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EDUCATIONAL POLICIES COMMITTEE AGENDA

2 October 2014

A meeting of the Educational Policies Committee will be held on 2 October 2014 at 3:00 pm in Old Main 136 (Champ Hall Conference Room)

I. Approval of the minutes of the 9 September 2014 meeting (see below)

II. Subcommittee Reports

a. Curriculum Subcommittee (Ed Reeve)

Course Approvals

Request from the Department of Computer Science to reduce the number of PhD credits. (see below)

Request from the Department of Geology to discontinue the current BS degree in Applied Environmental Geoscience and create an emphasis in Applied Environmental Geoscience in the existing BS. (see below)

Request from the Department of Mechanical and Aerospace Engineering to offer a PhD in Aerospace Engineering. (see below)

b. Academic Standards Subcommittee (Scott Bates)

No report

c. General Education Subcommittee (Norm Jones)

September 16, 2014, 8:30 A.M.
Champ Hall Conference Room

Present: Dean Adams, College of Engineering; Janet Anderson, Provost's Office; Eddy Berry, Social Sciences; Dan Coster, Quantitative Intensive; Brock Dethier, Writing Program; Doug Fiefia, USUAS President; Laura Gelfand; Caine College of the Arts; Norm Jones, Chair; Dawn Kirby, College of Humanities and Social Sciences; Harrison Kleiner, Connections; Kacy Lundstrom, Library; Brian McCuskey, Humanities; Kris Miller, Honors; Karen Mock, Natural Resources; Bob Mueller, Regional Campus; Dick Mueller, College of Science; Melanie Nelson, USU Eastern; Lauren Skousen, Secretary; Larry Smith, Provost's Office

Absent: Lawrence Culver, American Institutions; Kathy Chudoba, Business; Cindy Dewey, Creative Arts; Ryan Dupont, Life and Physical Sciences; Stephanie Hamblin,

University Advising; Mary Leavitt, Advising; Shelley Lindauer, Emma Eccles Jones
College of Education; John Mortensen, Student Services; Lee Rickords, College of
Agriculture and Applied Sciences

Call to Order – Norm Jones

Approval of Minutes – August 19, 2014

Motion to approve made by Brian McCuskey; seconded by Laura Gelfand.

Course Approvals

MUSC 3030 (DHA) Cindy Dewey

Motion to approve made by Laura Gelfand; seconded by Brian McCuskey.

Approved.

Course/Designation Removals

N/A

Syllabi Approvals

HONR 1340 (BSS) Eddy Berry

Motion to approve made by Eddy Berry; seconded by Richard Mueller. Maria Norton is the instructor of the approved syllabi. Approved.

NDFS 5230/6230 (CI)..... Brock Dethier

Motion to approve made by Brock Dethier; seconded by Eddy Berry. Heidi Wengreen is the instructor of the approved syllabi. Approved.

Business

Vote for Chair Elect 2015-2016

Prior to this meeting there was one nomination for chair elect: Dawn Kirby. Floor opened to other nominations. Motion to accept Dawn Kirby's nomination by acclamation made by Dick Mueller. All approved.

The Regents' General Education Task Force will hold the "What is an Educated Person XVII?": Building and Assessing the Whole Degree" Conference Oct. 30-31, 2014 at the Zermatt Resort, Midway, UT. Members of the Committee who are interested in attending should talk to Norm.

In the next few months, the National Institute for Outcomes Learning Assessment and the American Association of Colleges and Universities will publish profiles of USU's Gen Ed program as a model of what can be done to integrate Gen Ed into the curriculum.

After more than a decade of handling transfer and articulation issues in General Education, along with general curricular appeals, Norm is turning the job of enforcement over to our new Vice Provost, Janet Anderson. He will continue to handle appeals until October 1, after which they should be directed to Janet, Janet.anderson@usu.edu. All issues concerning policies and course approvals will

continue to come to the Gen Ed Subcommittee of the EPC, which Norm continues to chair.

Other Business

N/A

EDUCATIONAL POLICIES COMMITTEE MINUTES

4 September 2014

A meeting of the Educational Policies Committee was held on 4 September 2014 at 3:00 pm in Old Main 136 (Champ Hall Conference Room)

Present: Larry Smith, Chair
Roland Squire, Registrar's Office
Heidi Kesler
Michele Hillard, Secretary
Richard Mueller, College of Science
Karen Mock, Quinney College of Natural Resources
Kevin Olson, Caine College of the Arts (representing Nick Morrison)
Norm Jones, General Education Subcommittee Chair
Flora Shrode (representing Kacy Lundstrom), Libraries
Ed Reeve, Curriculum Subcommittee Chair
Kelly Fadel, Huntsman School of Business
Nathan Straight, Regional Campuses
Thom Fronk, Engineering
Betty Hassell (representing Melanie Nelson), USU-Eastern

Absent: Scott Bates, Academic Standards Subcommittee Chair
Jared Schultz, Education and Human Services
Doug Fiefia, USUSA President
Derek Hastings, Graduate Studies Senator
Dawn Kirby (representing Eddy Berry), Humanities and Social Sciences
Scott DeBerard, Graduate Council

III. Approval of the minutes of the 3 April 2014 meeting

Dick Mueller moved to approve the minutes of the 3 April 2014 meeting. Ed Reeve seconded; motion approved.

IV. Subcommittee Reports

a. Curriculum Subcommittee (Ed Reeve)

All courses and changes were approved including the additions of Math & Stats prerequisites.

Norm Jones moved to approve the business of the Curriculum Subcommittee.
Richard Mueller seconded; motion approved.

b. Academic Standards Subcommittee (Scott Bates) – No Report

No August 2014 meeting of the Academic Standards Committee.

c. General Education Subcommittee (Norm Jones)

Dick Mueller moved to approve the report of the 19 August 2014 Gen Ed meeting.
Kelly Fadel seconded; motion approved.

August 19, 2014, 8:30 A.M.
Champ Hall Conference Room

Present: Dean Adams, College of Engineering; Lawrence Culver, American Institutions; Laura Gelfand, Caine College of the Arts; Norm Jones, Chair; Dawn Kirby, College of Humanities and Social Sciences; Harrison Kleiner, Connections; Shelley Lindauer, Emma Eccles Jones College of Education; Brian McCuskey, Humanities; Kris Miller, Honors; Bob Mueller, Regional Campuses; Dick Mueller, College of Science; Melanie Nelson, USU Eastern; Lauren Skousen, Secretary

Absent: Eddy Berry, Social Sciences; Kathy Chudoba, Business; Dan Coster, Quantitative Intensive; Brock Dethier, Communication Intensive; Cindy Dewey, Creative Arts; Ryan Dupont, Life & Physical Sciences; Doug Fiefia, ASUSU President; Stephanie Hamblin, University Advising; Mary Leavitt, Advising; Kacy Lundstrom, Library; John Mortensen, Student Services; Karen Mock, Natural Resources; Lezlie Park, Writing Program; Lee Rickords, College of Agriculture and Applied Sciences; Larry Smith, Provost's Office

Call to Order – Norm Jones

Approval of Minutes – April 15, 2014

Motion to approve made by Shelley Lindauer; seconded by Brian McCuskey.

Course Approvals

HIST 4822 (DHA) - **Withdrawn** Brian McCuskey
Faculty member withdrew submission.

