

**Improving STEM Retention for At-Risk Students
Using Aerospace Project-Based Learning
Centered on High-Powered Rocketry**

Principal Investigator

William Garrard

Department of Aerospace Engineering and Mechanics

University of Minnesota

William Garrard



110 Union Street

Minneapolis, MN 55455

612.625.9002

612.626. 1558 (fax)

wgarrard@aem.umn.edu

Office of Sponsored Projects

Administration

450 McNamara Alumni Center

200 Oak Street SE

Minneapolis, MN 55455-2070

612.624.5599

612.624.4843 (fax)

Improving STEM Retention for At-Risk Students Using Aerospace Project-Based Learning Centered on High-Powered Rocketry

i. Project Abstract

Rocketry provides exceptional intrinsic motivation for students of all ages. The University of Minnesota – Twin Cities (U of MN) and Century (Community) College propose a 2-year rocketry-centric project-based learning program to engage and improve retention of a cohort of diverse incoming freshmen. Cohort members will do hands-on designing, building, and flying of high-power rockets then proceed to build more-complex aerospace flight vehicles in Year 2.

High-power rocketry is exceptionally well-aligned with both the “Aeronautics” and the “Space” emphases of NASA. In this program students will not only build rockets but will strengthen their STEM learning by using rocket simulation software, wind tunnel data collection and analysis, and by using CAD/CAM to make custom parts in Century College’s state-of-the-art Digital Design and Fabrication Laboratory (AKA the “FAB LAB” – part of the MIT global FAB LAB network). In the FAB LAB students will gain practical hands-on experience with cutting-edge equipment such as 3D printers and laser cutters. Later in the program, students will select more-advanced aerospace build projects such as (a) more-advanced high-power rocketry, (b) payload-building for high-altitude balloon or suborbital rocket flights, or (c) building RC aircraft. Many of these 2nd-year projects will aim for participation in regional or national competitions.

Program participants will be recruited with special emphasis on the inclusion of women and students from underrepresented ethnic groups, as well as students at-risk for attrition from their intended STEM majors. Inspired by the successes and best practices regarding STEM retention of Minnesota’s Louis Stokes Alliances for Minority Participation (LSAMP) North Star STEM Alliance (NSSA), our program will also deliver academic peer-mentoring plus educational-enhancement activities aimed at smoothing the transition of community college participants into the U of MN and exposing all participants to undergraduate research opportunities and other STEM-related extracurricular projects, to motivate them to persevere with their STEM studies.

This project will significantly bolster the participants’ overall undergraduate experience and help them develop deep contacts supportive of their academic and long-term career aspirations. Furthermore, the program will help cultivate the life-long skills needed to succeed in STEM majors and in technical environments (such as at NASA) like teamwork, tenacity, innovation, communication, project management, and time management.

ii. Key Staff and Partners

William Garrard, Director of the MN Space Grant Consortium and Professor of Aerospace Engineering and Mechanics (AEM), U of MN – grant PI with extensive experience in aerospace education and advising student aerospace build teams

James Flaten, Associate Director of the MN Space Grant Consortium and Contract Professor of AEM, U of MN – has experience teaching freshman seminars in high-power rocketry and high-altitude ballooning and advising student build teams

Tim Grebner, Director of Engineering Program, Century College, White Bear Lake, MN – has developed an exceptionally effective introductory engineering curriculum for community college students; well-versed in articulation agreements with the U of MN

John Rupert, Manager of the Digital Design and Fabrication Laboratory and Engineering faculty, Century College, White Bear Lake, MN – 30 years of engineering experience and 12 patents with Honeywell and ATK; expert at spreading access to the FAB LAB to other institutions

Gary Stroick, High-Power Rocketry Mentor and president of Off We Go Rocketry, TRA Level 3 certified, Board Member of Tripoli Minnesota Rocketry Association, Prefecture #45 – non-faculty mentor of multiple student teams at Century and U of MN for both class and competition rockets
Faculty member (TBA) in the Minnesota Evaluation Studies Institute (MESI) in the Department of Organizational Leadership, Policy, and Development, U of MN, Minneapolis, MN – expert in program evaluation; supervise evaluation graduate student and lead publication/dissemination
Advisory Board

The primary instructors and evaluators will be assisted by an Advisory Board which will give feedback about programmatic activities, curriculum development, and program sustainability. The Advisory Board will consult with the primary instructors at least three times each year.

- Anne Hornickel, Program Director of Diversity and Outreach at the U of MN and the North Star STEM Alliance (NSSA) – expert on retention of minority students in STEM
- Gillian Roehrig, Professor in the Education Department at the U of MN – PI on several past NASA-funded and NSF-funded Education grants on NASA-related topics
- Demoz Gebre, Professor of Aerospace Engineering at the U of MN – (underrepresented) faculty researcher and mentor of many past aerospace student build teams.

iii. Project Description

Motivation and Goals

The project's primary purpose is to improve retention of freshman and sophomore students pursuing STEM majors and to increase the percentage of women and underrepresented minority students receiving STEM degrees. Some of our programmatic ideas come from the best practices of NSSA which has been successful in recruiting and retaining minority students in STEM following suggestions in the literature on ways to enhance participation of minority students¹ and to pick up on early clues regarding student attrition^{2,3}. Our program will complement the NSSA emphasis on engagement in research by using project-based learning activities which are effective at promoting student confidence and persistence in STEM studies.⁴ We will focus on aerospace activities like rocketry known to be powerful intrinsic motivators.⁵

Based on NSSA past results and best practices we are confident that cohort students will be more likely to complete STEM baccalaureate degrees than their peers because they will:

1. Form strong bonds with one another, their faculty advisor, and their peer mentor(s).
2. Improve the skills they need to be successful in STEM majors and the STEM workforce such as (a) working effectively in teams, (b) communicating technical content both orally and in written form, and (c) learning the basics of project management.
3. Experience the excitement of using cutting-edge design and fabrication technology.
4. Experience hands-on applications of subjects they are studying: engineering, physics, math, chemistry, and computer/programming classes.
5. (For community college participants) Experience a smoother transition to a baccalaureate program, especially one at the U of MN, because of early familiarity with the institutional facilities, culture, and by making advance personal contacts among students and faculty.

This program will specifically address the following areas of concern for AEM Department within the College of Science and Engineering (CSE) at the U of MN:

- The 2nd-to-3rd year retention rate for students in CSE which has been slightly less than 80% in most recent years, with retention of women students trending below 70% some years.
- The 4-year average of women students graduating in AEM is 8.4% which is below the national average of 14.2% for Aerospace departments.

Introduction

This project will engage a 40 cohort of students in project-based learning activities in high-powered rocketry then in other aerospace areas. This will excite them and expose them to the cutting-edge technologies that have revolutionized how professionals apply the basic principles of STEM. Students will gain experience using state-of-the-art technologies for analysis, parts manufacture, and testing of flight vehicles. Student teams will work in both competitive and collaborative ways, encouraging innovation and enabling them to experience the challenge and thrill of implementing new ideas. Students will come to better-appreciate the technology behind past achievements of, and future directions for, the aerospace industry and NASA.

