



ARIZONA STATE UNIVERSITY  
PROPOSAL TO ESTABLISH A NEW GRADUATE DEGREE

This template is to be used only by programs that have received specific written approval from the Provost's office to proceed with internal proposal development and review. A separate proposal must be submitted for each individual new degree program.

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**DEGREE PROGRAM**

**College/School(s) offering this degree:** College of Liberal Arts and Sciences (CLAS) in collaboration with the Ira A. Fulton Schools of Engineering (FSE)

**Unit(s) within college/school responsible for program:** School of Earth and Space Exploration (SESE)

**If this is for an official joint degree program, list all units and colleges/schools that will be involved in offering the degree program and providing the necessary resources:** Graduate Faculty will be drawn from: School of Earth and Space Exploration (SESE), School of Electrical, Computer and Energy Engineering (SECEE), School of Engineering for Matter, Transport and Energy (SEMTE), School of Computing, Informatics, and Decision Systems Engineering (SCIDSE)

**Proposed Degree Name** Doctor of Philosophy (PhD) in Exploration Systems Design

**Doctoral Degree Type:** PhD-Doctor of Philosophy

**Proposed title of major:** Exploration Systems Design

**Is a program fee required?** Yes  No

**Requested effective term: Fall and year:** 2011  
(The first semester and year for which students may begin applying to the program.)

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**PROPOSAL CONTACT INFORMATION**

(Person to contact regarding this proposal)

**Name:** Kelin Whipple

**Title:** Professor

**Phone:** (480) 965-9508

**email:** kxw@asu.edu

**DEAN APPROVAL**

This proposal has been approved by all necessary unit and College/School levels of review, and the College/School(s) has the resources to offer this degree program. I recommend implementation of the proposed degree program. (Note: An electronic signature, an email from the dean or dean's designee, or a PDF of the signed signature page is acceptable.)

**College Dean Name:** Paul C. Johnson FSE  
(See attached signature page)

**College Dean Signature** \_\_\_\_\_ **Date:** \_\_\_\_\_

**College Dean name:** Sid P. Bacon CLAS

(If more than one college involved) (See attached approval)

**College Dean Signature** \_\_\_\_\_ **Date:** \_\_\_\_\_

**ARIZONA STATE UNIVERSITY  
PROPOSAL TO ESTABLISH A NEW GRADUATE DEGREE**

This proposal template should be completed in full and submitted to the University Provost's Academic Council [mailto:curriculum@asu.edu]. It must undergo all internal university review and approval steps including those at the unit, college, and university levels. A program **may not** be implemented until the Provost's Office notifies the academic unit that the program may be offered.

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**DEGREE PROGRAM INFORMATION**

**Doctoral: PhD-Doctor of Philosophy**

**Proposed title of major:** Exploration Systems Design

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**1. PURPOSE AND NATURE OF PROGRAM**

- A. Brief program description** (This is a catalog type description of no more than 250 words. Include the distinctive features of the program that make it unique. Do not include program or admission requirements.)

The PhD in Exploration Systems Design offers students an advanced systems approach for developing scientific exploration technologies in a wide range of demanding environments on the Earth, planets, moons, and space. An emphasis is placed on a deep understanding of both, the scientific problems in exploration as well as the engineering techniques and limitations involved in providing technological solutions. This new trans-disciplinary degree program provides a unique platform to train systems engineers targeting technological development for exploration science. The curriculum will integrate SESE's science, instrumentation and systems engineering core courses with related coursework from the Fulton Schools of Engineering. Students will emerge from this program with an advanced knowledge in real-world exploration challenges giving them the ability to materially contribute solutions useful to the next generation of terrestrial and space-based explorers.

- B. Total credit hours required for the program: 84**

- C. Are any concentrations to be established under this degree program?**  Yes  No

- i. If "Yes", please check one:

- Students must select a concentration as part of this degree program  
 Concentrations are optional

- ii. If "Yes", list the name of the concentrations and the minimum number of credit hours required for each concentration.

Concentration Name	Number of credit hours for courses specific to the concentration
Instrumentation	9
Sensor Networks	9
Systems Engineering	9

(Please expand table as needed. Right click in white space of last cell. Select "Insert Rows Below")

**2. PROGRAM NEED.** Explain why the university needs to offer this program (include data and discussion of the target audience and market).