RELS 3050 (DHA/CI) DHA Approved - **CI Withdrawn** Brian McCuskey/Brock Dethier
CI has been pending since November 19th meeting; will now be removed.

SW 4100 (CI) **Approved** Brock Dethier
Motion to approve made by Dawn Kirby; seconded by Bob Mueller.

Course/Designation Removals

N/A

Syllabi Approvals

N/A

Business

Updated Gen Ed Website:

Norm Jones walked the committee through the website updates as well as the electronic approval process via DocuSign. The general consensus was that the website had been drastically improved and there was excitement over the new tools (syllabus tracking, IDEA course evaluations, electronic approval process, etc.). Brian

McCuskey suggested linking the designation criteria to the Citizen Scholar Degree Profile so that faculty members are less likely to focus solely on the degree profile while neglecting the designation criteria.

Nominations and vote for Chair Elect 2015-2016:

Norm Jones called for nominations for Chair elect for 2015-16. Dawn Kirby has been nominated, but nominations remain open. The vote will be held at the September meeting.

V. Other Business

Review of EPC and remind everyone of the R401 approval and review process.

Larry handed out the timeline, process flow chart, and R401 submission guide and discussed the policy and procedures.

Meeting adjourned at 3:30 pm

Cover/Signature Page - Abbreviated Template/Abbreviated Template with Curriculum

Institution Submitting Request: *Utah State University*

Proposed Title:

Currently Approved Title:

School or Division or Location:

Department(s) or Area(s) Location: *Department of Computer Science, College of Engineering*

Recommended Classification of Instructional Programs (CIP) Code¹ (for new programs):

Current Classification of Instructional Programs (CIP) Code (for existing programs): *11.07*

Proposed Beginning Date (for new programs): *upon approval*

Institutional Board of Trustees' Approval Date:

Proposal Type (check all that apply):

Regents' General Consent Calendar Items

R401-5 OCHE Review and Recommendation; Approval on General Consent Calendar

| SECTION NO. | | ITEM |
|-------------|-------------------------------------|---|
| 5.1.1 | <input type="checkbox"/> | Minor* |
| 5.1.2 | <input type="checkbox"/> | Emphasis* |
| 5.2.1 | <input type="checkbox"/> | (CER P) Certificate of Proficiency* |
| 5.2.3 | <input type="checkbox"/> | (GCR) Graduate Certificate* |
| 5.4.1 | <input type="checkbox"/> | New Administrative Unit |
| | <input type="checkbox"/> | Administrative Unit Transfer |
| | <input type="checkbox"/> | Administrative Unit Restructure |
| | <input type="checkbox"/> | Administrative Unit Consolidation |
| 5.4.2 | <input type="checkbox"/> | Conditional Three-Year Approval for New Centers, Institutes, or Bureaus |
| 5.4.3 | <input type="checkbox"/> | New Center |
| | <input type="checkbox"/> | New Institute |
| | <input type="checkbox"/> | New Bureau |
| 5.5.1 | <input type="checkbox"/> | Out-of-Service Area Delivery of Programs |
| | <input type="checkbox"/> | Program Transfer |
| 5.5.2 | <input checked="" type="checkbox"/> | Program Restructure |
| | <input type="checkbox"/> | Program Consolidation |
| 5.5.3 | <input type="checkbox"/> | Name Change of Existing Programs |
| 5.5.4 | <input type="checkbox"/> | Program Discontinuation |
| | <input type="checkbox"/> | Program Suspension |
| 5.5.5 | <input type="checkbox"/> | Reinstatement of Previously Suspended Program |
| | <input type="checkbox"/> | Reinstatement of Previously Suspended Administrative Unit |

**Requires "Section V: Program Curriculum" of Abbreviated Template*

Chief Academic Officer (or Designee) Signature:

I certify that all required institutional approvals have been obtained prior to submitting this request to the Office of the Commissioner.

Signature

Date: *09/04/2014*

Printed Name: *Nicholas S. Flann*

¹ CIP codes must be recommended by the submitting institution. For CIP code classifications, please see <http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55>.

Program Request - Abbreviated Template
Utah State University
Ph.D. Computer Science
09/01/2014

Section I: Request

The Computer Science Department requests to reduce the total minimum number of credit hours required to complete a Ph.D. to 70 hours, a reduction from the current value of 90. The change is motivated by the desire to bring USU Computer Science in line with other Ph.D. programs within the College of Engineering and with other CS Ph.D. programs at peer institutions, which require no more than 72 hours. We anticipate that this change will increase the competitiveness and effectiveness of our PhD program while having a minimal impact on aggregate instructional activities since reductions in credit hours per student will be offset by an increasing PhD program and student enrollment in classes.

| <i>All numbers are minimum credit hours</i> | Existing Ph.D. Program | | New Proposed Ph.D. program | |
|---|------------------------|------------|----------------------------|-------------------------------------|
| | without MS | with MS | without MS | with MS |
| 7000 level CS | 12 | 12 | 9 | 9 |
| Awarded from MS | 0 | 30 (fixed) | 0 | 0 to 30 |
| Seminar CS7900 | 2 | 2 | 2 | 2 |
| Dissertation | 27 | 27 | 18 | 18 |
| Additional courses | 33 | 3 | 21 | 3 |
| Remaining courses/dissertation | | | 20 | 38 – (hours awarded from MS) |
| Minimum Total | 90 | 90 | 70 | 70 |

There are three principal areas of change: a) the number of minimum dissertation credits is reduced by 9 hours, b) the minimum number of PhD classes is reduced by one class, c) satisfying the remaining credits needed becomes more flexible.

Section II: Need

Computer Science is one of the fastest growing job markets in the world, increasing the demand for graduates at BS, MS and PhD levels. New graduates in the USU CS department are experiencing multiple job offers at salaries higher than previous years. Significantly, this trend also applies to the PhD level principally because computer-related companies (such as Microsoft, Amazon, Google, Apple etc.) have growing internal research labs that seek PhDs to lead research and development of future products. Research shows that more than half of PhD graduates work in industry rather than academia ([Taulbee Survey](http://cra.org/resources/taulbee/) <http://cra.org/resources/taulbee/>))

According to the Computing Research Association annual [Taulbee Survey](http://cra.org/resources/taulbee/), Computer Science programs around the country are producing more PhDs than ever before, but increasing demand has kept pace and

this additional supply has not diminished employment or salary. Indeed, the [Taulbee Survey](#) reports an almost 100% placement and employment of PhDs in professional jobs. Salaries available from the [Bureau of Labor Statistics](#) (<http://www.bls.gov/ooh/computer-and-information-technology/home.htm>) give the median salary for computer research scientists at \$100,800 and tenure-track assistant professors at \$85,000 (for smaller public universities) and \$100,000 (for large private universities).

