# CSU California Unmanned Aerial System Competition (C-UASC)

MOJAVE AIR & SPACE PORT at RUTAN FIELD

Mojave, California

June 6-7, 2026

Organized by:

Cal State University – Los Angeles

and

Mojave Air & Space Port at Rutan Field

# Competition Rules

2026 Competition Rev. 0. (First Draft) 2025-09-27

## Contents

# About this document

This document contains the official rules for the 2026 C-UASC competition. The chief author of the document is Michael Thorburn. The rules are established by the organization partners at the California State University and the Mojave Air & Space Port at Rutan Field with consultation from our technical advisors. Updates to the rules will be published periodically to clarify items or make necessary corrections.

- Rev 0 of the 2026 C-UASC Competition Rules. Dated 2025-09-27. The initial draft of the rules. We have highlighted some updates from the 2025 rules and welcome feedback. We intend to publish Rev 1 before the competition registration opens on November 1.

# About the Competition

The competition is organized by California State University and by Mojave Air & Space Port at Rutan Field. It is a student competition, open broadly to teams of students from universities, colleges, and community colleges. All entrants will be required to comply with rules imposed by Mojave Air & Space Port at Rutan Field and by the California State University.

## Purpose and Tasks

The competition requires students to design, integrate, and demonstrate a small Unmanned Aerial System (sUAS) capable of safe flight and the execution of a set of tasks.

The mission tasks are:

- Waypoint Navigation
- Circuit Time Trials
- Package Drop, (a package is dropped to a target at a prescribed location)
- Package Delivery, (a package is delivered to a target at a prescribed location with requirements on the impact force)
- Target Identification and Localization. (Various targets on the ground are identified, classified, and localized in a prescribed field)
- Package Recovery (a package in the field is picked up and returned to the operators)

The UAS aircraft configuration can be a:

- Rotocopter,
- Fixed-Wing Vehicle, or
- VTOL (Vertical Takeoff and Landing) Vehicle

The UAS must include a Ground Control System (GCS). The GCS are the sets of ground-based hardware and software that allow UAS operators to communicate with and control the UAV and its payloads.

## Community Forum

Beginning this year, Cal State LA is creating an online space for both the C-UASC and C-3DPAC competitions on Discord! The space will serve as a means to communicate directly with teams and

members, to discuss potential rule changes and clarify any questions teams may have. You can join the space through this link: https://discord.gg/6txvXNzfWq, or through the link on the C-UASC webpage.

# Introduction to Rules

## Use of Mojave Air & Space Port

Teams shall comply with all operational requirements of the Mojave Air & Space Port. These requirements will be posted separately on the competition website. They will include:

- Operation within FAA Part 107 guidelines
- Operation at or below 400 feet above ground level (AGL)
- Always Remaining within Line of Sight (LOS) of the UAS Pilot
- No photos or video taken of personnel or property belonging to entities that are non-participating in this competition.

The agreement with Mojave Air & Space Port at Rutan Field, describing the rules of operation, will be posted on the competition website.

## Requirements Imposed by the CSU

### Registration

Teams will be required to register for the event on the webpage (https://www.calstatela.edu/ecst/uav-competitions . Each team will be required to provide all the information requested in the application prior to the competition. This will include information about, but not limited to:

- Insurance and Indemnification
- UAS FAA registration
- Team Members and Pilots

### Safety and Emergency Operations

All UAS must be operated in accordance with safety rules imposed by the CSU and those by the Mojave Air & Space Port at Rutan Field.

#### *Standard Operations Plan*

Each team must submit a plan that defines standard operations and complies with the safety rules. This plan should include:

- Operations checklists
- Pilot roles and responsibilities

#### *Emergency Operations Plan*

**Each team must submit a plan for emergency operations. This plan must include a plan for lost link, loss of control, or loss of communication with the UAS during flight!**

#### *Preflight Checklist*

A preflight checklist will be prepared combining the team's operations plans and those from the competition and Mojave Air & Space Port Operations. Each team must complete and submit this preflight checklist the competition management before their first flight on each day of the competition.

# Team Description and Composition of Teams

Teams are composed of students from colleges or universities.