This two-year series of hands-on projects, coupled with Educational-Enhancement (EE) activities (described later), will complement students’ regular studies. Here is an overview:

	Hours – Total 210 hours	Major Topics/Activities
Year 1		
Late-summer 2013 (~August)	1 week (5-6-day) workshop; Total 40 hours	<ul style="list-style-type: none"> · High-power rocketry (cooperation/competition) · EE: Cohort community building, peer mentoring, and academic support
Academic Year 2013/2014 1-credit class each semester	30 weeks; Average of 2 hours/week; Total 60 hours	
	Total 100 hours	
Year 2		
Early-summer 2014 (~May)	1 week (5-6-day) workshop; Total 40 hours	<ul style="list-style-type: none"> · Projects selected from advanced rocketry, high-altitude ballooning, etc. · EE: Bridge to Baccalaureate, introduction to research, internships, and STEM prof. organizations
Academic Year 2014/2015 1-credit class each semester	30 weeks; Average of 2 hours/week; Total 60 hours	
Spring 2015 (~April)	1.5-day symposium; Total 10 hours	
	Total 110 hours	

Recruiting

Century College has an enrollment of nearly 15,000 students, 37% of whom are minority students and 55% of whom are female. Century co-hosts the “916 Program” which serves 500 seniors from 18 local high schools each semester with on-campus career-specific training in 40 different areas, including Computer Aided Design and Engineering. Access to these students will allow Century to collect ample applications for the NASA Scholars program, selecting a cohort of incoming students with interests and aptitude in STEM, but potential life situations that make them at-risk for attrition. This will also help achieve our diversity metrics. Century will also identify students in the 916 Program who are planning to attend the U of MN, for potential inclusion in the U of MN cohort. The bulk of the U of MN cohort will be recruited through admissions visits and in person, when they are on campus for summer orientation. Twenty students will be selected for the NASA Scholars program at Century and twenty at the U of MN.

Student Support

Cohort members will achieve “significant engagement” with over 160 hours of contact time. Students will also receive direct financial support at the rate of \$500 per summer workshop and \$500 per semester for 2 years, provided they are making adequate academic progress toward a STEM baccalaureate degree and participating in the NASA Scholars curricular and EE activities. Overall each student will attend 2 workshops, earn 4 credits, and receive \$3000 of direct support.

Summer 1 Workshop

The NASA Scholars will begin the program by participating in a 1-week workshop in the summer before their first fall semester, to smooth their transition into college. As part of this workshop, students will become bonded to their cohort and work with second year (or older) peer mentors. Students will receive basic rocketry instruction and work in teams to build and fly high-power rockets from kits. These basic elements of transition, bonding, and early hands-on successes are recommended by the NSSA for retaining students in STEM. Above all, this will be a fun experience, getting students very excited about rocketry and about STEM in general.

Year 1 Rocketry Course and Educational-Enhancement Activities

During Year 1 all the students will participate, in teams of about 5, in a 1 credit per semester high-power rocketry course, in addition to their regular classes. In this course they will learn more about RockSim (rocketry simulation software) and SolidWorks (CAD software) and make custom parts for their rockets in the FAB LAB. They will also learn more about rocket avionics, altimeters, and dual-deploy. Teams from Century will pair up with teams from the U of MN to collaborate on multiple rockets to satisfy different sets of design requirements.

In addition to curricular lessons on rocketry and the rocket design/build, cohort students will be offered a joint series of educational enhancement activities following the best practices of the NSSA. In Year 1 educational enhancement activities will include regular meetings with peer mentors and faculty advisors for academic support, meetings with older students with past rocketry experience, cohort bonding and community-building activities, and opportunities to learn more about resources on their respective campuses.

Summer 2 Workshop

Early in the second summer the NASA Scholars will participate in a second 1-week workshop that will include a “fly-off” and team presentations about Year 1 rockets plus explicit instruction on project/team management and more-advanced technical topics. Then the workshop will kick off Year 2 aerospace vehicle projects. Project options may include (a) “advanced” high-power rocketry, aimed toward participation in rocketry competitions such as the WI Space Grant’s Midwest Regional rocketry competition or NASA’s USLI national competition, (b) building science/engineering payloads and using high-altitude balloons, high-powered rockets, or NASA suborbital rockets to loft them into near space or outer space, possibly through the AIAA’s CanSat competition, NASA’s RockSat program, or NASA’s HASP ballooning program, and (c) building RC aircraft, aimed toward participation in national RC aircraft competitions.

Year 2 Aerospace Course and Educational-Enhancement Activities

In Year 2 students will work in new teams and take another 1 credit per semester course designing and building different types of aerospace projects. Regardless of their Year 2 project, students will benefit immensely from the skills, knowledge, and connections gained in Year 1. Students will delve into more-complex build projects that may involve using microcontrollers, low-cost sensors, robotics, more-advanced simulation software, and higher-level math. Students will do more of their own programming and data analysis and will also serve as peer mentors to other students just starting out in high-power rocketry.

In addition to aerospace activities, cohort students will again be offered a series of educational enhancement activities, inspired by best practices of the NSSA. These will focus on preparing students for higher-level engagement with their chosen major, making the transition from community college to a 4-year institution (primarily for Century students), plus lab tours, presentations about research, and coaching on how to get involved in undergraduate research through Undergraduate Research Opportunities Program (UROP) and Research Experiences for

Undergraduates (REU) programs. There will also be opportunities to learn about local aerospace-related industries, STEM professional organizations, and internship opportunities.

End-of-Program Symposium

Late in the second spring the final formal event of the NASA Scholars program will be to participate in a student symposium, to share with other teams and with the general public the results of their Year 2 aerospace design/build projects. This ~1.5-day event will also include time for post-program assessment as well as time for cohort members to talk about their experiences as NASA Scholars and their plans for the future.

Parallel Activities

To support the sustainability and leveraging of this program, there will be three additional tasks pursued in parallel with the NASA Scholars programming described above.

1. The rocketry curriculum will be articulated in a joint effort by the U of MN and Century so that future Century students can receive specific rather than generic credit for this course. This will greatly increase the value of the course to the students and reduce the need for subsidies to attract future students into the rocketry program.
2. Both the U of MN and Century will engage other 2-year or 4-year colleges in high-power rocketry by sharing rocketry curriculum and by being open to running additional training workshops and negotiating access to the FAB LAB at Century and wind tunnel testing. Articulation of the curriculum will make this more attractive to other institutions as well.
3. At the end of the first year both Century and the U of MN will engage an additional 20 entering freshmen into a first-year rocketry course, funded separately from this grant. Students in that class will be mentored by the NASA Scholars, now in their second year. This will engage the NASA Scholars in motivating (and retaining!) other STEM students.

iv. Management Plan

The U of MN will serve as lead institution and administer this grant through the MN Space Grant Office in the AEM Department. Century will be funded through a subcontract. Both Century and the U of MN will manage their own curriculum development and delivery, but instructors will share their lesson plans and will collaborate closely on joint activities such as summer workshops and the program-ending symposium, use of the FAB LAB and wind tunnel facilities, and regular joint educational-enhancement activities.

Program evaluation, including preparing the results for publication and dissemination, will be conducted under the direction of a MESI faculty member (yet to be named) and one graduate student. MESI will select overarching evaluation questions with a group of key stakeholders. Results from student focus groups will allow the PI, in consultation with the Advisory Board, to make adjustments to the program over the course of the 2 years.

v. Goals and SMART Objectives

Goal A.1 Contribute to the STEM pipeline by engaging cohort students and tracking their progress toward STEM baccalaureate degrees.

