

ACADEMIC AFFAIRS COUNCILS

AGENDA ITEM: 4.D (1)

DATE: June 10, 2015

SUBJECT: Intent to Plan: SDSU Bachelor of Science in Precision Agriculture

South Dakota State University (SDSU) requests approval to develop a proposal for a Bachelor of Science (B.S.) degree in Precision Agriculture. The program would include interdisciplinary collaboration between the Department of Agricultural and Biosystems Engineering, the Department of Plant Science, the Department of Mathematics and Statistics, and the Department of Electrical Engineering & Computer Science. The program would prepare students for careers bridging the gaps between agronomy, agriculture machinery management, and data sciences through high-speed sensor technology as well as preparing students to use data in agronomic decision-making processes. Precision Agriculture is a quickly growing field, yet no other university currently offers a major; approval of the program would give SDSU a first-to-market advantage.

University Mission and System Strategic Goals

South Dakota Board of Regents Policy 1:10:2 establishes the mission of SDSU to serve as the “Comprehensive Land Grant University to meet the needs of the State and region by providing undergraduate and graduate programs of instruction in the liberal arts and sciences and professional education in agriculture, education, engineering, human sciences, nursing, pharmacy, and other courses or programs as the Board of Regents may determine (SDCL 13-58-1).”

The proposed baccalaureate major in Precision Agriculture meets the mission of SDSU by providing undergraduate instruction in agriculture, science, and engineering. In addition, the program aligns with SDSU’s strategic plan, IMPACT 2018, and the Board of Regents 2014-2020 Strategic Plan by increasing the total undergraduate degrees awarded, improving retention rates, improving academic quality and performance, and promoting economic development and research.

Related Programs in the System

No related programs exist within the Regental system. The Board of Regents approved minors at SDSU in Precision Agriculture and Engineering for Precision Agriculture in April of 2014.

RECOMMENDED ACTION

Move forward. Provide comments and concerns to Jay Perry.

Workforce Need, Student Demand, Projected Graduates

SDSU notes the 2014 South Dakota Ag Economic Contribution Study from the SD Department of Agriculture shows the crop sector provides over 70,000 jobs in South Dakota and the broader agricultural sector provides 20% of the state's employment. Precision Agriculture is viewed as an integral aspect of agricultural production's future. Employers voicing demand for graduates trained in Precision Agriculture include Raven Industries, Monsanto, and DuPont-Pioneer. The minor in Precision Agriculture (approved last year) already has 33 students enrolled. SDSU projects graduating 12 students per year with the Precision Agriculture major after full-implementation.

Board Policy

SDSU is not requesting any exceptions to Board Policy.

Off Campus and Distance Delivery

SDSU does not intend to request authorization to deliver the program online or off campus.

Budget and Resources

SDSU does not request any new State resources to implement or maintain the proposed program. SDSU will fund the program through reallocation of existing resources and external sources.

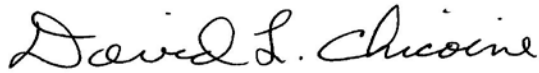
SDSU anticipates requesting a program fee of \$80 per credit hour consistent with the existing Agricultural Systems Technology program fee upon program approval.

South Dakota Board of Regents
Intent to Plan for a Baccalaureate Major in Precision Agriculture

UNIVERSITY:	South Dakota State University
DEGREE(S) AND TITLE OF PROGRAM:	Bachelor of Science, Precision Agriculture
INTENDED DATE OF IMPLEMENTATION:	Fall 2016

University Approval

To the Board and the Executive Director: I certify that I have read this intent to plan, that I believe it to be accurate, and that it has been evaluated and approved as provided by university policy.



 President of the University

 May 21, 2015

 Date

After approval by the President, a signed copy of the proposal should be transmitted to the Executive Director. Only after Executive Director review should the proposal be posted on the university web site and the Board staff and the other universities notified of the URL.