In response to these rapid changes and positive future prospects the USU CS PhD program needs to modernize to become more competitive, efficient and tailored to current and future market conditions. The principal problem with the current program is that it takes too long to complete because of unnecessary and burdensome requirements. Specifically, the current minimum 90 credit hour requirement is outdated and exceptionally high compared to peer institutions within the intermountain region and around the country as summarized below (click on the university name to review the complete requirements, or follow the link in the next table):

| University | Total | Min. Class | Min. Dissertation |
|---|--------------|-------------------|--------------------------|
| University of Utah | 50 | 27 | 14 |
| BYU | 66 | 48 | 18 |
| Montana State Univ. | 60 | 18 | 18 |
| University of Nevada | 72 | 30 | 24 |
| Univ. of Pittsburgh | 72 | 36 | 36 |
| Virginia Commonwealth Univ. | 70 | 42 | 18 |
| UNC Charlotte | 72 | 18 | 36 |
| Iowa State Univ. | 72 | 18 | 36 |

This reduction in credit hours to 70 brings the USU program into the range of peer institutions and combined with the new streamlined exam and student evaluation procedures (discussed below), will increase the effectiveness and PhD productivity of the department, but not diminish the quality of the PhD product. In fact, it is anticipated that a process more focused on productivity than credit hours will increase the quality of our PhDs.

| University | Web link |
|---|---|
| University of Utah | http://www.cs.utah.edu/graduate/hb2013-14/gradhbk2013-14-phd_cs.html |
| BYU | https://cs.byu.edu/graduate-policy-handbook-phd-program |
| Montana State Univ. | http://www.cs.montana.edu/phd-courses.html |
| University of Nevada | http://www.unr.edu/degrees/computer-science-and-engineering/phd?view=requirements |
| Univ. of Pittsburgh | https://cs.pitt.edu/grad/phd.php |
| Virginia Commonwealth Univ. | http://www.pubapps.vcu.edu/Bulletins/graduate/?did=20281 |
| UNC Charlotte | https://cci.uncc.edu/degree-requirements-current |
| Iowa State Univ. | https://www.cs.iastate.edu/graduate/cs_phd.php |

In tandem with this proposed change, the CS department has implemented a new [exam schedule](#) (<http://cs.usu.edu/htm/ph-d-examination-policy/>) and is introducing a new annual evaluation policy of PhD student's productivity similar to the procedure for faculty evaluations. Students enter data describing their research, teaching and service contributions into a digital measure-like system and are then ranked using a

published rubric. Student progress is reviewed by the departmental graduate committee and anonymized data is presented to the faculty, enabling faculty to identify poor and excellent students. The department then recognizes excellent students with awards during the annual graduate student reception. Students making unacceptable progress will be warned their first year and then if no improvement is made the second year, departmental support will be withdrawn.

Section III: Institutional Impact

It is anticipated that this change will enable the CS department to increase enrolment within the CS PhD program while maintaining or increasing admission standards because we will be offering a more competitive product.

No change in administrative structure will be required.

The CS department is growing in faculty and in students so it is anticipated that planned and actual new hires in faculty will fully support these proposed changes in the PhD program. No new staff will be needed. Current facilities will continue to be adequate.

Section IV: Finances

We anticipate no major cost increases or savings from this change. In addition to those standard procedures in place for PhD and plan A MS students, faculty in the CS department include monies for tuition awards in their grant proposals as required by the COE.

Cover/Signature Page - Abbreviated Template/Abbreviated Template with Curriculum

Institution Submitting Request: Utah State University
Proposed Title: B.S. in Geology with Applied Environmental Geoscience Emphasis (new emphasis)
Currently Approved Title: B.S. in Applied Environmental Geoscience (to be discontinued)
School or Division or Location: College of Science
Department(s) or Area(s) Location: Geology
Recommended Classification of Instructional Programs (CIP) Code² (for new programs): 40.0601
Current Classification of Instructional Programs (CIP) Code (for existing programs): 40.0699
Proposed Beginning Date (for new programs): 01/07/2015
Institutional Board of Trustees' Approval Date:

Proposal Type (check all that apply):

| Regents' General Consent Calendar Items | | |
|--|-------------------------------------|---|
| <i>R401-5 OCHE Review and Recommendation; Approval on General Consent Calendar</i> | | |
| SECTION NO. | | ITEM |
| 5.1.1 | <input type="checkbox"/> | Minor* |
| 5.1.2 | <input checked="" type="checkbox"/> | Emphasis* |
| 5.2.1 | <input type="checkbox"/> | (CER P) Certificate of Proficiency* |
| 5.2.3 | <input type="checkbox"/> | (GCR) Graduate Certificate* |
| 5.4.1 | <input type="checkbox"/> | New Administrative Unit |
| | <input type="checkbox"/> | Administrative Unit Transfer |
| | <input type="checkbox"/> | Administrative Unit Restructure |
| | <input type="checkbox"/> | Administrative Unit Consolidation |
| 5.4.2 | <input type="checkbox"/> | Conditional Three-Year Approval for New Centers, Institutes, or Bureaus |
| 5.4.3 | <input type="checkbox"/> | New Center |
| | <input type="checkbox"/> | New Institute |
| | <input type="checkbox"/> | New Bureau |
| 5.5.1 | <input type="checkbox"/> | Out-of-Service Area Delivery of Programs |
| | <input type="checkbox"/> | Program Transfer |
| 5.5.2 | <input type="checkbox"/> | Program Restructure |
| | <input type="checkbox"/> | Program Consolidation |
| | <input type="checkbox"/> | Name Change of Existing Programs |
| 5.5.3 | <input type="checkbox"/> | Name Change of Existing Programs |
| | <input checked="" type="checkbox"/> | Program Discontinuation |
| 5.5.4 | <input type="checkbox"/> | Program Suspension |
| | <input type="checkbox"/> | Reinstatement of Previously Suspended Program |
| 5.5.5 | <input type="checkbox"/> | Reinstatement of Previously Suspended Program |
| | <input type="checkbox"/> | Reinstatement of Previously Suspended Administrative Unit |

**Requires "Section V: Program Curriculum" of Abbreviated Template*

Chief Academic Officer (or Designee) Signature:

I certify that all required institutional approvals have been obtained prior to submitting this request to the Office of the Commissioner.

Signature

Date:

Printed Name:

² CIP codes must be recommended by the submitting institution. For CIP code classifications, please see <http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55>.

Program Request - Abbreviated Template
Utah State University
Bachelor of Science in Geology with an Applied Environmental Geoscience Emphasis
08/22/2014

Section I: Request

This request is to discontinue the current Bachelor of Science degree in Applied Environmental Geoscience and instead create an emphasis in Applied Environmental Geoscience in the existing Bachelor of Science degree in Geology.

Section II: Need

The Bachelor of Science (BS) in Applied Environmental Geoscience (AEG) has been in place for more than four years, but very few students have chosen to pursue this degree. From interviews with these students as well as other Geology majors, a serious concern that has been expressed is the value of the AEG degree, both in terms of its employability following graduation and its desirability for prospective graduate programs. Consequently, the Department of Geology at Utah State University has decided to discontinue the BS in AEG and instead offer an AEG emphasis in the existing BS in Geology due to the professional recognition of USU's Geology BS that already exists among both potential employers and other institutions of higher education that offer graduate degrees in the Earth and Geological Sciences.

Furthermore, because of concerns expressed by AEG majors during interviews regarding some of the elective courses for the BS in AEG, the Department of Geology has reassessed the curriculum and has made changes to the electives for the AEG emphasis in the BS in Geology that will make it more beneficial and attractive to students, and thus more enticing to potential majors. Please note, however, that the total number of credit hours required for both the BS in AEG and the AEG emphasis in the BS in Geology is exactly the same.

