| 1) Provide the student with the theory necessary to understand GPS operation. | X | X | X | | X | X | X | X | X | X | X |
| 2) Provide the student with hands on experience in the use of GPS equipment for various survey tasks including the establishment of survey control, topographic mapping, and construction layout. | X | X | X | | X | | | | X | X | X |

| Course & Credits: | GME 466 Boundary Law II, 3 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Evelyn Kalb | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| "The practice (of surveying) requires authoritative knowledge of common law in boundary locations particularly with regard to unwritten title transfer and admissible evidence, as well as the current statutory laws in the State of Oregon with respect to land subdivision and the legal responsibilities of a land surveyor." [Quoted from Oregon Administrative Rules, Chapter 820, Division 10 - Board of Engineering Examiners. Definitions 820-10-010(7)] | X | | | X | X | X | X | X | X | X | X |
| "The surveyor must obey the law in locating former divisions of land, in locating new divisions of land and in describing the land divided; hence he must know what the law is pertaining to these functions." [Quoted from Preface, page vii, Evidence and Procedures for Boundary Location by Brown, Robillard and Wilson, 2nd Ed.] | X | X | X | X | X | X | X | X | X | X | X |

| Course & Credits: | GME 468 Geomatics Practicum, 4 cr | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Instructor: | Tim Kent | | | | | | | | | | |
| Course Learning Objectives | ASAC-ABET General Program Criteria | | | | | | | | | | |
| | a | b | c | d | e | f | g | h | i | j | k |
| Self-guided and managed efforts based on the student's initiative | | X | | X | X | X | X | X | X | X | X |
| Teamwork with a lead person assigned to each project. Each student is expected to assist on any of the projects as the need arises | X | X | X | X | X | X | X | | X | X | X |
| Time management to reach or modify project goals | | X | X | X | X | | X | | | | |
| The value of community service projects | | | | | | | | X | | X | |

# Appendix B

# Mapping NCEES Fundamentals of Surveying Examination Questions to ABET Program Outcomes

A direct measure of surveying option program outcomes is the national FS licensing examination surveying option students are eligible to sit for during the spring of their senior year. A map showing correspondence of examination topics and ABET outcomes is shown below.

**NCEES Fundamentals of Surveying Examination Question Category**

1) Algebra and Trigonometry
2) Higher Math
3) Probability and Statistics
4) Basic Sciences
5) Geodetic Surveying Astronomy & Geodetic Surveying Calculations
6) Computer Operations & Programming
7) Written Communication
8) Boundary Law - Cadastral Law & Admin.
9) Business Law - Management Economics - Finance & Surveying Planning
10) Field Data Acquisition & Reduction
11) Graphical communication - Mapping
12) Photo-Image data Acquisition & Reduction
13) Plane Survey Calculation
14) Geographic Information System - Concepts
15) Land Development Principles

**ASAC-ABET General Criteria Program Outcomes**

(a) an ability to apply knowledge of mathematics, science, and applied sciences
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to formulate or design a system, process or program to meet desired needs
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify and solve applied science problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of solutions in a global and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.

Examination of the table shows significant redundancy between the FS examination topics and ABET program outcomes. Designing the Surveying option curriculum to address the FS examination topics also supports the goal of redundancy in ABET program outcome coverage. Distributed learning has proven to be effective in increasing student competencies.

| NCEES Exam Topic | Number of Exam Questions | ABET Program Outcomes | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | a | b | c | d | e | f | g | h | i | j | k |
| 1 | 19 | x | | | | x | | | x | | | x |
| 2 | 7 | x | | | | x | | | x | | | x |
| 3 | 8 | x | | | | x | | | x | | | x |
| 4 | 7 | x | | | | x | | | x | | | x |
| 5 | 10 | x | x | x | x | x | x | | x | x | x | x |
| 6 | 10 | x | | x | x | x | | | x | | | x |
| 7 | 10 | | | | x | x | | x | x | | | x |
| 8 | 2 | | x | x | x | x | x | x | x | x | x | x |
| 9 | 10 | x | x | x | x | x | x | x | x | | x | x |
| 10 | 17 | x | x | x | x | x | x | | x | x | x | x |
| 11 | 7 | | | x | x | x | x | x | x | x | x | x |
| 12 | 10 | x | x | x | x | x | x | | x | x | x | x |
| 13 | 17 | x | | x | x | x | | | x | | | x |
| 14 | 7 | x | x | x | x | x | x | x | x | x | x | x |
| 15 | 9 | x | | x | x | x | x | x | x | x | x | x |

# Appendix C

# Geomatics Department
# Program Outcome Evaluation Cycle

ABET definitions:
**Program Educational Objectives** are broad statements that describe what graduates are expected to attain within a few years after graduation.
**Student Outcomes** describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program.

