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THE RAC ACCREDITATION EXPERIENCE AT OIT

Earl F. Burkholder, PLS, PE

Oregon Institute of Technology
3201 Campus Drive
Klamath Falls, Oregon 97601-8801

BIOGRAPHICAL SKETCH

Earl F. Burkholder has taught upper division surveying classes at Oregon Institute of Technology (OIT) since September, 1980. Prior surveying and engineering experience includes 5 years with Commonwealth Associates, Inc. of Jackson, Michigan and 2 years with Gould Engineering of Flint, Michigan. A civil engineering graduate of Michigan (BS '73) and Purdue (MS '80), he has been registered as a Land Surveyor in 6 states and as a Professional Engineer in Michigan and Oregon. In August, 1985 he was appointed to a 3 year term as Editor of the Journal of Surveying Engineering and in December, 1986 was presented the "1986 Surveyor of the Year" award by the Professional Land Surveyors of Oregon.

ABSTRACT

At the 11th Surveying Teachers' Conference in Fresno, California, I reported on our preparations for an accreditation visit in November, 1984, by the Accreditation Board of Engineering & Technology Related Accreditation Commission ABET/RAC. Our program was accreditated as a result of that visit and we are now preparing for another visit this fall. This paper discusses our reasons for seeking the RAC accreditation, outlines our experience with the ABET/RAC accreditation process, and closes by sharing efforts we are making to maintain a robust surveying program in light of advancing technology, prevaling attitudes toward continuing education, lack of degree requirements for licensure and overlap of professions.

BACKGROUND

Oregon Institute of Technology (OIT) began in 1947 as a vocational rehibilitation school for veterans and has grown into a 2800 student body institute offering associate and bacculaureate degrees in engineering, health and business technologies. Two programs, surveying and nursing, are accredited as 4-year professional level programs.

Surveying has been prominent at OIT since the first 2-year technology program was implemented in 1949 and accredited by the Engineers' Council on Professional Development (ECPD) in 1953. The baccalaureate degree program, first implemented in 1966, was accredited in 1970 as "Bachelor of Technology in Civil Engineering Technology." In 1978 that degree title was changed to "Bachelor of Science in Civil Engineering Technology" (BSCET) and in 1983 to "Bachelor of Science - Surveying."

Before the change to "BS Surveying" the BSCET degree was accredited by the Technology Accreditation Commission (TAC) of Accreditation Board for Engineering & Technology (ABET, formerly ECPD). The OIT "BS Surveying" degree is now accredited by the Related Accreditation Commission (RAC) of ABET.

Prior to 1984 ABET would consider a program for accreditation according to program critria under either the:

Engineering Accreditation Commission (EAC) or the
Technology Accreditation Commission (TAC).

Beginning in 1984, ABET will also consider a program for accreditation according to program criteria under the:

Related Accreditation Commission (RAC).

The OIT "BS Surveying" program was one of two programs evaluated by ABET/RAC in 1984. The other one is the program at Ferris State in Big Rapids, Michigan. Since then two additional programs have been evaluated by ABET/RAC, one at University of Florida in Gainsville and one at Michigan Technological University in Houghton.

REASONS FOR SEEKING RAC ACCREDITATION

Aside from obvious reasons of prestige, there are practical reasons for seeking RAC accreditation for the OIT surveying program.

1. The title of the BSCET degree belied the rigor and content of the surveying curriculum. The TAC program cirteria were designed for engineering technology programs but the OIT BS surveying curriculum grew and matured far beyond those minimum levels.

2. Various state boards of engineering examiners ask questions from time to time about the value of a "technology" degree presented by OIT graduates seeking registration. In some cases, no degree at all is better than trying to explain (and get credit for) the educational content of BSCET degree in surveying?

3. As a service to OIT surveying graduates (and their employers) it was decided to change the name of the BSCET surveying degree to "BS Surveying." The name change was approved in 1983.

4. Paralleling those developments at OIT, nationwide discussions between ACSM and ABET resulted in formation of the Related Accreditation Commission within ABET.

5. By default, the only ABET surveying accreditation option open to OIT is the RAC. TAC will not acredit any program not containing the word "technology" in the degree title and, given the polytechnic mission of OIT, EAC accreditation is out of the question. At one time (before RAC was formed) it was suggested OIT should pursue "non-traditional" EAC accreditation, but that was not given serious consideration by OIT administrators.

