



## 2019 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 compete in **one division**, typically:

- Elementary School + Middle School + High School

### Requirements

Autonomous robot, any platform, costing \$1,500 USD or less, and meets the following design constraints, which will be **verified during Check-In**:

- **VIDEO SUBMISSION** must be/contain:
  - A 60 to 120 second video
  - Team Name
  - First Names ONLY of each team member
  - Community
  - Country name
  - Footage of each member in live action with the LAV
  - Logos of RoboRAVE International and the LAV challenge sponsor
  - LAV images of the envelope, burner, and basket + programmable processor(s)
  - Actual flight and demonstration of required tasks
  - Clear measurement process while in flight: time, height, distance, payload drop, & target
  - 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.

There are **no** specifics for the height that the balloon must ascend to or the size of the balloon envelope.

## Challenge Specifications

Use robotics to control of ascending, descending, and reascending before touching the ground 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.

- 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
  - Sensor(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" filling is allowed provided it is NON-flammable, and inert.

### Recommendations

- 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 but Arduino clones are very inexpensive.
- Programming language, open.
- **Outdoor flight is required** for your official LAV video.

### Things to Think About

- How you will 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?
- Going up, going down, going sideways without motors, fans, compressed gases... how does controlling a flap on top and/or on the side work to control direction?
- Tether cord is allowed to open a flap to perform descension, how will it work?

**Scoring Matrix**

<b>What will be scored</b>	<b>Full Value</b>	<b>80% Value</b>	<b>60% Value</b>	<b>Nice Try Value</b>
In-flight, <i>30s</i> 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	50
Horizontal flight, <i>10m</i> or more, robotic control	300	240	180	50
Payload dropped, closer to the target's center, more points	200	160	120	50
Originality of Design (LAV + robotics)	200	160	120	50
Video Creativity & Quality	200	160	120	50
<b>Total Points Possible</b>	<b>1400</b>	-	-	-