Objective A.1.1 Recruit 40 incoming students (20 at Century and 20 at the U of MN) for Year 1 participation in the NASA Scholars program.

Objective A.1.2 Retain at least 95% of the original NASA Scholars in STEM fields from Year 1 to Year 2 (the first benchmark date).

Objective A.1.3 Confirm that at least 80% of the original NASA Scholars are still making adequate academic progress toward a baccalaureate degree in a STEM field one year out

from this program (i.e. the second benchmark date – after Year 3). Note that for community college students, this entails transferring to a baccalaureate-degree-granting institution.

Goal A.2 Contribute to diversity in the STEM pipeline by engaging cohort students who are women and members of ethnic groups underrepresented in aerospace fields.

Objective A.2.1 Recruit at least 50% of the original NASA Scholars as women and at least 40% of the participants are women at each benchmark date.

Objective A.2.2 Recruit at least 25% of the original NASA Scholars as underrepresented students and at least 20% of the participants are underrepresented at each benchmark date.

Objective A.2.3 Increase the fraction of AEM women graduates to 12% starting two years out from this program (i.e. the third benchmark date – after Year 4).

Goal A.3 Benefit the U of MN by recruiting transfer students from the rocketry cohorts.

Objective A.3.1 Recruit to the U of MN at least 50% of the community college participants who transfer to a baccalaureate institution after the end of this program.

Goal A.4 Continue and expand institutional partnerships involving rocketry activities and use of the FAB LAB beyond the end of the 2-year grant period.

Objective A.4.1 Confirm that both the U of MN and Century use the curriculum developed and the expertise gained during this program to offer high-power rocketry opportunities and share fabrication and testing facilities use beyond the 2-year grant period.

Objective A.4.2 Make use of the lessons learned from the NASA Scholars program to engage at least one additional higher-education institution in making use of the rocketry curriculum and/or the FAB LAB facility at Century within one year of the end of this program.

vi. Evaluation and Communication Plan including citation(s) of evidence-based approach for project

Program evaluation is the methodological design, collection, and analysis of data about a program for purposes of decision-making. The major outcomes measures of this program concern student recruitment, participation, completion of a baccalaureate degree in a STEM field, and post-graduation STEM employment or advanced studies in a STEM field. The major impact questions are related to impacts on students' learning and professional development as outlined in the U of MN's Student Learning Outcomes and Student Development Outcomes. The decision makers will be the faculty advisors and Advisory Board of this grant. The decision makers for this group will identify a group of key stakeholders who will develop the program's Theory of Change and identify the program's overarching evaluation questions.

The evaluation design utilizes a mixed-methods design. A mixed-methods evaluation collects, analyzes, and "mixes" or integrates both quantitative and qualitative data at some stage of the process within a single evaluation for the purpose of gaining a better understanding of evaluation questions.⁶ A mixed-methods design provides triangulation of data, allowing for greater validity by seeking corroboration between quantitative and qualitative data. The collection of both quantitative and qualitative data also provides the opportunity for one set of data to help illuminate the other set of data.⁷ In this evaluation plan, the quantitative portion is a quasi-experimental methodological design, consisting of longitudinal assessment of parallel groups of students at the U of MN and Century. The qualitative portion consists of reflective surveys and focus groups with students to understand the relationship between their experiences in the STEM program and the student learning and student development outcomes.

Quantitative Methods: A 3-stage design for evaluation will include these outcome measures.

1. Pre-mid-post testing of interest and intent to complete a STEM degree will be administered at or before the start of the first workshop, mid-way through the program (~second workshop), and at the end of the program (~program-ending symposium). The survey instrument will be designed once the program theory and overarching evaluation questions have been identified.
2. Longitudinal assessment during the program will focus on accomplishments like completion of program components and will also address the impact on students' learning and development.
3. Longitudinal assessment after the program will consist of web-based surveys of student interests and STEM-related accomplishments, completion of a STEM baccalaureate degree, and post-graduation entry into STEM careers or advanced STEM studies. Post-program assessment will be collected at least once every 12 months until the student has taken their first step beyond a baccalaureate degree. Surveys will also address attitudes about the STEM field, persistence, and other items that answer the overarching evaluation questions.

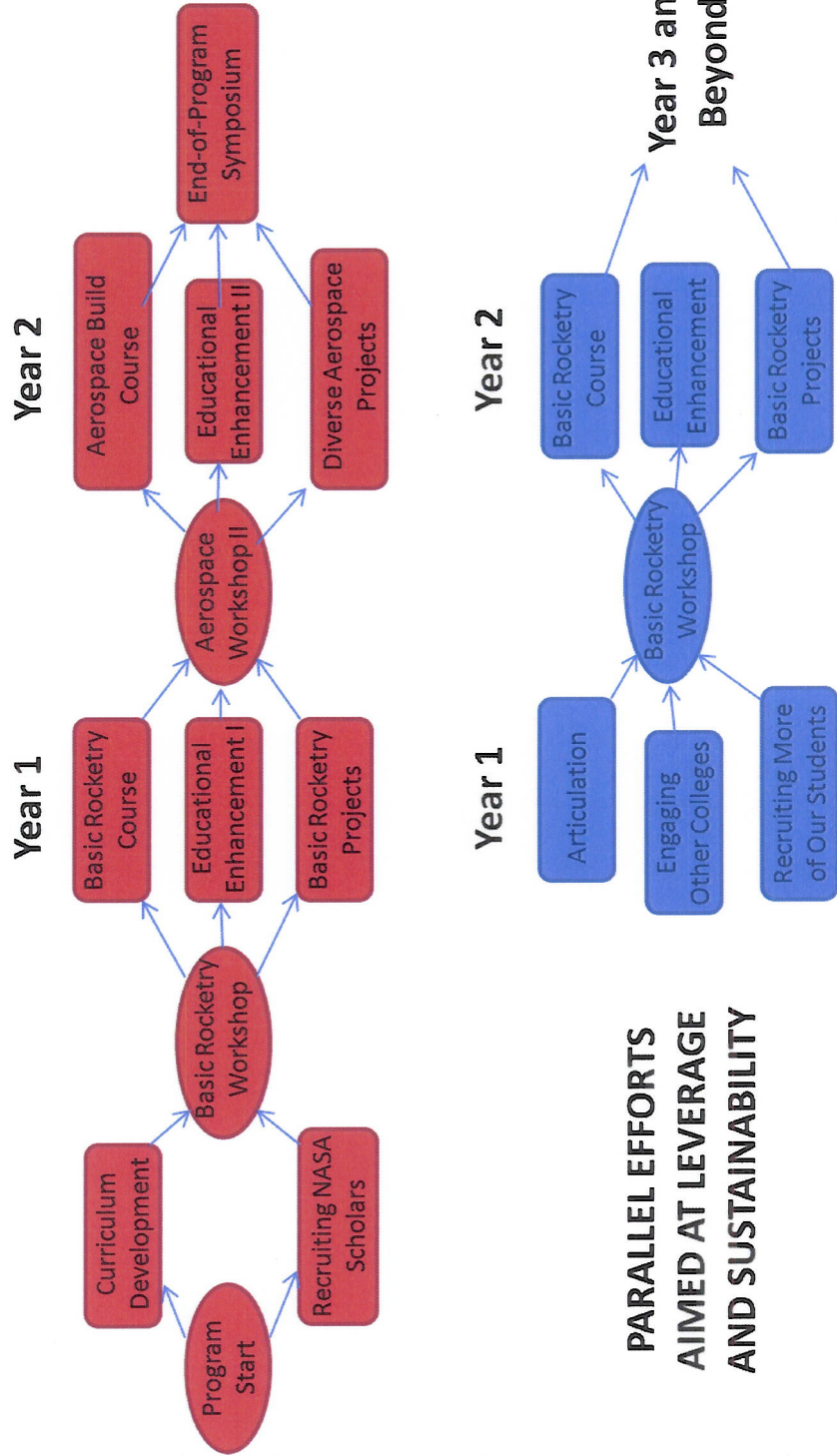
Qualitative Methods: Focus groups will be held throughout the program to better understand the student experience. This will allow the program leadership to make real-time adjustments to the program, as well as to collect data that will help illuminate the quantitative longitudinal data. Since one enrollment emphasis is on recruiting and retaining minority students and women, particular attention will be given to these groups. In Year 2, additional emphasis will also be placed on understanding the experience with, and impact of, the hands-on activities.

