February 19, 2016

MEMORANDUM

TO:   Jayanth R. Banavar  
       Dean, College of Computer, Mathematical, and Natural Sciences

FROM:  Elizabeth Beise  
       Associate Provost for Academic Planning and Programs

SUBJECT:  Proposal to Modify the Bachelor of Science in Geology by Adding a Geophysics Specialization (PCC Log No. 15025)

At its meeting on February 5, 2016, the Senate Committee on Programs, Curricula and Courses approved the proposal to modify the Bachelor of Science in Geology by adding a Geophysics Specialization. A copy of the proposal is attached.

The change is effective Fall 2016. Please ensure that the change is fully described in the Undergraduate Catalog and in all relevant descriptive materials, including the undergraduate program’s four-year plan (contact Lisa Kiely at lkiely@umd.edu for more information).

MDC/  
Enclosure

cc:  Andrew Harris, Chair, Senate PCC Committee  
     Barbara Gill, Office of Enrollment Management  
     Reka Montfort, University Senate  
     Erin Taylor, Division of Information Technology  
     Pam Phillips, Institutional Research, Planning & Assessment  
     Anne Turkos, University Archives  
     Linda Yokoi, Office of the Registrar  
     Cynthia Stevens, Office of Undergraduate Studies  
     Robert Infantino, College of Computer, Mathematical, and Natural Sciences  
     Richard Walker, Department of Geology
This is a proposal for the creation of the Geology Major – Geophysics Track. See attached.

To enable students to exploit the emergence of geophysics as a primary research discipline in the Department of Geology and prepare for careers in geophysics without the extraneous encumbrances of the professional track geology major.

APPROVAL SIGNATURES

1. Department Committee Chair

2. Department Chair

3. College/School PCC Chair

4. Dean

5. Dean of the Graduate School (if required)

6. Chair, Senate PCC

7. Chair of Senate

8. Vice President for Academic Affairs & Provost
Geology Major, Geophysics Track

1. This is a proposal to create a new undergraduate major track.

2. The “Requirements for the Major” section of the Catalog Description is to be as follows:

Requirements for the Geology Major, Geophysics Track

The geophysics curriculum is designed to meet the requirements of industry, graduate school, and government. For the B.S. degree, the students are required to complete introductory geology and physics requirements (39 credits) and upper-level requirements including depth options, context options, and breadth options (30 - 35 credits) in addition to the General Education Program requirements and the completion of at least 120 credits in total. In order to receive a degree in Geophysics, the department requires that students must have a grade of C- or better in the required geology courses.

Courses required for the B.S. in Geology are listed below. Some courses require field trips for which the students are expected to pay for room (if required) and board.

This new major track is proposed to enable students primarily interested in the application of the methods of physics to geosciences issues to take advantage of Geology’s growing corps of faculty specialists in geophysics, research expertise, and range of course offerings in this area, in order to gain access to the best careers and most prestigious graduate programs in this field. The proposed track recognizes that the professional requirements for entry into such careers and graduate programs are distinct from those of general geosciences. It is intended, therefore, to encourage rigorous preparation in mathematics and physics that the standard geology professional track does not require, while eliminating onerous geology requirements that are not required for advancement in geophysics.

Requirements for the major for the proposed geophysics track are:

Required Introductory Physics and Geology:

One of the following:
- GEOL 100 Physical Geology (3)
- GEOL 120 Environmental Geology (3)
- GEOL 110—Introductory Geology Lab (1)
- MATH 140—Calculus I (4)
- MATH 141—Calculus II (4)
- MATH 241—Calculus III (4)

One of the following:
- PHYS 161—General Physics: Mechanics and Particle Dynamics (3)
- PHYS 171—Introductory Physics: Mechanics and Relativity (3)
PHYS 165— Introduction to Programming for the Physical Sciences (3)
PHYS 174— Introductory Physics Laboratory (1)
PHYS 272— Fields (3)
PHYS 273— Waves (3)
PHYS 275— Experimental Physics I: Mechanics, Heat, and Fields (2)
PHYS 276— Experimental Physics II: Electricity and Magnetism (2)