1. What is the general nature of the proposed program? What is the expected demand for graduates in South Dakota? What is the need for the proposed program?

South Dakota State University (SDSU) requests permission to plan a Bachelor of Science degree in Precision Agriculture. The general nature of the proposed program is to prepare students for careers that bridge the gaps between agronomy, agriculture machinery management, and data sciences caused by the rapid evolution of high-speed sensor technology. Graduates from this program will be prepared to meet the rapidly advancing, multifaceted, need of incorporating ever larger amounts of data into agronomic decision making processes. The proposed program would be developed through an interdisciplinary collaboration between the Department of Agricultural and Biosystems Engineering, the Department of Plant Science, the Department of Mathematics and Statistics, and the Department of Electrical Engineering & Computer Science. By integrating fundamental knowledge from these diverse curriculum areas into one program, SDSU will prepare graduates to lead the “Big Data” revolution that is sweeping across all areas of agriculture.

Expected Demand for Graduates in South Dakota

The expected demand for these graduates in South Dakota is great because agriculture is a major driver of the South Dakota economy. The 2014 South Dakota Ag Economic Contribution Study, authorized by the SD Department of Agriculture, found that the crop sector of South Dakota agriculture alone provided 12% or 70,104 jobs in South Dakota. The entire agricultural sector provides 20% of the employment in South Dakota.¹ Precision Agriculture will be an integral part of future agricultural production and a thorough knowledge in precision agriculture will be a prerequisite for obtaining many future jobs in agriculture.

¹ <https://sdda.sd.gov/legacydocs/Secretary/PDF/2014.south.dakota.ag.economic.contribution.study.pdf#page=23>

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Need for the Proposed Program

Most farmers lack the expertise to take full advantage of the wide range of available precision agriculture technology. That creates a significant job market for people who can provide these services to farmers. Farmers depend on seed suppliers, fertilizer suppliers, chemical suppliers, machinery suppliers, and others who have the specific expertise to help them maintain an economically sustainable enterprise. Each and every one of these agronomic service providers needs employees knowledgeable in current precision agriculture technology. They also need employees who understand new technology as it is developed.

Companies such as Raven Industries in Sioux Falls, who invents, designs, manufactures, and sells electronic hardware that allows many practices in precision agriculture to be possible, need well educated employees in all aspects of their business. Companies such as Monsanto and DuPont-Pioneer need highly trained agronomists who can use high output tools to collect, analyze, and interpret information on their numerous test plots scattered across South Dakota. SDSU's first-in-the-nation Precision Agriculture major will contribute greatly to this workforce.

2. What is the relationship of the proposed program to the University's mission as provided in South Dakota statute and Board of Regents Policy?

The statutory mission of South Dakota State University in SDCL 13-58-1: *Designated as South Dakota's Land-grant University, South Dakota State University, formerly the State College of Agriculture and Mechanical Arts, located at Brookings, in Brookings County, shall be under the control of the Board of Regents and shall provide undergraduate and graduate programs of instruction in the liberal arts and sciences and professional education in agriculture, education, engineering, human sciences, nursing and pharmacy, and other courses or programs as the Board of Regents may determine.*

Board Policy 1:10:2 South Dakota State University Mission Statement authorizes associate, baccalaureate, first professional and graduate degrees. SDSU may offer "Baccalaureate programs in the agricultural sciences, aviation, education, engineering and technology, human sciences, humanities and liberal arts, nursing, performing and visual arts, pharmaceutical sciences, physical and biological sciences, and social sciences." A major in Precision Agriculture meets the mission of SDSU by directly providing undergraduate instruction in science, engineering, and agriculture.

A major in Precision Agriculture supports the Board of Regents Strategic Plan 2014-2020:

1. Student Success

- Increase total undergraduate degrees awarded
 - The new program would be the first of its kind in the United States, and would allow SDSU to attract students from South Dakota as well as out of state and international.
- Improve retention and graduation rates
 - The new program would foster improved first-year retention as well as improved four and six year graduation rates. The first to market advantage for

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the program at SDSU would position the university as a leader in a field that garners significant student interest in the Midwest region.