We will work with a faculty member (yet to be named) in the Minnesota Evaluation Studies Institute (MESI) at the University of MN, and a 25% time graduate student under their supervision, to finalize the design and implementation of the evaluation. MESI is a nationally-recognized resource for evaluation of programs in higher education. These evaluators will be primarily responsible for dissemination and publication of program results to the broader STEM education community, in parallel with faculty advisors engaging other local colleges.

vii. References

1. Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline; Committee on Science, Engineering, and Public Policy and Global Affairs. (2011) *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*. Washington, D.C.: The National Academies Press.
2. Tinto, V. P. (1994) *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). Chicago, IL: University of Chicago Press.
3. Campbell, C. M., and Mislevy, J. (2009) "Students' perceptions matter: Early signs of undergraduate student retention/attrition." *Paper presented at the North East Association for Institutional Research Annual Conference*. Baltimore, MD.
4. Perrenet, J.C., Bouhuijjs, P.A., and Smits, J.G.M.M. (2000) "The Suitability of Problem-based Learning for Engineering Education: theory and practice," *Teaching in Higher Education* 5 (33) 345-358.
5. Hunt, E.M., Lockwood-Cooke, and P, Kelley, J. (2010) "Linked-Class Problem-Based Learning In Engineering: Method And Evaluation," in *American Journal of Engineering Education* 1 (1) 79-87.
6. Creswell, J. W., & Clark, V. L. P. (2007). *Designing and conducting mixed methods research*, Wiley Online Library.
7. Doyle, L., Brady, A. M., & Byrne, G. (2009). "An overview of mixed methods research," *Journal of Research in Nursing*, 14(2), 175-185.

NASA Scholars Program – Schedule/Timeline



Summary Budget

	Period 1 (05/01/2013 - 04/30/2014)		Period 2 (05/01/2014 - 04/30/2015)	
	Budget	Match	Budget	Match
	Minnesota Space Grant Consortium STEM Retention Grant Budget for University of Minnesota			
Salaries	9,294	10,000	9,294	11,000
2 Faculty Advisors		10,000		11,000
4 Undergraduate Students	9,294		9,294	
Benefits	744	3,490	744	3,839
Faculty @ 34.9%		3,490		3,839
Undergraduate Student @ 8.0%	744		744	
Subtotal Salaries and Benefits	10,038	13,490	10,038	14,839
Travel	0	5,200	24,000	4,800
1. (domestic)		5,200	24,000	4,800
Other Direct Costs	189,789	11,486	205,561	11,021
1. Materials and supplies	15,874	9,486	22,339	9,021
2. MESI (Evaluation services)	26,471		26,471	
3. Professional Services (Gary Stroick)	8,000		4,000	
4. Scholarships/stipends	30,000		30,000	
5. Subcontract to Century College	109,444	2,000	122,751	2,000
Total Direct Costs	199,827	30,176	239,599	30,660
Modified Total Direct Costs	85,383		86,848	
Indirect Costs 33% MTDC	28,176		28,660	
TOTAL DIRECT AND INDIRECT COSTS	228,003	30,176	268,259	30,660
2-Year Total: STEM Pilot Grant		2-Year Total: Match		
496,262		60,836		

Budget Details and Narrative

The budget is used to fund hands-on aerospace build projects for the student cohort: high-power rocketry the first year and a variety of aerospace options the second year, with each build project preceded by a one-week summer workshop. Expenses break down as follows:

Student Direct Support

- Workshop Stipends – Cohort members each receive a \$500 stipend for participating in each 1-week summer workshop. Each workshop will include at least 40 hours of activities so this is comparable to a pay rate of no more than \$12.50/hour.
- Semester Scholarships – Cohort members each receive a \$500 scholarship each semester that they remain eligible for, and active in, the program. Eligibility is defined as “making adequate academic progress toward a baccalaureate degree in a STEM field.” And

activity entails enrolling in the NASA Scholars class for 1 credit per semester, being engaged in the aerospace design/build, and attending educational-enhancement offerings.

Personnel

- Faculty advisors – Each institution will provide at least 2 faculty advisors to work with cohort students each year. The faculty advisors at the U of MN will be Garrard, PI on the grant, and Flaten. The faculty advisors at Century will be Grebner and Rupert. Advisors will be compensated for attending the summer workshops (\$2,500 if central to workshop planning and instruction (Flaten and Rupert) and \$1,500 if attending in a supporting role (Garrard and Grebner)). In Year 1 Rupert will also receive \$10,000 for overall workshop organization and curriculum development. Faculty advisors will also receive \$3,000 for advising projects during the academic year. Each institution will organize their students into about 4 teams of 5 each year, so faculty advisors will (on average) work with two teams. The rate of pay of all faculty advisors will be approximately \$40/hour, with Year 1 hours being about 40 + 75 hours for Garrard and Grebner (workshop, academic year), about 25 + 40 + 75 hours for Flaten (workshop prep, workshop, academic year), and 25 + 40 + 200 + 75 + 50 for Rupert (workshop prep, workshop, course development, academic year, Fab Lab support of all 8 teams). Year 2 is similar, but without additional course development. The benefits rate for faculty is 34.9% at the U of MN and 30% at Century.
- Peer mentors – Each institution will hire 4 peer mentors to attend the workshops, assist with the build projects, and provide academic support. Peer mentors will be paid ~\$12/hr at the U of MN and \$9/hr at Century and will work ~5 hrs/wk during the academic year
- Outside mentor – Gary Stoick from Off We Go Rocketry and the Tripoli MN high-power rocketry club will assist with program organization, workshop instruction, and mentoring teams at both schools. He will also provide private launches. Stroick will receive a flat stipend of \$8,000 in Year 1, when he is engaged with all 8 teams, plus \$4,000 in Year 2, when he is only engaged with the “advanced” rocketry team(s). He will contribute over 300 hours during the 2 years, making his rate of pay \$40/hour like the faculty advisors.
- Evaluation – We have contracted with the Minnesota Evaluation Studies Institute (MESI) at the U of MN for program evaluation. They will provide one 1/4 time graduate student for 4 full semesters plus two summers, paid at a rate of \$20/hr (plus tuition and health benefits). This results in a total expense of \$10,400 plus benefits of \$7285 each year. An MESI faculty member will provide supervision of the evaluation effort for \$100/week for the 2 years and MESI will also receive \$750 each year for administrative/clerical support.

