

## REDEFINING STEM EDUCATION: INITIATING AND DEVELOPING A PRE-COLLEGE AEROSPACE TEAM

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### Abstract

Many researchers forecast the New Space Economy to exceed one trillion dollars (USD) by 2040. To meet this need, it is vital that space-faring nations and those choosing to capitalize on this new domain embrace new strategies to enhance and further develop their STEM workforces. The answer is to educate the workforce of the future through an industry lens. Traditional educational models lead to boredom and uninspired students who can too easily lose interest in the pursuit of a long-term STEM career. Moreover, traditional STEM education churns out cookie-cutter students who may test well or have a high GPA but who have no real product to show for themselves upon graduation. As such, changing the way STEM education is defined can produce a well-trained and motivated STEM workforce of the future especially when it comes to aerospace education. A prime example of this novel educational model is the Wolfpack CubeSat Development Team (WCDT) located in South Florida, United States. Operating as part of the Aerospace and Innovation Academy, the mission of the Wolfpack is to design, build, test, and fly CubeSats as early as middle and high school. In general, the model of the Wolfpack best positions students to remain in the STEM pipeline through their college years and more must be done to reshape traditional STEM education to reflect an industry connection. Although the WCDT continues to grow, there remains insufficient aerospace resources and access for all students who may want to learn through an industry lens; however, individual members have begun creating school-based teams that collaborate with the WCDT. This paper will look more closely at The Greene School Aerospace Team, based at a private school in Palm Beach County, Florida, US, of which the authors are a part. The teammates who participate in this fledgling program undertake real-world aerospace work in the form of aerospace policy advocacy, international mentorship for a team in Japan, and CubeSat design. This paper will also explore the successes and failures that are associated with starting brand-new experiential teams.

**Keywords:** *New space economy, STEM education, Wolfpack CubeSat Development Team, mentorship, experiential learning.*

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### 1. Introduction

The New Space Economy, expected to surpass one trillion dollars by 2040, presents vast opportunities for economic growth and technological innovation (Cheng et al., 2019). To capitalize on these opportunities, the U.S. must reshape its STEM education strategies, ensuring a workforce equipped with both the technical and soft skills needed for the rapidly evolving aerospace industry. Traditional STEM education, with its emphasis on theoretical knowledge and standardized testing, is not enough to meet the demands of this growing sector (Coulter & Herman, 2020). Students need hands-on experience, early engagement, and industry connections to thrive in fields like aerospace. Traditional STEM education in America is often criticized for its lack of engagement and practical application. In many schools, the focus on textbooks and exams leaves students without the real-world skills required for problem-solving in STEM fields. The absence of industry-connected mentorship, practical training, and funding for innovative programs exacerbates this issue. To combat this, it is essential to foster early engagement in STEM, offering students the opportunity to build technical skills and a STEM identity from a young age. To solve this problem, The Aerospace and Innovation Academy, with its Wolfpack CubeSat Development Team, approaches education through an industry lens, and as it has grown, offshoots at individual teammates' schools have begun to take place in other parts of Palm Beach County, other states, and even other countries (Christenson et al., 2022). One such team is The Greene School, a small private school educating students K-12. The Greene Aerospace Team (GAT) originally began in 2022, when two educator authors both taught

at the school. With his extensive aerospace experience as founder of the AIA and WCDT, Kevin Simmons brought aerospace education to his science classrooms, while Shawna Christenson encouraged debate students to participate in aerospace legislative efforts. Initially, the team started out as a school elective, which allowed ample field experiences to take the place of regular classroom instruction.

## **2. Innovative models: The Wolfpack CubeSat development team**

The Wolfpack CubeSat Development Team (WCDT), which operates under the Aerospace and Innovation Academy in the US, is an after-school, online program that provides middle and high school students real-world aerospace opportunities in three main areas: engineering, entrepreneurship, and policy. The group began after COVID, when Simmons saw a need to create the experiences he had done with his original middle-school team who no longer had access once they matriculated to high school. The Wolfpack's mission is to design, build, test, and fly CubeSats—small, affordable satellites—which help students to gain hands-on experience in engineering (Grainger Engineering Office of Marketing and Communications, n.d.). At publication of this paper, the team has successfully launched three CubeSat missions and is currently working on their fourth, a biological payload that seeks to investigate the ability of bacteria to break down PET (Christenson et al., 2022). Simmons is able to foster this high-level learning through his "BLUE-SKY Learning" philosophy, which breaks down large, complex projects into manageable tasks, fostering problem-solving and building confidence. He focuses on the building of soft skills alongside the necessary technical skills needed for STEM careers of the future. Students also engage in activities like writing technical papers, creating educational content, and advocating for aerospace policy, preparing them not just for technical careers but for leadership roles in communication and advocacy as well (Cheng et al., 2019). His success with these students has led to team mentoring for aerospace groups in Peru, India, England, Switzerland, and even Japan.

