

Submission date: January 31, 2020

Program/s in this review: Geomatics (AAS-BS)

Specialized accrediting agency (if applicable): ABET

Campuses where the program is delivered: Anchorage

Members of the program review committee:

- Caixia Wang, Associate Professor & Department Chair, Program Committee Chair, UAA
- Gennady Gienko, Professor, UAA
- David Brock, Term Assistant Professor, UAA

1. Centrality of Program Mission and Supporting Role (700 words or less)

Relevancy of the programs

- Geomatics BS program is one of only 20 four-year programs in this discipline in the US that are ABET-accredited under the Applied and Natural Sciences or Engineering Accreditation Commissions, and the **only** program of its type in **Alaska**. We are one of the few programs that offer both 4-year and 2-year degrees in the same department.
- The program provides the level of education required by the State of Alaska in obtaining professional surveying licenses.

Supporting other academic programs

- Our program provides service courses to *Civil Engineering* to meet its ABET requirements and *Construction Management*.
- Other support provided to other academic programs described in the next section.

Partnerships with outside agencies, businesses, or organizations

- Our BS program is developing a **2+2 program partnership** with the matched AAS program at *Bellingham Technical College (BTC)* in Washington State. Initial intention has been agreed upon by both programs and their associated colleges; articulation agreement in progress.
- The program has a very active and strong **Advisory Board**, representing both government and industry stakeholders, which are our primary external stakeholders.
 - In the summer of 2019, Geomatics Advisory Board led a fund-raising effort to financially support the department in order to offer scheduled courses in fall 2019, due to its recent departure of 2 full-time faculty members followed by a hiring freeze caused by significant budget reductions. **In less than three weeks, the effort raised slightly over \$150k.**
- The program continues to be the **program of choice** for State and Federal agencies and private companies in Alaska to hire both student interns and entry-level professionals.
- The department partnered with **National Geodetic Survey (NGS)** of NOAA to manage a CORS station on the roof of ECB, which was part of the CORS network providing Global Navigation Satellite System (GNSS) data in support of various applications throughout the US, its territories and a few foreign countries.
- The program has been proactive in planning and organizing the **Alaska Surveying and Mapping Conference**, held in Anchorage/Fairbanks each year.

Specific workforce development and employment opportunities relevant to the program

- The education offered by the program is required by the State of Alaska in acquiring professional surveying licenses.
- A serious **shortage** of qualified and skilled workers in geospatial industry, representing a multi-billion sector of the US economy, exists to meet the demands of this fast-growing industry, driven by an aging workforce and low replacement rates according to National Society of Professional Surveyors (NSPS).

- U.S. Bureau of Labor Statistics, Employment Projections program writes “Job opportunities for those with a bachelor’s degree in surveying or a related field are expected to be excellent. ... As a result, those with the right combination of skills and a bachelor’s degree from a school accredited by ABET will have the best job opportunities.” Additionally, the report states that employment opportunities, over the next decade (**2018-2028**), for surveyors will increase by **6%**, cartographers & photogrammetrists, and GIS specialists will increase by **15%**. All these employment opportunities will require a baccalaureate degree in Surveying or a related field, that our program covers
- Many local employers are forced to employ graduates from out of state (19% of the workforce is nonresident), suggesting the potential growth of the program to meet demand.

Sources of extramural support and funding for the program

- **Excellence in Geomatics** fund donated from industry stakeholders to fully support the term faculty position and adjunct faculty positions in AY 2020-2021
- **Al Talcott Surveying and Mapping** fund donations
- 2013 Microsurvey, Star-Net Software Grant
- ESRI and PCI Natural Resources Imagery Grant
- Technical and Vocational Education Program (TEVP) unencumbered fund
- Russian Academy of Science and Department of Education
- DAT/EM Software Grant
- Selected examples of funding agencies/companies for sponsored research projects in the program:
 - Anchorage City Museum
 - US Army Corps of Engineering
 - US Geological Survey
 - Department of Homeland Security
 - USDA Natural Resources Conservation Service
 - Hilcorp Energy Company
 - NASA/EPSCOR
 - NSF

Any high demand job designation for the program

- BS Geomatics is listed as a “high demand” degree.
- Geomatics is emerging information technology. In addition, it is one of the fastest-growing information sciences in the United States with geospatial technologies and their applications in every major industry.