Workshop Expenses

- Hardware and Sustenance – During the workshop an average of \$2,000 will be spent on hardware (rocketry in Year 1, diverse topics in Year 2) on each team of 5 students. An additional \$840 will be spent on sustenance expenses for the students, their peer mentor, and the faculty advisors and mentor. Non-expendable items purchased for the workshop will be available for re-use during the follow-on academic year build projects.
- Non-aerospace supplies – Each institution is allocated \$1,000 each year for workshop-related non-aerospace supplies.
- Student travel – Each student team will rent a minivan for the 5-6 day summer workshop, allowing them to travel between campuses, attend launches, go on field trips, etc. Vans are \$600 (rental and gas) so for 8 teams this is a total charge of \$4,800.
- Advisor travel – Each faculty advisor is granted \$200 per year for program-related local travel. This will be used for traveling between campuses for workshop preparation plus

attending the workshop days and attending launches (typically driving separately and having peer mentors drive the student vans).

Build Project Expenses

- Hardware – During Year 1 each team is allocated \$3,000 for hardware expenses, plus \$1,000 which they may spend on custom parts at the Fab Lab (some of this might be spent during the summer workshop). Year 2 projects will generally be more expensive, so the allocation is increased to \$4,500 (+ \$1,000 for the Fab Lab) per team (on average), with the advisors retaining the prerogative to distribute funding non-evenly if necessary.
- Competition Travel – Many Year 2 projects include out-of-state travel, often to national competitions. The projects for Year 2 will not be finalized until late in Year 1, based on cohort student interests and faculty advisor availability. The budget includes \$1,200 per advisor plus \$1,000 per student for “competition travel” (though some teams will travel to non-competition events). In most cases, except for possibly in-state high-altitude ballooning, this travel funding will be expended during a single multiple-day trip to an out-of-state (competition) launch event. It will be distributed to cover travel (by surface rather than by air, for most projects), accommodations, and per diem. For example, teams doing “advanced” rocketry that are invited to participate in the USLI competition in Huntsville, AL, will pool travel funding for the students plus their advisor (\$6,200 total). This will be spent on a ~6-day trip to Huntsville: about \$1,200 for a rental van and gas, about \$2,000 for meals, and about \$3,000 for hotel accommodations (4 rooms for 6 nights at about \$125/room). Travel expenses for other projects will be similar.

Educational-Enhancement Activities

- Following the best practices of the NS STEM Alliance, we will organize approximately once-a-month joint educational-enhancement activities for cohort members. These will involve presentations about curricular and extra-curricular opportunities such as on-campus research, industry tours, internships, and more. Each yearly budget includes \$4,800 for van rental and gas so that cohorts can travel to off-campus events, plus \$1,000 per institution for miscellaneous expenses relating to enhancement activities.

Indirect Costs

- The U of MN’s College of Science and Engineering (CSE) will collect indirect on the grant award at a rate of 33% on all U of MN expenditures (except for direct cohort student stipends and scholarships), including MESI expenses, as well as on the first \$25K of the subcontract to Century. This will total \$56,836 over the course of 2 years. CSE has generously agreed to return this to the program for U of MN expenses (see Match below).
- The MESI program claims 12% indirect which is used to allow them to continue to offer evaluation services at a modest rate and hence benefits our program. This totals \$5,672.
- Century claims 29% indirect, but only on faculty salary and benefits. This is used to maintain their physical plant and operate their institution, which benefits our program because half our cohort students are from Century and the other half will be using their facilities for both of the summer workshops and the Fab Lab. This totals \$11,687.

Match

- The U of MN will claim the \$56,836 of returned CSE indirect as match. This funding will be used for advisor salaries and benefits, van rentals, and some materials and supplies.
- Century will claim as match the value associated with the fact that they are not charging the program for hosting the two summer workshops and allowing students from both institutions access to their Fab Lab facilities. This is valued at \$4,000 over 2 years.

SOW and Budget for Century College (subcontract in excess of \$100,000).

**Minnesota Space Grant Consortium
Century College Proposed Statement of Work
*Improving STEM Retention for At-Risk Students Using
Aerospace Project-Based Learning Centered on High-Powered Rocketry*
April 2013 to April 2015
Co-PIs: John Rupert and Tim Grebner**

STATEMENT OF WORK

We propose to recruit a cohort of 20 incoming freshman for fall 2013 and work with them over the course of the following two years on aerospace-related hands-on projects, to motivate them to continue with STEM studies and to ultimately transfer to a baccalaureate institution and complete a baccalaureate degree in a STEM field. Our cohort will collaborate with a similar cohort of students at the U of MN organized by Aerospace professors W. Garrard and J. Flaten.

In Year 1 of this 2-year program we will organize and host a 1-week summer workshop at Century College on the topic of High-Power Rocketry in which students from both institutions will learn the basics of rocketry then build and fly kit-rockets. Students will be introduced to the Fab Lab at Century and design and fabricate parts there for the duration of the program. During the academic year following this summer workshop, cohort students will enroll in a 1-credit-per-semester class to learn more high-power rocketry techniques and to work in teams to build additional rockets in a collaborate/compete model with teams from the U of MN.

J. Rupert will serve as lead organizer for the rocketry summer workshop, assisted by J. Flaten and G. Stroick, a mentor from the Tripoli MN High-Power Rocketry Club. Rupert will also organize instruction regarding the use of the Fab Lab and take the lead in developing curriculum for the follow-on “basic” high-power rocketry class. That curriculum will be made available to the U of MN and, during Year 2 and beyond, to other interested colleges or universities.

Year 2 will begin with a second week-long summer workshop, also hosted by Century College and organized by Rupert, with assistance from Flaten and others. This workshop will begin with a wrap-up of Year 1 activities – student presentations and a fly-off of Year 1 rockets. Then it will continue with additional content on more-advanced technical topics and explicit instruction on project/team management. Students will then divide into new teams according to their personal interests, to pursue a variety of more-complex aerospace build projects. The last days of the workshop will be a kick-off of the Year 2 build activities, after which students will again enroll in a 1-credit-per-semester class for the duration of the academic year to design, build, test, fly, and analyze their Year 2 aerospace vehicle. Year 2 options for student teams may include (a) “advanced” high-power rocketry, aimed toward participation in regional or national rocketry competitions such as NASA’s USLI program, (b) building science/engineering payloads and using high-altitude balloons, high-powered rockets, or NASA suborbital rockets to loft them into near space or outer space, possibly through the AIAA’s CanSat competition or NASA’s RockSat program, and (c) building RC aircraft, aimed toward participation in the national SAE heavy-lift competition. Exactly which of these topics will be pursued and which faculty will supervise them in Year 2 remains to be negotiated, but at least some of the student teams will be advised from Century College by Rupert and Grebner. Year 2 will end with a student symposium (host TBA) in which students will present their projects to the whole cohort and to the general public.

During both years cohort members will also participate in educational-enhancement activities about once a month, planned and held jointly with the U of MN. In Year 1 these extra events will

be based on the successful model of the North Star STEM Alliance and focus broadly on issues related to succeeding in college, including peer mentoring and extra academic support. In Year 2 enhancement events will focus on engaging with a specific major, making the transition from community college to a baccalaureate program (especially for Century students), learning about professional STEM organizations, as well as presentations and research lab tours informing students of undergraduate research opportunities (especially at the U of MN) and internship opportunities, including NASA summer internships, for students to pursue after Year 2.

