

GEOMATICS DEPARTMENT

Assessment Report

2007-08

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 an ongoing 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.

This period of staff change was handled with minimal impact on program quality, and leaves the geomatics program with an exceptionally strong faculty with varied backgrounds and expertise which greatly complement each other.

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 recruited heavily 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. This 5-year \$750,000 agreement funds a 4th geomatics faculty position with approximately half-time release for geomatics recruiting and outreach activities. This 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 the BLM a \$2,000 scholarship. These scholarships have proven to be an effective recruiting tool.

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 civil engineering 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 of 2007.

Fall Terms	Year (2003-04)	Year (2004-05)	Year (2005-06)	Year (2006-07)	Year (2007-08)
Full-time Students	38	39	46	46	65

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 is not particularly useful.

Fall Terms	Year (2002-03)	Year (2003-04)	Year (2004-05)	Year (2005-06)	Year (2006-07)
First-time Students	3	2	0	5	6
Changed major	0	1	1	2	0

Table IB Retention Trends for Past Five Academic Years

Degrees Awarded

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

Fall Terms	Year (2002-03)	Year (2003-04)	Year (2004-05)	Year (2005-06)	Year (2006-07)
First-time Students	10	7	10	7	10

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, with only 2 responses for the 10 graduates in 2006. Geomatics faculty were able to contact graduates and assist Career Services in obtaining significant placement and salary data for 9 of 10 graduates in the class of 2005. The employment rate was 100%, with a median starting salary of \$49,920. 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. Private sector graduate salaries tend to be in the range of \$45,000 to \$65,000 depending upon geographic location.

A summary of geomatics graduates for the last 5 years is shown below, with their status at the time of graduation indicated.

Year Graduated	Licensure (If Applicable)	Initial Employment/ Other Placement
2003	FS	BLM
2003	FS	Private Firm
2003	FS	Private Firm
2003	Unknown	Private Firm
2003	FS	Private Firm
2003	Unknown	Unknown
2003	FS	Unknown
2004	Unknown	Private Firm
2004	FS	Private Firm
2004	Unknown	Private Firm
2004	PS	Private Firm
2004	FS	Unknown
2005	FS	BLM
2005	FS	BLM
2005	FS	BLM
2005	FS	County Govt
2005	FS	County Govt
2005	FS	Private Firm
2005	FS	Private Firm
2005	Unknown	Private Firm
2005	FS	Private Firm
2005	FS	Private Firm
2005	PS	Private Firm
2005	Unknown	Not Seeking Employ.
2005	FS	Private Firm
2005	FS	Private Firm
2005	FS	Private Firm
2006	Unknown	BPA
2006	Unknown	Private Firm
2006	Unknown	Private Firm
2007	FS	Private Firm
2007	FS	Private Firm
2007	FS	BLM
2007	FS	Private Firm
2007	FS	Unknown
2007	FS	Unknown
2007	Unknown	Unknown

Table ID Graduate status

SECTION II – DEPARTMENTAL ASSESSMENT SUMMARY

Geomatics Industrial Advisory Committee

At the 19 October 2007 Geomatics Industrial Advisory Committee meeting, topics of discussion included:

- GIS Option curriculum review– Mason Marker and John Ritter
- Surveying Option curriculum review of legal course sequence – Evelyn Kalb and Jack Walker
- PLSO Student Chapter Update – officers
- Curriculum modifications to meet 180 credit OUS requirement for both degree options
- ABET Program Assessment – Jack Walker and Mason Marker
- Department mission statement
- April, 2007 FS Examination results for geomatics seniors
- The revised student peer evaluation process for GME 163 and GME 351
- Department Educational Objectives
- GIS Option Program Outcomes
- Surveying Option Program Outcomes

Recommendations of IAC members, and subsequent geomatics department discussions, resulted in modifying the departmental objectives common to both program options. Program outcomes for the new GIS option were revised, and the required ABET a-k outcomes will continue to be used for the Surveying option.

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. These real-world projects have proven to be extremely valuable in creating an awareness of the complexities of dealing with clients, meeting changing demands, and resolving unanticipated difficulties.
- Industry speakers are invited to make presentations at the PLSO Student Chapter meetings.
- Various geomatics classes tours offices of the Klamath County Surveyor, assessor, planning department, etc. to expose students to researching land record information.