Proposed program will enable ASU to prepare graduate students to provide key roles in space research and technology development, environmental and geologic engineering, earth resource exploration, and water and environment use policy. The School in collaboration with Fulton Schools of Engineering will leverage its significant strengths in knowledge, discoveries, and transdisciplinary resources in planetary science, geological science, and aerospace engineering to address critical shortfalls in the national and regional training of the next generation of geoscientists and aerospace engineers. Arizona has an expanding space industry with major new investments, and is prepared to engage new technologies to monitor and understand environmental issues in Arizona, the southwest, and throughout the world. SESE will collaborate with Fulton Schools of Engineering and actively engage the broader community in its research, teaching and outreach projects, stressing the School's role in integrating engineering, science, and technology to address the major environmental and resource issues that the U.S. and the world face. The state, region, and nation will benefit from the development of a graduate program Exploration Systems Design that prepares well-educated, global citizens who have the tools, knowledge and state-of-art technology to address key problems of a global nature, whether they are working in the private or the public sector.

**3. IMPACT ON OTHER PROGRAMS.** List other academic units that might be impacted by the proposed program and describe the potential impact (e.g., how the implementation of this program might affect student headcount/enrollment, student recruitment, faculty participation, course content, etc. in other programs). Attach letters of collaboration/support from impacted programs.

School of Electrical, Computer and Energy Engineering - 10 faculty from this school will participate in the Graduate Faculty, in addition some core courses are drawn from the school.

School of Engineering for Matter, Transport and Energy - 3 faculty from this school will participate in the Graduate Faculty, in addition some core courses are drawn from the school.

School of Computing, Informatics, and Decision Systems Engineering - 3 faculty from this school will participate in the Graduate Faculty in addition some core courses are drawn from the school.

**4. PROJECTED ENROLLMENT** How many new students do you anticipate enrolling in this program each year for the next five years? Please utilize the following tabular format.

<b>5-YEAR PROJECTED ANNUAL ENROLLMENT</b>					
	<b>1<sup>st</sup> Year</b>	<b>2<sup>nd</sup> Year</b> (Yr 1 continuing + new entering)	<b>3<sup>rd</sup> Year</b> (Yr 1 & 2 continuing + new entering)	<b>4<sup>th</sup> Year</b> (Yrs 1, 2, 3 continuing + new entering)	<b>5<sup>th</sup> Year</b> (Yrs 1, 2, 3, 4 continuing + new entering)
Number of Students Majoring (Headcount)	5	15	30	45	60

**5. STUDENT LEARNING OUTCOMES AND ASSESMENT**

**A. List the knowledge, competencies, and skills** students should have when they graduate from the proposed degree program. (You can find examples of program Learning Outcomes at <http://www.asu.edu/oue/assessment.html>).

Program Outcomes: Graduates from the Exploration Systems Design Program will be able to develop technologies for future earth and space exploration.

- These graduates will be able to successfully integrate science and engineering.
- They will provide solutions for real-world challenges in exploration.

Competencies

- Reduce complex problems to their most important attributes; and design and carry out experiments, models, or observations that address these attributes.
- Capacity for critical thinking regarding scientific and engineering problems and findings
- Ability to work collegially, fairly, and effectively in groups on research projects.
- Ability to use technology effectively in learning, research and discovery.
- Capacity for informal and formal communication of science concepts through various media (writing, graphics, oral presentations).

Knowledge Outcomes

- Physical and chemical nature of materials that make up the universe, galaxies, stars, and planets.
- Relationship of scientific requirements to engineering technology.
- Effective interactions of technologies.
- Knowledge and novel discovery of engineering design for exploration and of exploration as a discipline.
- Knowledge and capability of instrumentation design and assembly.
- Supporting research of biology, chemistry, geoscience, physics, and mathematics.

Skills Outcomes

- Connect scientific drivers and/or data with engineering applications and solutions.
- Assess the best path to a goal from a set of options, including cost, risk, schedule and state-of-art technology.
- Integrate science and engineering in their dissertation projects.
- Preparation to progress to professional positions, such as Member of Technical Staff at NASA/JPL, Research Scientist at DOD etc.

