

# TSA Lumenier Drone Competitive Event Guide 2018-19

**Overview**

Unmanned Aerial Vehicles (drones) are used across the world for civilian, commercial, and industrial applications. Teams will research, design, construct, and program a drone that will be used to demonstrate their ability to complete the challenge or solve the problem for that year. Details about the competition and information related to it will soon be posted on the TSA website under Competitions/Themes and Problems.

This is an open source event, meaning that equipment and software can be designed and created or purchased from any manufacturer that meets the outlined specifications.

# Eligibility

1. Participants are limited to one (1) team, one (1) entry per chapter.
2. There is a limit of six (6) representatives per team for the demonstration and for the semifinalist LEAP interview.

# Time Limits

1. Entries must be started and completed during the current school year.
2. Participants are given time prior to their demonstration to practice.
3. Time limit will be depend on the specific challenge.
4. The demonstration begins when the judges’ give instruction to begin.
5. Semifinalists (top 12 teams) will participate in a LEAP interview that will last a maximum of five (5) minutes.

# Leap Leadership Resume/Interview

A Team LEAP Leadership Resume is required for this event and must be submitted with the notebook at event check-in. Semifinalists will respond to interview questions related to their submitted LEAP Resume for a maximum of five (5) minutes.

# Attire

Competition attire, as described in the National TSA Dress Code section of this guide, is required for all parts of this event.

# Safety

**Safety Eyewear**

Participants are required to wear safety-approved eyewear during the on-site phase of this event. Prescription eyewear will need to have side shields to be considered safety eyewear. Should a team member remove the eyewear and fail to replace it, he/she will be reminded once. If there is a second infraction, the team will be asked to leave the competition. Sunglasses are not suitable.

# FLIGHT SAFETY DURING COMPETITION

* 1. Participants are required to wear safety–approved eyewear during the on-site phase of this event. Sunglasses are not suitable.
  2. Pilots may not fly in an intentionally dangerous manner.
  3. Pilots may only fly their aircraft within the hot zone of the competition field.
  4. Teams may only fly their aircraft when instructed to do so by a field referee.
  5. Pilots will be asked to crash land or ground their aircraft if its flight course poses a threat to any individuals or goes beyond the boundaries of the playing field.
  6. Pilot may only connect a battery to the drone when the drone is on the hot table and told to do so by the chief referee.
  7. The transmitter must be placed on the table and remain untouched when a team member is connecting a battery to the aircraft and placing it on the field.
  8. Pilots and spotters will wear eye protection and safety vest when in the flying area.
  9. Drone teams will adhere to all safety rules and directions of game officials.

# FAA REGULATIONS AND AMA GUIDELINES:

1. The FAA Advisory Circular 91-57A is extremely pertinent to the outdoor operation UAVs. Please take the time for your team to read this document and abide by its rules during outdoor operation. <http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-57A.pdf>
2. When you fly outside, you fly in public airspace, which means that no matter the situation, you must ALWAYS GIVE WAY TO THE LARGER MANNED AIRCRAFT. This rule is imperative to the safety of those in the air and the continuation of the UAV hobby in general.
3. Abide by the Academy of Model Aeronautics National Aircraft Safety Code: https:// [www.modelaircraft.org/files/105.pdf](http://www.modelaircraft.org/files/105.pdf)
4. Abide by the Academy of Model Aeronautics National Aircraft sUAS Safety Guide: <http://suas.modelaircraft.org/ama/images/sUAS_Safety_Program_web.pdf>

# GENERAL DRONE SAFETY

1. Aircraft may not be armed when being held by an individual.
2. When configuring an aircraft using the INAV or any other software, it is imperative that no propellers be attached to said aircraft’s motors.
3. Team members may not fly their aircraft over or near other individuals.

# BATTERY SAFETY

1. Team members should always be present during the charging of a Lithium Ion battery.
2. Follow good Li-ION treatment practices:
   1. Do not discharge batteries below 30%.

b. Always Charge and store batteries inside fireproof containers.

1. Never charge a battery that is puffy or punctured.
2. Never charge faster than 1C.
3. Stop Charging immediately if a battery heats up.
4. Lithium Ion battery fires are chemical fires that do not require oxygen to burn, so if a battery ignites:
   1. DO NOT POUR WATER ON THE BATTERY. Doing so only makes the fire worse?
   2. DO NOT PLACE THE BATTERY IN A SEALED CONTAINER TO SMOTHER THE FIRE.
   3. DO NOT USE A STANDARD HOUSEHOLD FIRE EXTINGUISHER.
5. If a battery ignites:
   1. PLACE THE BATTERY IN A BUCKET OF SAND.
   2. THEN COVER THE BATTERY WITH AN ADDITIONAL LAYER OF SAND.
   3. PLACE A PLASTIC BAG FULL OF SAND OVER THE BATTERY.

