MEMORANDUM

DATE: December 2009 Submissions

TO: Chief Academic Officers
Montana University System

FROM: Sylvia Moore, Deputy Commissioner of Academic & Student Affairs &
Mary Moe, Deputy Commissioner of Two-Year Education

RE: Level II Submission Items

The campuses of the Montana University System have proposed new academic programs or changes under the Level II approval process authorized by the Montana Board of Regents. The Level II proposals are being sent to you for your review and approval. If you have concerns about a particular proposal, you should share those concerns with your colleagues at that institution and try to come to some understanding. If you cannot resolve your concerns, you need to notify the Office of the Commissioner of Higher Education by January 4, 2009. That notification should be directed to Sarah Elkins, program coordinator for Academic & Student Affairs. If Sarah does not hear from you, in writing, by January 4th, OCHE will assume that the proposals have your approval.

The Level II proposals are as follows:

Montana State University

- Montana State University filed a request to offer a minor in Astrobiology *ITEM146-2003-R0110*
- Montana State University is requesting approval to offer a Certificate and a minor in Land Surveying *ITEM146-2004-R0110* *ITEM146-2005-R0110*

January 14, 2010

ITEM 146-2003-R0110 **Approval to Establish a Minor in Astrobiology; Montana State University-Bozeman**

THAT: The Board of Regents of Higher Education authorizes Montana State University-Bozeman to establish a Minor in Astrobiology.

EXPLANATION: Montana State University is proposing a new Astrobiology minor to effectively promote and educate students on aspects of multidisciplinary and cross disciplinary science while at the same time bridging science and humanities.

The Astrobiology Minor will draw mainly from existing course offerings in the following departments: Earth Sciences, Physics, Chemistry & Biochemistry, Cell Biology & Neuroscience, Ecology, Plant Sciences and Plant Pathology, and History & Philosophy. As part of the new curriculum MSU will be developing two new courses for which development funding has already been secured from the Astrobiology Biogeocatalysis Research Center and the Thermal Biology Institute. The proposed curriculum responds to the continuing demand for multidisciplinary and crossdisciplinary courses and curricula. As MSU continues to grow faculty expertise in this area, students are increasingly seeking an associated curriculum. As a minor, students will be able to use this program to complement curricula in their majors.

The Astrobiology Minor would be an excellent complement to research and teaching strengths of a number of departments and research centers such as the Thermal Biology Institute and the Astrobiology Biogeocatalysis Research Center. TBI has an extended track record for creating research training opportunities for undergraduates. The Minor would enhance the curriculum of the aforementioned departments. The principal goal of the minor is to develop students' literacy in astrobiology so they can critically evaluate claims related to this field that they encounter well after their college education has ended.

M O N T A N A B O A R D O F R E G E N T S

LEVEL II REQUEST FORM

Item No.:	**146-2003-R0110**	**Date of Meeting:**	**January 14, 2010**
Institution:	**Montana State University-Bozeman**		
Program Title:	**Minor in Astrobiology**		

Level II proposals require approval by the Board of Regents.

Level II action requested (check all that apply): Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

- ☐ 1. Change names of degrees (e.g. from B.A. to B.F.A.)
- ☒ 2. Implement a new minor or certificate where there is no major or no option in a major;
- ☐ 3. Establish new degrees and add majors to existing degrees;
- ☐ 4. Expand/extend approved mission; and
- ☐ 5. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.

Specify Request:

Montana State University-Bozeman is proposing a new Astrobiology minor to effectively promote and educate students on aspects of multidisciplinary and cross disciplinary science while at the same time bridging science and humanities. The Astrobiology Minor will draw mainly from existing course offerings in the following departments: Earth Sciences, Physics, Chemistry & Biochemistry, Cell Biology & Neuroscience, Ecology, Plant Sciences and Plant Pathology, and History & Philosophy. The proposed curriculum responds to the continuing demand for multidisciplinary and crossdisciplinary courses and curricula. As MSU continues to grow faculty expertise in this area, students are increasingly seeking an associated curriculum. As a minor, students will be able to use this program to complement curricula in their majors.

Astrobiology Minor at Montana State University

1. Overview

Montana State University is proposing a new Astrobiology minor to effectively promote and educate students on aspects of multidisciplinary and cross disciplinary science while at the same time bridging science and humanities. The Astrobiology Minor will draw mainly from existing course offerings in the following departments: Earth Sciences, Physics, Chemistry & Biochemistry, Cell Biology & Neuroscience, Ecology, Plant Sciences and Plant Pathology, and History & Philosophy. As part of the new curriculum MSU will be developing two new courses for which development funding has already been secured from the Astrobiology Biogeocatalysis Research Center and the Thermal Biology Institute. Plans for the new capstone course include communicating contemporary science to public audiences.