Finally, while the current AEG majors will be accommodated to allow completion of their degrees according to the existing requirements after the program is discontinued, all of the students interviewed have expressed their desire to switch to the AEG emphasis in Geology if it is approved for the reasons described above.

Section III: Institutional Impact

The proposed change is not anticipated to affect enrollments in any other instructional programs of affiliated departments or programs, nor will the proposed change affect any existing administrative structures. No changes in faculty or staff will be required, nor will any new physical facilities or modification to existing facilities be required. No equipment will need to be committed to initiate this change.

Section IV: Finances

The proposed change is not anticipated to result in any costs or savings to the Geology Department, College of Science, or Utah State University, nor are any budgetary impacts on other programs or units within Utah State University anticipated.

Section V: Program Curriculum

All Program Courses (with New Courses in Bold)

| Course Prefix and Number | Title | Credit Hours |
|---|--|----------------|
| Required Courses | GEO 1110 - Physical Geology | 3 |
| | GEO 1115 - Physical Geology Laboratory | 1 |
| | GEO 3200 - Earth Through Time | 4 |
| | GEO 3500 - Minerals and Rocks | 4 |
| | GEO 3550 - Sedimentation and Stratigraphy | 4 |
| | GEO 3600 - Geomorphology | 4 |
| | GEO 3700 - Structural Geology | 4 |
| | GEO 4700 - Geologic Field Methods | 3 |
| | GEO 5200 - Geology Field Camp | 5 |
| | GEO 5600 - Geochemistry | 3 |
| | CHEM 1210 - Principles of Chemistry I | 4 |
| | CHEM 1215 - Principles of Chemistry Lab I | 1 |
| | CHEM 1220 - Principles of Chemistry II | 4 |
| | CHEM 1225 - Principles of Chemistry Lab II | 1 |
| | MATH 1210 - Calculus I | 4 |
| | STAT 3000 - Statistics for Scientists | 3 |
| | PHYS 2210 - Physics for Sci and Engr I | 4 |
| | PHYS 2215 - Physics for Sci and Engr Lab I | 1 |
| | BIOL 1610 - Biology I | 4 |
| | BIOL 1620 - Biology II | 4 |
| GEOG 1800 - Intro to GIS | 3 | |
| Sub-Total | | 68 |
| Elective Courses | PSC 3000 - Fundamentals of Soil Sci and | 4 |
| | PSC 5130 – Soil Genesis, Morph, and Class | 4 |
| | OR | |
| | WATS 3700 – Fund of Watershed Sci and | 3 |
| | WATS 4490 – Small Watershed Hydrology | 4 |
| | GEO 5630 – Geologic Image Analysis or | 3 |
| | WATS 4930 – Adv GIS and Spatial Anal or | 3 |
| | WATS 5003 – Remote Sensing Land Surf or | 4 |
| | WILD 5750 – Applied Remote Sensing | 3 |
| | BIOL 2220 – General Ecology or | 3 |
| CHEM 3650 – Environmental Chemistry or | 3 | |
| PSC 3820 – Climate and Climate Change | 3 | |
| Sub-Total | | 13 - 15 |
| Track/Options (if applicable) | | |
| Sub-Total | | |
| *(This is the same number of credits as the BS in AEG) Total Number of Credits | | 81 - 83 |

Program Schedule

Freshman Year

Fall Semester (13 credits)

GEO 1110 - Physical Geology (4)
GEO 1115 - Physical Geology Laboratory (1)
CHEM 1210 - Principles of Chemistry I (4)
CHEM 1215 - Principles of Chemistry Laboratory I (1)
MATH 1210 - Calculus I (4)

Spring Semester (16 credits)

GEO 3200 - Earth Through Time (4)
GEO 3500 - Minerals and Rocks (4)
CHEM 1220 - Principles of Chemistry II (4)
CHEM 1225 - Principles of Chemistry Laboratory II (1)
STAT 3000 - Statistics for Scientists (3)

Sophomore Year

Fall Semester (16 credits)

GEO 3550 - Sedimentation and Stratigraphy (4)
GEOG 1800 - Introduction to Geographic Information Systems (3)
PHYS 2210 - Physics for Science and Engineering I (4)
PHYS 2215 - Physics for Science and Engineering Laboratory I (1)
BIOL 1610 - Biology I (4)

Spring Semester (13 credits)

GEO 3700 - Structural Geology (4)
PHYS 2220 - Physics for Science and Engineering II (4)
PHYS 2225 - Physics for Science and Engineering Laboratory II (1)
BIOL 1620 - Biology II (4)

Junior Year

Fall Semester (7 credits)

GEO 3600 - Geomorphology (4)
GEO 4700 - Geologic Field Methods (3)

Spring Semester (6 - 7 credits)

PSC 3000 - Fundamentals of Soil Science (4) **or**
WATS 3700 - Fundamentals of Watershed Science (3)
BIOL 2220 - General Ecology (3) **or**
CHEM 3650 - Environmental Chemistry (3) **or**
PSC 3820 - Climate and Climate Change (3)

Summer Semester (5 credits)

GEO 5200 - Geology Field Camp (5)

Senior Year

Fall Semester (0 - 7 credits)

PSC 5130 - Soil Genesis, Morphology, and Classification (4) (if PSC 3000 taken in previous spring)
WILD 5750 - Applied Remote Sensing (3) (if neither WATS 4930 nor WATS 5003 taken in following spring)

Spring Semester (0 - 8 credits)

WATS 4490 - Small Watershed Hydrology (4) (if WATS 3700 taken in previous spring)
WATS 4930 - Advanced GIS and Spatial Analysis (3) **or**
WATS 5003 - Remote Sensing of Land Surfaces (4) (if WILD 5750 not taken in fall)

Cover/Signature Page – Full Template

Institution Submitting Request: Utah State University
Proposed Title: PhD Degree in Aerospace Engineering
School or Division or Location: College of Engineering
Department(s) or Area(s) Location: Mechanical and Aerospace Engineering
Recommended Classification of Instructional Programs (CIP) Code³ : 14.0201
Proposed Beginning Date: 08/01/2015
Institutional Board of Trustees' Approval Date: MM/DD/YEAR

Proposal Type (check all that apply):

| Regents' Agenda Items | | |
|---|-------------------------------------|---|
| <i>R401-4 and R401-5 Approval by Committee of the Whole</i> | | |
| SECTION NO. | | ITEM |
| 4.1.1 | <input type="checkbox"/> | (AAS) Associate of Applied Science Degree |
| 4.1.2 | <input type="checkbox"/> | (AA) Associate of Arts Degree |
| | <input type="checkbox"/> | (AS) Associate of Science Degree |
| 4.1.3 | <input type="checkbox"/> | Specialized Associate Degree |
| 4.1.4 | <input type="checkbox"/> | Baccalaureate Degree |
| 4.1.5 | <input type="checkbox"/> | K-12 School Personnel Programs |
| 4.1.6 | <input type="checkbox"/> | Master's Degree |
| 4.1.7 | <input checked="" type="checkbox"/> | Doctoral Degree |
| 5.2.2 | <input type="checkbox"/> | (CER C) Certificate of Completion |
| 5.2.4 | <input type="checkbox"/> | Fast Tracked Certificate |

Chief Academic Officer (or Designee) Signature:

I certify that all required institutional approvals have been obtained prior to submitting this request to the Office of the Commissioner.

