

Connecticut Space Grant Consortium
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Connecticut Space Grant Consortium is a Capability Enhancement Consortium funded at a level of \$430,000 for fiscal year 2013.

PROGRAM GOALS

The NASA Connecticut Space Grant (CTSG) Consortium's goal is to further the efforts started through NASA's Education Strategic Framework by creating program initiatives with five major goals:

CTSG Goal 1: To establish and promote NASA-related research opportunities that draw on the collaborative strength of private, academic and government sectors.

1.1 Recruit at least two applicants per year for one or more of the following: NASA Summer Academy; Undergraduate Student Research Opportunity *Project (USRP)*.

1.2 Place students from Academic Affiliate Institutions at Industrial Affiliates for student research, projects and industrial internships.

1.3 Centralize and disseminate NASA related research opportunities.

1.4 Increase the breadth of student and faculty response to Connecticut Space Grant opportunities.

1.5 Facilitate the formation of teams to pursue NASA related research opportunities.

CTSG Goal 2: To support education initiatives that will inspire students to pursue careers in science, technology, engineering and mathematics (STEM).

2.1 Identify and engage at least six partners to inspire K-12 students.

2.2 Identify K-12 outreach sites, to foster diverse experiences for both student presenters and classroom participants. Require outreach of all “significant” award recipients.

2.3 Increase the number of higher education students submitting research project proposals in all 4-year Academic Affiliate Institutions. Obtain a minimum of 5 student applications from all research focused Affiliates (UConn, Wesleyan, and Yale) each year, and encourage increased student participation from all other Affiliates.

2.4 Maintain an up-to-date website for dissemination of educational and grant opportunities, and other Space Grant and NASA related news and resources.

2.5 Place students in industry in mentor/co-op/internship environments.

CTSG Goal 3: To raise the visibility of the Consortium.

3.1 Raise the profile of CTSG throughout the state by sharing information through the website, newsletter, and media events.

CTSG Goal 4: To promote workforce development that recognizes the current and future needs of the Connecticut economy.

4.1 Develop seminars around emerging technologies.

4.2 Work with local industry for career development in the workplace.

4.3 Develop courses/programs around workforce needs.

CTSG Goal 5: To develop sufficient resources for strong organizational growth consistent with the target of \$750,000 in total funding by 2015.

5.1 Secure sufficient outside funding for a part-time/full-time dedicated staff person.

5.2 Research best practices of top state consortiums.

5.3 Seek funding from industry, government and foundations.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1, 2, & 3)

Mr. C. MacDonald, University of New Haven: Internship with CT Corsair: “My time with Connecticut Corsair, made possible through the CT Space Grant Consortium, has been productive, educational, and beneficial to all parties involved. Through my efforts in outreach, the CTSGC received great publicity, as did the Corsairs, as did the STEM community and industry as a whole. My engineering work laid a solid framework for the electrical and computer aspect of the Corsair Simulator project, as well as building a major bridge between the computer and the actuator motors. Personally, I benefitted from this internship by furthering my knowledge base, teamwork skills, and professional networking.” (Outcome 1: Employ and Educate)

Mr. K. McIntosh, Fairfield University, Light Sport Aircraft Development using 4-stroke Motorcycle Engine: “This project has allowed me to have a better understanding of the aerospace industry and have a greater appreciation for all the work that goes into creating an aircraft of any kind. I have always had an interest in pursuing a career in which I can

physically work on a project or task that will have an impact on people in this society. My experiences with this project have furthered my desires to continue to my studies in engineering and start a career in which I can positively impact the lives of the people in this country.” (Outcome 1: Employ and Educate)

Mr. L. Guadagnoli, Central Connecticut State University, Hybrid Propellant Rocket Engine Team: “Our goal was to analyze the combustion of liquid oxygen with non-conventional solid fuels such as beeswax, paraffin etc., and create regression rates for various parameters of the rocket’s performance. We presented results of combustion tests over previous year at the 51st AIAA Conference. This trip encouraged me to bring back ideas to the team to enhance the capabilities of the rocket engine (such as techniques to gather good nozzle temperature readings). This was due to the advice received by aerospace engineers that I talked to while at the conference. The experience gained from the meeting was used for a senior capstone project.” (Outcome 2: Educate and Engage)