2. Need

a. To what specific need is the institution responding in developing the proposed program?

The proposed curriculum responds to the continuing demand for multidisciplinary and crossdisciplinary courses and curricula. As MSU continues to grow faculty expertise in this area, students are increasingly seeking an associated curriculum. As a minor, students will be able to use this program to complement curricula in their majors.

b. How will students and any other affected constituencies be served by the proposed program?

This program will offer a new and exciting choice for students interested in studying at the boundaries between the sciences and humanities, which will be attractive to those from both sides of this classical divide.

c. What is the anticipated demand for the program? How was this determined?

Demand for the program has not been formally assessed but anecdotal evidence suggests that this is an area with broad appeal to students from the sciences, humanities, social sciences, and the arts. One purpose of offering this as a minor is that it requires low initial investment, which allows interest to be gauged before resources are reallocated. It is anticipated that program will eventually graduate up to 15 students per year.

3. Institutional and System Fit

a. What is the connection between the proposed program and existing programs at the institution?

The Astrobiology Minor would be an excellent complement to research and teaching strengths of a number of departments and research centers such as the Thermal Biology Institute and the Astrobiology Biogeocatalysis Research Center. TBI has an extended track record for creating research training opportunities for undergraduates. The Minor would enhance the curriculum of the aforementioned departments.

b. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe. *No.*

c. Describe what differentiates this program from other, closely related programs at the institution (if appropriate). *N/A*

d. How does the proposed program serve to advance the strategic goals of the institution? *Expands undergraduate opportunities and supports multidisciplinary training.*

e. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation. *N/A*

4. Program Details

a. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

ASTROBIOLOGY (tentative catalog description)

The Astrobiology Minor is designed to educate students in this **interdisciplinary** field covering the varied scientific disciplines that contribute to our general understanding of life, the origin of life, the past history of life on Earth, possible futures for life on Earth, and the possible existence of life on other planetary environments.

The principal goal of the minor is to develop students' literacy in astrobiology so they can critically evaluate claims related to this field that they encounter well after their college education has ended.

<u>Required Courses (22 cr.)</u>
BIOL 101 or BIOL 215 (4 cr.)
ESCI 111 (4 cr.)
GEOL 210 (3 cr.)
PHIL 3XX (3 cr.) – What is Life? (to be developed; a preliminary version has been offered as LS 301)

PHYS 101, or PHYS 311, or PHYS 312 (3 or 4 cr.)
CHEM 101 or CHEM 121 or CHEM 131 (3 or 4 cr.)
BIOL/PHYS/CHEM 3XX (4 cr.) – Astrobiology (to be developed; multidisciplinary)

Elective Courses (6 cr.)

BCHM 340	GENERAL BIOCHEMISTRY
BCHM 441	BIOCHEMISTRY OF MACROMOLECULES
BCHM 442	METABOLIC REGULATION
BIOL 213	INTRODUCTORY BIOLOGY: CELLS TO ORGANISMS
BIOL 214	INTRODUCTORY BIOLOGY: MOLECULES TO CELLS
BIOL 301	PRINCIPLES OF GENETICS
BIOL 303	PRINCIPLES OF ECOLOGY
BIOL 403	EVOLUTION
ESCI 505	GEOMICROBIOLOGY
HIST 206	DARWINIAN REVOLUTION
HIST 207	SCIENCE AND TECHNOLOGY IN WORLD HISTORY
HIST 431	SCIENCE AND TECHNOLOGY IN SOCIETY
HIST 432	HISTORY OF MODERN SCIENCE
MB 301	GENERAL MICROBIOLOGY
PHIL 225	SCIENCE, PSUEDO-SCIENCE, AND SUBJECTIVITY
PHIL 378	PHILOSOPHY OF SCIENCE
PHYS 311	SOLAR SYSTEM ASTRONOMY
PHYS 312	STARS, GALAXIES, AND THE UNIVERSE
RELS 402	NATURAL, UNNATURAL, SUPERNATURAL

Note: At least one elective course must be at the 300 level or higher.

Proposed New Courses
PHIL 3XX (3 cr.) What is Life?
The course will raise questions about different views on the origin of life and allied issues. Since this is an active research area without concrete theories in sight about the origin of life, the course will raise more questions than it will answer. The newly emerging disciple that handles “What is life?” and allied questions is called “astro-biology.”