**B. Describe the plan and methods to assess** whether students have achieved the knowledge, competencies and skills identified in the Learning Outcomes. (You can find examples of assessment methods at <http://www.asu.edu/oue/assessment.html>).

Student Formative Assessment Metric

- Quality of knowledge learning in the completed scientific and engineering core courses

Student Summative Assessment Metric

- Quality of work, effectiveness and novelty of integration of science and technology in completion of their thesis research project .

Program Assessment Metrics

- Track career trajectories of graduates for 10 years.
- Annually review quality and effectiveness of the research projects and publication.

**6. ACCREDITATION OR LICENSING REQUIREMENTS (if applicable).** Provide the names of the external agencies for accreditation, professional licensing, etc. that guide your curriculum for this program, if any. Describe any requirements for accreditation or licensing.

**None**

**7. FACULTY, STAFF AND RESOURCE REQUIREMENTS**

**A. Faculty**

**i. Current Faculty.** List the name, rank, highest degree, area of specialization/expertise and estimate of the level of involvement of all current faculty who will teach in the program.

**SESE**

Name	Rank	Highest Degree	Specialization	Involvement
Arrowsmith, Ramon	Professor	Ph.D.	Surface processes, neotectonics	0.25
Behar, Alberto	Associate	Ph.D.	Robotics	1.0

	Professor			
Bell, James	Professor	Ph.D.	Planetary science, remote sensing	0.5
Bowman, Judd	Assistant Professor	Ph.D.	Cosmology, astronomical instrumentation	0.5
Christensen, Philip	Regent's Professor	Ph.D.	Remote sensing, planetary science	0.5
Clarke, Amanda	Associate Professor	Ph.D.	Volcanology, geologic hazards	0.25
Fouch, Matthew	Associate Professor	Ph.D.	Geophysics, seismology	0.25
Garnero, Edward	Professor	Ph.D.	Geophysics, seismology	0.25
Greeley, Ronald	Regent's Professor	Ph.D.	Planetary science, remote sensing	0.5
Groppi, Christopher	Assistant Professor	Ph.D.	Experimental astrophysicist	1.0
Hartnett, Hilairy	Assistant Professor	Ph.D.	Geochemistry, environmental biogeochemistry (joint faculty SESE and Chem & Biochem)	0.25
Hodges, Kip	Director, Foundation Professor	Ph.D.	Tectonics, geochemistry	0.25
Robinson, Mark	Professor	Ph.D.	Planetary science, remote sensing	0.5
Saripalli, Srikanth	Assistant Professor	Ph.D.	Robotics engineering	1.0
Scowen, Paul	Associate Research Professor	Ph.D.	Astronomical Instrumentation	0.5
Shock, Everett	Professor	Ph.D.	Geochemistry, environmental biogeochemistry (joint faculty SESE and Chem & Biochem)	0.25
Vivoni, Enrique	Associate Professor	Ph.D.	Hydrogeology (joint faculty with SESE and Civil & Environmental Engineering)	0.25
Whipple, Kelin	Professor	Ph.D.	Surface processes, geomorphology	0.25
Yu, Hongyu	Assistant Professor	Ph.D.	Sensor development, environmental sensing, (joint faculty with SESE and Mechanical & Aerospace Eng)	1.0

**SECEE**

Name	Rank	Highest Degree	Specialization	Involvement
Aberle, James	Associate Professor	Ph.D.	Wireless communications; modeling of complex electromagnetic phenomena	0.25-0.5

Bakkaloglu, Bertan	Associate Professor	Ph.D.	RF and mixed-signal IC design	0.25-0.5
Barnaby, Hugh	Associate Professor	Ph.D.	Semiconductors, microelectronic device and sensor design	0.25-0.5
Cao, Yu	Associate Professor	Ph.D.	Physical modeling of nanoscale technologies	0.25-0.5
Christen, Jennifer Blain	Assistant Professor	Ph.D.	3D and non-traditional microfabrication; microfluids	0.25-0.5
Jalali-Farahani, Bahar	Assistant Professor	Ph.D.	Analog integrated circuits	0.25-0.5
Kiaei, Sayfe	Associate Dean, Professor	Ph.D.	Wireless transceiver design	0.25-0.5
Papandreou-Suppappola, Antonia	Professor	Ph.D.	Waveform-agile sensing; time frequency processing	0.25-0.5
Thornton, Trevor	Professor	Ph.D.	Nanostructures; molecular electronics and sensors	0.25-0.5
Yu, Hongbin	Assistant Professor	Ph.D.	Nanostructures; nano device fabrication	0.25-0.5