PROGRAM ACCOMPLISHMENTS

1. The CTSG Consortium presently has membership composed of higher education and research institutions along with industrial partners, and informal education organizations. With 15 member schools, we are clearly committed to support Outcome 1, ‘Contribute to the development of the STEM workforce in disciplines needed to achieve NASA’s strategic goals’. As a means to meet our Consortium strategic goal of promoting NASA-related research opportunities (CTSG Goal 1) and workforce development that recognizes the needs of the CT economy (CTSG Goal 4), we leverage our financial resources by partnering with a wide range of groups that have complementary interests in our state. Our broad-based efforts in support of Outcome 1 are listed below.
 - 1.1. An undergraduate and graduate student research fellowship program, in which students work on projects related to NASA’s mission. To date, 3 research fellowships have been awarded (1 graduate, 2 undergraduate). Additionally, 3 more research fellowships will be awarded during the upcoming Spring Semester (1 graduate, 2 undergraduate).
 - 1.2. Project grants, which provide funding for project materials and supplies, are available for both graduate and undergraduate students. To date, 5 of these grants have been awarded, and 6 awards are available for the upcoming spring semester (5 of which will be project grants, and one of which will be a senior design/capstone project grant).
 - 1.3. Two travel grants were awarded, and 5 are available in the spring for student travel to conferences, NASA competitions, or visits to NASA Centers.
 - 1.4. Student opportunities also exist in the form of participation in a NASA Academy internship (2 summer interns, 1 spring semester), participation in the Rock-On Workshop (4 student participants, 2 informal educators), and an intensive 1-week Helicopter/UAV workshop (5 CT participants, also open to National network).

- 1.5. Summer internships are available within numerous local aerospace companies (e.g. Pratt & Whitney, Sikorsky, United Technologies Aerospace Systems, etc.). In addition, our consortium supports internships at many smaller aerospace supply companies within our state's borders (such as our industrial affiliates HABCO, Inc. or our non-academic affiliate Connecticut Center for Advanced Technology and Connecticut Corsair). These companies provide meaningful internship opportunities as well as varied projects for our students. The internships are divided into two categories: one for 4-year undergraduate college students and one for community college students enrolled at the states' lone MSI – Capital Community College. During FY 2013, 6 students participated in industrial internships at CT Corsair, Proton OnSite, Pratt & Whitney, United Technology Aerospace Systems, and Sikorsky. Three spring semester MSI internships will be awarded (start date in February 2014) for community college students at UConn Health Center, Hartford Hospital, and Mount Sinai Rehabilitation Hospital's Mandell Center for Multiple Sclerosis.
 - 1.6. Faculty research grants provide important student research assistant opportunities, as well as expand the body of scientific knowledge within STEM. Five different faculty grants are available, including research grants, seed research grants, faculty collaboration grants, STEM education research grants, and curriculum development grants. Faculty travel awards are also available. To date, 2 research grants, 1 seed research grant, 1 collaboration grant and 1 curriculum development grant have been awarded to faculty at 5 different academic affiliate institutions. In addition, 2 of each grant type are available for spring 2014 awarding.
2. The CTSG Consortium continues to work with elementary and secondary education groups, in addition to our collegiate affiliates, in order to strengthen the ability of our consortium to influence Outcome 2, 'attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty'. The goal for the activities described below is to inspire students to pursue STEM in college (CTSG Goal 2).
 - 2.1. Higher education initiatives to *Educate and Engage*
 - 2.1.1. An undergraduate scholarship is awarded for students studying in fields of interest to NASA. One scholarship was awarded to each of the 11 undergraduate Academic Affiliate members of the Consortium.
 - 2.1.2. Scholarships will be awarded to students from each participating community college to support students studying STEM fields, and for those with a desire to continue their education at a four-year college. Six scholarships will be awarded in the upcoming spring semester, 2 for each community college affiliate.
 - 2.1.3. CT Space Grant continues to support the Helicopter/UAS workshop. The workshop was successfully completed during Summer 2013. Changes were made to update the curriculum for this past summer's program to further emphasize UAV topics. CTSG supported 5 student participants in the workshop. In addition, 24 students from the National Space Grant network

attended the workshop (participating Space Grant Consortia included DE, FL, MA, NC, NE, NJ, NY, OR, PR, WA, and WV.)

2.2. K-12 initiatives to *Educate and Engage*

2.2.1. Two seats within the summer helicopter training workshop are reserved for gifted high school students from CT to help further inspire these students to pursue STEM majors in college, and to spread the word about STEM within their peer base.

2.2.2. K-12 initiatives to *Educate and Engage* include support of CPEP (CT Pre-Engineering Program), a summer program for middle and high-school students, support of various K-12 initiatives, and required outreach of our student fellowship awardees.

2.2.3. Two other summer programs were supported for K-12 students, one for middle school girls (Mad About Science) and one for high school students (UNH Engineering Camp).