Signature

Date:

Printed Name:

**R 401 Executive Summary
Utah State University
PhD Degree in Aerospace Engineering
Department of Mechanical and Aerospace Engineering
August 2014**

Program Description

The Department of Mechanical and Aerospace Engineering (MAE) at USU seeks to offer a new PhD (Doctor of Philosophy) degree program in Aerospace Engineering to complement the current MS in Aerospace Engineering and the current MS and PhD programs in Mechanical Engineering. Aerospace Engineering is the primary branch of engineering associated with design, construction, testing, and technology development for all types of flying vehicles including airplanes, rockets, missiles, and spacecraft. Currently, the PhD in Mechanical Engineering degree is being used to accommodate both mechanical and aerospace engineering graduate students who successfully complete the Mechanical Engineering doctoral program. The proposed new degree program will establish a separate degree path for aerospace engineering graduate students and attract new students that specifically desire a PhD graduate degree in Aerospace Engineering. This can be accomplished without any change to our current faculty, staff, and coursework.

Role and Mission Fit

The proposed PhD graduate degree program in Aerospace Engineering is consistent with the role of USU as set forth in Regent's Policy R312. The PhD in Aerospace Engineering will support the Regent's mission for a doctoral granting institution "*through discovery, creation, and transmission of knowledge through a graduate educational program.*" More specifically, Regent's Policy R312-4.1.2 states that "*the mission of Utah State University is to be one of the nation's premier student centered land grant and space grant universities by fostering the principle that academics come first; by cultivating diversity of thought and culture; and by serving the public through learning, discovery, and engagement.*" Additionally, the proposed program is complementary to ongoing research at the Space Dynamics Lab (SDL). In a letter of support from the USU Research Foundation (USURF), President Scott Hinton states that "*USURF and SDL would welcome and encourage an Aerospace PhD at USU. We think that the program you are proposing would complement and support much of the work that is the core of SDL's business.*"

Faculty

The MAE department has 16 tenured and tenure-track faculty members, all with doctoral degrees. Eight faculty members, including four with doctoral degrees in Aerospace Engineering, have expertise directly related to the proposed aerospace engineering program as well as current research projects in aerospace that will support the proposed PhD degree program.

Labor Market Demand

Nearly 80,000 engineers are currently employed in aerospace, significantly higher than the number employed in computer hardware, nuclear engineering, biomedical engineering or chemical engineering, among other fields. (IEEE, <http://www.todaysengineer.org/2012/may/career-focus.asp>) Over the decade from 2012 to 2022, the Bureau of Labor Statistics projects a 7% growth in employment for aerospace engineers. Overall, Utah is one of the top ten states in the nation in the concentration of aerospace employment. Given the large concentration of aerospace industries in Utah, USU graduates with a PhD in aerospace engineering will clearly be "first in line" to fill these available high-paying positions; keeping "home-grown" talent "close to home."

Student Demand

Presently the MAE department supports a PhD in Mechanical Engineering. A new PhD in Aerospace Engineering will provide graduate students with an option that is more focused on the specialized topics that are central to aerospace engineering. Graduates with a PhD in aerospace engineering will be better prepared and more competitive in the aerospace industry. Students wanting a PhD degree in aerospace engineering will be able to stay in Utah rather than go out of state. As stated previously, this change will help to keep home-grown talent close to home.

When the PhD in Aerospace Engineering program is approved, there exists a potential for an initial small decrease in the number of students pursuing a PhD in Mechanical Engineering. However, because of the previously-described market demand and the desire of many students to choose a program with a PhD in Aerospace Engineering, overall enrollment in MAE's PhD programs is projected to increase during the next five years.

Statement of Financial Support

Indicate from which of the following the funding for this new degree program will be generated:

- Legislative Appropriation
- Grants.....
- Reallocated Funds.....
- Tuition dedicated to the program
- Other

The MAE's full-time PhD graduate students receive graduate research or graduate teaching assistantships to help finance their education. All of the research assistantships are supported by grants and contracts initiated by the faculty. These grants and contracts also provide research equipment, materials, and supplies used by the students in their courses and research associated with the PhD degree.

Similar Programs Already Offered in the USHE

Currently, there no Aerospace Engineering PhD degree within the Utah System of Higher Education. Thus, offering the Aerospace PhD degree better positions USU to capture regional talent that would otherwise leave the state. A flourishing PhD program in aerospace engineering will likely attract students who would not have previously considered USU.

R 401 Proposal
PhD Degree in Aerospace Engineering
Department of Mechanical and Aerospace Engineering
Utah State University

Section I: The Request

Utah State University (USU) requests approval to offer the Doctor of Philosophy degree in Aerospace Engineering effective Fall Semester 2015. The program has been approved by the institutional Board of Trustees on xx.

Section II: Program Description

Overview

The Department of Mechanical and Aerospace Engineering (MAE) at USU seeks to offer a new PhD (Doctor of Philosophy) degree program in Aerospace Engineering to complement the current MS in Aerospace Engineering and the current MS and PhD programs in Mechanical Engineering. Aerospace Engineering is the primary branch of engineering associated with design, construction, testing, and technology development for all types of flying vehicles including airplanes, rockets, missiles, and spacecraft. Currently, the PhD in Mechanical Engineering degree is being used to accommodate both mechanical and aerospace engineering graduate students who successfully complete the Mechanical Engineering doctoral program. The proposed new degree program will establish a separate degree path for aerospace engineering graduate students and attract new students that specifically desire a PhD graduate degree in Aerospace Engineering. MAE offers sufficient foundation and aerospace courses that provide the breadth and depth needed for a quality aerospace PhD degree program without the need to develop any new courses.

PhD Degree Requirements

The PhD degree requires 72 credit hours beyond the bachelor's degree and 42 credit hours beyond the Master's degree and will comply with all Graduate School requirements for PhD programs of study including a formal dissertation. All students must pass 3 PhD Qualifier Exams, a dissertation proposal defense, and a final dissertation defense. PhD degree requirements also consists of core courses (5000-, 6000-, and 7000-level) in aerospace engineering, advanced mathematics, technical electives, and quality aerospace research. A summary of PhD degree requirements is provided below.

Aerospace Engineering (PhD) Degree Requirements

| Beyond the BS - 72 credits | Beyond the MS - 42 credits |
|--|---|
| Coursework*: 24 credits (minimum) Aerospace Core <ul style="list-style-type: none">• must include MAE 5500 and 5560 if not previously completed 21 credits (minimum) Aerospace Electives/Other <ul style="list-style-type: none">• No more than 6 credits MAE 7930 Doctoral Publications | Coursework*: 12 credits (minimum) Aerospace Core <ul style="list-style-type: none">• must include MAE 5500 and 5560 if not previously completed 6 credits (minimum) Aerospace Electives/Other <ul style="list-style-type: none">• No more than 6 credits MAE 7930 Doctoral Publications |

- No more than 6 credits MAE 5930/6930/7930 Independent Study courses.

6 credits advanced math

Dissertation Research

21 credits MAE 7970

Dissertation Proposal & Final Defense

*No more than 21 credits of 5000- level coursework

- No more than 6 credit MAE 5930/6930/7930 Independent Study courses.