**SEMTE**

Name	Rank	Highest Degree	Specialization	Involvement
Chattopadhyay, Aditi	Professor	Ph.D.	Adaptive structures; structural health monitoring	0.25-0.5
Newman, Nate	Professor	Ph.D.	Semiconductor, superconductor and dielectric materials	0.25-0.5
Santos, Veronica	Assistant Professor	Ph.D.	Hand biomechanics, robotics, prosthetics	0.25-0.5

**SCIDSE**

Name	Rank	Highest Degree	Specialization	Involvement
Burleson, Winslow	Assistant Professor	Ph.D.	Human computer interaction	0.25-0.5
Kambhampati, Subbarao	Professor	Ph.D.	Artificial intelligence	0.25-0.5
Gupta, Sandeep	Professor	Ph.D.	Sensor Networks	0.25

ii. **New Faculty.** Describe the new faculty hiring needed during the next three years to sustain the program. List the anticipated hiring schedule and financial sources for supporting the addition of these faculty.  
None

iii. **Administration of the program.** Explain how the program will be administered for the purposes of admissions, advising, course offerings, etc. Discuss the available staff support.

Existing Staff within the School of Earth and Space Exploration will administer the program. Primary Administrative functions will be performed by the SESE Academic Support Staff (Rebecca Polley, Becca Dial) and by SESE's Associate Director for Graduate Education, Dr. Ramon Arrowsmith, assisted by SESE's Graduate Admissions and Graduate Oversight Committees. Administration will be parallel to administration of SESE's current PhD degrees. Although a significant number of faculty are involved from the Fulton Schools of Engineering, the administration of the program will be the sole responsibility of the School of Earth and Space Exploration. This is intended to simplify the administrative processes such as admissions, liaison with Graduate College etc.

**B . Resource requirements to launch and sustain the program.** Describe any new resources required for this program's success such as new staff, new facilities, new library resources, new technology resources, etc None

## 8. CURRICULAR STRUCTURE OF THE PROPOSED PROGRAM

**A. Admission Requirements** The requirements listed below are Graduate College requirements. Please modify and/or expand if the proposed degree has additional admissions requirements.

- i. **Degree.** Minimum of a bachelor's degree (*or equivalent*) or a graduate degree from a regionally accredited College or University of recognized standing in a related field such as Engineering, Computer Science, Geological Sciences, Physics

Modify or expand, if applicable:

To be eligible for admission to the graduate program applicants must:

1. Bachelor's degree in Sciences/Engineering
2. Bachelor's degree GPA above 3.0
3. Submit general GRE scores; exam must have been taken within last 5 years. There is not a minimum score requirement for the GRE exams because scores are taken into consideration with the academic record and other materials as a whole. Meeting the minimum criteria does not guarantee admission to the program.
4. Demonstrate English proficiency via the TOEFL or IELTS, if necessary. More information regarding English proficiency and required scores can be found at <http://graduate.asu.edu/admissions/international.html>

Applications for fall admission are due by January 15th of the same year. Applications for spring admission are due by October 1st of the previous year. Admissions for starting in the Spring will be for special circumstances only – most students will start in the Fall term. There is sufficient flexibility in core course options that students that do start in the Spring will not be disadvantaged.

Students are expected to select a faculty member who agrees to serve as their research advisor for the duration of the program. Given the broad range of expertise necessary for the diverse research topics under study in the program, it is expected that the students committee will have faculty from multiple schools.

Students who are admitted with a B.S. that is not in their area of study, may be required by the Graduate Committee or their Research Advisor to take additional courses to complete their background. These will be listed as deficiencies in their admission letter and are not expected to count towards their degree requirements. All required course work must be completed before the student can hold a dissertation technical review. The following courses provide a general guideline for the competencies required by the student for each concentration.