BIOL/PHYS/CHEM 3XX (4 cr.) Astrobiology
Astrobiology is a new, multidisciplinary field of science encompassing astronomy, biology, biochemistry, genomics, chemistry, atmospheric chemistry, geochemistry, paleontology, geology, and many other fields of science and technology. Astrobiology includes the study of the origin of life, the connections between the evolution of life and of environments, the potential for life and life's actual distribution in our solar system and beyond, and future of life on Earth and in space.

b. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

The program would be implemented for students matriculating Fall 2010 with a target of 10-15 minors.

5. Resources

a. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

Two new course offerings will be developed using funds that have been committed by the Astrobiology Biogeocatalysis Research Center, and the Thermal Biology Institute. The Montana Space Grant Consortium may also contribute to this project. The new courses are anticipated to have sufficient demand to justify incorporating them into the regular teaching loads of the department.

b. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need. *No*

6. Assessment.
How will the success of the program be measured?

Questionnaires will be used to assess students' views on the new course offering during their development stage. Graduation numbers in the minor will be tracked, and the minor will be subject to program review as part of the normal BOR process.

7. Process Leading to Submission
Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

The program has been reviewed and approved by MSU's Undergraduate Studies Committee and the Academic Affairs sub-committee of Faculty Senate.

January 14, 2010

ITEM 146-2004-R0110 **Approval to Establish a Certificate in Land Surveying; Montana State University-Bozeman**

THAT: The Board of Regents of Higher Education authorizes Montana State University-Bozeman to establish a Certificate in Land Surveying

EXPLANATION: The objective of the requested Certificate in Land Surveying is to streamline the application process at the Montana Board of Professional Engineers and Professional Land Surveyors level for the Fundamentals of Surveying (FS) Exam. Currently, if a student desires to start on the path of becoming a Professional Land Surveyor, they have to take a series of Montana Board of Professional Engineers and Professional Land Surveyors approved courses to become eligible to sit for the Fundamentals of Surveying Exam. As board members and class offerings change over time, it is difficult for students to become eligible to take the FS exam because of the need for a course-by-course assessment. The Montana Board of Professional Engineers and Professional Land Surveyors, the Montana Association of Registered Land Surveyors (MARLS), and the Department of Civil Engineering want to formalize this process for satisfying the requirement to become eligible to take the FS exam by tying it to a formally recognized curriculum. All elements of the curriculum are currently offered. Lastly, offering a Land Surveying Certificate at MSU could attract more students to the University. This is a very attractive option for the person who is looking to retrain for a different career.

M O N T A N A B O A R D O F R E G E N T S

LEVEL II REQUEST FORM

Item No.:	**146-2004-R0110**	**Date of Meeting:**	**January 14, 2010**
Institution:	**Montana State University-Bozeman**		
Program Title:	**Land Surveying Certificate**		

Level II proposals require approval by the Board of Regents.

Level II action requested (check all that apply): Level II proposals entail substantive additions to, alterations in, or termination of programs, structures, or administrative or academic entities typically characterized by the (a) addition, reassignment, or elimination of personnel, facilities, or courses of instruction; (b) rearrangement of budgets, cost centers, funding sources; and (c) changes which by implication could impact other campuses within the Montana University System and community colleges. Board policy 303.1 indicates the curricular proposals in this category:

- ☐ 1. Change names of degrees (e.g. from B.A. to B.F.A.)
- ☒ 2. Implement a new minor or certificate where there is no major or no option in a major;
- ☐ 3. Establish new degrees and add majors to existing degrees;
- ☐ 4. Expand/extend approved mission; and
- ☐ 5. Any other changes in governance and organization as described in Board of Regents' Policy 218, such as formation, elimination or consolidation of a college, division, school, department, institute, bureau, center, station, laboratory, or similar unit.

Specify Request:

The Department of Civil Engineering at Montana State University requests approval to offer a certificate in land surveying. The objective of this program is to streamline the application process at the Montana Board of Professional Engineers and Professional Land Surveyors level for the Fundamentals of Surveying (FS) Exam. Also, it will make graduates more attractive in the workforce marketplace. All elements of the curriculum are currently offered, but the existence of the certificate will greatly simplify the process for students. Offering a Land Surveying Certificate at MSU would attract more students to the University. This is a very attractive option for the person who is looking to retrain for a different career.

