MARYLAND
ROBOTICS CENTER

STUDENT PREPARATION TO ADVANCE ROBOTICS IN COLLEGE (SPARC) CERTIFICATE PROGRAM

TRACK: UNCREWED AERIAL SYSTEMS (UAS)

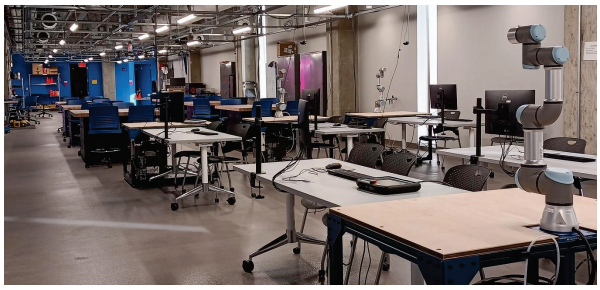
Program Syllabus

Summer 2026

PROGRAM INFORMATION

The "Uncrewed Aerial Systems (UAS)" Track of the *Student Preparation to Advance Robotics in College (SPARC) Certificate Program* introduces high school students to the fundamentals of **aerial robotics** and **autonomous navigation** through a highly hands-on, build-and-program experience. Students will learn how UAS (i.e., drones) sense the world, make decisions, and move purposefully through real environments—connecting core concepts in mechanical design, electronics, programming, and artificial intelligence.

Through a combination of short lectures, guided build sessions, demonstrations, and structured lab activities, participants will get hands-on experience assembling a drone, integrating key hardware components (such as motors, motor drivers, and onboard sensors), and learning how to program the robot's behavior. Students will develop and test algorithms for autonomy, including perception (interpreting sensor data), planning (choosing actions), and control (executing smooth, accurate motion). As the track progresses, students will imbue their robot with artificial intelligence to help it perform autonomous tasks—such as navigating through gates and making decisions in uncertain conditions. The track culminates in a final demonstration in which each student team's drone must autonomously navigate a series of racing gates, using its sensors and onboard intelligence to reach the goal without human intervention.



The Maryland Robotics Center (MRC) Robotics and Autonomy Lab supports robotics prototyping and manufacturing, and mobile robotics research.

PROGRAM FORMAT

The program will run for three weeks, with instructional hours scheduled Monday through Friday from 9:00 AM to 3:30 PM. Participants must be signed in and signed out of the program each day by an authorized adult; however, students with signed waivers from their legal guardians may be permitted to sign themselves in and out. For the final day of the program, participants may invite guests to attend the final project presentations and demonstrations, which will be followed by the SPARC Certificate Conferment Ceremony.

Daily Schedule

9:00 – 9:15 AM	Student Drop-Off
9:15 AM – 12 PM	Morning Activities
12:00 – 1:00 PM	Lunch
1:00 – 3:15 PM	Afternoon Activities
3:15 – 3:30 PM	Student Pick-Up

PROGRAM INSTRUCTOR

Professor Mumu Xu, Associate Professor of Aerospace Engineering
Affiliate Faculty, Maryland Robotics Center

COURSE SCHEDULE (SUBJECT TO CHANGES)

		Morning Topics & Activities	Afternoon Topics & Activities
Week 1 Foundations and Assembly	**M**	• Program Overview & Team Formation • Facilities/MRC Labs Tours	• Introduction to drones; drone racing; basic flight
	T	• Safety Protocols, team formation, race concept and design	• Drone assembly and overview
	W	• Manual flight testing	• Manual flight testing
	Th	• Manual flight testing	• Manual flight testing
	F	• Intro to Linux and Command Line	• Intro to Linux and Command Line
Week 2 Control and Perception	**M**	• Programming and codebase overview	• OpenCV and gate detection
	T	• If/Then Flight states	• Simulation Stack
	W	• Simulation Stack	• "First Autonomous Flight"
	Th	• Team design: Navigating through a gate	• Team design: Navigate through a gate
	F	• Team design: Navigating through multiple gates	• Team design: Navigating through multiple gates
Week 3 Autonomy	**M**	• Fine-tuning and testing	• Final Project Presentations
	T	• Fine-tuning and testing	• Final Project Presentations
	W	• Testing in Armory	• Testing in Armory
	Th	• Testing in Armory	• Testing in Armory
	F	• Final Project Presentations & Demonstrations • SPARC Certificate Conferment Ceremony	

UNCREWED AERIAL SYSTEM TEAM DESIGN CHALLENGE:
THE SKYBOUND CUP

The program culminates in the **SkyBound Cup**. Working in teams, you will deploy your autonomous flight stacks onto a race course. Your drone must navigate turns, altitude changes, and gates without a single human touch. It's a high-stakes test of your code's efficiency and your hardware's durability.

By the end of the program, students will have transitioned from hobbyists to junior robotics engineers. Beyond walking away with a deep proficiency in **Python-based robotics** and **Linux environments**, participants gain a tangible "portfolio project" for college applications and future internships. Students leave with a refined ability to debug complex systems under pressure—a skill that translates directly to any field in STEM. More importantly, they depart with a new mindset: seeing challenges not as roadblocks, but as optimization problems waiting to be solved.