



## 2020 Lighter Than Air Vehicle Challenge

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

### Division:

### **SPECIAL EVENT –**

**FREE for Elementary School students & family & teachers.**

Come, build, decorate, and "fly" your non-robotic, hot air balloon design – FREE to participate...help us make this a HUGE uplifting moment at RRNA 2020's 1<sup>st</sup> collaborative MASS ASCENSION, Saturday Morning, May 9, 10:00a

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

- Middle School: autonomous, ascending/descending control
- High School: MS tasks AND horizontal control; payload dropping

### Requirements:

For Middle School and High School Divisions, ONLY:

#### **1. Check-In (at event)**

- a. Autonomous robot, any platform, costing \$1,500 USD or less
- b. Can ascend (~50cm) and stop
- c. "LAV filling material" is inflammable, and inert
- d. No unsafe components that can become unstable and come apart
- e. Any pressurized tanks needed for inflation are **NOT allowed INSIDE** the convention center

#### **2. Additional Details:**

- a. Video
  - i. 60-120 seconds
  - ii. Actual flight
    1. Clear measurements of movement
      - a. MS-HS: ascending & descending heights, stopping points
      - b. HS: horizontal motion; point of payload release
- 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
  - 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” substance is allowed **provided it is NOT in a pressurized tank inside the event hall, and 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 with Arduino clones the least expensive.
- 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 descent, how will it work?

**Scoring Matrix:**

What is Scored?	Full Value	80% Value	60% Value	Nice Try Value
(MS & HS) In-flight, 30s or more	100	80	60	20
(MS & HS) Ascends	100	80	60	20
(MS & HS) Descends, without touching the ground, closer to the ground, more points	100	80	60	20
(MS & HS) Ascends using robotics	200	160	120	50
(HS <b>only</b> ) Horizontal flight, 10m or more, robotic control	300	240	180	50
(HS <b>only</b> ) Payload dropped, closer to the target's center, more points	200	160	120	50
(MS & HS) Originality of Design (LAV + robotics)	200	160	120	50
(MS & HS) Video Creativity & Quality	200	160	120	50
<b>Total Points Possible</b>	<b>MS – 900 max; 210 min HS – 1400 max; 310 min</b>			