Background and Purpose
On January 14, 2004, President George W. Bush unveiled a new direction and vision for NASA to send humans to explore the moon, Mars and beyond. The Exploration Systems Mission Directorate (ESMD) is dedicated to creating a constellation of new capabilities, supporting technologies and foundational research that enables sustained and affordable human and robotic exploration.

NASA continues to contribute to our Nation’s efforts in achieving excellence in science, technology, engineering and math (STEM) education. This includes contributing to the development of the STEM workforce in disciplines needed to achieve NASA’s strategic goals.

The purpose of the ESMD Higher Education Grants is to train and develop the highly skilled scientific, engineering, and technical workforce of the future needed to implement the Vision for Space Exploration. Through this solicitation, proposals should provide opportunities to involve a diverse group of students (graduate and undergraduate) in substantive, hands-on engineering experiences to prepare them for future careers in space. Systems engineering experience is a key aspect of these opportunities.

The following are areas critical to the future of space exploration. These are the design, engineering, and research areas that we will consider ESMD-relevant when we review proposals:

- **Spacecraft** - Guidance, navigation and control; thermal; electrical; structures; software; avionics; high speed re-entry; modeling; power systems; interoperability/commonality; advanced spacecraft materials; crew/vehicle health monitoring; life support.
- **Propulsion** - Propulsion methods that will utilize materials found on the moon or Mars, “green” propellants, on-orbit propellant storage, motors, testing, fuels, manufacturing, soft landing, throttleable propellants, high performance, and descent.
- **Lunar and Planetary Surface Systems** - Precision landing hardware, software, in-situ resource utilization (ISRU), navigation systems, extended surface operations, robotics, environmental analysis, radiation protection, spacesuits, life support, power systems.
- **Ground Operations** - Pre-launch, launch, mission operations, command and control software systems, communications, landing and recovery.
Exploration Systems Higher Education Grants

1. NASA Exploration Internships – Will provide students with ESMD-relevant work experience in industry or at a NASA center. Students should be engaged in hands-on engineering projects with a strong and involved placement mentor. Internships are open to juniors, seniors and graduate students, and can be placed as either a) short duration, full-time (e.g., 10 weeks), or b) longer duration, part-time (full academic year) internships. Interns will be required to provide an end-of-internship report (format will be provided). SDSGC anticipates that at least four internship applications will qualify for support under the ESMD guidelines and that these will be carried out during spring and/or summer 2007.

A list of available internship opportunities at NASA Centers is posted at: http://education.ksc.nasa.gov/ESMDSpaceGrant/Internships.htm

Budget and Stipend Purpose: Up to four students will be funded at stipend amounts of $6,000 per student (includes travel funds) for spring 2007 semester or summer 2007 break. The purpose of both undergraduate and graduate stipends is to reward past accomplishments and recognize potential future achievements. The stipends are made to individuals and are not to be considered compensation for employment.

2. NASA Exploration Engineering Challenge Team Grants - Provide grants to two or more teams within SDSGC higher education institutions to participate in existing national level, ESMD-related engineering design challenges. Examples include: University Rocket Launch Competition, University Student Launch Program, American Astronomical Society CanSat competition, NanoSat-4 Competition, The Great Moonbuggy Race, etc. Funds can be used to buy materials, attend pre-challenge workshops, or travel to competition sites.

The priorities are to:
- Promote competition in national level programs to interact with students and faculty with similar interests from other regions,
- Maximize the number of college or university students participating, and
- Provide experience working in interdisciplinary teams.

Teams will have the opportunity to submit a report on the role that systems engineering played in their interdisciplinary design effort. An additional prize for the Best Systems Engineering Paper will be awarded by NASA. This prize is independent of the budget below. Details about this competition will be provided separately.

A list of relevant engineering challenge team competitions is posted at: http://education.ksc.nasa.gov/ESMDSpaceGrant/NationalCompetitions.htm

As part of the funding of ESMD engineering design competition teams, SDSGC will request that teams develop community outreach activities that highlight the excitement of their engineering team projects and the relevance to NASA’s Exploration mission. For
example, SDSM&T’s Aero Design and Robotics teams already provide excellent hands-on demonstrations to precollege groups at SD Space Days. Robotics team members also run RoboCamps in the summer for precollege groups. SDSGC will encourage participating institutions to compete in new challenge competitions that are particularly relevant to ESMD, such as the University Rocket Launch Competition, the University Student Launch Program, the American Astronomical Society’s CanSat competition, and the Great Moonbuggy Race.

**Budget:** $5,000 distributed among two or more teams.

SDSGC anticipates that two engineering challenge teams will be eligible for support under the proposed ESMD program and that at least 30 students will participate.

**Eligibility and U.S. Citizenship Requirement**
All applicants must be citizens of the United States. All students of U.S. citizenship, including underrepresented students and persons with disabilities, are encouraged to apply.

**Application Procedure**
Applications are open for either or both of the following grant types and must be completed and submitted to the SD Space Grant Consortium Headquarters Office at SDSM&T by 4:00 p.m., November 1, 2006.