2. *Academic Quality and Performance*
 - Grow the number of students participating in experiential learning
 - The new program's interdisciplinary nature would increase students' exposure to hands-on, experiential learning with apropos internship opportunities in many different occupational specialties.
3. *Research and Economic Development*
 - STEM Education
 - The new program would foster an increase in graduation in the STEM fields, with a strong emphasis on agronomy, data sciences, mathematics and statistics, and agricultural systems technology.
 - Economic Development
 - The new program would provide a stream of graduates that are well prepared to work in the fast growing precision agriculture sector, both in South Dakota and around the world.

3. Are there any related programs in the regental system? If there are related programs, why should the proposed program be added? If there are no related programs within the system, enter "None."

None

4. Are there related programs at public colleges and universities in Minnesota, North Dakota, Montana, and Wyoming?² If there are related programs in these states list below under each state and explain why the proposed program is needed in South Dakota. If there are no related programs in a state, enter "None" for that state.

Minnesota	None
North Dakota	None
Montana	None
Wyoming	None

² This question addresses opportunities available through Minnesota Reciprocity and the Western Undergraduate Exchange in adjacent states. List only programs at the same degree level as the proposed program. For example, if the proposed program is a baccalaureate major, then list only related baccalaureate majors in the other states and do not include associate or graduate programs.

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5. Are students expected to be new to the university or redirected from other programs? How many majors are expected in the first years of the program? How many graduates are expected?

It is expected that students for this new major will be both new to the University and redirected from other programs. A portion of the students currently enrolled in Agronomy, Agricultural Science, and Agricultural Systems Technology may be interested in the new major. This interest is based on student enrollment in current classes focused on precision agriculture. The minor in Precision Agriculture was listed in the catalog for the first time in the fall of 2014 and was awarded to 4 graduates in December of 2014. One more graduate will receive the minor in the spring of 2015. Thirty-three students have currently declared their intent to pursue the Precision Agriculture minor. The Engineering for Precision Agriculture minor has two students listed as pursuing the minor and two students already received the minor in December of 2014. A significant effort will be made to attract students to SDSU from across the region and nation through marketing and via an on-line introduction to precision agriculture. We will develop this course for unlimited enrollment similar to Oklahoma State University, who is offering a MOOC entitled "Farm to Fork" with an enrollment of 600 students. A MOOC in precision agriculture will draw on an untapped market. One option that will be explored is awarding credit for the MOOC after a student has completed a higher level class on campus. By having this enticement to engage with SDSU faculty, SDSU has an opportunity to build an early relationship with perspective students. This will hopefully attract students to campus that other wise may have chosen other land grant universities.

Displays will be setup on campus to make the 1000+ high school students aware of the precision agriculture major when they are on campus for state FFA convention. Interactive display modules will be constructed for the team of Ag Ambassadors to use to promote precision agriculture as they visit dozens of high schools across South Dakota, Minnesota, and Iowa.

A conservative estimate for the initial cohort is 15 students, including junior and senior level students who change their major to Precision Agriculture.

	Academic Years				
	2016	2017	2018	2019	2020
Estimated Enrollment Target	15	32	49	65	75
Students in the major (fall)	15	32	49	65	75
Completions by graduates	0	0	5	7	12

6. Does the university intend to seek authorization to deliver this entire program at any off-campus locations? If yes, enter location(s) and intended start date(s). Does the university intend to seek authorization to deliver this entire program by distance technology? If yes, identify delivery method(s) and intended start date(s).

Off-campus	No
Distance delivery	No

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7. What are the University's plans for obtaining the resources needed to implement the program? Indicate "yes" or "no" in the columns below.