Depending on the background of the student and the concentration they choose the student must satisfy the following competencies:

**Instrumentation Concentration:**

A BS degree in EE/MAE is preferred. Ideally the student will have completed courses in Digital Systems and Circuits (EE 425 or equivalent) and undergraduate courses in Circuit Theory (EE 334) and Sensor and Control Systems (MAE 318). Alternatively the students can take SES 330 – Practical Electronics and Instrumentation (taught by Chris Groppi and Alberto Behar) to satisfy any deficiencies.

**Systems Engineering Concentration:**

Successful completion of a Senior Capstone/Design Project is an admissions requirement for this concentration. For students who have not had a Design course, they are required to take SES 405 Systems Engineering as a deficiency course.

**Sensor Networks Concentration:**

A BS in EE/CS is preferred. The students should have completed courses in Embedded Systems (CSE 325 or equivalent), programming, data structures and algorithms (CSE 100 and CSE 310 or equivalent) which may be designated as deficiency courses during admissions.

- ii. **GPA.** Minimum of a 3.00 cumulative GPA (scale is 4.0=A) in the last 60 hours of a student's first bachelor's degree program Modify or expand, if applicable:
- iii. **English Proficiency Requirement for International Applicants.** If applicable list any English proficiency requirements that are higher than and/or in addition to the Graduate College requirement. (See Graduate College policy and procedures <http://graduate.asu.edu/admissions/international.html#proficiency>):
- iv. **Required Admission Examinations.**  
 GRE     GMAT     Millers Analogies     None Required
- v. **Application Review Terms.** Indicate all terms for which applications for admissions are accepted and the corresponding application deadline dates, if any:
  - Fall      Deadline (month/year): January 15<sup>th</sup> of the same year
  - Spring      Deadline (month/year): October 1<sup>st</sup> of the previous year
  - Summer      Deadline (month/year):

**B. Degree Requirements.** Below provide the curricular requirements for the proposed degree program.

- i. **Total credit hours (cr hrs) required for the degree program:** 84
- ii. **Core courses.** List all required core courses and total credit hours for the core (required courses other than internships, thesis, dissertation, capstone course, etc). Omnibus number courses can not be used as core courses. Permanent numbers must be requested by submitting course proposal to ACRES for approval.

**Total cr hrs for required core courses:** 6

All courses are currently available - no new courses involved.

Two Science Courses (6 credit hours) Selected from SESE Graduate Course Catalog (SES and GLG courses; (these courses must be approved by the Dissertation Committee).



Please see section 8.B.vii for the courses required for the concentrations.

**iii. Elective Courses**

**Total cr hrs for program electives:** 57 cr hrs

Provide a sample list of elective courses:

Remaining credit hours may be chosen from among electives offered by all the participating units, with approval from the dissertation committee and filed in the student's POS.

**A list of Suggested Electives is given below. Please note that this list is not all-inclusive**

GLG598 Fundamentals of Planetary Geology  
AST 521 Stars and Interstellar Medium I  
AST 522 Stars and Interstellar Medium II  
AST 523 Stars and Interstellar Medium III  
AST 531 Galaxies and Cosmology I  
AST 532 Galaxies and Cosmology II  
AST 533 Galaxies and Cosmology III  
GLG 460 Astrobiology (SESE)  
GLG 598 Topic: Remote Sensing  
GLG 598 Topic: Volcanology  
GLG 598 Topic: Geomorphology  
GLG 598 Topic: Geophysics  
GLG 598 Topic: Geodynamics  
GLG 598 Topic: Meteorites and Cosmochemistry  
GLG 591 Topic: Isotope Geochemistry

IEE 598 Topic: Introduction to Systems Engineering  
CSE 591 Topic: Machine Learning  
CSE 591 Topic: Statistical Analysis and Pattern Recognition  
EEE 591 Topic: Feedback Systems  
EEE 591 Topic: Computer Controlled Systems  
EEE 591 Topic: Instrumentation for Extreme Environment Systems  
EEE 598 Topic: MEMS for Earth and Space Exploration  
AST 598 Topic: Astronomical Instrumentation  
SES 498 Topic: Robotics  
SES 405 Exploration Systems Engineering  
EEE 591 Topic: Health Physics: Principles of Radiation  
CSE 598 Topic: Wireless Sensor Networks  
CSE 591 Topic: Green Computing and Communication

**iv. 400-Level Courses.** No more than 6 credit hours of 400-level coursework can be included on graduate student program of study.