# Procedure

1. Participants will report to the event coordinator at the time and place stated in the conference program to sign up for demonstration times and submit the team notebook along with the LEAP Leadership Resume.
2. Participants arrive at the demonstration site for their time slot, a maximum of six (6) participants are allowed into the demonstration room per team. Teams will set up, prepare, and have time to practice before their demonstration.
3. Drones will be judged for compliance to design parameters prior to the demonstration.
4. When the judges are ready for the demonstration, they will warn the participants before beginning.
5. Once the judges instruct the demonstration to begin, the demonstration must finish within the allotted time.
6. Participants may restart their demonstration if need be, but must stop when their time is up.
7. Evaluators will independently assess teams based on their demonstration and portfolios. Semifinalists will be determined and posted by the CRC.
8. Semifinalist teams will report to the time/place stated in the conference program to sign up for a semifinalist LEAP interview.
9. No more than six (6) representatives per team report, bringing drone equipment with them, for the semifinalist LEAP interview. The interview will last a maximum of five (5) minutes.
10. No more than two (2) team members pick up their entry from the display area at the time and place stated in the conference program.

It is essential that students and advisors routinely check the TSA website ([www.tsaweb.org](http://www.tsaweb.org/)) for updated information about TSA general rules and competitive events. This information is found on the website under Competitions/Updates. When students participate in any TSA competitive event, they are responsible for knowing of updates, changes, or clarification related to that event.

# Regulations - Drone

**For reasons of safety and equanimity amongst chapters, the following drone regulations and drone specifications are required:**

1. **Drone Dimensions:** Length: 280mm-290mm, Width: 320mm-330mm, Height: 48-49mm, Frame Thickness: 1.8mm-2mm
2. **Drone Powertrain:** LX2205 2400KV Motors, 5” Propellers, 32 bit 35 Amp ESCs
3. **Drone Batteries:** Lithium Ion battery with built in BMS for improved safety (LIPOS not permitted)
4. **Drone Safety Bumpers:** 2mm Carbon Fiber bumpers with mesh covering, fully surrounding all propellers (no gaps more than 10mm above or below propeller).
5. **Fly Away Safety Protection:** Obstacle Avoidance sensors and GPS, that in conjunction with Pixhawk flight controller restrict the drone from flying higher than 10 feet above ground indoors or outdoors.

# Regulations – Other

1. A team that fails to appear for its demonstration forfeits evaluation.
2. LEAP Leadership Resume (see Forms Appendix or TSA website)/Interview - Teams document, in the LEAP leadership resume (see resume template), the leadership skills that the team has developed and demonstrated while working on this event. Semifinalists will respond to questions about the content of their resume as part of their LEAP interview. The LEAP Leadership Resume/interview guidelines and other resources can be found on the TSA website.
3. Documentation materials (comprising “a portfolio”) are required and should be secured in a clear front report cover. The report cover must include the following single-sided, 8.5” x 11” pages, in this order:
   1. Title page with the event title, the conference city and state, the year, and the team chapter ID number (identification numbers are issued on site); one (1) page
   2. Table of contents; pages as needed
   3. Purpose and description of the drone; one (1) page
   4. Design and test log, including date, test duration, problems, redesigns, and other comments; maximum five (5) pages
   5. Electrical diagram of drone; two (2) pages
   6. Programming performed and capabilities of program.
   7. List of resources that includes materials, parts, software, hardware, and sources of information used in the development of the project; one (1) page
   8. Plan of Work log that indicates preparation for the event, as noted by date, task, time involved, team member responsible, and comments (see Forms Appendix or TSA website); one (1) page
   9. Completed Student Copyright Checklist (see Forms Appendix or TSA website); permission letters for copyrighted material, if incorporated; pages as needed

# Evaluation

Evaluation is based on performance, device artisanship, documentation of design efforts, and LEAP requirements. Please refer to the official rating form for more information.

# Stem Integration

This event aligns with the STEM educational standards noted below. Please refer to the STEM Integration section of this guide for more information.

# TSA And Careers

This competition connects to one or more of the career areas featured in the TSA AND CAREERS section of this guide. Use *The Career Clusters* chart and the *TSA Competitions and The Career Clusters* grid as resources for information about careers.