2.3. K-12 teacher initiatives to Educate and Engage

2.3.1. CTSG sponsored a teacher training workshop called FOCUS: Energy, which provided instruction for middle and high school science teachers. This three-day program partners 15 middle and high school science teachers with college faculty, allowing them an opportunity to develop new curricular activities that meet state education standards, along with providing them materials and lesson plans to implement the activities.

2.3.2. Two Hartford area teachers participated in the Northeast Regional Teacher Workshop, sponsored by Massachusetts Space Grant. This five-day workshop enabled teachers to participate in the Summer LEGO Engineering Institute, where teachers learned techniques and obtained lessons for implementation in their local school and/or community.

3. The Consortium continues to maintain existing community links within the informal education field (e.g. museums and science centers) and seeks new partnerships in order to impact both NASA Education Outcome 3, ‘build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA’s mission’, and CTSG Goal 2 (to support education initiatives that will inspire students to pursue careers in STEM) and CTSG Goal 3 (to raise the visibility of CTSG). Community-involvement partnerships include our longstanding affiliation with the New England Air Museum (NEAM), as well as working with the Connecticut Science Center, and the Discovery Museum and Planetarium, among others.

3.1. CTSG sponsored a state-wide ‘NASA Space Day’ in April 2013, where both academic and non-academic affiliate institutions held special NASA-related events. The 2013 ‘festivities’ included the following:

3.1.1. A show and presentation at the campus planetarium at Eastern Connecticut State University, with the goal to reach more diverse communities.

- 3.1.2. The NASA Space Day (Space Expo) event expands on the New England Air Museum's mission of presenting the story of aviation and space exploration. Over 1,500 visitors attended Space Expo 2013; many of them visiting the Museum for the first time. Special guests at Space Expo 2013 included NASA Astronaut Ret'd Jerry Ross, the frequent flyer of NASA astronauts and one of two astronauts who have the most hours spacewalking, NASA scientist, Sabrina Thompson, shared her enthusiasm for what she does at Goddard Space Center and the *Yoyo People* put on a performance appealing to all ages that took Yoyo demonstrations into space. All visitors left the 2013 event with a copy of *I am a Space Shuttle* by Becky Cross, having met an astronaut, and realizing that the aerospace industry is within their reach.
- 3.1.3. NASA Space Day activities at the Connecticut Science Center included special showings of the film *3D Sun*, space-themed story time, astronaut ice cream tastings and live science demonstrations, including a miniature astronaut suit, nanotechnology and opportunities for kids to interact with space systems engineer Ed O'Connor. More than 2,000 people came to the Science Center on NASA Space Day.
- 3.1.4. The Discovery Museum and Planetarium was open free to the public in celebration of Connecticut's NASA Space Day 2013. Activities included special planetarium shows, space demonstrations, table displays on astronomy, solar telescope viewing, evening telescope program and display of high altitude balloon hardware. Over 1,000 people attended the event.
- 3.2. CTSG held a Career & Grants Expo, a networking event that brought together students, researchers, and industry representatives at the Pratt & Whitney Museum Hangar. Previous Space Grant supported projects were on display, and new partnerships were developed. This event was open to all members of the CTSG Consortium. In total, 130 people attended.
- 3.3. One Aerospace Educator was sponsored at the New England Air Museum. The person acts to lead museum activities, and helps to develop new exhibits and hands-on activities.
- 3.4. The CT Invention Convention (CIC) is a supported event which encourages children to explore STEM fields. In 2013, 8,000 student inventors participated, from 130 elementary and middle schools across the state. At the CIC, the 130 finalists shared their inventions with over 8,000 judges, parents/guardians and members of the public.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

The following data illustrate Connecticut's success in contributing to the NASA PART measures at this half-way point in our programmatic cycle.

- **Student Data and Longitudinal Tracking:** The total awards granted to students in Academic Year 2013-2014 = 69; Fellowship/Scholarship = 42; Higher Education & Research Infrastructure = 27; NOTE: At this point in the program cycle, 40 (56%) of the awards have been distributed, the remaining will be awarded during spring 2014.

To date, 13 (32.5%) of the total student award recipients were underrepresented students; 11 (27.5%) of the total award recipients were women. Of those most recently awarded, 95% are still enrolled in their current degree programs.