## **3. Expanding the model: The greene school aerospace team (GAT) efforts**

The Greene School in West Palm Beach, Florida, continued after the educators left the school as the two student authors, among others, are members of the Wolfpack. The GAT has participated in various aerospace competitions and experiences including High Altitude Balloon (HAB) missions. This model of experiential learning fit well with the school's original focus on a unique Passion Pathways Project, which helps students identify their interests and develop a specialized portfolio over four years prior to graduation. This model not only builds skills but ensures that students are actively engaged in learning that is both relevant and inspiring (STEM Education Data and Trends, n.d.). Since its inception, the team focus has moved to more individualized approaches as the school also has made changes in its mission for graduating seniors to move away from Passion Pathways; however, the subset of GAT as WCDT continues to thrive in the form of students who participate in research and conferences such as ISDC (International Space Development Conference) and COSPAR (Committee on Space Research), which was held in Busan, South Korea, this past summer. There, six GAT/WCDT teammates presented their research on an international scale (Service, T. N., 2022). Another way to incorporate speaking through an aerospace lens is the policy work the WCDT does each year in their home state's legislative advocacy days. Greene students participated in Florida Space Days for two years when Simmons taught at the school, and the activity continues through the policy work of one of the student authors of this paper. As co-lead of the WCDT's policy efforts, Kniskern has worked on creating a legislative appropriation that would bring the possibility of CubeSat to underserved students in schools throughout Palm Beach County. Her efforts helped to secure a previous appropriation that helped Palm Beach State College to host summer camps this past year for at-risk youth in our area. This year, the policy team seeks to expand those camps and outreach with efforts to reach even more students (Christenson et al., 2022). The work students do at the legislative level helps young people understand how the government works at the state and local level, further defining the meaning of hands-on experiential learning. In addition to the soft skills of writing and presenting, a Japanese American GAT/WCDT member connected with a school in Japan. After presenting about STEM education and his experiences as an American STEM student and WCDT team member, the student helped to coordinate a collaboration with the Wolfpack. Since this past summer, there are potentially two interested Japanese schools, some of whom will be attending a WCDT summer camp at Kennedy Space Center. The student will be learning about CubeSat basics in an effort to collaborate on a future mission with the American students. This kind of international collaboration showcases the power of integrating STEM with real-world projects that blend passion, skills, and promotes real-world aerospace education at a global level.

#### 4. Challenges in scaling innovative models

While models like those at the Wolfpack CubeSat Development Team and The Greene School show great promise, significant challenges remain in scaling such programs across the broader educational system. One of the primary obstacles is the shortage of qualified mentors with industry experience. These mentors are crucial for guiding students through complex, real-world projects and helping them connect theoretical knowledge with practical applications (Coulter & Herman, 2020). After Simmons and Christenson left The Greene School, it was difficult for the momentum to continue, and while several students are exploring their aerospace passions through WCDT, others have dropped out. There is also a need for more funding to support project-based learning, maintain industry-standard equipment, and provide schools with the resources they need to implement these programs effectively (Cheng et al., 2019). This is especially true for public school teams, and precisely why legislative advocacy efforts are necessary. Building strong partnerships between schools and industries is another key challenge. Connections with aerospace companies, research institutions, and government agencies are essential for providing students with real-world experiences, such as internships, mentorships, and collaborative projects. These connections ensure that students understand the practical applications of their studies and can envision potential career paths in STEM fields. To succeed in the New Space Economy, the U.S. must overhaul its STEM education approach, moving away from traditional models that focus on theory and standardized testing. Instead, schools must offer hands-on, project-based learning that connects students to real-world applications and industry practices. Programs like the Wolfpack CubeSat Development Team and the Greene Aerospace Team exemplify how early, immersive engagement in aerospace and other STEM fields can foster a deep, lasting interest in these disciplines.

#### 5. Conclusion

The potential of the New Space Economy is immense, but to fully realize its benefits, the U.S. must invest in a robust, forward-thinking STEM education system. Arguably, other nations should consider these models as well. Early engagement in STEM, particularly through hands-on, industry-connected projects, is essential for preparing students to succeed in the evolving space industry. The success of programs like the Wolfpack CubeSat Development Team and the Greene Aerospace Team demonstrates the power of innovative educational models that combine technical training with real-world applications. By addressing challenges like mentor shortages, funding gaps, and industry partnerships, we can create a generation of students who are ready to lead in the New Space Economy and beyond.

#### References

- Cheng, S., Gerhard, D., Gendron, F., & Ziffle, V. (2019). Incorporation of high-altitude balloon experiment in high school science classrooms. *Creative Education, 10*, 262-272. <https://doi.org/10.4236/ce.2019.102021>
- Christenson, S., Shinde, P., & Simmons, K. (2022). Disruptive education: Use of emulators and high-altitude balloons as precursors to CubeSats in a middle-high school setting. *44th COSPAR Scientific Assembly*. Held 16-24 July, 2022. Online at <https://www.cosparathens2022.org/Abstract/A0.4-0005-22>.
- Coulter, X., & Herman, L. (2020). The lure of autocratic education in a somewhat democratic society. *Athens Journal of Education, 7*, 331-352. <https://doi.org/10.30958/aje.7-4-1>
- Grainger Engineering Office of Marketing and Communications. (n.d.). High-altitude balloon class emphasizes hands-on learning. Aerospace Engineering | UIUC. Retrieved June 11, 2022, from: <https://aerospace.illinois.edu/news/high-altitude-balloon-class-emphasizes-hands-learning>
- Service, T. N. (2022, February 28). *High altitude balloon satellite launched by students of Chaman Bhartiya School, Bengaluru. Tribune India News Service*. Retrieved April 10, 2022, from: <https://www.tribuneindia.com/news/schools/high-altitude-balloon-satellite-launched-by-students%C2%A0of-chaman-bhartiya-school-373877>
- STEM Education Data and Trends. (n.d.). *How do U.S. 15-year-olds compare with students from other countries in math and science?* National Science Foundation. Retrieved January 24, 2022, from: <https://www.nsf.gov/nsb/sei/edTool/data/highschool-08.html>