Year 2 will also see parallel efforts towards articulation of rocketry curriculum with the U of MN, led by Grebner, and towards disseminating curriculum and engaging additional colleges and universities in high-power rocketry activities as well as use of the Fab Lab, led by Rupert.

Rupert and Grebner will both receive salary and benefits for helping with the summer workshops and for advising aerospace build teams during the two academic years. Rupert will receive additional support for curriculum development for both the workshop and the “basic” rocketry course. The hourly rate for both Rupert and Grebner will be \$40/hour, and each will contribute the number of hours consistent with their stipend, or more.

CENTURY COLLEGE SUBCONTRACT BUDGET

Minnesota Space Grant Consortium STEM Retention Grant Subcontract Budget for Century College				
	Period 1 (05/01/2013 - 04/30/2014)		Period 2 (05/01/2014 - 04/30/2015)	
	Budget	Match	Budget	Match
Salaries	27,344	0	18,344	0
2 Faculty Advisors	10,000		11,000	
1 Faculty Stipend for Curriculum Development	10,000			
4 Undergraduate Students	7,344		7,344	
Benefits	6,000	0	3,300	0
Faculty @ 30.0%	6,000		3,300	
Subtotal Salaries and Benefits	33,344	0	21,644	0
Travel	5,200	0	27,600	0
1. (domestic)	5,200		27,600	
Other Direct Costs	63,360	2,000	69,360	2,000
1. Materials and supplies	33,360		39,360	
2. Scholarships/stipends	30,000		30,000	
3. Facilities use: workshop space and Fab Lab		2,000		2,000
Total Direct Costs	101,904	2,000	118,604	2,000
Indirect Costs 29% on Faculty Stipend and Benefits	7,540		4,147	
TOTAL DIRECT AND INDIRECT COSTS	109,444	2,000	122,751	2,000
2-Year Total Subcontract to Century College		2-Year Total Match from Century College		
232,195		4,000		

CURRICULUM VITA

William L. Garrard

Education

B. S. Mechanical Engineering, University of Texas at Austin, 1962
Ph. D. Engineering Mechanics, University of Texas at Austin, 1968

Employment

1967-73 Assistant Professor, Aerospace Engineering and Mechanics
University of Minnesota
Summer 1973 Principal Research Engineer, Honeywell Systems and
Research Center, Minneapolis Minnesota
1973-1986 Associate Professor, Aerospace Engineering and Mechanics
University of Minnesota
1983-1991 Assoc. Dept. Head, Aerospace Engineering and Mechanics
University of Minnesota
1986-present Professor, Aerospace Engineering and Mechanics
University of Minnesota
1991-present Director, Minnesota Space Grant Consortium
University of Minnesota
1991-2006 Department Head, Aerospace Engineering and Mechanics
University of Minnesota
1995 Visiting Scientist, CERT/ONERA (Centre d'Etude et de
Recherches de Toulouse/Office National d'Etudes et
Recherches Aéropatiales) Toulouse, France

Honors

1996 Educational Award for Excellence from the U. S. Army Soldier Systems Command
2005 Fellow, American Institute of Aeronautics and Astronautics (AIAA)
2003 AIAA Certificate of Appreciation from Aerodynamic Decelerator Committee
2006/2007 Aerospace Division ASEE/AIAA John Leland Atwood Award
The Atwood Award is bestowed annually upon an outstanding aerospace engineering
educator in recognition of the educator's contributions to the profession.

Professional Service

Evaluator for Aerospace Engineering Programs, Engineering Accreditation Commission,
Accreditation Board for Engineering and Technology, 1995 – present
AIAA Commissioner, Accreditation Board for Engineering and Technology, 2001-2006
AIAA Society Liaison, Accreditation Board for Engineering and Technology, 2008-present
Chair, National Council of NASA Space Grant Directors, 2006-2008

Research

Mathematical modeling and control of aerospace vehicles and dynamics of parachute systems

Teaching

Graduate and undergraduate courses in dynamics, control and performance of aerospace vehicles, feedback control theory, aeroelasticity, analysis and design of parachute systems, aerospace vehicle design

Short Courses Organized and Taught

Short Courses in Parachute Systems Technology: Fundamentals, Concepts, and Applications. Held at the University of Minnesota, Minneapolis MN, 1982, Sandia Labs, Albuquerque NM, 1985, DFVLR, Munich, West Germany, 1987, Natick MA, 1990. Toulouse, France, 1992, Cocoa Beach FL, 1992, Johnson Space Center Houston TX, 1994, Minneapolis MN, 1998.

RECENT PUBLICATIONS

Vibhor Bageshwar, William Garrard, Rajesh Rajamani, "Model Predictive Control of Transitional Maneuvers for Adaptive Cruise Control Systems," IEEE Transactions on Vehicular Technology, vol. 53, number 5, pp 1573-1586, Sept 2004

Vibhor Bageshwar, Demoz Gebre-Egziabher, William L. Garrard, Tryphon T. Georgiou, "Stochastic Observability Test for Discrete-Time Kalman Filters," AIAA Journal of Guidance, Control and Dynamics, May/June 2009

Joseph Mueller, Yiyuan Zhao, and William L. Garrard, "Optimal Ascent Trajectories for Stratospheric Airships Using Wind Energy," AIAA Journal of Guidance, Control and Dynamics May/June 2009

Yiyuan Zhao, William L. Garrard and Joseph Mueller, "Benefits of Trajectory Optimization in Airship Flights," AIAA Paper-2004-6257, AIAA ATIO Conference, Chicago, IL, Sept. 20-23, 2004

Hammer, J, D. Gebre-Egziabher, W. Garrard and S. Morgan, "Sky Spirit: Integration of UAV Design into an Aerospace Design Course," AIAA Paper 2005-6959. Infotech@Aerospace Conference, Arlington, VA. Sept. 2005

Bageshwar, V. L., D. Gebre-Egziabher, W. Garrard, et al "Minnesat: Attitude Estimation, Filters, and Experiments Onboard a Nanosatellite" AIAA/Utah State University Conference on Small Satellites, Logan Utah, August 14-17, 2006

Travis Drayna, Michael Barnhardt, Graham Candler, William Garrard, "Detached Eddy Simulations of the MSL Parachute at Supersonic Conditions," AIAA Paper 2007-2529, AIAA Aerodynamic Decelerator Systems Conference, Williamsburg, VA, May 21-24, 2007

Bageswhar, Vibhor, Gebre-Egziabher, Demoz, Garrard, William, Shestople, Paul, and Adams, Michael, "Inertially-Aided Vector Matching Algorithm for Attitude Determination of Spin Stabilized Satellites," AIAA 2008-6295, 2008 AIAA Guidance, Navigation and Control Conference, August 2008

Vladimir Gidzak, Michael Barnhardt, Travis Drayna, Ioannis Nompelis, Graham V. Candler, William Garrard, "Comparison of Fluid-Structure Interaction Simulations of the MSL Parachute with Wind Tunnel Tests," AIAA 2009-2971, AIAA Aerodynamic Decelerator Systems Conference, Seattle, WA, May 4-7, 2009

APPENDIX B: CERTIFICATION OF COMPLIANCE

By submitting the enclosed certification form in response to this announcement, the authorizing official provides assurance that the jurisdiction is in compliance with the certifications listed. The summaries for the existing certifications state:

1) A. Debarment, Suspension, and Other Responsibility Matters Primary Covered Transactions

This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 34 CFR Part 85, Section 85.510, Participant's responsibilities. The regulations were published as Part VII of the May 26, 1988 Federal Register (pages 19160 - 19211). Copies of the regulation may be obtained by contacting the U.S. Department of Education, Grants and Contracts Service, 400 Maryland Avenue, S.W. (Room 3633 GSA Regional Office Building No. 3), Washington, DC. 20202-4725, telephone (202) 732-2505.