CURRICULUM DESIGN CRITERIA

In presenting "The BS Surveying Degree at OIT" to the 11th Surveying Teachers' Conference in 1984, I listed and discussed the following factors affecting surveying curriculum content:

1. General education requirements imposed by the Oregon State System of Higher Education.
2. The Oregon State Board of Engineering Examiners syllabus of topics to be included in a 4-year surveying curriculum.
3. Alumni feedback relating to specific applicaitons in geodesy and computer applications.
4. ABET/RAC program criteria for Surveying & Mapping programs as submitted by ACSM to ABET and approved by the ABET Board of Directors.
5. Examples drawn from other surveying programs.
6. Talents and expertise of existing faculty to teach given courses.

The point of repeating the list here is to highlight the shift we had to make relative to the hierarchy in preparing for the next visit. In effect, we had to move the ABET/RAC criteria to the top of the list. Fortunately, we were still able to meet the general education requirements and Oregon State Board of Engineering Examiners' criteria.

We did, however, have to ask the OIT curriculum planning commission to make exceptions to two established campus-wide policies in order to accommodate the changes required to meet ABET/RAC criteria. We had to increase the total number of credit (quarter system) hours to 203 (from 200) and we had to reduce the business component from 12 credits to 9. Both changes were contrary to established campus policy and were quite difficult to get approved.

ABET/RAC REQUIREMENTS

Specific ABET/RAC minimum requirements for Surveying & Mapping and Similarly Named Engineering-Related Programs include:

I. Basic Science & Mathematics

A.	Basic science	15 semester hours
B.	Mathematics beyond trigonometry	15 semester hours

II. Engineering-Related Sciences

A.	Surveying & Mapping Sciences	15 semester hours
B.	Surveying & Mapping Professional Practice	15 semester hours
C.	Combination of above	15 semester hours

It is not my intent to promote or take issue with existing criteria, but to describe our experience in meeting them. First, it should be noted that RAC criteria for surveying programs were never intended to be "between" engineering and technology, but to exist as "equal to but different from" the traditional design catagories found in the engineering criteria.

If RAC criteria are to be considered "equal" to EAC criteria, it is paramount that the basic science and math components are comparable. Although the math requirement of the RAC "Program Level and Course Requirements" states college algebra is the normal beginning point for the study of mathematics in engineering-related programs, the more restrictive "Program Criteria for Surveying & Mapping and Similarly Named Engineering-Related Programs" submitted by ACSM states unequivocally that the 15 semester hours of mathematics shall be in courses beyond trigonometry. Admittedly, the EAC mathematics requirement states that math studies must include differential and integral calculus and differential equations while the more restrictive (?) ACSM "Program Criteria for Surveying and Similarly Named Engineering Programs" states that coursework in mathematics must include matrix algebra and statistics.

Including additional math in the OIT surveying curriculum was not necessarily popular with students, but (other than increasing total credits for the surveying degree) it was not a big problem either. OIT offers numerous excellent math courses and we already had a surveying least squares elective being taught each year which can count toward the math requirement.

Meeting the basic science criteria was more of a problem. OIT surveying students routinely take the physics/chemistry courses, but we needed another course to meet the 45 quarter hours of combined math/science required by RAC. We solved that problem by removing the "science" component from our Field and Geodetic Astronomy course and having it taught by the math/physics department as a generic astronomy class available to all majors. Surveying students taking Field and Geodetic Astronomy are required to take the science course in astronomy as a prerequisite. They also have a separate science elective which is generally met with chemistry, biology or other earth science course.

Given the number of surveying courses offered at OIT, it was not difficult to meet the total program requirements in Surveying & Mapping Sciences, but on the first visit we were judged deficient in meeting two of the following six catagories. (RAC requires acceptable course offerings in at least 5 of the 6 areas.)

1. Field surveying instruments and methods.
2. Photogrammetric mapping and image interpretation and remote sensing.
3. Surveying calculations and data adjustment.
4. Geodetic coordinates and astronomy.
5. Cartographic representation, projections and map production.
6. Computer-based multipurpose cadastre, geographic information systems.

We met the first 4 catagories with room to spare on the first RAC visit. We made no serious attempt to meet the computer-based multi-purpose cadastre catagory because we felt we had covered the other five items acceptably. However, the visitation team requested significant changes in the cartographic catagory. We since redesigned our "advanced surveying computations" course to include additional conformal mapping theory along with the state plane coordinate material. The redesigned course will also cover additional cartography topics.