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 are exposed to the global and cultural impact of their profession.

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

- Provide students with a broad foundation in major geomatics and GIS disciplines
- Prepare students to function effectively on multidisciplinary teams
- Prepare graduates to enter into professional practice
- 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 at the time of graduation. It is anticipated that if students achieve these outcomes, they will be able to achieve program 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 a revolutionary 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, and industry standards of practice. 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 any university to be a leader in implementing new technology. The geomatics department successfully partners with industry and equipment vendors to determine the most effective methods to incorporate new technologies into the curriculum. The department’s Industrial Advisory Committee (IAC) is exceptionally valuable in providing useful input, and equipment vendors offer extremely favorable discounts to acquire new technology.

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 before the university can catch up. It is essential to provide students with an education which prepares them for the rapid changes they will encounter during their career.

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 first 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	2-year
Alumni	annual
Student Focus Groups	varies

Table IIIA Geomatics Constituents

The Geomatics Department Surveying option is designed to ensure students satisfy ASAC-ABET Criterion 3: Establishing and Assessing Program Outcomes. The GIS option currently offers ESRI Certification, and will seek appropriate professional accreditation as it evolves.

The Surveying option curriculum was carefully designed, and monitored by faculty with the goal 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. Geomatics faculty do not have the freedom to teach course content as they see fit. Faculty are expected to adhere to the curriculum design incorporated into the syllabus of each course. This concept is encapsulated in the statement “The whole is greater 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 phrases students can understand are published in every 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 mapping course outcomes to ABET program outcomes is shown in appendix A. Content of sequential courses was designed to provide appropriate overlap, breadth and depth in outcome 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 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, and have multiple redundancies. The IAC is used to provide an independent analysis of program assessment data to corroborate faculty analysis of the data.

At the annual geomatics faculty retreat, and at department meetings, assessment results are analyzed, and corrective actions formulated. Significant course changes are made only after 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 – SUMMARY OF 2007-08 GEOMATICS DEPARTMENT ASSESSMENT

Geomatics Department Retreat

During convocation week in September the geomatics department held a half-day retreat, with program assessment a major topic of discussion. It was decided that professor Marker would serve as co-assessment coordinator, and assume duties of the department coordinator during the 2008-09 academic year, pending completing of his PhD dissertation.

Geomatics Department Assessment Meeting

At the 18 April 2008 Geomatics Department meeting, 2 hours were devoted to assessment. Discussion included 1) Analyzing OIT ISLO 4 Critical Thinking assessment results. 2) Revising program outcome assessment cycles for both degree options. Program outcome assessment cycles are summarized in Appendix C.

GME 434 Advanced GIS - Critical Thinking Exercise

Exercise Description:

This exercise consists of a short (6-8 pages) paper where the student explores a topic of controversy in the field of Geographic Information Systems (GIS). The purpose of this exercise is for the student to identify an area of controversy within the profession, gather information concerning this controversy, and defend a position of their choosing using the information that they have reviewed.

Goals:

The goals for this exercise are as follows:

- 1) Introduce students to topics of controversy within their chosen profession.
- 2) Develop the students ability to locate timely information on a topic of interest by using peer reviewed journal articles, popular press articles, and the world wide web.
- 3) Develop the student's ability to analyze information on a controversial topic, formulate a position on that topic, and then defend that position against competing positions.
- 4) Provide the students with the opportunity to improve written communication skills within their chosen profession.
- 5) Evaluate evidence, and synthesize information from multiple sources including the internet, professional journals, and published texts.

Analysis of Results:

The percentage of students meeting baseline data are shown below. The overall percentage for all performance criteria is 77%.

Performance Criteria	Results
1. Identifies and explains problem/question/issue	100%
2. Recognizes stakeholders and contexts	80%
3. Frames personal responses and/or acknowledges other perspectives	70%
4. Evaluates assumptions	70%
5. Evaluates evidence	60%
6. Evaluates implications, conclusions, and consequences	80%

Table IVA GME 434 Critical Thinking Summary

Item 5 Analysis: Although students were required to use multiple sources in addition to the internet, most only used the internet. It appears students preferred to lose a few percentage points rather than expend the effort and time to research other sources. After discussion, the consensus was that an increase in the point value associated with researching multiple sources is the best method to motivate students to perform the additional research.