- a. The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
 - i. Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
 - ii. Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
 - iii. Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
 - iv. Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default.
- b. Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

B. Certification Regarding Lobbying for Contracts, Grants, Loans, and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:

- c. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- d. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- e. The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certificate shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000 for each such failure.

The summaries for the additional certifications are given in the following three sections and the certification form is in section E.4. This certification form must be completed and returned as part of the jurisdiction's proposals.

C. Assurance of Compliance with the National Aeronautics and Space Administration Regulations Pursuant to Nondiscrimination in Federally Assisted Programs

As a condition of receipt of Federal financial assistance, the Applicant Institution, acknowledges and agrees that it must comply (and require any subgrantees, contractors, successors, transferees, and assignees to comply) with applicable provisions of national laws and policies prohibiting discrimination, including but not limited to:

Title VI of the Civil Rights Act of 1964, as amended, which prohibits recipients of federal financial assistance from discriminating on the basis of race, color, or national origin (42 U.S.C. 2000d et seq.), as implemented by NASA Title VI regulations, 14 C.F.R. Part 1250.

As clarified by Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination on the basis of limited English proficiency (LEP). To ensure compliance with Title VI, the Applicant must take reasonable steps to ensure that LEP persons have meaningful access to its programs in accordance with NASA Title VI LEP Guidance to Grant Recipients (68 Fed. Reg. 70039). Meaningful access may entail providing language assistance services, including oral and written translation, where necessary. The Applicant is encouraged to consider the need for language services for LEP persons served or encountered both in developing budgets and in conducting programs and activities. Assistance and information regarding LEP obligations may be found at <http://www.lep.gov>.

Title IX of the Education Amendments of 1972, as amended, which prohibits discrimination on the basis of sex in education programs or activities (20 U.S.C. 1681 et seq.) as implemented by NASA Title IX regulations, 14 C.F.R. Part 1253. If the Applicant is an educational institution:

- f. The Applicant is required to designate at least one employee to serve as its Title IX coordinator (14 C.F.R. §1253.135(a)).
- g. The Applicant is required to notify all of its program beneficiaries of the name, office, address, and telephone number of the employee(s) designated to serve as the Title IX coordinators. (14 C.F.R. §1253.135(a)).
- h. The Applicant is required to publish internal grievance procedures to promptly and equitably resolve complaints alleging illegal discrimination in its programs or activities (14 C.F.R. §1253.135(b)).
- i. The Applicant is required to take specific steps to regularly and consistently notify program beneficiaries that the Applicant does not discriminate in the operation of its programs and activities. (14 C.F.R. §1253.140).

Section 504 of the Rehabilitation Act of 1973, as amended, which prohibits The Applicant from discriminating on the basis of disability (29 U.S.C. 794) as implemented by NASA Section 504 regulations, 14 C.F.R. Part 1251.

The Applicant is required to designate at least one employee to serve as its Section 504 coordinator (14 C.F.R. §1251.106(a)).

The Applicant is required to notify all its program beneficiaries of the name, office, address, and telephone number of the employee(s) designated to serve as the Section 504 coordinator (14 C.F.R. §1251.106(a)).

The Applicant is required to publish internal grievance procedures to promptly and equitably resolve complaints alleging illegal discrimination in its programs or activities (14 C.F.R. §1251.106(b)).

The Applicant is required to take specific steps to regularly and consistently notify program beneficiaries that the Applicant do not discriminate in the operation of its programs and activities. (14 C.F.R. §1251.107).

The Age Discrimination Act of 1975, as amended, which prohibits the Applicant from discriminating on the basis of age (42 U.S.C. 6101 et seq.) as implemented by NASA Age Discrimination Act regulations, 14 C.F.R. Part 1252.

The Applicant also acknowledges and agrees that it must cooperate with any compliance review or complaint investigation conducted by NASA and comply (and require any subgrantees, contractors, successors, transferees, and assignees to comply) with applicable provisions governing NASA access to records, accounts, documents, information, facilities, and staff. The Applicant must keep such records and submit to the responsible NASA official or designee timely, complete, and accurate compliance reports at such times, and in such form and containing such information, as the responsible NASA official or his designee may determine to be necessary to ascertain whether the Applicant has complied or is complying with relevant obligations and must immediately take any measure determined necessary to effectuate this agreement. The Applicant must comply with all other reporting, data collection, and evaluation requirements, as prescribed by law or detailed in program guidance.

Certification of Compliance

Title: Improving STEM Retention for At Risk Students Using Aerospace Project-Based Learning Centered on High Powered

Principal Investigator: William Garrard

Institution University of Minnesota

Street/PO Box: 110 Union St, 107Akerman Hall

City Minneapolis State: MN Zip: 55455 Country: USA

Email: wgarrard@umn.edu

Phone: 612-625-9002 Fax: 612-626-1558

Certification of Compliance with Applicable Executive Orders and U.S. Code

By submitting the proposal identified in the Cover Sheet/Proposal Summary either in response to a NASA Research Announcement or as an Unsolicited Proposal, the Authorizing Official of the proposing institution (or the individual proposer if there is no proposing institution) as identified below:

- Certifies that the statements made in this proposal are true and complete to the best of his/her knowledge;
- Agrees to accept the obligations to comply with NASA award terms and conditions if an award is made as a result of this proposal; and
- Confirms compliance with all provisions, rules and stipulations set forth by these Certifications [namely,
 - A. *Debarment & Suspension.*
 - B. *Certifications, Disclosures, and Assurances Regarding Lobbying*
 - C. *Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs*

Willful provision of false information in this proposal and/or its supporting documents, or in reports required under an ensuing award, is a criminal offense (U.S. Code, Title 18, Section 1001).

Title of Authorizing Official: _____

Signature: _____ Date: _____

Name of Proposing Institution: University of Minnesota

Phone: 612-624-5599 Fax: 612-624-4843 E-mail: awards@umn.edu

Cage Code: ODH95 DUNS Number: 555917996 TIN Number: 416007513

2. REPRESENTATION BY PROSPECTIVE RECIPIENT THAT THEY ARE NOT THE ASSOCIATION of COMMUNITY ORGANIZATIONS for REFORM NOW (ACORN) or a SUBSIDIARY of ACORN

- (a) In accordance with section 534 of the Consolidated and Further Continuing Appropriations Act of 2012 (Pub. L.112-55), none of the funds made available by the Act may be distributed to the Association of Community Organizations for Reform Now (ACORN) or its subsidiaries.
- (b) The prospective recipient represents, by submission of its offer, that it is not the Association of Community Organizations for Reform Now (ACORN) or a subsidiary thereof, and that no funds made available under this award will be distributed to ACORN or its subsidiaries.