2. **Program Demand (including service to other programs), Efficiency, and Productivity (7 year trend; 1400 words or less)**

External program demand

- The State of Alaska requires a four-year ABET-accredited baccalaureate degree in Geomatics for education requirement in obtaining licensure. The geomatics program is the **only one** in the state of Alaska and is **one of the largest**, if not the largest, across the USA. The closest places to get a BS degree in surveying in the US are Oregon, Idaho, and California.
- The nature of the Geomatics profession requires frequent and prolonged fieldwork in the Alaskan wilderness, and the employers often mention that once graduated, Alaskan students are well fit in this environment and tend to stay in Alaska.
- The enrollment data show a **41% increase** in the declared majors in the program during the last 7 years, which indicates strong external demand. Another observation is the changes in student demographics: while the majority of student population in 2013 were non-traditional students, in today’s class 69% are under the age of 29, with the steady trend of increasing popularity among high school graduates - 38% of students had enrolled in the program straight after the high school. This is a reflection of the continuous effort of the Geomatics department and the College in outreach and recruitment activities.
- The graduates from the Geomatics programs are **100%** employed within a few months after graduation. In fact, most students get their jobs while pursuing Geomatics degrees. The main employers are Federal and State

Agencies and corporations (BLM, DOT, DNR, USGS, Alaska Railroad, etc.), Municipality of Anchorage, Mat-Su and other boroughs, Alaska Native Corporations (CIRI, Ahtna, Tatitlek, and others), as well as large national companies and small businesses (Enstar, Chugach Electric, Alyeska Pipeline, ConocoPhillips, BP, and others).

- Industry professionals require many of our courses for professional development as the geospatial technologies continue evolving.

Internal program demand

- The program offers service courses to students majoring in Civil Engineering, and students majoring in Construction Management.
- Geomatics department classes are approved for elective credits for the BA/BS degrees in *Environment and Society*, *Natural Sciences*, and *Legal Studies*.
- Our program offers **Minor in GIS**, and **GIS** courses to support other BS/BA programs and graduate programs in disciplines such as *Geological Sciences*, *Biological Sciences*, *Geography and Environmental Resources*, *Environmental Science*, *Fisheries*, etc.
- The program supports the *Interdisciplinary Studies Master's program* and *graduate programs* in other departments such as *Anthropology*, *Geological Sciences*, *Biology Sciences*, etc.

Efficiency

- *Graduation time and rate.* On average, with the enrollment of 81, we graduate 15 students per year. In spite of the fact that most students have part-time or full-time jobs in the geomatics industry, it takes 4.9 years for the average student to graduate with a BS degree from our program. The IR data confirms the stable rate of graduation during the past 7 years.
- *Course pass rates.* The program offers classes with two prefixes: GEO (Geomatics) and GIS (Geographic information systems). The course pass rates are 90-93% in the Geomatics courses, and 77-90% in GIS classes. The data show very high graduation rates, which indicate that students who failed (or dropped) a GEO class do typically re-take it next year. Slightly lower pass rates in GIS classes can be explained by the fact that the lower-division (100-200 level) GIS classes are often taken as electives by non-Geomatics majors, who may not be stimulated in re-taking the class.

Instructional productivity

- The SCH production is steady over the last 7 years, and averages in 1,493 credit hours per year. The Full-Time Equivalent Faculty is 4.4 on average
- On the annual basis, the Geomatics Department offers 72 required credits, 13 elective credits for Geomatics majors, and 4 service credits for Civil Engineering and Construction Management programs. To offer required and service courses only (without electives) with the nominal teaching load of 18 credits per academic year, the required FTEF is 4.2 which is in correspondence with the average FTFF from the IR data. The actual number of full-time positions in the department was 4 in all years under the review (plus 6-9 credits taught by adjuncts annually). In the same time, the IR data for 2019 show FTEF= 5.3 for 2019. This value can be interpreted in the way that several faculty members had teaching load exceeding the nominal 18 credits, and to teach all credits in that year the Department would have needed to have one extra full-time faculty with the annual nominal teaching load (18 credits) accepted by the University IR for calculations of FTEF.
- Instructional productivity, expressed as the ratio FTES/FTEF in the IR data is 11.3 on the average, with the average class size of 14.2 students (it will bring the class size value to up to 16 if the Departmental FTEF numbers are used for calculations). While the class size might seem small for many courses (such as GER, and classes in large programs), the smaller classes have certain benefits for technically-focused disciplines which require acquiring hands-on skills not only to use specific equipment but gain practical experience in planning and executing fieldwork in the wild Alaskan environment. The larger classes will be difficult to manage and students in these classes will be disadvantaged. Lab classes, in particular, are conducted in the field with industry-standard equipment, making small sections necessary. In the same time, the Department offers several computer-based classes, which are taught in larger groups using both face-to-face and innovative online technologies (several faculty members participated in the UAA Technology Fellows program and have developed many classes for online delivery under the guidance of the AI@eLearning Department at UAA). To further increase the departmental productivity and reduces the cost of attending the college, the department

is actively participating in the Textbook Affordability movement at UAA adopting the free or low-cost course materials.