ITEM 146-2004-R0110 **January 14, 2010**
Proposal

Land Surveying Certificate

1. Overview

Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

The Department of Civil Engineering and the College of Engineering at Montana State University seek approval to offer a certificate in land surveying. The objective is to streamline the application process at the Montana Board of Professional Engineers and Professional Land Surveyors level for the Fundamentals of Surveying (FS) Exam, and to make its graduates more attractive in the workforce marketplace. All elements of the curriculum are currently offered, but the existence of the certificate (and accompanying minor for students pursuing an undergraduate major) will greatly simplify the process for students.

2. Need

a. To what specific need is the institution responding in developing the proposed program?

If a student desires to start on the path of becoming a Professional Land Surveyor, they have to take a series of Montana Board of Professional Engineers and Professional Land Surveyors approved courses to become eligible to sit for the Fundamentals of Surveying Exam. As board members and class offerings change over time, it is difficult for students to become eligible to take the FS exam because of the need for a course-by-course assessment. The Montana Board of Professional Engineers and Professional Land Surveyors, the Montana Association of Registered Land Surveyors (MARLS), and the Department of Civil Engineering want to formalize this process for satisfying the requirement to become eligible to take the FS exam by tying it to a formally recognized curriculum (as well as be able to formally recognize the extra effort in taking courses in the surveying related area). At the last in-state MARLS annual conference, a committee meeting was held regarding pursuing a Land Surveying Certificate at MSU in Bozeman. It was unanimously well received by the committee. Lastly, offering a Land Surveying Certificate at MSU could attract more students to the University. This is a very attractive option for the person who is looking to retrain for a different career.

b. How will students and any other affected constituencies be served by the proposed program?

This proposed certificate will formalize what was already in place since the early 1990s. Students who pursue this option will be served because they will have formal recognition of their educational path as well as an easier path to licensure.

In a regional analysis, Flathead Community College offers a two-year Associates Degree in Land Surveying. In discussions with David Dorsett, Department Head of the Surveying program at Flathead Community College, it was agreed that the proposed certificate will not interfere or eliminate the need for their program. There were no other surveying related programs in the state of Montana that the Montana Board of Professional Engineers and Professional Land Surveyors recognize mainly due to the lack of a registered land surveyor on the faculty. The status quo is basically maintained with the addition of making the certificate in Land Surveying at MSU in Bozeman formal. The proposed MSU Land Surveying Certificate fills both a geographical and strategic need.

c. What is the anticipated demand for the program? How was this determined?

No explicit analysis of possible increased demand has been conducted. The rationale makes sense if only to serve current demand. MSU has a substantial number of courses and presence in surveying and closely related disciplines. Mature and new faculty have an extensive background in surveying and surveying related instruction, and several courses are taught with an emphasis on surveying applications. Also, a Professional Land Surveyor licensed in Montana is part of the faculty at MSU.

3. Institutional and System Fit

a. What is the connection between the proposed program and existing programs at the institution?

There is no counterpart of this Land Surveying Certificate at MSU.

b. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

Implementing the new Land Surveying Certificate will require no new course development.

c. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

n/a

d. How does the proposed program serve to advance the strategic goals of the institution?

Students are already engaged in internships and opportunities in surveying or a closely related field. This gives them a more publicized and formalized career path that as a profession needs an influx of members.

Representatives from Professional Land Surveyors in general are very supportive of this idea.

Among the needs met (explicitly and/or implicitly) for MSU Bozeman Five Year Vision (http://www.montana.edu/upba/vision/visiondocfy06-fy11.pdf implemented 2006) by the Land Surveying Minor *(impact of Land Surveying Certificate described in italics)*:

> **I. Student Body**
> A. MSU Bozeman will enroll approximately 13,000 headcount students. The Fall 2005 enrollment was approximately 12,250. *Land Surveying Certificate is a recruiting tool.*
> B. Approximately 27% of these students will be nonresidents, slightly higher than the current 25% nonresident rate (counting Western Undergraduate Exchange and international students). *Land Surveying Certificate is a recruiting tool for undergraduate students.*
>
> **II. Faculty and Staff**
> F. The University will increasingly attract a strong and diverse faculty*. Explicitly sanctions and enhances our ongoing and future activities in surveying.*
>
> **III. Curriculum**
> A. MSU Bozeman will be nationally recognized as a leader in the integration of learning and discovery at the undergraduate level. *Land Surveying Certificate at MSU Bozeman fills a regional and national need.*

e. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

There is no similar program in the MUS system to the proposed MSU Land Surveying Certificate. The closest is Flathead Community College's (FVCC) Associates Degree in Land Surveying. They do not offer BS degrees in engineering. The main correspondence with FVCC was to ensure that no harm would come to their program.