- **Minority-Serving Institution Collaborations:** The CTSG office is working with Capital Community College, Connecticut's only officially recognized MSI, to launch a health science/engineering research internship opportunity. Research partners have been identified (University of Connecticut Health Center, Mount Sinai Rehabilitation Hospital, and Hartford Hospital), and applications are being collected for an internship start date in February 2014. Three spring semester internships will be awarded this semester, and an additional 3-5 will be awarded for the summer.
- **NASA Education Priorities:**
 - **Authentic, hands-on student experiences in science and engineering disciplines:** The following is a summary of the graduate and undergraduate fellowships awarded by CTSG during FY 2013:
 - Graduate Research Fellowship – Students engage in research related to space/aerospace science or engineering under the guidance of a faculty member or a mentor from industry.
 - Undergraduate Research Fellowship – Students engage in research related to space/aerospace science or engineering under the guidance of a faculty member or mentor from industry. Students may be preparing for senior design projects, honors research, or searching for an educational experience, which is consistent with the mission of NASA.
 - Student Project Grants – This award allows students, or groups of students, to purchase items needed for projects that are beyond the normal funds allocated by departments, colleges and universities. These awards may also be used in preparation for NASA sponsored design competitions.
 - Travel Grants – Students may apply for travel grants to visit NASA centers to use unique facilities, to present their NASA related work at professional meetings, to visit NASA researchers for collaboration purposes, and/or to participate in NASA sponsored competitions and events.
 - Industrial Internship – Students are matched with CT industry partners in space/aerospace science or engineering fields, under the guidance of a mentor from industry. Students may participate in summer (full time, 10 week) or Academic Year (part-time, one semester) internships.
 - MSI Internship - Students from Capital Community College, the state's lone MSI, are matched with research projects in the fields of health sciences and engineering. This opportunity allows community college students to participate in meaningful research, an experience they would not normally have access to during typical community college study.
 - Helicopter/UAS Workshop - Students from CT and around the nation work together to study, design, and build both helicopter and UAV

models. This workshop will begin an even/odd rotation with North Carolina Space Grant starting with the summer of 2014 program.

- **Diversity of institutions, faculty, and student participants:**
 - Institutional Diversity: The affiliate distribution of the student awards was: CCSU 4 (6.5%), ECSU 1 (1.6%), Fairfield University 2 (3.3%), SCSU 1 (1.6%), Trinity College 4 (6.5%), University of Bridgeport 2 (3.3%), UCONN 10 (16.4%), UCONN Health Center 0, University of Hartford 7 (11.5%), University of New Haven 4 (6.5%), Wesleyan 2 (3.3%), Yale 3 (4.9%), Capital Community College 0 (to be awarded Spring 2014), Gateway Community College 0 (to be awarded Spring 2014), Naugatuck Valley Community College 0 (to be awarded Spring 2014).
 - Faculty Diversity: Seven (7) awards were granted in fall 2013, 2 (29%) were female, and 3 (43%) were underrepresented minority. Faculty awards were spread over 5 different affiliate institutions.
 - Student Diversity: As of the date of reporting, the directly funded student participant diversity for awards for AY 2013 - 2014 reports 13 (32.5%) of the total student awards were awarded to underrepresented students; 11 (27.5%) of the total awards were awarded to women.

- **Engage middle school teachers in hands-on curriculum enhancement:** In partnerships with CCAT, the 3-day FOCUS: Energy Teacher Workshop was successfully administered during the summer of 2013. Fifteen (3 male, 12 female) in-service HS/MS teachers attended the workshop. 14 “student hands-on” activities were supported, and approximately 1,500 students indirectly benefited from this program.

- **Summer opportunities for secondary students on college campuses:**
 - Mad About Science, University of Hartford: CTSG funded 6 scholarships for middle school girls to attend a two-week long summer camp where they spent the afternoon participating in hands on STEM activities.
 - Engineering & Science Summer Experience, University of New Haven: CTSG funded 2 scholarships for high school participants to attend a week-long summer camp in which they discovered the excitement of working on engineering and science projects.
 - Connecticut Pre-Engineering Program (CPEP) Summer Gaming Challenge: CTSG helped to support this program which runs all summer long, and enables middle school students to improve their math proficiencies by engaging in fun and challenging activities.

- **Develop and sustain Community College relationships:** The CTSG is transitioning from a previous relationship with the Colleges of Technology in the CT State Community College System, to relationships with each individual college. Three relationships are currently in place with Capital

Community College (MSI), Naugatuck Valley Community College, and Gateway Community College, with more in process. The number of Community College affiliates will grow to a minimum of 5 by the end of the 2013-2014 Academic Year, and three will be added each year until all interested community colleges are affiliate members of CTSG.