REPRESENTATION BY CORPORATIONS REGARDING AN UNPAID DELINQUENT TAX LIABILITY OR A FELONY CONVICTION UNDER ANY FEDERAL LAW

- (a) In accordance with sections 544 and 543 of the Consolidated and Further Continuing Appropriations Act of 2012 (Pub. L.112-55), none of the funds made available by that Act may be used to enter into a grant or cooperative agreement with any corporation that -
 - (1) Has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability, where the awarding agency is aware of the unpaid tax liability, unless an agency has considered suspension or debarment of the corporation and made a determination that this action is not necessary to protect the interests of the Government; or
 - (2) Was convicted (or had an officer or agent of such corporation acting on behalf of the corporation convicted) of a felony criminal violation under any Federal law within the preceding 24 months, where the awarding agency is aware of the conviction, unless an agency has considered suspension or debarment of the corporation and made a determination that this action is not necessary to protect the interests of the Government.
- (b) The prospective recipient represents that -
 - (1) It is is not a corporation that has had any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability; and

(2) It is [] is not [] a corporation that was convicted, or had an officer or agent acting on behalf of the corporation convicted, of a felony criminal violation under a Federal law within the preceding 24 months.

CERTIFICATION BY PROSPECTIVE RECIPIENTS REGARDING FEDERAL INCOME TAX FILING and FEDERAL INCOME TAX VIOLATIONS

(a) In accordance with section 527 of the Consolidated and Further Continuing Appropriations Act of 2012 (Pub. L.112-55), none of the funds made available by the Act may be used to enter into a grant or cooperative agreement in an amount greater than \$5 Million unless the prospective recipient certifies in writing to NASA that, to the best of its knowledge and belief, the prospective recipient has filed all Federal tax returns required during the three years preceding the certification, has not been convicted of a criminal offense under the Internal revenue Code of 1986, and has not, more than 90 days prior to certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

(b) The prospective recipient's proposal shall include a signed written certification as follows -

To the best of my knowledge and belief, ---(name of offeror)--- has filed the Federal tax returns required during the three years preceding this certification, has not been convicted of a criminal offense under the Internal revenue Code of 1986, and has not, more than 90 days prior to certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

Recipient _____

Signature _____

Name _____

Title _____

Date of execution _____

3. Assurance

Institution Name: University of Minnesota

Proposal Title: Improving STEM Retention for At Risk Students Using Aerospace Project-Based Learning
Centered on High-Powered Rocketry

Grant Number:

Assurance of Compliance – China Funding Restriction (DEVIATION FEB 2012)

(iv) An Assurance of Compliance with The Department of Defense and Full-Year Appropriation Act, Public Law 112-10 Section 1340(a); The Consolidated and Further Continuing Appropriation Act of 2012, Public Law 112-55, Section 539; and future-year appropriations herein after referred to as “the Acts”, whereas:

(1) NASA is restricted from using funds appropriated in the Acts to enter into or fund any grant or cooperative agreement of any kind to participate, collaborate, or coordinate bilaterally with China or any Chinese-owned company, at the prime recipient level and at all subrecipient levels, whether the bilateral involvement is funded or performed under a no-exchange of funds arrangement.

(2) Definition: “China or Chinese-owned Company” means the People’s Republic of China, any company owned by the People’s Republic of China, or any company incorporated under the laws of the People’s Republic of China.

(3) The restrictions in the Acts do not apply to commercial items of supply needed to perform a grant or cooperative agreement.

(4) By submission of its proposal, the proposer represents that the proposer is not China or a Chinese-owned company, and that the proposer will not participate, collaborate, or coordinate bilaterally with China or any Chinese-owned company, at the prime recipient level or at any subrecipient level, whether the bilateral involvement is funded or performed under a no-exchange of funds arrangement.

Title of Authorizing Official: _____

Printed Name: _____ Signature: _____

Date: _____

Name of Proposing Institution: University of Minnesota _____

Phone: 612-624-5599 _____ Fax: 612-624-4843 _____

E-mail: awards@umn.edu _____

APPENDIX C: CONSORTIUM DIRECTOR ENDORSEMENT

The Space Grant Consortium Director has reviewed and agrees with the contents of the proposal. This signature indicates the endorsement by the Director acknowledging this proposal as one of the two possible submissions from the consortium for this specific solicitation.

*Director: Please affirm concurrence through signature on the line below. An **electronic signature** is acceptable.*

X William GARRARD

Name (PLEASE PRINT)

Consortium Director

Director, MN Space Grant Consortium

X 

Signature

Consortium Director

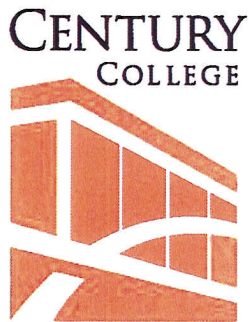
Dec. 12, 2012

To Whom it May Concern:

We acknowledge that we are identified as Collaborators to the proposal entitled **Improving STEM Retention for At-Risk Students Using Aerospace Project-Based Learning Centered on High-Powered Rocketry**, submitted by William Garrard to the NASA Cooperative Agreement Notification NNH12CH0004C, and that we intend to carry out all responsibilities identified for us in this proposal. We understand that the extent and justification of our participation as stated in this proposal will be considered during peer review in determining in part the merits of this proposal. We have read the entire proposal, including the management plan and budget, and we agree that the proposal correctly describes our commitment to the proposed activities at the University of Minnesota.

Dr. William Garrard
Director of the MN Space Grant
Professor of Aerospace Engineering
University of MN – Minneapolis

Dr. James Flaten
Associate Director of the MN Space Grant
Contract Professor of Aerospace Engineering
University of MN – Minneapolis



December 12, 2012

To Whom It May Concern:

We acknowledge that we are identified by name as Collaborators to the proposal, entitled **Improving STEM Retention for At-Risk Students Using Aerospace Project-Based Learning Centered on High-Powered Rocket**, that is submitted by William Garrard to the NASA Cooperative Agreement Notification NNH12CH0004C, and that we intend to carry out all responsibilities identified for us in this proposal. We understand that the extent and justification of our participation as stated in this proposal will be considered during peer review in determining in part the merits of this proposal. We have read the entire proposal, including the management plan and budget, and we agree that the proposal correctly describes our commitment to the proposed activities at Century College.

Sincerely,

Tim Grebner
Engineering Faculty

John Rupert
Fabrication Lab Faculty

Off We Go Rocketry

3600 France Ave S
St Louis Park, MN 55416
952.201.3002
president@OffWeGoRocketry.com
www.OffWeGoRocketry.com



December 12, 2012

RE: Innovative Pilot in STEM Education Solicitation

To Whom It May Concern:

I acknowledge that I am identified by name as a Collaborator to the proposal, entitled **Improving STEM Retention for At-Risk Students Using Aerospace Project-Based Learning Centered on High-Powered Rocketry**, that is submitted by William Garrard to the NASA Cooperative Agreement Notification NNH12CH0004C, and that I intend to carry out all responsibilities identified for us in this proposal. I understand that the extent and justification of our participation as stated in this proposal will be considered during peer review in determining in part the merits of this proposal. I have read the entire proposal, including the management plan and budget, and agree that the proposal correctly describes my commitment to the proposed activities at the University of Minnesota and Century College.

Sincerely,

A handwritten signature in blue ink that reads "Gary Stroick". The signature is fluid and cursive, with the first name "Gary" being more prominent.

Gary Stroick
President
Off We Go Rocketry, LLC