Valid until
9.30.2022

RoboRAVE International
A Collaborative Robotics Program

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Lighter Than Air Vehicle Challenge

Goal

Design, build, and fly an autonomous Lighter than Air Vehicle (LAV) to perform various tasks.

Who Can Play

Teams in this challenge participate as two (2) **separate divisions**, typically:

- Elementary School (ES): simple vertical lift, no robotic control
- Middle School (MS): autonomous, ascending/descending robotic control
- High School (HS)l: MS expectations + horizontal robotic control
- University/Professional (UP): HS expectations + payload delivery robotic controlled

Requirements

For MS, HS, and UP divisions;

1. **Check-In before participating**
    a. Teams demonstrate an autonomous robot, any platform, costing $1,500 USD or less
    b. Can ascend (~50 cm) and stop
    c. “LAV filling material” is inflammable, and inert
    d. Design has NO unsafe components that can become unstable and come apart during flight
    e. Any pressurized tanks needed for inflation must be handled according to accepted safety procedures (tank, storage, safety labeling, etc.)
2. **Additional Details:**
    a. Video Requirements
        i. 60-120 seconds demonstrating successful flight according to each division’s challenge requirements
        ii. Actual flight
            1. Clear measurements of movement
                a. MS: ascending & descending heights, stopping points
                b. HS: MS + horizontal flight
                c. UP: HS + delivery of payload
        iii. Names
            1. Members, First Name ONLY
            2. Community/School/Group, Country
        iv. LAV images to include
            1. Envelope/LAV design
            2. Burner/inflation technique
            3. Basket/body
            4. CPU(s)
            5. Sensor(s)
        v. Code – two (2) samples
        vi. Live action of members involved with LAV process
        vii. Logos
            1. RoboRAVE International

2. LAV challenge sponsor, if sponsored
3. School/Group/Community (optional)
    - Any use of music must be royalty-free with **at least the artist and title of the piece** listed in the video.
- If present, then have a working robot for your division's tasks.

Challenge Specifications

Use robotics to control ascent, descent, and stopping before touching the ground. If HS division, then followed by autonomously controlled horizontal flight, minimum of *10m,* during which time the LAV drops a payload, of your choice, closest to any point on the circumference of the 10m circle.

- There are **no** specifics for the height that the balloon must ascend to or the size of the balloon envelope.
- Any type of lighter than air vehicle can be designed and built.
- No drones (including helicopters, planes, etc).
- Any combination of 3 motors and/or servos for operating flaps, vertical / horizontal motion, dropping payload are allowed.
- Any type of programmable processor can be used.
- Tether lines:
    - For triggering descent, if needed
- Robotics - CPU, Sensors, etc: (*suggested* purposes below)
    - A programmable processor, any type
    - Senor(s) for:
        - Control closing flap for ascension
        - Observe the ground to trigger closing flap and activating burner
        - Managing horizontal flight
        - For detecting target
        - For releasing payload
- Design of LAV - open for innovative ideas.
- A "Lighter than Air" substance is allowed **provided it is NOT in a pressurized tank inside the event hall, and it is NON-flammable, and inert.**

Things to Think About

- Weight is your enemy, keep it light.
- Wind is your biggest enemy; fly on very, very calm days.
- Two video submissions will be allowed; **if** and **only if**, you've made improvements on your LAV design or quality of video.
- Sensors to consider:
    - Altimeter
    - Ultrasonic
    - Temperature
- Motors or Servos? Servos tend to be smaller and lighter.

- Programmable processors open with Arduino clones the least expensive.
- Programming language, open.
- **Outdoor flight is required** for your official LAV video.
- How will you show flight time on your video?
- How will you show horizontal distance on your video?
- What system will generate enough heat for lift and be SAFE at the same time?
- What outside temperature would be for ideal flying conditions?
- While a tether cord is allowed to open a flap to perform the descent, how will it work?

Scoring Matrix

To be done for a score	Full Value	80% Full Value	60% Full Value	20% Full Value
In-flight, *30s* or more	100	80	60	20
Ascends	100	80	60	20
Descends, without touching the ground, closer to the ground, more points	100	80	60	20
Ascends using robotics	200	160	120	40
Horizontal flight, *10m* or more, robotic control	300	240	180	60
Payload dropped, closer to the target's center, more points	200	160	120	40
Originality of Design (LAV + robotics)	200	160	120	40
Video Creativity & Quality	200	160	120	40
Total Points *Possible*	**1400**	***1120***	***840***	***280***