3 credits advanced math

Dissertation Research

21 credits MAE 7970

Dissertation Proposal & Final Defense

*No more than 15 credits of 5000- level coursework

Purpose of the Degree

The new degree program will attract new PhD students to the MAE graduate studies and research program and provide graduate students with the opportunity to receive a degree more directly aligned with the academic and research skills that are critical to the aerospace industry. Students completing this degree program will possess skills sought by research organizations in industry, government, and academia requiring advanced design, research, and technical management in aerospace engineering. The PhD in Aerospace Engineering will support the Utah-based aerospace industry, as well as other prominent regional and national aerospace companies and research laboratories.

Institutional Readiness

The new degree program will be administered by the MAE Department, which has in place the administrative infrastructure necessary to manage the program. There is a graduate committee that oversees the graduate programs and a full-time staff member assigned to the graduate program. Presently, the MAE department supports a PhD program in Mechanical Engineering. The PhD program in Aerospace Engineering will place more emphasis on core aerospace engineering coursework, but will not require additional institutional resources or the development of new courses. In a very real sense, the level of effort and cost to administer this degree program will be the same as that already being accomplished for the Mechanical Engineering PhD degree.

Faculty

Eight faculty members in MAE have appropriate backgrounds and research interests in aerospace engineering to support the program. In the past, these faculty members have supported the MS program in Aerospace Engineering and a degree specialization in aerospace under the MS program in mechanical engineering.

Professors:

Christine Hailey - PhD Mechanical Engineering, University of Oklahoma, 1985 (aerodynamics and flight mechanics)

Associate Professors:

Rees Fullmer – PhD Mechanics Engineering, University of Utah, 1985 (guidance, navigation and control)
 Steven Folkman - PhD Mechanical Engineering, Utah State University, 1990 (aerospace structures)
 David Geller - PhD Space Physics and Astronomy, Rice University, 1999 (guidance, navigation and control)
 Steven Whitmore - PhD Aerospace Engineering, University of California, Los Angeles, 1989 (flight mechanics and propulsion)

Assistant Professors:

Aaron Katz - PhD Aeronautics and Astronautics, Stanford University, 2009 (computational fluid dynamics)
Currently two additional faculty positions are being filled at the assistant professor level to support the needs of the Aerospace Engineering curriculum.

Staff

Additional staff lines will not be required. The current resources within the Department of Mechanical and Aerospace Engineering will be able to accommodate this new program.

Library and Information Resources

Two major library resources needed for the new program are the IEEE Xplore database and a series of journals produced by the American Institute of Aeronautics and Astronautics. The Merrill-Cazier library presently subscribes to these resources. See attached letter from the Merrill-Cazier Library.

Admission Requirements

Applicants with a bachelor's or master's degree in Aerospace Engineering or Mechanical Engineering from an ABET-accredited program can apply. For unrestricted admission to the program, students are required to have a minimum 3.3 GPA and successfully pass the GRE exam. The subject GRE is not required. Additional coursework in aerospace engineering fundamentals may be required in individual cases. All graduate students are expected to have a working knowledge of a computer programming language.

Student Advisement

The mechanics of admission to the programs and fulfilling program requirements are handled by our full-time staff graduate advisor. As students are admitted to the program, they are assigned a temporary faculty advisor who guides them on which courses to take the first semester and how to prepare for the PhD Qualification Exams. During the first semester, students select a graduate committee and a major professor who advise them throughout the rest of their program.

Justification for the Number of Credits

The number of credits required for this program is the same as the currently offered PhD in Mechanical Engineering which is overseen by the Graduate School.

External Review and Accreditation

As with the current PhD program in Mechanical Engineering and practice throughout the United States, no accreditation will be sought.

Projected Enrollment

Table 1. Projected enrollment for the PhD Aerospace Engineering Degree.

| Year | Student FTE | Student Headcount | # of Faculty | Mean FTE-to-Faculty Ratio |
|-------------|--------------------|--------------------------|---------------------|----------------------------------|
| 1 | 4 | 4 | 8 | 0.50 |
| 4 | 6 | 6 | 8 | 0.75 |
| 3 | 8 | 8 | 8 | 1.00 |
| 4 | 9 | 9 | 8 | 1.13 |
| 5 | 10 | 10 | 8 | 1.25 |

Section III: Need

Program Need

Within the intermountain region, only Arizona State University, University of Arizona, and the University of Colorado at Boulder offer PhD programs in Aerospace Engineering. There are no Aerospace Engineering PhD degree programs in Wyoming, Nevada or Idaho, or within the Utah System of Higher Education (USHE). Thus, offering the Aerospace PhD degree better positions USU to capture regional talent that would otherwise leave the state. A flourishing PhD program in aerospace engineering will likely attract students who would not have previously considered USU.

Labor Market Demand

Nearly 80,000 engineers are currently employed in aerospace, significantly higher than the number employed in computer hardware, nuclear engineering, biomedical engineering or chemical engineering, among other fields. (IEEE, <http://www.todaysengineer.org/2012/may/career-focus.asp>) According to the U.S. Department of Labor, Bureau of Labor Statistics, aerospace engineers are expected to have a 7% growth in employment during the decade of 2012 to 2022.

Overall, Utah is one of the top ten states in the nation in the concentration of aerospace employment. In 2011, the Economic Development Corporation of Utah listed the leading aerospace organizations in Northern Utah. Largest amongst these organizations is Hill Air Force Base (HAFB) located just south of the city of Ogden, and near the towns of Clearfield, Riverdale, Roy, Sunset, and Layton. HAFB is the host unit for the USAF Material Command's 75th Air Base Wing. This unit provides support for the Ogden Air Logistics Complex (OALC) and its subordinate organizations. The OALC is the worldwide manager for a wide range of aircraft, engines, missiles, software, avionics, and accessories components. The largest private employer is Alliant Technology Systems (ATK) with the Space Systems Division groups located in Magna and Promontory, and its Aerospace Structures Division in Clearfield.

These large-scale employers are supported by a significant group of medium-sized employers including Aircraft and Space Defense Groups of Moog Inc., the Parker-Hannifin Corporation, Boeing Utah Company, and the Northrop Grumman Space and Missile Systems Group, all of Layton, Utah.

The Space Dynamics Laboratory, North Logan, Utah is a University Affiliated Research and Development Center (UARC) and a sub-unit of the Utah State University Research Foundation (USURF). It is a medium-sized non-commercial employer of aerospace engineers. SDL expects to continue to hire new PhD aerospace engineers as they have done for the past 50 years, and it would be to SDL's advantage if these PhD engineers were "home-grown" right in their own backyard.

Multiple small private supplier and integration organizations provide to this network of large-to medium scale employers. Examples of these small support vendors include Compositex, Inc., Sandy, Utah, a manufacturer of rocketry cases and nozzles; Groen Brothers Aviation Global, Inc., Salt lake City, Utah, a designer of high-performance rotorcraft for both civil and military applications; Borsight, Inc., Ogden, Utah, an aerospace systems integrator; and Hypercomp, Inc., Brigham City, Utah, a manufacturer of composite pressure vessels.