The 1987-88 curriculum is listed in Appendix A and shows each course the student is expected to take in each of the 12 terms on campus. Note there are few "free" electives as we had to meet the demands of many masters in putting it all together. We are convinced, however, of the quality in the program and are proud of what we have to offer anyone desiring to earn a BS Surveying degree. We have a number of exceptional students who graduate with the BS Surveying degree each year and those who go on to graduate school seemingly do quite well.

EFFORTS TO MAINTAIN A ROBUST SURVEYING PROGRAM

It is impossible to build a perfect curriculum, but we continually strive to improve what we have and to adpat to ever changing opportunities within the surveying profession. Some of our efforts include:

1. Implementing "field-to-finish" technology and procedures.

   In 1985 we submitted a grant proposal to the National Science Foundation for purchase of a Wild Field-to-Finish system including the T2000 electronic theodolite, DI-5 EDM, data collector, HP computer, HP plotter and surveying software. The grant was approved and we took delivery of the final components in September, 1986. Using the system represents a quantum leap in our efforts to stay current.

2. Nurturing our existing Co-op program.

   The Co-op program, especially with the Bureau of Land Management, has been extremely beneficial to the OIT surveying program. Students are also employed under a co-op arrangement with other organizations and federal agencies but not nearly to the extent as with BLM. Since beginning in 1968 over 150 students have participated in the co-op program and most went on to earn the 4-year degree in surveying. Many of them are still with BLM.

3. Recruiting talented young people.

   In 1981 OIT had more surveying students than we had staff or equipment to accommodate. Since then surveying enrollment has dropped, first to comfortable levels, then below. We now find ourselves in a position of consolidation and agressive recruiting. On the positive side, placement has been quite good the past several years, but it is hard to compete with the "glamour" programs on campus (computers and electronics) for talented students. The local chapter of the Professional Land Surveyors of Oregon sponsored a TRIG-STAR contest in one local high school last year and in 5 area high schools this year. In each case we had an opportunity to visit the school and demonstrate modern surveying equipment to the whole class who took the test. Response to that kind of personal contact is quite favorable.

4. Recruiting within the profession.

   Another co-op program benefit is the recruiting co-op students do for surveying. One estimate is that each person out on 6 months of co-op is responsible for two others deciding to attend OIT. While it may be an overstatement, the point is that our students are our best recruiting ally. With enrollment down the way it is, a greater effort is being made to involve current and former students in recruitment activities. Finally, we take advantage of opportunities such as this meeting to share with and learn from others having similar interests and concerns.

5. Organizing an alumni event for surveying graduates.

   During 1986-87, OIT is celebrated it 40th anniversary. Rather than one huge event, it was decided to stage numerous "small" events throughout the academic year. The surveying curriculum held a GPS Workshop for the surveying alumni May 29-30, 1987 with Larry Hothem of NGS as the featured speaker and several vendors attending to demonstrate various receivers. Response to the idea was very favorable and many persons participated to make it a success. (This paper is being written before the fact. Details of the event will be delivered in person.)

LOOKING TO THE FUTURE

What does the future hold for the program at OIT and for the surveying profession at large? I don't have a crystal ball, but according to OIT President Blake (an avowed futurist), "the future belongs to those who plan for it." I would hope that we as surveying educators might continue discussing issues of mutual interest with the idea of planning intelligently for the future. For myself, I need help to decide:

1. Is surveying registration really necessary? It is so easy to become registered, you don't need to have a formal education if you are willing to study on your own and/or take the test several times. Being registered no longer (if it ever did) separates the professional from the technician. I certainly agree registration is a milestone in the life of each practicing professional, but current standards of "minimum competency" are much lower than they should be?

2. Shouldn't all surveyors be required to meet similar minimum educational requirements as other professionals? Much of the innovative work being done in the surveying profession is not by surveyors, but by cartographers, photogrammetrists, geodesists, engineers, land planners, and computer specialists. Is surveying as a profession being defined too narrowly to achieve the "critical mass" necessary for its success? I'm afraid it is.

3. What is the difference (if any) between surveying and engineering? The debate has been going on my entire professional life and the arguments have come full circle. Each profession promotes a definition which serves a given interest at a given time. Is it possible to write an acceptable definition of engineering which excludes surveying? I rather doubt it. On the hand, modern survey practice goes far beyond the traditional scope of engineering in many areas. Is it practical, necessary or possible to define either to the exclusion of the other? I think not.