Teams will be organized into three categories:

- Development Team
- Competition Team
- Competition Guests

## Development Team

The development team must consist of undergraduate students who attend school for at least one semester during the academic year. The team may have at most two graduate students participate during the academic year. The team must have at least one student from the school being represented and may have students from other schools. A school may have multiple teams, but a student may only be on one team. There are no limits to the number of students on the Development Team.

## Competition Team

The team of students which participate in the Mission Flight Demonstration. The competition team must be at most a 12-person subset of the development team. Members of the competition team may participate onsite or participate remotely (e.g. over the internet), but remote members cannot hold safety-critical roles or perform safety-critical functions.

## Key Competition Team Members

### Team Captain

One member of the competition team will fill the role of team captain during the competition year. This student will be the primary point of contact for the judges. All questions, comments, statements, and deliverables must be submitted by the team captain. The judges must be immediately notified of any team captain change.

### Advisor

Each team must have a school faculty member/advisor or official point of contact (POC) from the team's school. Teams whose entire team is age 18 years or above are not required to have the advisor or school official travel with the team, otherwise at least two adults shall travel with the team and shall take full responsibility for the students. The advisor will be permitted to observe the team at the flight line but is forbidden from communicating or otherwise assisting the team during setup, mission, or tear down. While the advisor may teach concepts, answer questions, provide high-level guidance, and review deliverables before submission, the students must design, manufacture, and operate the system on their own and must produce all deliverables on their own.

### Team Pilots

Any member of the team that will control a portion of a UAS flight, for test or for competition, at the competition site will be deemed a UAS pilot.

- UAS pilots must be members of the Academy of Model Aeronautics (AMA). https://www.modelaircraft.org/membership/enroll

- UAS pilots must have completed the FAA Trust Course and have a Certificate (or be a Certificated Remote Pilot and have a Part 107 certificate).
    - The Recreational UAS Safety Test (TRUST) | Federal Aviation Administration (faa.gov).
    - https://www.faa.gov/uas/commercial_operators

Pilots must submit their AMA membership numbers and a copy of their TRUST (or Part 107) certificates and be prepared to show them at a safety inspection or at the flight line.

### *Nominal Pilot Team*

The nominal Pilot Team will have a Safety Pilot, a GCS Operator, and one or more Payload Operators.

### *Safety Pilot*

The Safety Pilot is focused on safety-related functions and communications as defined in the Team's operational and emergency operations plans. The Safety Pilot used during the year can be a student, the advisor, or non-student. While the UAS occupies the runway or airspace, the Safety Pilot must not have any other roles and must maintain continuous unaided visual line of sight with the vehicle (no FPV). If the Safety Pilot performs any other tasks during mission time, the mission will be terminated. The Safety Pilot counts as one of the members of the competition team. If the pilot is not a member of the development team, then the pilot is limited to safety related functions and communication and must not advise or participate in other roles.

### *GCS Operator*

The Ground Control Station (GCS) operator is responsible for operating the autopilot including setting parameters, uploading mission objectives like waypoints, monitoring for performance and compliance, and intervening as necessary. While the UAS occupies the runway or airspace, the GCS Operator must not have any other roles and must maintain situational awareness of the UAS, the autopilot subsystem, and the ground control station. For example, the GCS Operator cannot operate payloads. If the GCS Operator performs any other tasks during mission time, the mission will be terminated. The GCS Operator counts as one of the members of the competition team and is classified as a Team Pilot.

### *Payload Operators*

The Payload Operator is a member of the team who is responsible for operating the UAS payloads, such as:

- A package drop, delivery or recovery mechanism
- A camera and any camera gimbal

## Pilot-In-Charge (PIC)

Each flight must have a Pilot-In-Charge (PIC). Every PIC must have a valid FAA Remote Pilot Certificate so that the competition can operate under Part 107 rules. The PIC would nominally be the GCS Operator. If a team does not have a certified PIC, then the competition will provide a PIC to supervise the Pilot Team during the flight under Part 107 rules.

## Competition Guests

Each team will be allowed to bring additional guests to the competition. If desired, these guests may be development team members, but they cannot assist with the mission demonstration.

# Flight Competition and Demonstration

## UAS Vehicles Type and Weight

### UAS Types

The UAS may be:

- Rotocopters,
- VTOL (Vertical Takeoff and Landing) Vehicles, or
- Fixed-Wing Vehicles

### UAS Weight

The UAS weight limits are:

- The fully-loaded UAS must weigh less than 55 pounds (25 kg) as the competition operates under FAA Part 107 rules (14 CFR Part 107 -- Small Unmanned Aircraft Systems).
- The fully-loaded weight includes the weight of the UAS and any package it is carrying as part of a mission task (e.g. the Delivery Package.)