Despite the changing environment of the aerospace industry, where NASA's operations have scaled back significantly, demand for aerospace engineers by private, commercial, and national defense employers is still strong. Over the decade from 2012 to 2022, the Bureau of Labor Statistics projects a 7% growth in employment for aerospace engineers. This growth is primarily driven by two emerging markets 1) unmanned aerial vehicle (UAV) and their integration into civil airspace, and 2) commercial space ventures both crewed

and robotic. These emerging markets will require the creation and development of a wide swath of highly specialized technologies in order to become viable, and will clearly support a large pool of employees with advanced aerospace engineering degrees. Given the large concentration of aerospace industries in Utah, USU graduates with a PhD in aerospace engineering will clearly be "first in line" to fill these high-paying positions; keeping "home-grown" talent "close to home." USU and SDL already host the annual "SmallSAT" international conference on small spacecraft technologies; and the introduction of the PhD degree in Aerospace Engineering will better position Utah State to become the de facto leader of small spacecraft world.

Student Demand

Presently the MAE department supports a PhD in Mechanical Engineering. A new PhD in Aerospace Engineering will provide graduate students with an option that is more focused on the specialized topics that are central to aerospace engineering. Graduates with a PhD in aerospace engineering will be better prepared and more competitive in the aerospace industry. Students wanting a PhD degree in aerospace engineering will be able to stay in Utah rather than go out of state. As stated previously, this change will help to keep home-grown talent close to home.

When the PhD in Aerospace Engineering program is approved, there exists a potential for an initial small decrease in the number of students pursuing a PhD in Mechanical Engineering. However, because of the previously-described market demand and the desire of many students to choose a program with a PhD in Aerospace Engineering, overall enrollment in MAE's PhD programs is projected to increase during the next five years.

Section IV: Impact and Benefits

Collaborations with and Impact on Other USHE Institutions

There will be no impact on other USHE institutions.

Benefits

The PhD in Aerospace Engineering will directly impact the goals of the USHE to prepare a workforce and develop advanced aerospace technologies that will directly impact Utah's economy. This proposed degree will make USU graduates more competitive for aerospace engineering positions within Utah as well as elsewhere in the aerospace industry. By having more engineers educated and trained for their needs, the Utah aerospace companies are, presumably, going to be more competitive in competing for new contracts and developing new aerospace technologies.

Consistency with Institutional Mission

The mission of USU is to be one of the nation's premier student-centered land-grant and space-grant universities by fostering the principle that academics come first, by cultivating diversity of thought and culture, and by serving the public through learning, discovery, and engagement.

The proposed PhD in Aerospace Engineering enhances the University's reputation as a space-grant institution through both its graduates and research productivity. It supports the University Mission Statement in the following ways:

1. The department becomes more student-centered by providing a program to meet the needs of the students.

2. The doctoral program will improve academics in aerospace engineering by fostering research in the forefront of the field, consistent with the USU mission to be one of the nation's premier space-grant universities.

The doctoral program will serve the public by application of the research produced. It will also serve the growing aerospace industry in Utah with a better-prepared work force.

Section V: Program and Student Assessment

Program Assessment

The major goal for the program is to graduate PhD students with expertise in aerospace engineering and who are prepared to meet the needs of research organizations in industry and academia. Attainment of this goal will be measured by the placement rate of graduates within local and national research laboratories in industry, government, and academia.

Expected Standards of Performance

The standard of performance for all students is a grade of C or better in all classes required for the degree and to maintain an overall program GPA of 3.0 or higher in order to graduate with a PhD degree. In addition, all PhD students must satisfactorily pass a set of qualification exams within 3 semesters of being admitted to the aerospace engineering PhD program, and pass a dissertation defense upon completion of their dissertation research. PhD students are also expected to publish in peer-reviewed journals before completing their PhD program of study. These standards are already well established in the Graduate School as well as for the existing Mechanical Engineering PhD degree program.

Section VI: Finances

Funding Sources

The proposed PhD in Aerospace Engineering builds on MAE's MS in Aerospace Engineering Program and the aerospace specialization in place within MAE's undergraduate program. Additional funding is not required.

Reallocation

No budget transfers or reallocations will be requested or needed to offer a quality program as explained in the next section.

Impact on Existing Budget

A new aerospace PhD degree will enhance the MAE graduate program with virtually no impact on existing budgets.

Faculty: This new degree will have no impact on faculty salaries since new faculty positions are not needed to offer the degree. In reality, each professor is constantly managing his/her time to maintain a research program that includes preparing proposals, contract management, student mentoring, teaching courses, publishing research results, and providing University and professional service. Experience has shown that even though the required student contact time increases with the number of graduate advisees, the overall workload may not increase but actually decrease because there is more graduate student support for developing and maintaining the research productivity. The MAE Faculty feels that the benefits of the projected enrollment offset the time costs to manage the program.

Staff: This new degree program will have no impact on staff work load and staff salaries.

Facilities: During the past five years, the MAE department has been planning for and working toward increased graduate enrollment and has sufficient office/study space to accommodate the expected small enrollment increase. Most of the incidental cost associated with graduate students is already covered by the research grants/contracts and F&A return such that the impact on E&G funds is essentially zero.

Operating Costs: Increase in enrollment results in increased copy service charges and other miscellaneous expenses. MAE has already been using electronic communications more and more to curb paper and copy expenses. This will continue such that these costs will be minimal for this degree program. In summary, the additional work load imposed by this degree is minimal and will have no impact on tasks that would normally be done by current faculty and staff.

Budget Explanation: Salaries, wages, and benefits represent the expenses associated with teaching the courses for the new PhD Aerospace program. Since these courses are already being taught, the revenue to pay for these expenses is simply a reallocation within current department funds. Thus, the difference, revenue less expenses, is zero. The teaching expenses are based on eight faculty members with an approximately 50% teaching role assignment, and with a 50/50 split between mechanical engineering courses and aerospace engineering courses. The expenses are thus approximately 25% of our current salaries, wages, and benefits for these faculty members. Note that any additional expenses associated with research will be externally funded.

Comments for Table 2:

- FTE = 10 credits
- Tuition increase is estimated at 8%.
- Salary and Wages increase is estimated at 3%.
- Benefit increase follows the Sponsored Programs rates
- **No new funding is required for this program.**

Table 2. Projected Aerospace PhD Program Revenue and Expenses

| | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|--------------------------|-----------------------|--------|--------|--------|--------|--------|
| Students | | | | | | |
| | Projected FTE | 4 | 6 | 8 | 9 | 10 |
| | Cost Per FTE | 12,173 | 10,843 | 9,811 | 9,455 | 9,139 |
| | Student/Faculty Ratio | 0.50 | 0.75 | 1.00 | 1.13 | 1.25 |
| Projected Tuition | | | | | | |
| | Gross Tuition | 21,897 | 35,473 | 51,081 | 62,063 | 74,476 |
| | Tuition to Program | 0 | 0 | 0 | 0 | 0 |
| 5 Year Budget Projection | | | | | | |
| | | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
| Expenses | | | | | | |
| | Salaries & Wages | | | | | |
| | Benefits | | | | | |

| | | | | | | |
|---------------|---------------------------|---|---|---|---|---|
| | Total Personnel | N/A – All costs are currently covered in existing programs. There are no additional faculty or staff FTE, library or other operational funds required | | | | |
| | Current Expense | | | | | |
| | Travel | | | | | |
| | Capital | | | | | |
| | Library Expense | | | | | |
| Total Expense | | | | | | |
| Revenue | | | | | | |
| | Legislative Appropriation | | | | | |
| | Grants | N/A – Funded through existing resources | | | | |
| | Reallocation | | | | | |
| | Tuition to Program | | | | | |
| | Fees | | | | | |
| Total Revenue | | | | | | |
| Difference | Revenue-Expense | 0 | 0 | 0 | 0 | 0 |