4. Program Details

a. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

The Course of Study is uncomplicated, and all of the courses, facilities, and expertise are in place for the framework of a Land Surveying Certificate. In fact, the implementation of this certificate is overdue. The Course of Study for the Land Surveying Certificate is as follows:

Montana State University

NON-DEGREE CERTIFICATE
For Land Surveying Intern Exam Only

Total Credits Required – **66 Semester Credits**

Mathematics: Number of Semester Credits Required – **7** (select from below)

Course	Description	Credits
M 151	PRECALCULUS	4
M 165	CALCULUS FOR TECHNOLOGY I	3
M 166	CALCULUS FOR TECHNOLOGY II	3
M 171	CALCULUS I	4
M 172	CALCULUS II	4
M 221	MATRIX THEORY	3

Basic Science: Number of Semester Credits Required – **8** (select from below)

Course	Description	Credits
PHYS 205	COLLEGE PHYSICS I	4
PHYS 206	COLLEGE PHYSICS II	4
PHYS 211	GENERAL AND MODERN PHYSICS I	4
PHYS 212	GENERAL AND MODERN PHYSICS II	4
CHMY 121	INTRODUCTION TO GENERAL CHEMISTRY	4
CHMY 141	COLLEGE CHEMISTRY I	4
CHMY 143	COLLEGE CHEMISTRY II	4
GEO 101	INTRODUCTION TO PHYSICAL GEOLOGY	4

Written Communication: Number of Semester Credits Required – **6** (select from below)

Course	Description	Credits
WRIT 101	COLLEGE WRITING I	3
WRIT 201	COLLEGE WRITING II	3
WRIT 221	INTERMEDIATE TECHNICAL WRITING	3

Oral Communication: Number of Semester Credits Required – **6** (select from below)

Course	Description	Credits
COM 110 or	INTRODUCTION TO PUBLIC COMMUNICATION	3
CLS 101 or	KNOWLEDGE AND COMMUNITY	3
US 101	FIRST YEAR SEMINAR	3
and		
BUS 201	MANAGERIAL COMMUNICATION	3
CLS 201	KNOWLEDGE AND COMMUNITY	3

Drafting: Number of Semester Credits Required – **4**

Course	Description	Credits
ME 115	ENGINEERING DESIGN GRAPHICS	1
ME 116	ENGINEERING DESIGN GRAPHICS LAB	1
TE 230	2-D COMPUTER-AIDED DRAFTING	3

Surveying Techniques: Number of Semester Credits Required – **11**

Course	Description	Credits
CE 201	SURVEYING	3
CET 202	CONSTRUCTION SURVEYING AND EARTHWORK	3
	OR	
CE 350	TRANSPORTATION ENGINEERING	3
CE 363	ADVANCED SURVEYING COMPUTATIONS	3
CE 463	PHOTOGRAMMETRY	2

Principals and Practice of Surveying: Number of Semester Credits Required – **9**

Course	Description	Credits
CE 361	LEGAL PRINCIPLES OF SURVEYING	3
CE 362	U.S. PUBLIC LAND SURVEY SYSTEM	3
CE 464	PROJECT DESIGN IN SURVEYING	3

Principals and Practice of Surveying Related Electives: Number of Semester Credits Required – **15** (select from below)

Course	Description	Credits
CE 456	HIGHWAY GEOMETRIC DESIGN	3
LRES 357	GPS FUNDAMENTALS & APPLICATIONS IN MAPPING	3
LRES 426	REMOTE SENSING AND DIGITAL IMAGE PROCESSING	3
LRES 457	ADVANCED GPS MAPPING FOR GIS	3
GPHY 284	INTRODUCTION TO GIS SCIENCE AND CARTOGRAPHY	3
GPHY 384	ADVANCED GIS AND SPATIAL ANALYSIS	3
GPHY 484	APPLIED GIS AND SPATIAL ANALYSIS	3
STAT 216	INTRODUCTION TO STATISTICS	3
I&ME 350	APPLIED ENGINEERING DATA ANALYSIS	2
BUS 361	INTRODUCTION TO BUSINESS LAW	3
I&ME 325	ENGINEERING ECONOMY	3
AGEC 337	AGRICULTURAL LAW	3

b. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

Implementation of the program will require little more than including the Land Surveying Certificate in the MSU COURSE BULLETIN and will not require a phasing-in. It can be available immediately.

An estimate of students involved in the Land Surveying Certificate would be about one to two students, based upon past data.

5. Resources

a. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

No additional faculty resources are needed at this time to implement the Land Surveying Certificate program.

b. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

There are no additional resources needed to implement the program.