	Development/Start-up	Long-term Operation
Reallocate existing resources	Yes	Yes
Apply for external resources	Yes	Yes
Ask Board to seek new State resources	No	No
Ask Board to approve new or increased student fee	No	No

The courses proposed to be used in the undergraduate program, except for the MOOC, will come from courses currently being offered in existing undergraduate programs in the SDSU Colleges of Agriculture and Biological Sciences and the Jerome J. Lohr College of Engineering. The students for this proposed undergraduate program will help bolster the enrollment in existing courses. The Precision Agriculture program will be developed and delivered through the use of existing faculty development funds, reallocation due to student movement into the program from other programs, tuition funds gained from new students attracted to SDSU due to the proposed program. A program fee of \$80 per credit hour, consistent with the existing Agricultural Systems Technology program fee, will be requested. In addition, strategic reinvestment requests will be made to the university and funding will be sought from external partners. Raven Industries already has a presence on campus and is supporting student interns, senior design projects, and donating equipment that is used in hands-on teaching laboratories. There are many other potential partners such as the agricultural COOPs across the region. Farm equipment dealerships have become fairly large corporations and are highly interested precision agriculture. The major farm equipment manufacturers such as AGCO, Case, John Deere, and CAT are likely potential donors as are the South Dakota commodity organizations. The planning process will allow time to fully engage potential partners to determine the extent of their interest in supporting the new major.

8. Curriculum Example: Provide (as Appendix A) the curriculum of a similar program at another college or university. *The Appendix should provide the required and elective courses in the program. Catalog pages or web materials may be used. Identify the college or university and explain why the program may be used as one model when the proposed program is developed.*

No other university offers a baccalaureate major in Precision Agriculture. SDSU will have a first-to-market advantage by creating a multi-disciplinary major that prepares undergraduates for employment in precision agriculture. The major will reside in the College of Agriculture and Biological Sciences, but will have coursework in the Jerome J. Lohr College of Engineering and the College of Arts and Sciences. At the faculty level, disciplinary strength will remain a focus, but that expertise will be delivered under the multi-disciplinary umbrella of the major. While two recently introduced minors, for agronomists and for engineers, are meeting the needs of students wishing to preserve disciplinary identity, this precision agriculture major will meet the needs of students wishing to distinguish their skills in the employment marketplace and will reach out to a wider geography of students by virtue of being first-to-market. Employers today are clamoring

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for graduates who know how to work in rapidly evolving precision-management areas. The final design of the curriculum will merge traditional fields of study with state-of-the-art multidisciplinary courses emphasizing advances in precision agriculture technology. SDSU is already leading the USDA Challenge Grant initiative to develop curriculum for precision agriculture. To ensure the most relevant programming possible, a summer 2015 curriculum development task force will define learning outcomes that are informed by the needs of industry. Engagement with the above mentioned Advisory Board will help to ensure that learning outcomes are responsive to industry needs.

Appendix A

Curriculum Example

Component	Subjects	Discipline	Credits
General Education	Composition, Speech, Social Science, Humanities, Math, Natural Sciences, Social & Environmental Responsibility	English, Speech, Economics, History, Math, Biology, Chemistry, Geography	35
Discipline	Geospatial Imaging, Plant & Soil Sensing, Field Use Technology, Intro to Precision Agriculture, Intro to Statistics, Applied Informatics, Intro to Computer Science, Big Data Management, Plant Growth, Soils, Plant Genetics, Production Economics	Electrical Engineering, Agricultural Engineering, Statistics, Computer Science, Plant Science, Soil Science, Economics,	40
Support Courses	Advanced Precision Agronomy, Statistics, Informatics, Data Acquisition, Data Processing, Economics of Precision Agriculture, Introduction to Ag Electronics, Electrical Diagnostics, Hydraulics, Agro-Climatology, Computer applications in Agriculture, Autonomous Systems and Telematics, Ag Machinery systems, Plant Pathology, Insect Pest Management, Soil Fertility, Weed Science, Wheat Production, Soybean Production, Corn Production	Plant Science, Soil Science, Statistics, Agricultural Systems Technology	45
Total			120