

GIFTS: Getting Aloft in Engineering

Dr. Mary L Bowden, University of Maryland, College Park

Director - Maryland Space Grant Balloon Payload Program Senior Lecturer and Keystone Instructor A. James Clark School of Engineering University of Maryland College Park

Dr. Mary Bowden is a Senior Lecturer and Keystone Instructor in the Aerospace Engineering Department at the University of Maryland College Park (UMD) where she specializes in teaching undergraduate Structures and Space Systems Design courses. She received her Bachelor's degree from Cornell University in 1978, and a PhD in Aeronautics and Astronautics from MIT in 1988. After graduation, Dr. Bowden spent 10 years working in the aerospace industry for a number of different companies, most notably AEC-Able Engineering, an aerospace structures and mechanisms company that built the solar array deployment masts for the International Space Station.

Currently, in addition to teaching, Dr. Bowden is the Director of the Balloon Payload Program at UMD, sponsored by the Maryland Space Grant Consortium, with the goal of giving aerospace students access to near-space. Undergraduates have the opportunity to build small engineering and scientific payloads that are lifted by weather balloon to altitudes over 100,000 feet. The Balloon Payload Program just accomplished its 125th tracked flight. In addition, Dr. Bowden is the regional director for the Southeast Pod of the Nationwide Eclipse Ballooning Project, training seven other teams to launch balloons and gather scientific data during the total solar eclipse of 2024.

GIFTS: Getting Aloft in Aerospace Engineering at UMD

Every first-year student needs a support group to learn the ropes and be successful as they enter engineering. While this function could be provided by the squad at the dorm, by fraternity brothers or sorority sisters, or maybe members of the marching band, it is proposed that an engineering design and test team, structured properly, may be the most effective support group. The example used to illustrate this concept is the **University of Maryland** Ballooning Team. The nominal research goal of the team is to design, build, test, and fly small engineering payloads on helium-filled weather balloons up to the edge of the atmosphere, and recover them when they return to earth by parachute. But the real purpose of this team is to provide a supportive environment for all students who join, and especially for first- and second-year engineering students who develop teamwork and social skills, in addition to confidence, resiliency, and basic hands-on engineering abilities. In order to be effective, the team must also include a sufficient number of upperclassmen (juniors and seniors) to serve as teachers, mentors, and team leaders – and there are tremendous benefits for these students as well.

Benefits to 1st and 2nd Year Students	Benefits to Upperclassmen
• development of basic engineering skills	• learning by teaching & problem-solving
• community of like-minded students	• mentoring and being a role model
• motivation for further learning	• developing leadership skills
• connecting w/ academically useful upperclassmen	• belonging and running community
• learning to deal with failure	• resume, internships, money

For an extracurricular community like this to thrive, it is important to instill in these students a shared set of values that include: **1)** active recognition that everyone is welcome, no matter how much or how little experience they bring, no matter what their personal background is, and, perhaps most importantly, no matter how they want to participate on the team or how much time they have to contribute; **2)** respect for the engineering work done by the team, which is technically challenging and which requires many different skills and many different people working together to accomplish not just building experiments, but also actually launching them, tracking them successfully, and recovering them safely; and **3)** appreciation of the fact that every experiment or event that is not successful is an educational experience which is at least as valuable!

Implementation of these fundamental principles starts with the faculty advisor actively putting them into practice, for example by sincerely greeting and welcoming every new student who shows up. Teaching the technical skills is best done by the upperclassmen who most recently learned these skills and understand the complexity and the difficulty. And dealing constructively and positively with failure is a necessary learned procedure that all first- and second-year students can benefit from, and that will serve them well in many aspects of their college life.

These principles could easily be duplicated in other undergraduate engineering groups, for example a rocket club, a race-car crew, or a robotics competition team. The key is to hook the freshmen early – we do a fun ‘back-to-school’ launch and put them to work immediately to build their confidence and give them aspirational and achievable goals. Then, they are also encouraged from early on to participate in “Collaborative” Design Reviews (CDR’s) both to learn what’s important and to have a voice on the team. Finally, they are recognized as they move up with added responsibility and financial compensation for those who take in leadership and mentoring roles. The educational value of being on this kind of technical team is undeniable, and the camaraderie and sense of community that develop are priceless.