### Minimum UAS Capability

The UAS must have the ability to:

- Complete any one of the missions within a single flight (batteries may be changed between flights).
- Turn in a radius not larger than 150 ft (46 m).
- Detect and respond accordingly to breaches of geo-fence or loss of pilot control (RTL or land).
- Be remotely commanded by a pilot on the ground, in the case of any situations requiring intervention.

## Visual Line-of-Sight and Location of the Pilot and Ground Control Station

Location during the UAS mission flights:

- The Pilot-in-Charge (PIC), GCS Operator, Safety Pilot, and Payload Pilots will be located in the Compass Rose throughout the flight.The Pilot-In-Charge (PIC) GCS Operator and Safety Pilot must always maintain visual line-of-sight of the UAS.
- The GCS Operator must have continuous uninterrupted access to the GCS display throughout the Mission Demonstration.
- The number of students on the Pilot Team allowed on the Compass Rose may be limited by the competition organizers or the Mojave Air & Space Port Operations.

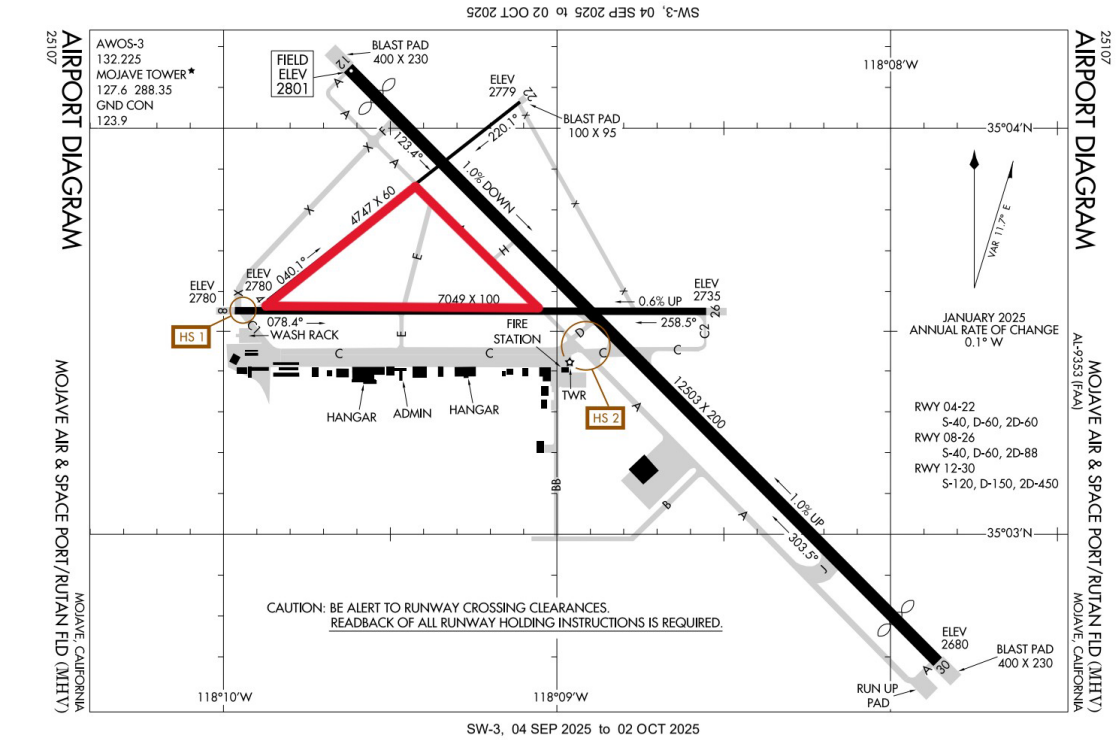
### GCS Display Requirements

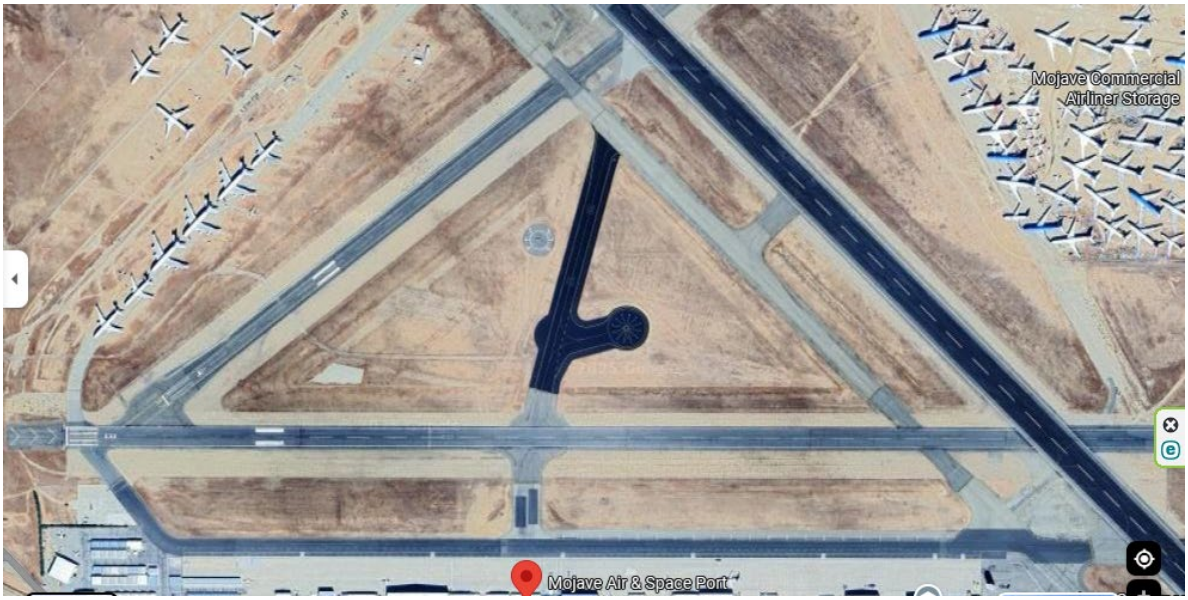
- The GCS Display must
    - Show a map showing the flight boundaries and the UAS position.
    - Indicate the UAS speed and altitude.

## Facilities Infrastructure, Flight Boundaries and Environment

### Course Map

The course is at the Mojave Air & Space Port at Rutan Field in Mojave, California.




### Flight Area and Geofence

- All flights are limited to the area defined by Runway 8-26, Runway 4-22 and Taxiway A.

- The Geofence is essentially defined by the intersections of these Runways (and Taxiway). UAS must stay within the Geofence Boundary.
- The latitude and longitude of the points precisely defining the Geofence and Flight Area are found in the Appendix.

### Compass Rose

- The Compass Rose is approximately midway up and to the East of Taxiway E.