6. Assessment

How will the success of the program be measured?

CE has had in place for a number of years a comprehensive and successful assessment plan for all of its programs (see http://www.montana.edu/wwwprov/assessment/assessmentplans.htm). We continually assess objectives and outcomes at the program and course levels. These assessments are mandatory for our national accreditation (ABET), an accreditation we have held for many years. Our current assessment plan and assessment methods will be consistently applied to the Land Surveying Certificate.

However, we will provide specialized assessment that focuses on such issues as student, employer, and alumni satisfaction aimed specifically at the minor. Land Surveying Certificate student placement will be monitored. We will continue to monitor the progress of our students, with the specific emphasis on surveying related activities. Since our students are already engaged in surveying related activities, and have a long track record of successful careers in surveying, the Land Surveying Certificate has been needed for a long time to serve our students. This is a case where MSU has the responsibility to provide academic support for well-established demand.

7. Process Leading to Submission

Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

The proposed curriculum was first presented to the CE Curriculum Committee and faculty for approval. Then the proposed curriculum was presented to the College of Engineering Curriculum for review and feedback. Lastly, the proposed Land Surveying Certificate was reviewed by the MSU Undergraduate Studies Committee.

Civil Engineering and the College of Engineering at MSU each have Industrial Advisory Boards with members from engineering, construction, and surveying related companies. The implementation and progress of the program will be periodically reviewed by these boards. We will engage these members for specific guidance and support for the Land Surveying Certificate.

January 14, 2010

ITEM 146-2005-R0110 **Approval to Establish a Minor in Land Surveying; Montana State University-Bozeman**

THAT: The Board of Regents of Higher Education authorizes Montana State University-Bozeman to establish a Minor in Land Surveying.

EXPLANATION: The objective of the requested Minor in Land Surveying is to streamline the application process at the Montana Board of Professional Engineers and Professional Land Surveyors level for the Fundamentals of Surveying (FS) Exam. Currently, if a student desires to start on the path of becoming a Professional Land Surveyor, they have to take a series of Montana Board of Professional Engineers and Professional Land Surveyors approved courses to become eligible to sit for the Fundamentals of Surveying Exam. As board members and class offerings change over time, it is difficult for students to become eligible to take the FS exam because of the need for a course-by-course assessment. The Montana Board of Professional Engineers and Professional Land Surveyors, the Montana Association of Registered Land Surveyors (MARLS), and the Department of Civil Engineering want to formalize this process for satisfying the requirement to become eligible to take the FS exam by tying it to a formally recognized curriculum. All elements of the curriculum are currently offered. Students who pursue this option will be served because they will have formal recognition of their educational path as well as an easier path to licensure because Montana and other states will look favorably upon a Bachelors of Science in Civil Engineering with a Land Surveying Minor.

ITEM 146-2005-R0110 **January 14, 2010**
Proposal

Minor In Land Surveying

1. Overview

Provide a one paragraph description of the proposed program. Be specific about what degree, major, minor or option is sought.

The Department of Civil Engineering and the College of Engineering at Montana State University seek approval to offer a minor in land surveying. The objective is to streamline the application process at the Montana Board of Professional Engineers and Professional Land Surveyors level for the Fundamentals of Surveying (FS) Exam, and to make its graduates more attractive in the workforce marketplace. All elements of the curriculum are currently offered, but the existence of the minor (and accompanying certificate for students not pursuing an undergraduate major) will greatly simplify the process for students.

2. Need

a. To what specific need is the institution responding in developing the proposed program?

The need for the Surveying Minor at MSU in Bozeman is compelling and long overdue. MSU has strong programs in Civil Engineering, Construction Engineering Technology, and Bio-Resource Engineering. If a student desires to start on the path of becoming a Professional Land Surveyor also, they have to take a series of Montana Board of Professional Engineers and Professional Land Surveyors approved courses in conjunction with their degree to become eligible to sit for the Fundamentals of Surveying Exam. As board members and class offerings change over time, it is difficult for students to become eligible to take the FS exam because of the need for a course-by-course assessment. The Montana Board of Professional Engineers and Professional Land Surveyors, the Montana Association of Registered Land Surveyors (MARLS), and the Department of Civil Engineering want to formalize this process for satisfying the requirement to become eligible to take the FS exam by tying it to a formally recognized curriculum (as well as be able to formally recognize the extra effort in taking courses in the surveying related area). At the last in-state MARLS annual conference, a committee meeting was held regarding pursuing a Land Surveying Minor at MSU in Bozeman. It was unanimously well received by the committee.

b. How will students and any other affected constituencies be served by the proposed program?