# Sample Careers Related to this Event

1. Aeronautical Engineer
2. Physics Teacher
3. Software Engineer
4. Mechanical Engineer
5. Aircraft Systems Engineer
6. Electronics Technician
7. Industrial Applications Specialist
8. Electrical Engineer
9. Customer Support Manager
10. Research and Development Scientist

# Event Coordinator Instructions

**Personnel**

* 1. Event Coordinator
  2. Assistants, two (2) or more
  3. Evaluators, two (2) or more
  4. Timekeeper
  5. Evaluators for semifinalist interviews, two (2) or more

# Materials

1. Coordinator’s packet, containing:
   1. Event guidelines, one (1) copy for the coordinator ad for each evaluator
   2. TSA Event Coordinator Report
   3. List of evaluators/assistants
   4. Marking pens
   5. Signs for door(s) reading “Do Not Open, Flight in Progress, Knock for Entry”
   6. Stopwatches, three (3)
   7. Results envelope
   8. Envelope for LEAP Leadership Resumes
   9. LEAP Interview Judging Protocol

# Responsibilities

1. Upon arrival at the conference, report to the CRC room and check the contents of the coordinator’s packet. Review the event guidelines and check to see that enough evaluators/assistants have been scheduled.
2. Inspect the area(s) in which the event is being held for appropriate setup, including room size, chairs, tables, outlets, etc. Notify the event manager of any potential problems.
3. One (1) hour before the event is scheduled to begin, meet with evaluators/assistants to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.
4. For participants who violate the rules, the decision either to deduct 20% of the total points earned or to disqualify the entry must be discussed and verified with the evaluators, event coordinator, and a CRC manager.
5. Check in all entries and collect LEAP Leadership Resumes at the time stated in the conference program. The coordinator should have each team sign up for a specific time for its demonstration (within the time frame designated for the event). Once each team has scheduled a demonstration time, make sure that the participants understand that they are to return fifteen (15) minutes before their scheduled demonstration time
6. At the designated time, evaluators individually assess and score entry portfolios (prior to demonstrations), as well as device compliance to competition parameters.
7. Notify the event manager immediately of any team reporting for the demonstration portion of the event that is not on the coordinator’s report. A team not on the report is permitted to participate, but the coordinator MUST confirm the team’s eligibility. If it is found that the team is not registered for the event, the team is disqualified.
8. Evaluators independently assess each team’s demonstration to determine twelve (12) semifinalists. Evaluators may take notes, but scoring occurs only after all team members have left the event room.
9. Submit semifinalist results to the CRC for posting.
10. Meet with semifinalist teams at the time/place stated in the conference program to allow teams to sign up for a LEAP interview time.
11. Inspect the area in which the interviews are to take place. Ensure that there is a table and seating for participants and evaluators.
12. Meet with semifinalist evaluators to review the LEAP Judging Protocol. If questions arise that cannot be answered, speak to the event manager before the semifinalist LEAP interviews begin.
13. Conduct semifinalist LEAP interviews. Interviews should be a maximum of five (5) minutes in length. Evaluators determine the ranking of the finalists, discuss, and break any ties.
14. Review and submit the finalist results and all items/forms in the results envelope to the CRC room.
15. If necessary, manage security and the removal of materials from the area.

# Scoring

# Specifications

Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box. If an item is missing, leave the box blank and place a check mark in the box labeled ENTRY NOT EVALUATED. If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

* Portfolio is present.
* Model is present.
* Completed LEAP Leadership Resume is present.
* ENTRY NOT EVALUATED

**Judges Rubric**

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| --- | --- | --- | --- | --- | --- |
| **Section 1: Log and Documentation (0-40 Points)** |  |  |  |  |  |
| **CRITERIA** | **10 Points** | **8 Points** | **6 Points** | **4 Point** | **0 Points** |
| Roles of team members and time properly logged. | All team members made significant contributions. Log filled out thoroughly, with detailed timeline. | All team members made documented contributions.  Log content was available, but missing some details. | Most team members participated and log fairly well documented.  Missing data and records. | Log was partially complete, but missing many areas. Mixed participation by members. | Log non-existent or team members are unfamiliar with log contents. |
| Parts inventory and repairs | Log of all parts, technical problems with parts and replacements  /repairs well documented. | Most parts accounted for with history of usage and issues. | Most parts listed and tracked. Not much detail of repairs and issues. | Parts list available, but no history of inventory, repairs, replacements. | No parts inventory or repair log. |
| Illustrations of design and concepts | Thorough descriptions of enhancement s and modifications to drone and its ancillary | Most descriptions of enhancements and modifications to drone and its ancillary components | A few descriptions of enhancements and modifications to drone and its ancillary components | Illustrations provided were very basic. | No Illustrations provided |