Item 3 and 4: The difficulties with the severe winter weather, campus closure, illness, and class disruptions appeared to contribute to lower achievement in these areas. No specific changes are recommended.

GIS 316 Geospatial Vector Analysis I - Critical Thinking Exercise

GIS 316 Geospatial Vector Analysis I requires students to complete a project realigning fire district boundaries. This project was assessed for critical thinking skills, the percentage of students meeting baseline data are shown below. The overall percentage for all performance criteria is 83%. There were no concerns raised with student abilities.

Performance Criteria	Results
1. Identifies and explains problem/question/issue	83%
2. Recognizes stakeholders and contexts	100%
3. Frames personal responses and/or acknowledges other perspectives	N/A
4. Evaluates assumptions	100%
5. Evaluates evidence	N/A
6. Evaluates implications, conclusions, and consequences	100%

Table IVB GME 316 Critical Thinking Summary

GME 466 Boundary Law II - Critical Thinking Exercise

GME 466 Boundary Law II required a student research paper which was evaluated for critical thinking. These papers were assessed for critical thinking, the percentage of students meeting baseline data are shown below. The overall percentage for all performance criteria is 84%. There were no concerns raised with student abilities.

Performance Criteria	Results
1. Identifies and explains problem/question/issue	100%
2. Recognizes stakeholders and contexts	91%
3. Frames personal responses and/or acknowledges other perspectives	91%
4. Evaluates assumptions	82%
5. Evaluates Evidence	82%
6. Evaluates Implications	73%
7. Grammar and Writing Style	82%
8. Follows Instructions	73%

Table IVC GME 466 Critical Thinking Summary

Geomatics Industrial Advisory Committee Meeting

1. The 19 October 2007 Geomatics Industrial Advisory Committee meeting discussion included:
 - Discussions of 2006 ASAC-ABET visit accreditation actions.
 - GIS Option curriculum review– Mason Marker and John Ritter
 - Surveying Option curriculum review of legal course sequence – Evelyn Kalb and Jack Walker
 - PLSO Student Chapter Update – officers
 - Curriculum modifications to meet 180 credit OUS requirement for both degree options
 - ABET Program Assessment – Jack Walker and Mason Marker
 - Department mission statement
 - April, 2007 FS Examination results for geomatics seniors
 - The revised student peer evaluation process for GME 163 and GME 351
 - Department Educational Objectives

- GIS Option Program Outcomes
- Surveying Option Program Outcomes
- Initiate consideration for GIS Option students to take an examination similar to the GIS Professional certification examination as a direct measure of program outcomes.

Recommendations of the IAC members and subsequent geomatics department discussions resulted in modifying the departmental objectives common to both program options. Program outcomes for the new GIS option were revised, and the required ABET a-k outcomes will continue to be used for the Surveying option.

2. The 9 May 2008 Geomatics Industrial Advisory Committee meeting discussion included:

- Review of Surveying option surveying engineering courses
- PLSO Student Chapter Update – officers
- 2008-09 approved curriculum changes
- NCEES licensing examination results
- Department Educational Objectives – final review
- Surveying Option Program Outcomes
- Geomatics department scholarship drive update
- ODOT total station donation & EFF grant - \$230,000
- Wide-screen “reader board” to replace cork boards
- Geomatics department website management

Senior Exit Survey

GME 468 Senior Practicum students were asked to complete a senior exit survey. The survey obtained data on both program outcomes and objectives, and strengths and weaknesses. Eight surveying option students completed the survey; a summary of results is shown below. The GIS option had its first graduate in June 2008; however this individual did not complete the survey.

Students were asked to rate how well they felt the program prepared them to meet the ABET program outcomes. A scale of 1) Excellent 2) Average and 3) Below Average was used. The results are highly positive for all outcomes, and no corrective action is required.

ABET Criteria	Rating			Average Rating
	1	2	3	
a	7	1	0	1.125
b	5	3	0	1.375
c	6	2	0	1.250
d	8	0	0	1.000
e	6	2	0	1.250
f	8	0	0	1.000
g	7	1	0	1.125
h	6	2	0	1.250
i	7	1	0	1.125
j	5	3	0	1.375
k	6	2	0	1.250

Students were asked to rate how well they felt the program prepared them to meet program objectives which are common to both the GIS and Surveying options.