Enrollment

- The IR enrollment data are in line with the departmental records and indicate the steady growth of the program. In the past five years, the value of Enrollment/FTEF has increased from 124.1 to 164.6 (a 32% increase) which indicates the growth and sustainable development of the program.
- The program began transitioning its courses to be offered online, in addition to face-to-face delivery, since Fall 2017, which has allowed us to enroll students across the State of Alaska and from around the country.

Cost/revenue

- The average value of Cost/SCH is \$346.94 and Tuition revenue/SCH is \$228.82, which indicates that the tuition covers approximately 66% of the programs' cost, which is above the UAA average (62%).

3. Program Quality, Improvement and Student Success (1500 words or less)

Specialized accreditation process and status

- Originally established in 1971 to meet the needs of industry in Alaska and licensure, a two-year Associate of Applied Science program in Surveying and Mapping was developed. In 1991, it was extended to create a 4-year baccalaureate degree. The 4-year degree was first accredited by ABET in 1995, and has been continuously accredited since then. In the 1990s, the program name was changed from Surveying and Mapping to Geomatics, for both the AAS and BS programs, to reflect the broader offerings.
- Since the overhaul revisions in 2014, three specialized concentrations have been offered in Surveying, Geospatial Science and Geospatial programming.
- The program has evolved to include the latest technologies in Geospatial fields including Geographic Information Systems (**GIS**), Global Positioning Systems (**GPS**), Light Detection and Ranging (**LiDAR**), and Unmanned Aircraft Systems (**UAS**).

Currency of the curriculum, and availability & indications of quality of distance offerings

- In the 2013-14 academic year, the Geomatics department has undertaken an extensive curricular redesign, which began with an extensive industry survey and a focus session with industry representatives and the Geomatics Advisory Board. This effort has been intended to make sure that the program curriculum closely aligns with industry needs. Response from industry has been very favorable towards then new curriculum.
- The program began transitioning its courses to be offered online, in addition to face-to-face delivery, since fall 2017. The program currently has over 90% courses transitioned completely, with a goal to complete all courses in spring 2021. The program has installed two new dedicated servers in summer 2014 and fall 2018, which have helped to enhance and extend our distance delivery options so that more students can access the education we provide.
- Most core Geomatics courses have been revised to model the "Quality Matters" standard as the department has started to offer the courses required for the program via distance. Two faculty have enrolled and passed the "Quality Matters" course offered through UAA. The other faculty in the program will complete the course as time allows. In addition, through the synchronized delivery and partnering with local licensed surveyors, all enrolled students (online or face-to-face) are ensured to have the equivalent learning experiences and achieve the same learning outcomes from the program.

Innovative program design

- We are one of the few programs that offer both 4-year and 2-year degrees in the same department. The AAS degree is designed to be completed included in the BS degree. This allows students who complete the surveying concentration in the AAS degree to be entitled to the BS degree in the same department.

Program student learning outcomes assessment

- The program has an assessment process to collect data on student outcomes, and an evaluation process that shows how this data is used to improve the program. The evaluation process contains both direct and indirect measures. Direct measures allow the examination or observation of student knowledge against a measurable norm. Indirect measures attempt to ascertain the value of the learning experience through methods that do not

involve actual student performance related to a specific outcome. A disadvantage of indirect measures is that assumptions must be made regarding the results of activities such as exit interviews, focus groups, and questionnaires. Accordingly, direct measures of student outcomes provide important advantages in program assessment.

- The Assessment of the AAS Geomatics program is tied directly to the ABET-accredited Bachelor of Science program in Geomatics. Both programs share the same core course and the AAS program is a subset of the BS program. As such, both programs by default go through a rigorous assessment, and model the ABET criteria for continuous improvement.
- The Bachelor of Science in Geomatics underwent an ABET general review and site visit in 2016. This resulted in reaccreditation for the program. It can be implied that the AAS should also be commended and noted as being a strong program.
- ABET selected the BS in *Geomatics 2016 Self Study* to display at the 2017 ABET Symposium as an example of an especially well-prepared report. Only a few dozen reports receive this honor internationally each year. The report included general criteria, students, program educational objectives, student outcomes, continuous improvement, curriculum, faculty, and facilities. Since the AAS models the BS Program assessment plan and the results of our ABET visit were very favorable, it is believed that the current system of assessment should be continued.