### Waypoints

- All Waypoints are contained within the Flight Area. They will be provided the day of the competition. The waypoints from 2025 are provided in the appendix, for reference.

### Mission Target Areas

- The location of the targets for the Package Delivery, Package Drop, Package Recovery and Target Identification and Localization missions are all located in the southern half of the Flight Area and west of Taxiway E.

### Available Runway

- Rotocopters and VTOL vehicles will be taking off from and landing at the Compass Rose.
- Fixed-Wing UAS will be able to use the taxiway E, by the compass rose, as a runway.

### Radio Frequency (RF)

- The competition management will not provide any RF Spectrum Management
- Each team should expect other teams to be using similar equipment (e.g. same autopilot) and teams must ensure that they don't allow invalid connections (e.g. connecting to another team's autopilot).
- Teams found intentionally jamming or interfering with another team's communications will be eliminated from the competition.

## Flight Qualification and Proof of Safe Flight

- Before the first flight, all UAS must qualify.
  - Qualification is possible before the day of competition by teams submitting a video showcasing the same behavior as would be expected of qualifying at the compass rose.
  - If a team cannot qualify before the day of competition, they will be allowed to qualify in lieu of their first allowed flight slot. In this case, the remainder of the first flight slot will not be usable for mission tasks.
  - Before proceeding to Compass Rose to initiate flight, each team must demonstrate that Emergency Operations Software functions properly. This must be signed off by the PIC and recorded by the Field Event Manager.
- To qualify, the UAS must
  - Demonstrate it can take off, perform a simulated breach of a small geofence (can be a simple circular fence surrounding the takeoff position), and RTL/land safely.
  - Teams may find it easier to simulate a fence breach by flying in a non-GPS mode such as Stabilize or Altitude Hold