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|  | components created. | captured and documented. | created. |  |  |
| Materials used from event kit | A thorough list of materials are listed, labeled and include dimensions/m aterials. | Most materials are listed with labeling and dimension/mater ial information provided. | Some materials listed with labeling. | Materials listed, but no labels | No materials listed. |
| **Section 2: Problem-Solving and Solution (0-**  **40 Points)** |  |  |  |  |  |
| **CRITERIA** | **10 Points** | **8 Points** | **6 Points** | **4 Point** | **0 Points** |
| Problem solving statement and solution | In depth description of the problem and the approach to solve documented. | Problem described in some detail, as well as some solutions documented. | Problem described with little documentation on solution. | Little documentation of problem or solution. | No problem statement |
| Description of principles used for payload lifting and release. | Full description of thought process and solution to lift and release payloads. | Some description provided of both processes and solutions for payload management | A few processes and solutions described. | Sparse information available on approach to problem set. | No principles provided. |
| Isometric hand drawing of the prototype used to grab payloads. | Properly dimensioned and with high quality. | Fair quality with some dimension information. | Fair quality with minimal dimension information. | Basic drawings. | No drawings. |
| Aesthetic Appeal | Drone and all added components stylish and attractive. | Drone and some components visually appealing. | Some aesthetic appeal to drone and components. | No modifications made for aesthetics, but drone and equipment in good shape. | Drone and components badly worn. |
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| **Section 3: Teamwork and Safety (0-30** |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- |
| **Points)** |  |  |  |  |  |
| **CRITERIA** | **10 Points** | **8 Points** | **6 Points** | **4 Point** | **0 Points** |
| Team work | Members of team worked very well together. | Most members participated and worked well together. | Some minor issues apparent in team work and participation. | Team work was noticed, but lacking. | No teamwork observed. |
| Leverage strengths of each team member | Each team member had specific roles they were good at and clearly understood. | Most team members were responsible and did well with assigned tasks. | Some team members well aligned with strengths. | Many team member strengths not used. | No apparent understanding of each team members strength. |
| Safety | Drone and safety equipment was used properly at all times. | Drone and safety equipment was used properly most of the time. | Some safety practices implemented, but some missing. | Few safety factors seen. | Safety was often absent. |
| **Section 4: Drone Operations**  **(0-90 Points)** |  |  |  |  |  |
| **CRITERIA** | **30 Points** | **20 Points** | **10 Points** | **5 Point** | **0 Points** |
| Successful Flight Plan | All desired payloads and point areas properly obtained. | Most payloads lifted and release as desired. | Some payloads lifted and released. | Most payload tasks did not work properly. | No payload success. |
| Programming | Flight Controller was programmed and operated as desired. | Flight Controller operated okay, with most tasks being completed. | Flight controller was modified, but many challenges completing tasks. | Minor programming of Flight Controller | No programming included. |
| Flying ability | Complete course without incident. | Complete course without dropping object or hitting net. | Complete course without dropping object. | Complete course with one object delivered1 | Did not complete course. |

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# Semifinalist Interview

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| --- | --- | --- | --- |
| **CRITERIA** | **Minimal Performance 1-4 Points** | **Adequate Performance 5-8 Points** | **Exemplary Performance 9-10 Points** |
| **LEAP Leadership Resume/Interview** See Regulation K and instructions on TSA website  (X2) | The team’s efforts are not clearly communicated, lack detail, and/ or are unconvincing; few, if any, attempts are made to identify and/or incorporate the LEAP Be. Know. Do. criteria. | The team’s efforts are adequately communicated, include some detail, are clear, and/or are generally convincing; identification and/or incorporation of the LEAP Be. Know. Do. criteria is adequate. | The team’s efforts are clearly communicated, fully-detailed, and convincing; identification and/ or incorporation of the LEAP Be. Know. Do. criteria is excellent. |

**How this event fits in to the study of Aerospace Technologies.**

The following standards will all be required to research, design, build, code, and fly a drone:

[http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/curriculum-frameworks/2018-](http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/curriculum-frameworks/2018-19-frameworks/engineering-technology-edu.stml) [19-frameworks/engineering-technology-edu.stml](http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/curriculum-frameworks/2018-19-frameworks/engineering-technology-edu.stml)

* 1. Demonstrate an understanding of the characteristics and scope of technology.
  2. Demonstrate an understanding of the core concepts of technology.
  3. Demonstrate an understanding of the attributes of engineering design.
  4. Demonstrate an understanding of and be able to select and use information and communication technologies
  5. Demonstrate an understanding of and be able to select and use transportation technologies.
  6. Demonstrate safe and appropriate use of tools and machines in aviation/aerospace technologies.
  7. Demonstrate an understanding of aviation electrical, mechanical, hydraulic, and pneumatic systems.
  8. Demonstrate knowledge of robotics as it relates to the aviation/aerospace industry.
  9. Demonstrate problem solving using troubleshooting, research and development, invention and innovation, and experimentation.
  10. Demonstrate technical knowledge of computer control as it is related to aviation/aerospace projects.