A scale of 1) Excellent 2) Average and 3) Below Average was used. The results are highly positive for all outcomes, and no corrective action is required.

GIS and Surveying options program objectives

- a) Provide students with a broad foundation in major geomatics and GIS 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.

Program Outcome	Rating			Average Rating
	1	2	3	
a)	8	0	0	1.000
b)	7	1	0	1.125
c)	7	1	0	1.125
d)	8	0	0	1.000

A summary of reported program strengths is shown below. The results are quite positive, and no corrective action is needed.

- The program is real hands-on. We really get a feel of using the equipment and learn how to actually complete a whole project. We also have small class sizes that you get to know your fellow students and teachers are usually there to answer questions when you need them.
- The student to teacher ratio and hands-on learning. After working in the field for 2 summers the knowledge gain from attending OIT has made a difference in how I work and how I look at surveying as a profession. The only weakness I think the geomatics department has is having too many work options.
- Great faculty-to-student ration, surveying equipment/technology, industry support, job placement
- Field practice, hands-on labs, and knowledgeable professors
- The overall education @ OIT is far superior to any other school for students I have spoken to. While taking the FLS I felt confident that my education was more than adequate to pass. While talking to others I realized that we were way more prepared than others taking the test.
- Higher level courses, teacher interactions
- Great small classes, professional people teaching classes, small teacher to student ratio. Teachers really available for questions and involved in my education processes.

A summary of reported program weaknesses is shown below. There is no common thread among reported weaknesses. Corrective action regarding solar observations was made by incorporating solar observations into GME 162 Plane Surveying II in spring 2008. No specific actions will be taken regarding other comments.

- No (geomatics department) computer lab, more (geomatics) faculty, more applied projects
- Sometimes it seems there is not enough time in a term to cover all the material of a course, so we end up skipping over some stuff or rushing too fast through the material.
- Preparation w.r.t. software & equipment, limited software access
- Boundary classes
- A few FLS questions on solar observations, not covered in our classes. A brief explanation would be helpful.
- GPS equipment problems
- Instructions for labs got confusing; software/equipment did not work often. I was out of sequence, and had too much computer programming early on for a computer illiterate person. Made things more difficult later on.

Other Assessment Meetings

Discussion at the 16 December 2007 Geomatics department meeting included finalizing curriculum modifications to meet 180 credit OUS requirement for both degree options with as little impact on program quality as possible.

Northwest Commission on Colleges and Universities (NWCCU) accreditation meetings with Beth Murphy regarding institutional assessment reporting requirements. This resulted in mapping the number of direct and indirect assessment methods used to measure surveying option program outcomes to demonstrate that an adequate mix of direct and indirect measures was employed. A schedule for assessing program outcomes was developed and summarized in appendix C

Analysis of Geomatics Department Assessment Data

Analysis of constituent input identified the following findings and/or actions.

1. Analysis of program educational objectives (identical for both program options) identified some degree of duplication. Some objectives were difficult to measure and demonstrate achievement. Revised program educational objectives listed below will be included in the 2008-09 OIT catalog.
 - 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.

2. Analysis of program learning outcomes for both the GIS and Surveying Options resulted in no changes for the Surveying option, which currently uses the ASAC-ABET a-k outcomes. Revised student learning outcomes listed below for the GIS Option will be included in the 2008-09 OIT general catalog.
 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.
3. Since NCEES began distributing FS examination results, we now have data from 3 examination cycles. Since the makeup of the examination changes slightly each year, and the number of senior students sitting each year is small, it is important to look for long term trends when analyzing results. It was decided to clearly 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 “excellent performance”. Topics flagged as excellent performance on all 3 examinations were a) Higher mathematics, b) Probability and statistics, c) Basic sciences, Graphical communication – mapping, and d) GIS – concepts. Only one topic was flagged as a possible weakness on all 3 examinations, which was Written communication. This will be investigated further and discussed with the communications department. The average passing rate on these examinations is 84% which is quite high, and speaks well of the surveying option.
4. Analysis of the number of direct and indirect measures for each Surveying Option outcome was made to ensure there adequate number and types of measures.