## Flight Demonstration

### Mission Time and Order of Flights

- Order of flights will be established by the Field Event Manager.
- Teams must be ready for transportation to the Compass Rose at their appointed time.
    - If a team is not ready, they may lose their turn for that flight.
- After transportation to the Compass Rose, Teams will have 10 minutes to initiate flight.
- Teams will have 10 minutes to complete a flight (for each mission element).
  [This requirement will be discussed in forums in advance of competition. Objective is to keep things moving….]

### Target for Package Drop and Package Delivery Missions

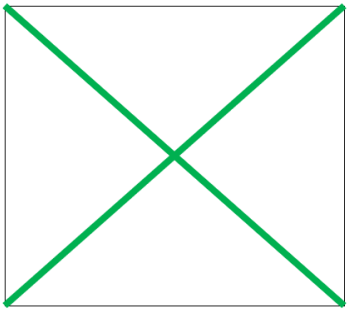
The target will be approximately 5 m in diameter. The target will be identified by a large red bullseye.

- Example:

### Target for Package Recovery Mission

The Package will be placed on a large white target with a green X

- Example (Target Location Identifier for Package Recovery Mission):



## Flight/Mission Timing

#### *Flight Start*

Once the teams have assembled at the Compass Rose the Judge will announce, for each flight, the start time. Teams are expected to be ready to go when they arrive at the Compass Rose. UAS should be fully configured, in advance. Judges may allow some time to attach packages or change batteries between flights.

### *Flight Finish/Landing*

The UAS will be required to land safely. Judge will determine the time of the completion of the flight and, if necessary, the UAS will be removed from the runway.

### *Mission Selection*

Each team will be given 4 flights and may select which of the missions it will attempt in each flight. If a mission is repeated, the best score will be recorded for purposes of the competition.

## Flight/Mission Definitions

### *Waypoint Navigation Flight*

Within the region defined by the flight boundaries, there will be as many as 7 waypoints defined.

- Waypoint data will be provided on the day of competition to teams in an unordered list of latitude, longitude, and altitude (in meters) of each waypoint.
- The UAS shall fly a path of its own determination passing each of the waypoints.
- The UAS shall complete the Waypoint Navigation Flight in less than 10 minutes.
- A small data logger provided by the Judges containing a GPS and radio transmitter must be attached to the UAS for the entirety of the waypoint navigation segment. Details regarding the size and mass of the logger will be announced in the coming months. Teams are responsible for ensuring the logger can be securely mounted to the UAS.
- Waypoint navigation flights will not be scored using team-provided data, rather, data from the Judge-provided data logger will be used to determine accuracy of the UAS at each waypoint.

### *Circuit Time Trial*

Within the region defined by the flight boundaries, there will be as many as 7 circuit waypoints defined.

- Circuit waypoints will be provided on the day of competition to teams in an ordered list of latitude, longitude, and altitude (in meters) of each circuit waypoint.
- The UAS shall fly a path between the waypoints in order.
- The UAS shall be allowed a maximum of three full circuits to set a time.
- The UAS shall pass within 2 meters of each waypoint, as determined by the Judge-provided data logger, or the timing for that lap will be invalidated.
- The fastest of the valid laps will be used for final scoring.

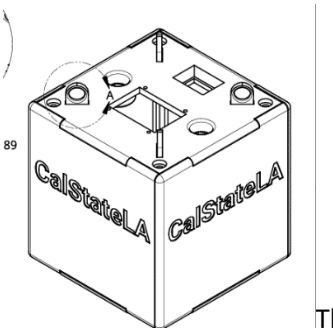
### *Package Drop*

- The UAS shall drop a package at a well-marked target.
- The package will be provided. It is a beanbag that weighs approximately 130g and is 6.4cm in diameter. An example may be found on amazon.com https://www.amazon.com/dp/B07YSYLXR4?ref=ppx_pop_dt_b_product_details&th=1
- The impact of the dropped package will not be measured.

- The time of the flight will be measured and factored into the score.
- The primary scoring metric will be the accuracy of the drop after the package comes to rest. Meaning, if the package impacts near center but bounces outwards, less points will be awarded.