1. Are 400-level ASU courses allowed on student program of study for this degree?  Yes  No

2. If yes, how many credit hours? 6

**v. Culminating experience** for the proposed program (please check all that apply and provide requested information):

	Required?	Brief description of the applied project or the capstone course, as applicable.	Course prefix and number	Credit hours
Thesis (master's only)	<input type="checkbox"/>			
Applied Project (master's only)	<input type="checkbox"/>			
Capstone course (master's only)	<input type="checkbox"/>			
Dissertation (doctoral only)	<input checked="" type="checkbox"/>	Design and Development of an innovative technology/instrument	SES 799	12 cr hrs

(Please expand table as needed. Right click in white space of last cell. Select "Insert Rows Below")

- vi. **If applicable, provide the following information about any concentration(s) associated with this degree program.** Please attach a sample program of study with timeline for each concentration listed below.

**Concentration name:** PLEASE SEE BELOW.

**Total cr hrs for the courses required for the proposed concentration:** 9

**Students have to select one of the three Concentrations in the Program:**

1. Instrumentation
2. Sensor Networks
3. Systems Engineering

**1. Instrumentation students must take 3 of the following 6 courses (9 credit hours):**

EEE 425 Digital Systems and Circuits  
 EEE 433 Analog Integrated Circuits  
 EEE 523 Advanced Analog Integrated Circuits  
 EEE 539 Introduction to Solid State Electronics  
 EEE 527 Analog to Digital Converters  
 EEE 481 Computer Controlled Systems

**2. Sensor Networks students must take 3 of the following 6 courses (9 credit hours):**

CSE 534 Advanced Computer networks  
 CSE 535 Mobile Computing  
 EEE 551 Information Theory  
 CEE 581 Advanced Earth Systems Engineering and Management  
 EEE 554 Random Signal Theory  
 EEE 507 Multidimensional Signal Processing

**3. Systems engineering students must take 3 of the following 8 courses (9 credit hours):**

IEE 572 Design of Engineering Experiments  
 CSE 571 Artificial Intelligence  
 CSE 574 Planning and Learning Methods  
 MAE 547 Mechanical Design and Control of Robots  
 MAE 525 Mechanics of Smart Materials and Structures  
 IEE 547 Human Factors Engineering  
 IEE 573 Reliability Engineering  
 IEE 552 Strategic Technological Planning

- vii. **For Doctoral Degrees, indicate the Master's Degree Credit Allowance:** If approved by the student's supervisory committee, does the program allow up to 30 credit hours from a previously awarded master's degree to count towards the degree requirements for this doctoral program? Yes or No
- viii. **Committee:** Required Number of Thesis or Dissertation Committee Members (must be at least 3 including chair or co-chairs): 5
- ix. **Foreign Language Exam.**  
Foreign Language Examination(s) required? Yes No  
  
If yes, list all foreign languages required:
- x. **Course Prefix(es)** Provide the following information for the proposed graduate program.  
a. Will a new course prefix(es) be required for this degree program?  
Yes  No   
b. If yes:  
  - Complete the New Prefix Request Form for each new prefix. This form can be located on the Office of the Executive Vice President and Provost of the University Curriculum Development website at <http://provost.asu.edu/curriculum>.
  - Submit the completed form as part of this proposal submission.
- xi. **New Courses Required for Proposed Degree Program.** Provide course prefix, number, title, and credit hours and description for any new courses required for this degree program.  
**None**



ARIZONA STATE UNIVERSITY  
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DEGREE PROGRAM

College/School(s) offering this degree: College of Liberal Arts and Sciences (CLAS) in collaboration with the Ira A. Fulton Schools of Engineering (FSE)

Unit(s) within college/school responsible for program: School of Earth and Space Exploration (SESE)

If this is for an official joint degree program, list all units and colleges/schools that will be involved in offering the degree program and providing the necessary resources: Graduate Faculty will be drawn from: School of Earth and Space Exploration (SESE), School of Electrical, Computer and Energy Engineering (SECEE), School of Engineering for Matter, Transport and Energy (SEMTE), School of Computing, Informatics, and Decision Systems Engineering (SCIDSE)

Proposed Degree Name Doctor of Philosophy (PhD) in Exploration Systems Design

Doctoral Degree Type: PhD-Doctor of Philosophy

Proposed title of major: Exploration Systems Design

Is a program fee required? Yes  No

Requested effective term: Fall and year: 2011  
(The first semester and year for which students may begin applying to the program.)