Appendix A: Program Curriculum

All Program Courses

| PhD Beyond BS Course Requirements | Credit Hours (minimum) |
|--|-----------------------------------|
| Core Courses | 24 |
| Math Courses | 6 |
| Dissertation Research | 21 |
| Technical electives/other credits | 21 |
| Total Credits | 72 |

| PhD Beyond MS Course Requirements | Credit Hours (minimum) |
|--|-----------------------------------|
| Core Courses | 12 |
| Math Course | 3 |
| Dissertation Research | 21 |
| Technical electives/other credits | 6 |
| Total Credits | 42 |

Existing Aerospace Core Courses

Fall Semester

MAE 5500 Aerodynamics
MAE 5560 Dynamics of Space Flight
MAE 6500 Potential Flow
MAE 6510 Aircraft Dynamics and Flight Simulation
MAE 6540 Advanced Astrodynamics
MAE 7540 Advanced Astrodynamics Techniques/Applications

Spring Semester

MAE 6340 Spacecraft Attitude Control
MAE 6560 Spacecraft Navigation
MAE 6930 Advanced Control of Aero Vehicles

Summer Semester

MAE 6530 Advanced Propulsion
MAE 6570 Optimal Space Guidance
MAE 6930 Monte Carlo and Linear Covariance Techniques
MAE 7560 Optimal Estimation/Aerospace

Aerospace Technical Electives

Fall Semester

MAE 5310 Dynamic Systems and Controls
MAE 5420 Compressible Fluid Flow
MAE 6180 Dynamics & Vibrations
MAE 6410 Fluid Dynamics

MAE 7360 Optimal and Robust Control
MAE 6320 Linear Multivariable Control
ECE 5230 Space Systems Engineering
ECE 6240 Space Environment Engineering
ECE 6650 Optics I

Spring Semester

MAE 5440 Computational Fluid Dynamics
MAE 5510 Dynamics of Atmospheric Flight
MAE 5540 Propulsion Systems
MAE 6440 Advanced Computational Fluid Dynamics
MAE 6490 Turbulence*
MAE 6550 Advanced Structural Analysis
MAE 7330 Nonlinear and Adaptive Control
MAE 7350 Intelligent Control Systems

All Semesters (Fall, Spring, and Summer)

MAE 5930, 6930, 7930 Special Topics (must be Aero focused)

Approved Mathematics Courses

- a. MATH 5270: Complex Variables
- b. MATH 5410: Methods of Applied Mathematics
- c. MATH 5420: Partial Differential Equations
- d. MATH 5460: Introduction to Theory and Application of Nonlinear Dynamics Systems
- e. MATH 5760: Stochastic Processes
- f. MATH 6270: Complex Variables
- g. MATH 6410: Ordinary Differential Equations I
- h. MATH 6420: Partial Differential Equations I
- i. MATH 6440: Ordinary Differential Equations II
- j. MATH 6450: Partial Differential Equations II
- k. MATH 6470: Advanced Asymptotic Methods
- l. MATH 6610: Numerical Analysis
- m. MATH 6620: Numerical Analysis
- n. MATH 6640: Optimization
- o. ECE 6010: Stochastic Processes in Electronic Systems
- p. ECE 6030: Mathematical Methods for Signals and Systems
- q. STAT 5200 Design of Experiments
- r. MAE 7560 Optimal Estimation for Aerospace Systems

New Courses to be Added in the Next Five Years

No new courses are currently planned. However, to enhance the program and continually strengthen its relevance, it is expected that new courses will be integrated over time into the program using well established practices.

Appendix B: Program Schedule

The following is a sample program of study for the Aerospace Engineering PhD beyond the BS.

| PhD Aerospace Engineering (Year 1) | | | Yr 1 Credits |
|------------------------------------|-----------------------|--------------------------|-----------------|
| Fall 1 | Spring 1 | Summer 1 | |
| MAE 5500 | MAE 6340 | MAE 6530 | |
| MAE 5560 | MAE 5540 ¹ | | |
| MAE 5420 ¹ | MAE 5440 ¹ | | |
| 9 hours | 9 hours | 3 | 21 |
| ¹ Technical Elective | | | |
| PhD Aerospace Engineering (Year 2) | | | Yr 2 Credits |
| Fall 2 | Spring 2 | Summer 2 | |
| MAE 6500 | MAE 6560 | MAE 6570 | |
| MAE 6540 | Math 5420 | | |
| MAE 5310 ¹ | MAE 6440 ¹ | | |
| 9 hours | 9 hours | 3 hours | 21 |
| ¹ Technical Elective | | | |
| PhD Aerospace Engineering (Year 3) | | | Yr 3 Credits |
| Fall 3 | Spring 3 | Summer 3 | |
| MAE 6410 ¹ | MAE 7970 | MAE 7560 ^m | |
| ECE 5230 ¹ | | | |
| 6 hours | 9 hours | 3 hours | 18 |
| ¹ Technical Elective | | ^m Math Course | |
| PhD Aerospace Engineering (Year 4) | | | Yr 4 Credits |
| Fall 4 | Spring 4 | Summer 4 | |
| MAE 7970 | MAE 7970 | | |
| 6 hours | 6 hours | | 12 |
| | | | <hr/> |
| Total Credits | | | 72 |

The following is a sample program of study for the Aerospace Engineering PhD beyond the MS.

| PhD Aerospace Engineering (Year 1) | | | Yr 1 Credits |
|------------------------------------|-----------------------|-----------------|------------------|
| Fall 1 | Spring 1 | Summer 1 | |
| MAE 5500 | MAE 6340 | MAE 6530 | |
| MAE 5560 | MAE 5540 ¹ | | |
| MAE 5420 ¹ | MATH 5420 | | |
| 9 hours | 9 hours | 3 | 21 |
| ¹ Technical Elective | | | |
| PhD Aerospace Engineering (Year 2) | | | Yr 2 Credits |
| Fall 2 | Spring 2 | Summer 2 | |
| MAE 7970 | MAE 7970 | | |
| 6 hours | 6 hours | | 12 |
| ¹ Technical Elective | | | |
| PhD Aerospace Engineering (Year 3) | | | Yr 3 Credits |
| Fall 3 | Spring 3 | Summer 3 | |
| MAE 7970 | MAE 7970 | | |
| 6 hours | 3 hours | | 9 |
| | | | Total Credits 42 |

Appendix C: Faculty

Professors:

Christine Hailey - PhD Mechanical Engineering, University of Oklahoma, 1985 (aerodynamics and flight mechanics)

Associate Professors:

Rees Fullmer – PhD Mechanics Engineering, University of Utah, 1985 (guidance, navigation and control)

Steven Folkman - PhD Mechanical Engineering, Utah State University, 1990 (aerospace structures)

David Geller - PhD Space Physics and Astronomy, Rice University, 1999 (guidance, navigation and control)

Steven Whitmore - PhD Aerospace Engineering, University of California, Los Angeles, 1989 (propulsion)

Assistant Professors:

Aaron Katz - PhD Aeronautics and Astronautics, Stanford University, 2009 (computational fluid dynamics)

Currently two additional faculty positions are being filled at the assistant professor level to support the needs of the Aerospace Engineering curriculum.