One of the following
• PHYS 274— Mathematical Methods for Physics I (3) and GEOL 351 (3): Statistics for Geoscientists
• MATH 240— Linear Algebra (3) and MATH 246— Differential Equations for Scientists and Engineers (3)

Total credits: 39

Geophysics Upper Level Requirements:

GEOL 393—Senior Thesis I - Proposal (3)
GEOL 394—Senior Thesis II - Research (3)
GEOL 446—Geophysics (3)

Total credits: 9

Depth Requirements: Choose three of the following:

GEOL 412—Geology of Terrestrial Planets (3)
GEOL 447—Observational Geophysics (3)
GEOL 455—Marine Geophysics (3)
GEOL 456—Engineering Geology (3)
GEOL 457—Seismology (3)
GEOL 460—Field Geophysics (3) (currently submitted for VPAC approval)

Total credits: 9

Context Requirement: Choose two of the following:

AOSC 400— Physical Meteorology of the Atmosphere (3)
AOSC 424— Remote Sensing of the Atmosphere and Ocean
AOSC 431— Atmospheric Thermodynamics (3)
AOSC 432— Dynamics of the Atmosphere and Ocean (3)
GEOL 322— Mineralogy (4)
GEOL 340— Geomorphology (4)
GEOL 341— Structural Geology (4)
GEOL 342— Sedimentation and Stratigraphy (4)
GEOL 423— Optical Mineralogy (4)
GEOL 443— Petrology (4)
GEOL 451— Groundwater (3)
GEOL 463 — Economic Geology (3)  
GEOL 472 — Tectonics (3)  

Any upper level (300 or higher) Geology course with the approval of the undergraduate director not used to satisfy above requirements.

Total credits: 6 - 8

**Breadth requirement:** Choose two of the following:

- PHYS 373 Mathematical Methods for Physics II (3)
- PHYS 371 Modern Physics (3)
- PHYS 401 Quantum Physics I (4)
- PHYS 402 Quantum Physics II (4)
- PHYS 410 Classical Mechanics (4)
- PHYS 411 Intermediate Electricity and Magnetism (4)

Total credits: 6 - 8

**Recommended courses:** One of the following:

- CHEM131 and CHEM132 Chemistry I - Fundamentals of General Chemistry and General Chemistry I Laboratory
- CHEM135 and CHEM136 General Chemistry for Engineers and General Chemistry Laboratory for Engineers

Overall total credits: 69 – 73

Matriculated Geology majors are expected to take all courses on campus unless specific departmental permission is given.

**Reasons for the proposal:**

During the last decade, the number of Geology’s faculty with primary specializations in the application of the methods of physics to geologic issues has increased from zero to four, joining other researchers whose work dovetails with this discipline. Consequently, Geology’s research output in this field has exploded and our geophysics-related course offerings have increased from two courses to eight. At the same time, geophysics continues to rise in prominence as a professional field with significant industrial and academic applications. The proposed Geology Geophysics Track major seeks to bring to our undergraduate curriculum the benefits of this extraordinary growth in departmental know-how and professional opportunities in an appropriate academic context. Our specific goals are to:

1.) Marry Geology’s curriculum with that of the Departments of Physics, Mathematics, and Atmospheric and Oceanic Sciences to create a synesthetic curriculum encompassing all relevant skills for a career in geophysics.
2.) Eliminate academic barriers represented by requirements to the traditional Geology Professional Track major that are not necessary or appropriate for individuals seeking careers in geophysics. By this means, we hope to provide seamless access to students with significant preparation in physics and mathematics.

3.) Maintain equitable levels and distribution of faculty workload.

The requirements of the Geophysics Track have been developed collaboratively by the Departments of Geology, Physics, Mathematics, and Atmospheric and Oceanic Sciences to that end. Letters of support from Physics, Mathematics, and Atmospheric and Oceanic Sciences are attached to this proposal.

Based on an informal survey of Physics majors, we anticipate at least ten Geophysics majors to be declared at any time.