PROPOSAL CONTACT INFORMATION  
(Person to contact regarding this proposal)

Name: Kelin Whipple

Title: Professor

Phone: (480) 965-9508

email: kxw@asu.edu

DEAN APPROVAL

This proposal has been approved by all necessary unit and College/School levels of review, and the College/School(s) has the resources to offer this degree program. I recommend implementation of the proposed degree program. (Note: An electronic signature, an email from the dean or dean's designee, or a PDF of the signed signature page is acceptable.)

College Dean Name: Paul C. Johnson

FSE

College Dean Signature

Date: 10-4-10

College Dean name: Sid P. Bacon

CLAS

(If more than one college involved)

College Dean Signature

Date:

## **CLAS APPROVALS**

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**From:** Sid P. Bacon [mailto:spb@asu.edu]  
**Sent:** Monday, October 11, 2010 5:17 PM  
**To:** curriculumplanning@asu.edu  
**Cc:** Jenny Smith; Roxann Gonzales  
**Subject:** PhD in Exploration Systems Design

The College of Liberal Arts and Sciences Curriculum Committee and Senate have approved the attached proposal for a PhD in Exploration Systems Design. I strongly support this proposal.

Thank you.

Sid

**SID P. BACON**

Dean of Natural Sciences

**College of Liberal Arts and Sciences**

Arizona State University | P.O. Box 876505 | Tempe, Arizona 85287-6505  
480.965.4795 | Fax: 480.965.1093 | e-mail: [Sid.Bacon](mailto:Sid.Bacon@asu.edu)

**ASU College of Liberal Arts and Sciences** — *Transforming learning, discovery and lives*

## Proposal for Curriculum Action - Impact Form

Date September 16, 2010

To: Stephen Phillips  
Unit: Sch Elect Compnr & Energy Engr

From: Kelin Whipple

As a step in the procedures governing new course approval, the attached course proposal is provided for your review and response. Please complete this form and return to Kelin Whipple (kxw@asu.edu).

Proposed New Graduate Program PhD

Title Exploration Systems Design

I have no objection to the proposed graduate program.

I object to the proposed graduate program.

Reasons for objection and/or other comments/recommendations:

Signature of Reviewer: Stephen M. Phillips

## Proposal for Curriculum Action - Impact Form

Date September 16, 2010

To: Kyle Squires  
Unit: Sch Engr of Matter, Transport and Energy

From: Kelin Whipple

As a step in the procedures governing new course approval, the attached course proposal is provided for your review and response. Please complete this form and return to Kelin Whipple (kxw@asu.edu).

Proposed New Graduate Program PhD

Title Exploration Systems Design

I have no objection to the proposed graduate program.

I object to the proposed graduate program.

Reasons for objection and/or other comments/recommendations:

Signature of Reviewer: Kyle D. Squires

## Proposal for Curriculum Action - Impact Form

Date September 16, 2010

To: Ronald Askin  
Unit: Sch Computing, Informatics and Descision Systems

From: Kelin Whipple

As a step in the procedures governing new course approval, the attached course proposal is provided for your review and response. Please complete this form and return to Kelin Whipple (kxw@asu.edu).

Proposed New Graduate Program PhD

Title Exploration Systems Design

I have no objection to the proposed graduate program.

I object to the proposed graduate program.

Reasons for objection and/or other comments/recommendations:

Just a minor comment. There are a few inconsistencies in the document such as stating that two faculty from the School of Computing, Informatics and Decision Systems Engineering will participate and then listing three names.

Signature of Reviewer: Ronald Askin, Director, School of Computing, Informatics and Decision Systems Engineering