*Package Delivery*

The UAS will be required to deliver a package to a well-marked target.

- 

The delivery package will be provided.
- The package is a 3D-printed cube. It is approximately 10cm along each side. The detailed description of the cube is posted on the competition website.
-
- The package will be equipped with accelerometers to measure impact of the delivery. **The maximum impact allowed is 5 g (50m/s^2).**
- The UAS shall complete the Package Delivery Flight in less than 10 minutes.

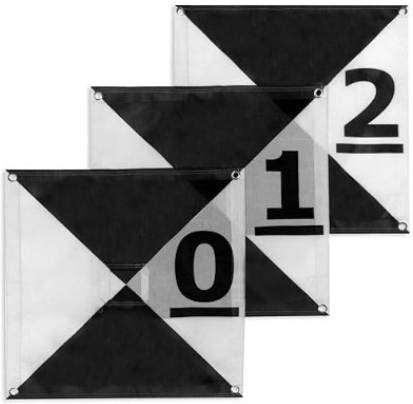
*Target Localization*

- Several items will be placed in specified region within the geofence. The UAS will have 10 minutes to identify, classify and localize the targets.
- The targets are Ground Control Points (GCP) used for surveying by drones. They are approximately square. There will be between three and four GCP of approximately 1.2m along a side defining an area in which there will be 5-10 square targets of approximately 0.6 meters along a side. These smaller targets will need to be localized individually and will all have black numbers in one of the white sections.
- You can see examples of the targets on Amazon.com

  https://www.amazon.com/dp/B07PHPFPJ3?ref_=pe_84950070_737224720&th=1

1.2 meter GCP

0.6m GCP




*Package Recovery*

The Package Recovery mission is still to be defined. (9/28/2025).

The Package will be small, like the package drop, but possibly with some feature added to facilitate attachment.

The Package will be placed on a target (described above) to facilitate its location.

## Score for Flight Evaluation

The score for the flight evaluation event will be composed of scores measuring:

- the accuracy in which the UAS navigates the course defined by a set of waypoints within an allotted time
- the time it takes to complete a circuit trial of defined waypoints
- the accuracy in which the UAS drops a small package to a marked target and the time it takes to make the delivery
- the accuracy in which the UAS delivers a small package to a marked target and the impact force of that delivery within an allotted time
- the completeness and correctness of the identification, classification and localization of targets in a specified area of the field within an allotted time
- the ability and time it takes to recover a package

In the following section, details for each of the tasks, and how the UAS performance will be scored, are provided.

### *Total Score*

The total score for each team will be a weighted sum of the scores for the missions specified below. The weights will be discussion in user forums and finalized by December 1, 2025.

### *Autonomous Completion of Missions*

The competition is going to award additional points for missions that are carried out autonomously. The number of additional points will be discussed in user forums and finalized by December 1, 2025.

### Waypoint Navigation Score

- X = square root of sum of squared errors between waypoints and corresponding closest point on UAS path as measured by GPS system.
- M = mean value of X collected from each of the competitors
- S = square root of sum of squared errors collected from each competitor

- The score is then calculated: $Z = 10 - (X - M)/S$

- The minimum score is 0

- If the UAS does not safely land within the allotted time, the score will be 0 and the value of X will not be used in the computation of the score for other teams.

### Circuit Time Trial Score

- The UAS shall pass within 2 meters of each waypoint, as determined by the Judge-provided data logger, or the timing for that lap will be invalidated.
- The fastest of the valid laps will be used for final scoring.

- X = the recorded time of flight of the UAS for this mission
- M = mean value of X collected from each of the competitors
- S = squareroot of sum of squared errors collected from each competitor

- The score is then calculated: $Z = 10- (X-M)/S$
- The minimum score is 0

### Package Delivery Score

The package delivery will be based on the Package Delivery Accuracy provide that:

- The Package Delivery Impact Force is within the limits defined by the competition
- The package is delivered withing the allotted time.

### Package Delivery Accuracy

- X = distance of location of dropped package from location of target center
- M = mean value of X collected from each of the competitors
- S = square root of sum of squared errors collected from each competitor

- The score is then calculated: $Z = 10 - (X - M)/S$
- The minimum score is 0

- If the UAS does not safely land the score will be 0 and the value of X will not be used in the computation of the score for other teams.