This proposed minor will formalize what was already in place since the early 1990s. Students who pursue this option will be served because they will have formal recognition of their educational path as well as an easier path to licensure because Montana and other states will look favorably upon a Bachelors of Science in Civil Engineering with a Land Surveying Minor as an example.

In a regional analysis, Flathead Community College offers a two-year Associates Degree in Land Surveying. In discussions with David Dorsett, Department Head of the Surveying program at Flathead Community College, it was agreed that the proposed minor will not interfere or eliminate the need for their program. There were no other surveying related programs in the state of Montana that the Montana Board of Professional Engineers and Professional Land Surveyors recognize mainly due to the lack of a registered land surveyor on the faculty. The status quo is basically maintained by formalizing the minor in Land Surveying at MSU. The proposed MSU Land Surveying Minor fills both a geographical and strategic need.

c. What is the anticipated demand for the program? How was this determined?

No explicit analysis of possible increased demand has been conducted. The rationale makes sense if only to serve current demand. MSU has a substantial number of courses and presence in surveying and closely related disciplines. Mature and new faculty have an extensive background in surveying and surveying related instruction, and several courses are taught with an emphasis on surveying applications. Also, a Professional Land Surveyor licensed in Montana is part of the faculty at MSU. A common question during advising sessions of engineering undergraduates is: "When will the Land Surveying Minor be available?"

3. Institutional and System Fit

a. What is the connection between the proposed program and existing programs at the institution?

There is no counterpart of this Land Surveying Minor at MSU.

b. Will approval of the proposed program require changes to any existing programs at the institution? If so, please describe.

Implementing the new Land Surveying Minor will require no new course development.

c. Describe what differentiates this program from other, closely related programs at the institution (if appropriate).

n/a

d. How does the proposed program serve to advance the strategic goals of the institution?

Students are already engaged in internships and opportunities in surveying or a closely related field. This gives them a more publicized and formalized career path that as a profession needs an influx of members.

The Land Surveying Minor will enhance the undergraduate offerings at MSU in a career track with high need in the state. Representatives from Professional Land Surveyors in general are very supportive of this idea.

Among the needs met (explicitly and/or implicitly) for MSU Bozeman Five Year Vision (http://www.montana.edu/upba/vision/visiondocfy06-fy11.pdf implemented 2006) by the Land Surveying Minor *(impact of Land Surveying Minor described in italics)*:

> **I. Student Body**
> A. MSU Bozeman will enroll approximately 13,000 headcount students. The Fall 2005 enrollment was approximately 12,250. *Land Surveying Minor is a recruiting tool.*
> B. Approximately 27% of these students will be nonresidents, slightly higher than the current 25% nonresident rate (counting Western Undergraduate Exchange and international students). *Land Surveying Minor is a recruiting tool for undergraduate students.*
>
> **II. Faculty and Staff**
> F. The University will increasingly attract a strong and diverse faculty*. Explicitly sanctions and enhances our ongoing and future activities in surveying.*

III. Curriculum

A. MSU Bozeman will be nationally recognized as a leader in the integration of learning and discovery at the undergraduate level. *Land Surveying Minor at MSU Bozeman fills a regional and national need.*

D. There will be increased opportunities for interdisciplinary courses and programs and encourage team teaching across all disciplinary boundaries*. Land Surveying Minor accessible for wide variety of majors at MSU Bozeman.*

e. Describe the relationship between the proposed program and any similar programs within the Montana University System. In cases of substantial duplication, explain the need for the proposed program at an additional institution. Describe any efforts that were made to collaborate with these similar programs; and if no efforts were made, explain why. If articulation or transfer agreements have been developed for the substantially duplicated programs, please include the agreement(s) as part of the documentation.

There is no similar program in the MUS system to the proposed MSU Land Surveying Minor. The closest is Flathead Community College's (FVCC) Associates Degree in Land Surveying. They do not offer BS degrees in engineering. The main correspondence with FVCC was to ensure that no harm would come to their program.

4. Program Details

a. Provide a detailed description of the proposed curriculum. Where possible, present the information in the form intended to appear in the catalog or other publications. NOTE: In the case of two-year degree programs and certificates of applied science, the curriculum should include enough detail to determine if the characteristics set out in Regents' Policy 301.12 have been met.