**Prerequisites:** The proposed curriculum minimizes hidden prerequisites. Depending on Depth, Context, or Breadth options chosen, a student could finish the major without having to take any course not listed among the requirements. However, some courses that can be used to satisfy Context requirements require a semester of introductory Chemistry, which is therefore listed as recommended, and may be co- or pre-requisites with other courses listed alongside them (e.g. AOSC 431 is a pre-requisite for AOSC 432). Furthermore, currently, PHYS 373 is a co- or pre-requisite for other courses that can satisfy the Breadth requirement.

**Oversight and Record Keeping:** Will be performed, as currently, by the Department of Geology. The proposed track places no additional demands on Departmental, college, or campus resources.
### GEOLOGY MAJOR (GEOPHYSICS TRACK) sequence 1

**Name:**

**UID:**

**Advanced Placement Credit**

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**Total**

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| Eighth Semester | | |
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| **Spring** | **Credits** | **Grade** |
| GEOL 394* | 3 |
| Breadth Requirement 2 | 3 |
| Context Requirement 2 | 3 or 4 |
| Elective | 3 |
| Elective | 3 |
| | | |
| | | | | 31 or 32 |
| Summer | 15 or 16 | | | |

* Courses must be completed with a grade of "C-" or better

**Total Credits Earned**

121-122

**Repeat Credits Used**

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Dear Bob,

This letter is in support of the creation of an undergraduate geophysics track within the Dept. of Geology. I have reviewed the requirements for this major and feel the proposed course schedule provides the necessary and rigorous preparation for a career in geophysics that includes a sound foundation in math and physics. As a physicist in what some consider an applied physics field, one of the first things I look for when reviewing potential graduate students is their proficiency in physics and math. Students graduating from this geophysics program will be well prepared for graduate level work in a variety of programs. This will offer students more options for advanced degrees beyond a traditional geology program. Certainly, a student with good grades from this program would be competitive in many departments of atmospheric and/or oceanic science. I am unfamiliar with job opportunities in geophysics for bachelor degree recipients but I do not think that a strong math and physics background would considered anything other than positive.

Currently, there are several courses offered by AOSC that will fulfill the “Context Requirement” for this major and we envision a few new courses being considered for development in AOSC that may also be appropriate for this program. The AOSC undergraduate program is of similar size as the Geology undergraduate program (~50 majors) so I do not think that the addition of a few geology students to upper level AOSC courses will be a burden for the courses required for the AOSC program.

Sincerely,

Dr. Timothy P Canty  
Research Assistant Professor  
Director of Undergraduate and Professional Masters Programs  
Dept. of Atmospheric and Oceanic Science
RE: Proposed Geophysics Track in the Geology BS Major

I am pleased to support the formation of a Geophysics track as part of the Geology Bachelor of Science curriculum in the Department of Geology - College of Computer, Mathematical, and Natural Sciences. The proposal of this new track of studies is timely, as we face increases in interdisciplinary academic endeavors as well as diversification in the efforts and needs of industry. Under that context, it is critical to prepare our undergraduates with the skills necessary to thrive in areas such as Geophysics. The proposed curriculum for this track draws from already existing courses in the involved departments, ensuring ease on the side of the student and the administrators at our University. Importantly, the creation of this major will not have significant administrative or financial impacts on the Department of Physics.

This is a commendable initiative from Professors John Merck and Vedran Lekic that will increase the competitiveness of the University of Maryland. It will ensure that the University is able to recruit bright students interested in undergraduate studies within applied physics and geology. The Geophysics track would be an asset to our University and our College, and it has my full support.

Sincerely yours,

Thomas D. Cohen
Professor & Associate Chair for Undergraduate Education
Department of Physics
Re: Request regarding a proposal for a Geophysics major

Doron Levy

To: ichan-contact  
Cc: Vedran Lekic; John W Merck Jr

Hi Ved,

We fully support your request for a geophysics major and do not anticipate any noticeable changes in math class enrollments as a result of that.

Please let me know if you need an “official” version of this support statement, or if this email is sufficient.

Best regards -  
Doron

On Jun 9, 2015, at 3:35 PM, Ida Chan <ichan@math.umd.edu> wrote:

Hi Ved,

Thanks for the email. Sounds like an exciting new major!

I am forwarding your email to Doron, our Undergraduate Chair. I think the Letter of Support needs to come from him.

Thanks!

Ida