CONCLUSION

The surveying program at OIT has grown from offering a 2-year degree in the 1950's to a 4-year BT degree in the 1960's to a 4-year BSCET degree in the 1970's to an RAC accredited BS Surveying degree in the 1980's. Leaders of the program have been sensitive to the growth of surveying as a professional entity and have strived to serve the needs of the practicing professional as well as each student. Questions remain as to the success of RAC and its acceptance by 1) the surveying profession and 2) other professions. Regardless of the changing status of surveying in relation to engineering or other professions, the faculty at OIT are committed to providing each tuition paying student an opportunity to learn as much as possible about surveying. It is an exciting profession and one with many challenges for us all in the years to come.

REFERENCES

1. _____, (1986), "1985 Annual Report," Accreditation Board for Engineering and Technology, New York, New York.

2. Burkholder, Earl F., (1984), "The BS Surveying Degree at OIT," XIth Surveying Teachers' Conference, Fresno, California.

3. Burkholder, Earl F., (1986), "Recruiting Surveyors," ASPRS-ACSM Fall Convention, Anchorage, Alaska.

APPENDIX

OREGON INSTITUTE OF TECHNOLOGY

Bachelor of Science Surveying Curriculum
1987-88

Freshman Year

Fall		Cr
CET	131 Fundamentals of Surveying	5
EngT	101 Intro. to Engr. Problems	4
Mth	104 College Algebra	4
Wr	121 English Composition	3
PE	190 Physical Education	1
		17

Winter		Cr
CET	103 Plat Drafting	3
CET	132 Surveying Computations	3
EngT	110 Statics	3
Mth	105 Trigonometry	4
Wr	122 English Composition	3
PE	190 Physical Education	1
		17

Spring		Cr
CET	128 Contract Documents	3
CET	133 Route Surveying	5
Mth	106 Anal Geo & Intro to Calc	5
Sp	111 Fundamentals of Speech	3
		16
		50

Sophmore Year

Fall		Cr
CET	210 Fluid Mechanics	3
CET	212 Fluid Mechanics Lab	1
CET	233 Instrument Techniques	4
CET	240 Survey Law I	3
Ph	201 General Physics	4
	Health Elective	2
		17

Winter		Cr
CET	230 Geometrics	3
CET	235 Land Descriptions & Cadastre	4
Ph	202 General Physics	4
Wr	227 Technical Report Writing	3
	General Elective	3
		17

Spring		Cr
CET	220 Engineering Geology	3
CET	232 Const. & Engr. Surveying	4
CET	237 Boundary Surveying	5
	Elective: SSc or Psy	3
PE	190 Physical Education	1
		16
		50

Junior Year

Fall		Cr
CET	333 Control Surveying	4
Ph	203 General Physics	4
Mth	200 Calculus I	4
	Computer Programming El.	3
Sci	215 Topics in Astronomy	3
		18

Winter		Cr
CET	332 Computer Applications }	* 4
CET	301 Water & Sewer System Dsgn }	
Mth	201 Calculus II	4
BA	321 Financial Accounting	3
Psy	201 Psychology	3
	Humanities El. (300 Rec.)	3
		17

Spring		Cr
CET	338 Subd'n Planning & Platting	4
Sp	321 Discussion Processes	3
Mth	411 Statistical Methods	3
	Economics Elective	3
	Science Elective	4
		17
		52

Senior Year

Fall		Cr
CET	324 Photogrammetry	4
CET	434 Geodetic Position Comp.	4
	Social Science Elective	3
	Humanities Elective	3
	General Elective	3
		17

Winter		Cr
CET	428 Cartographic Applications	5
BA	340 Industrial Economics	3
Wr	327 Advanced Technical Writing	3
	Humanities Elective	3
	Math Elective	3
		17

Spring		Cr
CET	433 Advanced Road Design }	* 4
CET	431 Field & Geodetic Astronomy }	
CET	440 Survey Law II	3
CET	Elective	3
BA	Elective	3
	Math Elective or CET 435	4
		17
		51

* One of the two courses is required. The other can used as an elective.

Available CET electives include, but are not limited to:

CET 223 Soil Mechanics	CET 330 Modern Survey Instrumentation
CET 295 Cadastral Techniques	CET 407 LSIT Review
CET 303 Hydrology & Design of Drainage Structures	CET 435 Adjustment by Least Squares
	EngT 390 & 490 Co-op

An Associate Degree in Surveying Engineering Technology will be awarded upon completion of the Freshman and Sophmore years, 100 credit hours.

The Bachelor of Science - Surveying will be awarded to those fulfilling the requirements for all four years as listed above, 203 credit hours.