The Course of Study is uncomplicated, and all of the courses, facilities, and expertise are in place for the framework of a Land Surveying Minor. The Course of Study for the Land Surveying Minor is as follows:

Montana State University

Land Surveying Minor

Total Credits Required – **29 Semester Credits**

REQUIRED COURSES		**CREDITS**
• CE 201	SURVEYING ** #	3
• CET 202	CONSTRUCTION SURVEYING AND EARTHWORK **	3
	OR	
CE 350	TRANSPORTATION ENGINEERING #	3
• CE 363	ADVANCED SURVEYING COMPUTATIONS ^^	3
• CE 463	PHOTOGRAMMETRY ^^	2
• CE 361	LEGAL PRINCIPLES OF SURVEYING ^^	3
• CE 362	U.S. PUBLIC LAND SURVEY SYSTEM ^^	3
• CE 464	PROJECT DESIGN IN SURVEYING ^^	3
		TOTAL 20

ELECTIVE COURSES **9 CREDITS REQUIRED**

CE 456	HIGHWAY GEOMETRIC DESIGN ^^	3
AGEC 337	AGRICULTURAL LAW	3
LRES 357	GPS FUNDAMENTALS & APPLICATIONS IN MAPPING	3
LRES 426	REMOTE SENSING AND DIGITAL IMAGE PROCESSING	3
LRES 457	ADVANCED GPS MAPPING FOR GIS	3
GPHY 284	INTRODUCTION TO GIS SCIENCE AND CARTOGRAPHY	3
GPHY 384	ADVANCED GIS AND SPATIAL ANALYSIS	3
GPHY 484	APPLIED GIS AND SPATIAL ANALYSIS	3

TOTAL 29

** ALREADY IN CET CURRICULUM
# ALREADY IN CE/BREN CURRICULUM
^^ PROFESSIONAL ELECTIVE IN CET, CE, or BREN

b. Describe the planned implementation of the proposed program, including estimates of numbers of students at each stage.

Implementation of the program will require little more than including the Land Surveying Minor in the MSU COURSE BULLETIN and will not require a phasing-in. It can be available immediately.

An estimate of students involved in the Land Surveying Minor would be about three to five students in the beginning.

Given that the Land Surveying Minor is applicable to any undergraduate program provided that prerequisites are satisfied, it is difficult to estimate the total number of students participating in the minor. However, since the Land Surveying Minor is working within the existing infrastructure, some metrics for its impact are provided in Table 4 below.

Table 4. Impact of Implementing the MSU Land Surveying Minor

• Break-even point?	0* FTE students
• Enrollments / year?	5 - 25
• Graduates / year?	5 - 25
• MT jobs / year?	5 - 25

*There is no start-up investment required, so the “break-even point” for number of students is irrelevant.

5. Resources

a. Will additional faculty resources be required to implement this program? If yes, please describe the need and indicate the plan for meeting this need.

No additional faculty resources are needed at this time to implement the Land Surveying Minor program.

b. Are other, additional resources required to ensure the success of the proposed program? If yes, please describe the need and indicate the plan for meeting this need.

There are no additional resources needed to implement the program.

6. Assessment

How will the success of the program be measured?

CE has had in place for a number of years a comprehensive and successful assessment plan for all of its programs (see http://www.montana.edu/wwwprov/assessment/assessmentplans.htm). We continually assess objectives and outcomes at the program and course levels. These assessments are mandatory for our national accreditation (ABET), an accreditation we have held for many years. Our current assessment plan and assessment methods will be consistently applied to the Land Surveying Minor.

However, we will provide specialized assessment that focuses on such issues as student, employer, and alumni satisfaction aimed specifically at the minor. Land Surveying Minor graduation rates and student placement will be monitored. We will continue to monitor the progress of our graduates, with the specific emphasis on surveying related activities. Since our students are already engaged in surveying related activities, and have a long track record of successful careers in surveying, the Land Surveying Minor has been needed for a long time to serve our students. This is a case where MSU has the responsibility to provide academic support for well-established demand.

7. Process Leading to Submission

Describe the process of developing and approving the proposed program. Indicate, where appropriate, involvement by faculty, students, community members, potential employers, accrediting agencies, etc.

The proposed curriculum was first presented to the CE Curriculum Committee and faculty for approval. Then the proposed curriculum was presented to the College of Engineering Curriculum for review and feedback. Lastly, the proposed Land Surveying Minor was reviewed by the MSU Undergraduate Studies Committee.

Civil Engineering and the College of Engineering at MSU each have Industrial Advisory Boards with members from engineering, construction, and surveying related companies. The implementation and progress of the program will be periodically reviewed by these boards. We will engage these members for specific guidance and support for the Land Surveying Minor.