How well the program is doing on student success and what it is doing to facilitate it

- The program has a field lab component integrated into each core course. Many students have had internship opportunities through local government and private sector employers. Both of these are considered “student engagement in high impact practices” featured by the program.
- Students are widely involved in undergraduate research supervised by faculty in the program. The department encourages students to present at the local conferences such as the Alaska Surveying and Mapping Conference. The capstone class promotes students to work with industry, serve community and partner with professionals to tackle problems in the real world. Every year, the Geomatics Advisory Board members are invited to attend the presentations of capstone projects. Selected projects will be presented to the College of Engineering Advisory Board each year.
- Since the year of 2015, the program does mandatory advising for each Geomatics student. The advising takes place at the end of each semester, two weeks before the start of the enrollment. The faculty advise students on the choice of courses, their sequence, and check the program and university requirements in order to ensure that students will graduate without unnecessary delays due to taking classes out of sequence or not meeting prerequisites.

Student accomplishments

Upon graduation from the AAS Geomatics program, some students start working in the local industry, but the majority of students subsequently enroll in our Bachelor of Science degree. There is an increasing trend that the Geomatics AAS students return to the university to continue their education and receive a Geomatics BS degree from our department.

Some selected accomplishments of our BS and AAS students:

- 100% of our graduates who are pursuing careers in the surveying area have attempted the AELS Board’s Fundamentals of Surveying examination, with an overall pass rate of 100%.
- 89% of graduates became members of professional organizations relevant to their career of choice.
- 95% of graduates found employment in the fields within the Geomatics disciplines, including surveying of various types, mapping and cartography, GIS/LIS, remote sensing, geodesy, photogrammetry or hydrographic surveying.
- 100% of graduates will have completed at least one professional development course or session, or completed one higher education course.
- At least 50% of graduates will have taught at least one workshop or training session, made one conference presentation, or published one article relevant to their career.

- 21.4% of students are accepted into the next-stage academic program.
- We currently enjoy a 100% job placement upon graduation. The majority of our students are employed in either government or industry during the summer and over the school year.

We are unable to fill all requests for summer internships, and continue to be the *program of choice* for State and Federal agencies and private companies in Alaska to hire both student interns and entry-level professionals, such as Bureau of Land Management, US Forest Service, Alaska Department of Transportation and Public Facilities, Alaska Department of Natural Resources, R&M Consultants, Frontier Precision, Quantum Spatial, SurvBase, to name a few.

4. Program Duplication / Distinctiveness (300 words or less)

We are the *only* Geomatics program in the State of Alaska. Even more, this program is one of 20 ABET-accredited programs nationwide, which produce baccalaureate graduates in Geomatics or closely related fields. The nearest equivalent program is in Calgary, Canada, and after that, in Oregon. The closest in size of student population and breadth of the course offering is the Geomatics program at the University of Florida.

5. Summary Analysis (500 words or less)

Benefit to Institution

The Geomatics program benefits the institution by providing job-ready graduates that meet the needs of government and industry in the State of Alaska. The program is the only one of its kind in the State, attracting significant attention from industry and the community in the State and throughout the nation. Our enrollments are higher than many of the other well-known Geomatics programs in the country. The quality of our program enhanced the stature of the Institution.

Tie to Institution's Mission

The Geomatics program meets the mission of the University of Alaska Anchorage by disseminating knowledge of one of the world's oldest, but continuously evolving occupations through teaching, research, and service. The program helps the Institution to meet the educational and career needs of Alaskans in the vast geographical area that is Alaska and around the country.

Essential to The Institution

Geomatics offers courses that other programs rely on. Geospatial information is intertwined in every science major on campus and with many industries in Alaska and in the world. For example, we support the surveying instruction for the civil engineering and construction management programs, GIS instruction for Natural Sciences, Geography, Anthropology, Environment & Society, and boundary law courses for the degree in Legal Studies (basically, our field is essential for anyone who uses maps for their disciplinary work).

Unique Service

Geomatics is the only program in the State of Alaska that leads to Professional Surveying licensure. In addition, geospatial graduates and people with geospatial training are in high demand which demonstrates a unique service to the citizens of Alaska. Our graduates are eligible to be certified as a GIS Professional (GISP).

The high job demand and recognized reputation of the Geomatics program by the industry stimulate the currently enrolled students to stay on track and complete the degree in time. It is also assuring potential students and their parents in the high value of the degree, strong employment opportunities in the fast-growing industry, and perspectives of professional growth. Combined with online options, and strong, continuous industry support and industry-funded scholarships, the Geomatics program is a very attractive and viable option for many young generations (Alaskans and beyond) seeking a reputable profession and rewarding future.