1) **Student Internships** – open only to student applicants
2) **Design Team projects** – open to student and/or faculty applicants

1) **Student Internship Applications** - Must contain the following items.
   - Completed Application Form
   - Cover Letter including career goal statement with appropriate signatures
   - Brief Resume
   - Personal Reference Letter from faculty member

**Cover Letter**
The letter should include, but not necessarily be limited to, 1) the location and brief description of the proposed internship, 2) the applicant’s interest in the proposed internship, 3) what relevant education or experience the applicant has in relation to NASA ESMD mission objectives and the proposed internship, 4) the applicant’s current cumulative GPA, and 5) a career goal statement that briefly describes the applicant’s views of careers in human and robotic exploration of space, aerospace science, and/or engineering and what the applicant hopes to accomplish in the internship. The cover letter should not exceed two (2) typed, single-spaced pages.

**Faculty Recommendation Letter**
The student’s faculty mentor (who may or may not be the student’s faculty advisor) must provide a recommendation as to the acceptability of the student for the proposed internship.
Resume
A brief resume of the applicant must be included with the application. The student’s resume should include a short summary of education, training, experience and accomplishments.

2) Design Team Applications - Must contain the following items.
   • Completed Application Form
   • Cover Letter including career goal statement with appropriate signatures

Cover letter
An explanation of the ESMD-related engineering design team challenge (a project description) and how the South Dakota team will participate in it, including the estimated number of participants. The team participants’ contact information, grade level, major, and university should also be included. If a student completes the cover letter, the signature of a faculty advisor to the team must also be included. The cover letter should not exceed two (2) typed, single-spaced pages, but the list of participants and their contact information may be appended.

Selection Plan
Proposals and applications will be reviewed by the Consortium’s seven-member Management Team and selections made by December 1, 2006. Major review criteria will be similar for 1) internship, and 2) design team candidates and will emphasize: A) relevance to ESMD mission objectives; B) evidence of hands-on experience and interdisciplinary team approach; C) partnerships with industry, state research centers, NASA Centers, or other Space Grant consortia; D) potential contribution to the future NASA and aerospace industry workforce; and E) participation of students and faculty from diverse backgrounds. Projects that integrate aspects of both components (internships and design team competitions) are especially encouraged.

Final Report
1) For student interns, at the end of the stipend period, students will be required to provide an end-of-internship report including things like placement location, mentor, and project description. A format for this report will be provided.

2) For design team grant awardees, a final report must be submitted summarizing who participated, their final results/reports, any media coverage, feedback from participants, and lessons learned. A format for this report will be provided.
ESMD Application Form
SD Space Grant Consortium Student Fellowship/Scholarship Stipend Program
Application Deadline: November 1, 2006 (4:00 p.m.) --- For U.S. Citizens Only

One original of all materials must be submitted by 4:00 p.m. Nov. 1, 2006 to the attention of “SD Space Grant Consortium”, SD Space Grant Consortium, SDSM&T, 501 E. Saint Joseph St., Rapid City, SD 57701. **NOTE: Late or incomplete applications will not be accepted.**

I am a STUDENT applicant. I am a FACULTY applicant.

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<thead>
<tr>
<th>Name</th>
<th>Last</th>
<th>First</th>
<th>Middle Initial</th>
<th>Birth Date</th>
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<td>Local Address</td>
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<tr>
<td>Permanent Address</td>
<td>Street</td>
<td>City</td>
<td>State</td>
<td>Zip</td>
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E-mail address __________________________

**For STUDENT applicants only:**

Student status at time of requested stipend period: Freshman Sophomore Junior Senior Graduate Student
Are you a previous Space Grant Fellowship or Scholarship Awardee? Yes No

Cumulative GPA ______ Scale _____ Major/Minor ______________________

Degree Sought ____________________________ Expected Graduation Date ____________

Note that if you are selected for a stipend award, you will be required to submit your Social Security Number to the SD Space Grant Consortium headquarters office so that it may be supplied to SDSM&T’s Business Office for processing of the stipend.

**Indicate to which ESMD Program(s) you are applying:**

- NASA Exploration INTERNSHIP (students only – Fixed amount at $6,000/student)
- NASA Exploration Engineering DESIGN TEAM Grant (students and/or faculty – Up to $2,500/Team)

**Indicate Period for which Funding is Requested and Requested Amount:**

<table>
<thead>
<tr>
<th>Period</th>
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<td>Spring 2007</td>
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<tr>
<td>Summer 2007</td>
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Demographics: (Completion of this part of the application is voluntary, but is necessary if selected for an award)

GENDER: Male Female
RACE: Caucasian Pacific Islander Hispanic Native Amer. African Amer. Asian Other

How did you hear about this Fellowship/Scholarship Stipend Opportunity? ____________________________________________

By my signature below, I certify that I am a citizen of the United States, and am or will be either 1) a student enrolled as an Undergraduate or Graduate student, or 2) a faculty member at (name of college/university) during the period of the fellowship/scholarship stipend to which I am applying.

Student Signature __________________________ Date ____________

Faculty Signature __________________________ Date ____________ Phone No. ____________