- **Aeronautics research:** The following research projects/programs were supported by CTSG:
 - Helicopter/UAS Workshop, Central Connecticut State University
 - “Servo-Flap Rotor Blade Design and Wind Tunnel Test”, A. Gates, CCSU
 - “Biomimetic Simulation Study in Support of MAV Development”, K. Brzostowski, University of Hartford

- **Environmental Science and Global Climate Change research:** The following research project/program was supported by CTSG:
 - “Incorporating Satellite Remote Sensing Data into Hydrologic Models: Towards Improved Performance in Modeling Past and Reduced Uncertainty in Predicting the Future”, D. Parr, UConn

- **Enhance and support innovative research activities by early career faculty:** CTSG ranks junior faculty research proposals at a higher level than senior faculty proposals in an effort to foster innovative research in early career faculty. Three (3) of the faculty awards went to junior Faculty at affiliate institutions.
 - “Point Projection Ultrafast Electron Microscopy: Following Dynamics at the Atomic Scale”, B. Barwick, Trinity
 - “Regulating Protein Stability in Microgravity Environments”, C. Othon, Wesleyan
 - “Ballutes: a CFD Study”, M. Carnasciali, University of New Haven

IMPROVEMENTS MADE IN THE PAST YEAR

The Connecticut Space Grant College Consortium has made several changes in the past year that will provide improvements in its operation and improve the diversity of its award recipients. These improvements include a proposed change to a three person administrative team (vs the past two person team), increased participation from community colleges and an emphasis on recruiting students from outside engineering.

The first improvement is our proposed change to a three person administrative team. While this change will not officially take effect until 6/1/2014, we have already identified the third member of the administrative team, Dr. Beth Taylor, an assistant professor in

Health Sciences and Nursing. She has already started attending Space Grant meetings. She will become an Assistant Director in June 2014, but has already started contributing during the fall 2013 semester. Her access to the health care fields, and students within that area, will widen opportunities for female students in the CT Space Grant Consortium.

The second improvement is direct participation by individual Community Colleges. In the past, the CT Space Grant relied on the CT Colleges of Technology to represent all twelve (12) of Connecticut's Community Colleges. Now we have extended invitations to the three of the four community colleges which enroll the greatest number of under-represented students (Gateway, Naugatuck Valley and Capital). Capital CC is the state's sole Minority Serving Institution (MSI). We expect all three of these Community Colleges to be full academic members of our consortium during the spring 2014 academic semester. Additional Community Colleges will be added during the coming years, with Tunxis CC and Three Rivers CC already exploring membership in our consortium and their membership is expected by 6/1/2014.

The third improvement is our emphasis on recruiting female and diverse undergraduate students to our program. We have an internship program in place with Capital Community College that will start in the spring 2014 semester. In addition, we have placed an added weight to recruiting female and diverse students. Our campus directors have been notified of this emphasis, and we have specifically selected the campus director (a woman) from our administrative lead school to be in a field outside of engineering (Mathematics). We expect that these changes will dramatically improve student awards to closely align with the gender and diversity of the undergraduate student population in Connecticut.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Academic Affiliates: CT has 15 academic affiliates (*Capital Community College, Central Connecticut State University, Eastern Connecticut State University, Fairfield University, Gateway Community College, Naugatuck Valley Community College, Southern Connecticut State University, Trinity College, University of Bridgeport, University of Connecticut, University of Connecticut Health Center, University of Hartford (Lead Institution), University of New Haven, Wesleyan University, and Yale University*). These affiliates play an active role in A) project development and implementation, increasingly taking the lead on conceptualization and implementation of Consortium-funded new initiatives, such as the Community College scholarship program, the Life Support & Sustainable Living program, the helicopter workshop, and K-12 summer opportunities, and B) providing a Campus Director to continually expand campus engagement, providing leadership and membership on the grant selection committee, and serving as a conduit for faculty and students to connect with NASA centers and other STEM researchers. (Outcomes 1, 2 and 3)

Industrial Affiliates: CT has seven industrial affiliates (*Pratt & Whitney Aircraft, United Technology Aerospace Systems, UTC Research, Sikorsky Aircraft, UTC Power, Kaman Aerospace, and GKN Aerospace Services*). These affiliates provide important internship and research opportunities for CT's students and faculty. They also provide leadership guidance on an external advisory board, helping to ensure that the Consortium remains aware of industry trends and future hiring need projections related to STEM careers. (Outcomes 1 and 2)

Non-Academic Affiliates: CT presently has seven non-academic affiliates (*State of Connecticut, CT Science Museum, CT Corsair Project, New England Air Museum, Connecticut Center for Advanced Technology, the Discovery Museum and Connecticut Pre-Engineering Program*). The role of these affiliates is to help us promote STEM literacy throughout the state and to provide important internship and faculty research opportunities for affiliates within our state. (Outcomes 2 and 3)

The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.