Measure	Type of Measure
Curriculum Design Efforts	direct
Geomatics Practicum	direct
FS Examination	direct
Employers	indirect
Alumni	indirect
Student Focus Groups	indirect

Table IVD Geomatics Assessment Measures

5. 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.
6. Spring 2007 GME 468 Geomatics Practicum assessment efforts identified 2 students who possessed only minimal competency with specific fundamental surveying technology applications. This was surprising since these applications are included in numerous geomatics courses. This is a new weakness not previously identified. Further investigation revealed these students were “riding on the coattails” of team members. Student team peer evaluations did not identify this situation as these students were on

the same team in several courses, and “covered” for each other. Corrective action to prevent this weakness from reoccurring is the implementation of a skills assessment for each individual student in the following courses: GME 162 Plane Surveying II, GME 163 Route Surveying, and GME 452 GPS Applications.

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 and legislative actions.
- Excellent FS examination passing rate for surveying option senior students.
- Excellent feedback from employers and alumni for the surveying option.
- A history of excellent ABET program reviews.

Geomatics department weaknesses include.

- Two students who did not acquired necessary technical equipment competencies were not detected by the peer evaluation process. Individual competency tests will be implemented in the following courses.
 - GME 162 Plane Surveying II – Prof. Kalb, spring 2009
 - GME 163 Route Surveying - Prof. Marker, fall 2008
 - GME 452 GPS Applications – Prof. Marker, winter 2009
- Significantly low average score on the topic area “written communications” on the last three FS examinations. This will be further discussed by the geomatics department faculty, and communications faculty and a corrective course of action determined.

Geomatics Department Program Improvements

Further design and refinement of assessment processes and measures for the new GIS option will be completed by Professors Marker and Ritter during the fall quarter of 2008.

Appendix A

Holistic Curriculum Overview 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 are required to 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 whole is greater than the sum of the parts”. By analyzing student performance as a cohort advances through the curriculum allows change to be analyzed and 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, <u>Evidence and Procedures for Boundary Location</u> 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

NCEES Fundamentals of Surveying Examination Mapping Content Areas 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 Content Areas

- 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 below shows significant redundancy between FS examination topics and ABET program outcomes. This indicates that valid assessment conclusions can be made from analysis of examination results. Distribution of FS examination topics, and ABET program outcome coverage, throughout the curriculum has proven to be effective in increasing student learning.

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 defines program outcomes as 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 also be able to achieve program educational objectives after graduation.

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 10	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 09	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 GME 451 Geodesy	J Walker J Walker	Spring 09 Fall 08	TBD
b) an ability to design and conduct experiments, as well as to analyze and interpret data	GME 468 Geomatics Practicum GME 454 GPS Surveying	M Marker M Marker	Spring 09 Winter 09	Faculty project evaluation
c) an ability to formulate or design a system, process or program to meet desired needs	GME 444 Least Squares GME 351 Construction Surveying	J Walker M Marker	Spring 09 Spring 09	Project evaluation
d) an ability to function on multi-disciplinary teams	GME 163 Route Surveying GME 468 Geomatics Practicum	M Marker M Marker	Fall 08 Spring 09	Peer evaluation Faculty evaluation
e) an ability to identify and solve applied science problems	GME 351 Construction Surveying	M Marker	Winter 09	Research paper
f) an understanding of professional and ethical responsibility	GME 466 Boundary Law II	E Kalb	Winter 09	Research paper
g) an ability to communicate effectively	GME 433 Advanced GIS GME 241 Boundary Law I	M Marker E Kalb	Winter 09 Winter 09	Oral presentation Oral presentation
h) the broad education necessary to understand the impact of solutions in a global and societal context	GME 434 Advanced GIS GME 466 Boundary Law II	M Marker E Kalb	Winter 09 Winter 09	Project evaluation Research Paper
i) a recognition of the need for, and an ability to engage in life-long learning	GME 343 Boundary Surveying GME 466 Boundary Law II	E Kalb E Kalb	Fall 08 Winter 09	Court cases Research paper
j) a knowledge of contemporary issues	GME 372 Subdivision Design GME 452 Map Projections	M Marker J Walker	Spring 09 Winter 09	Questionnaire Questionnaire
k) an ability to use the techniques, skills, and modern scientific and technical tools necessary for professional practice.	GME 351 Construction Surveying GME 454 GPS Surveying	M Marker M Marker	Spring 09 Winter 09	Project evaluation Project evaluation