### Package Drop Score

The package drop score will be the mean of the Package Drop Accuracy Score and the Package Drop Time Score specified below.

### Package Drop Accuracy

- X = distance of location of dropped package from location of target center
- M = mean value of X collected from each of the competitors
- S = square root of sum of squared errors collected from each competitor

- The score is then calculated: $Z = 10 - (X - M)/S$
- The minimum score is 0

- If the UAS does not safely land the score will be 0 and the value of X will not be used in the computation of the score for other teams.

### Package Drop Time

- X = the recorded time of flight of the UAS for this mission
- M = mean value of X collected from each of the competitors
- S = squareroot of sum of squared errors collected from each competitor

- The score is then calculated: $Z = 10- (X-M)/S$
- The minimum score is 0

- If the UAS does not safely land, the score will be 0 and the value of X will not be used in the computation of the score for other teams.

### Identification, Classification and Localization Score

- Maximum Score will be 10.

- Teams will lose 1 point for each target for which the UAS failed to identify, classify, or localize properly. The criteria will be to localize within 9m of the target location.

### Package Recovery Score

The package recovery score will be time score specified below assuming the package is successfully recovered.

### Package Recovery Time

- X = the recorded time of flight of the UAS for this mission
- M = mean value of X collected from each of the competitors
- S = squareroot of sum of squared errors collected from each competitor

- The score is then calculated: Z = 10- (X-M)/S
- The minimum score is 0

### Caution: Impact of Heat and Wind

It can be hot and windy at Mojave Air & Space Port. In 2024 the density altitude at the time of the competition was 6500 ft (1980m) and there were winds at times gusting to 14 kts. The teams need to design their UAS to accommodate the environment.

## Design Competition

In addition to the documentation required from each to for purposes of demonstrating flight qualification, teams are encouraged to submit more design documentation to demonstrate the quality and creativity of the work they have performed. There will be a design and innovation prize awarded based on this documentation.

### Rules Governing Design Team and Design Competition Entries

- All Design Team Members shall be members of the Development Team.
- All design competition entries must also be entries in the Flight Competition.
- All design, analysis, and fabrication of the competition entry is the sole responsibility of the student team members.
- All design work must be performed by undergraduate or graduate students enrolled during at least one of the preceding Fall, Spring, or Summer terms at an accredited college or university.
- Designs may include commercial off-the-shelf parts but the integration of these parts and the design of the overall system, including hardware and software, must be done by the design team.
- Students may only participate on a single team. Faculty advisors may advise more than one team.

## Score for Design Competition

The score for the Design Competition will be based on several factors and evaluated by a panel of judges from industrial and academic partners.

Judges will evaluate:

- Well formulated engineering processes, analysis, and methodology
- Well described engineering design features
- Well described manufacturing processes
- Innovation in processes or materials
- Innovation in aircraft configuration, aerodynamics or structure
- Innovation in control systems, autonomy or computer vision
- Innovation in package-delivery system

# Appendix

## Geofence and Waypoints

Below are the locations of the vertices of:

- The geofence
- The portion of the field in which the package delivery target and localization targets are located
- The waypoints for the 2025 waypoint navigation mission are provided for reference. The 2026 waypoints will be provided on day of to the event.

| Name | Latitude | Longitude | Altitude (ft) |
|---|---|---|---|
| GF Point A | 35.05932 | -118.149 | 0 |
| GF Point B | 35.06496 | -118.156 | 0 |
| GF Point C | 35.06062 | -118.163 | 0 |
| GF Point D | 35.05932 | -118.163 | 0 |
| Package Target Area Boundary A | 35.06012 | -118.158 | 0 |
| Package Target Area Boundary B | 35.06012 | -118.16 | 0 |
| Package Target Area Boundary C | 35.05935 | -118.16 | 0 |
| Package Target Area Boundary D | 35.05935 | -118.158 | 0 |
| Waypoint A | 35.05987 | -118.156 | 50 |
| Waypoint B | 35.05991 | -118.152 | 100 |
| Waypoint C | 35.06121 | -118.153 | 75 |
| Waypoint D | 35.06312 | -118.155 | 50 |
| Waypoint E | 35.06127 | -118.157 | 50 |
| Waypoint F | 35.06206 | -118.159 | 75 |
| Waypoint G | 35.05989 | -118.16 | 100 |