The GIS option has proposed the assessment cycle shown below to assess program outcomes and OIT ISLO's as appropriate.

## Geomatics Department - GIS Option - Program Outcome Assessment Cycle

| Program Outcome | Application | Faculty | Term | Method |
|---|---|---|---|---|
| 1. Ability to work effectively in teams | GIS 446 GIS Database Development | J Ritter | Fall 09 | Peer & Faculty Evaluation |
| 2. An understanding of professional and ethical responsibility | GIS 456 GIS Management | J Ritter | Winter 09 | Research Paper |
| 3. Demonstrate critical thinking skills in solving geospatial problems | GIS 306 Geospatial Raster Analysis | J Ritter | Fall 09 | Project Evaluation |
| 4. Ability to devise database schema required for addressing geospatial problems | GIS 446 GIS Database Development | J Ritter | Fall 09 | Project Evaluation |
| 5. Ability to develop customized user interfaces appropriate for geospatial investigations. | GIS 351 Customizing the GIS Environment II | J Ritter | Spr 09 | Project Evaluation |
| 6. Ability to appropriately incorporate GPS, CAD, and historical paper-based record data into a GIS framework. | GIS 326 Geospatial Vector Analysis II | J Ritter | Spr 10 | Project Evaluation |
| 7. Ability to identify geospatial problems and the requisite method, or set of procedures needed to address the issue. | GIS 316 Geospatial Vector Analysis I | J Ritter | Winter 09 | Project Evaluation |
| 8. Ability to construct a clear, presentable cartographic product that addresses a geospatial issue | GIS 326 Geospatial Vector Analysis II | J Ritter | Spr 11 | Oral Presentation |
| 9. Understand the software/hardware requirements for implementing a scalable GIS. | GIS 456 GIS Management | J Ritter | Winter 10 | Research Paper |

## Geomatics Department - Surveying Option - Program Outcome Assessment Cycle

| Program Outcome | Application | Faculty | Term | Method |
|---|---|---|---|---|
| a) an ability to apply knowledge of mathematics, science, and applied sciences | GME 444 Least Squares<br>GME 451Geodesy | J Walker<br>J Walker | Spring 09<br>Fall 08 | Exam questions<br>Exam questions |
| b) an ability to design and conduct experiments, as well as to analyze and interpret data | GME 468 Geomatics Practicum<br>GME 454 GPS Surveying | M Marker<br>M Marker | Spring 09<br>Winter 09 | Faculty project evaluation |
| c) an ability to formulate or design a system, process or program to meet desired needs | GME 452 Map Projections<br>GME 351 Construction Surveying | J Walker<br>M Marker | Winter 09<br>Spring 10 | Project evaluation<br>Project evaluation |
| d) an ability to function on multi-disciplinary teams | GME 163 Route Surveying<br>GME 468 Geomatics Practicum | M Marker<br>M Marker | Fall 08<br>Spring 09 | Peer evaluation<br>Faculty evaluation |
| e) an ability to identify and solve applied science problems | GME 351 Construction Surveying | M Marker | Fall 09 | Research paper |
| f) an understanding of professional and ethical responsibility | GME 466 Boundary Law II | E Kalb | Winter 09 | Exam questions |
| g) an ability to communicate effectively | GME 434 Advanced GIS<br>GME 466 Boundary Law II | M Marker<br>E Kalb | Winter 09<br>Winter 09 | Research paper<br>Research paper |
| h) the broad education necessary to understand the impact of solutions in a global and societal context | GME 434 Advanced GIS<br>GME 466 Boundary Law II | M Marker<br>E Kalb | Winter 09<br>Winter 09 | Project evaluation<br>Research paper |
| i) a recognition of the need for, and an ability to engage in life-long learning | GME 468 Geomatics Practicum<br>GME 466 Boundary Law II | E Kalb<br>E Kalb | Spring 09<br>Winter 09 | Project evaluation<br>Research paper |
| j) a knowledge of contemporary issues | GME 372 Subdivision Design<br>GME 452 Map Projections | M Marker<br>J Walker | Spring 09<br>Winter 09 | Questionnaire<br>Project evaluation |
| k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice. | GME 351 Construction Survey<br>GME 454 GPS Surveying | M Marker<br>M Marker | Spring 09<br>Winter 09 | Project evaluation<br>Project evaluation |