International Micro Vehicle Conference and Competition



IMAV 2025 Competition Rules for Indoor and Outdoor Competitions, and Special Challenges

November 3 - 7, 2025

About

This is the official rule book, originally intended for the IMAV 2025,

This rulebook was elaborated in collaboration with the international committee members and the local organizing committee.

The General Chair, Jose Martinez-Carranza, of the IMAV 2025 served as Editor of this rule book and its future editions due to amendments.

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Foreword

Welcome to the 16th Edition of the International Micro Air Vehicle conference and competition (IMAV) 2025. The IMAV Conference is a prominent annual event that, since 2008, has brought together scientists, technologists, engineers, and enthusiasts from around the world dedicated to the research and development of micro aerial vehicles, such as drones and other small-scale unmanned aerial systems. This event serves as a platform for the exchange of knowledge on the latest advancements in autonomous flight technologies, navigation, artificial intelligence, and applications in various fields, from surveillance and rescue to environmental monitoring and precision agriculture.

After hosting the 12th IMAV 2020 online due to the pandemic, the 16th IMAV took place in San Andrés Cholula, Puebla, Mexico, from November 3 to 7, 2025. The event was organized by some of the most prestigious academic institutions in Mexico: the **Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE)**, **the Universidad de las Américas Puebla (UDLAP)**, and **the Benemérita Universidad Autónoma de Puebla (BUAP)**, with support from **the Federación Mexicana de Robótica (FMR)**, and additional collaboration from **the Centro de Investigación y de Estudios Avanzados del Instituto Politécnico Nacional (Cinvestav), Unidad Zacatenco.**

The IMAV competitions are divided into indoor and outdoor categories. Both categories present challenges that seek to push the boundaries of the technology of micro air vehicles. Competitors are expected to present novel hardware and software designs, including aerodynamic designs, a novel set of sensors, and exemplar capabilities such as flight endurance, agile flight, autonomous flight, intelligent behavior, and swarming coordination. In addition, two special challenges are introduced this year, one for each category. For indoors, the Noise-Free Challenge, and for outdoors, it is the Surveillance Challenge. Teams that address these challenges more effectively will receive a special award.

This year, the competition theme is **“Search and Rescue.”** This is motivated by the fact that Mexico sits at the boundary of three tectonic plates, causing frequent seismic activity. In September 1985 and September 2017, strong earthquakes caused severe damage to Mexico City and some neighboring cities. In the aftermath, buildings collapsed, trapping people and creating disaster zones whose access became difficult to bring aid.

Inspired by the scenario described above, IMAV 2025 presents a series of challenges in which micro air vehicles play a vital role in victim search, rapid access, aerial assessment of disaster zones, and the delivery of aid.

Therefore, teams were expected to present novel ideas, prototypes, and solutions that aimed to pave the way for the next generation of micro air vehicles, which can be deployed in real disaster scenarios, such as those mentioned earlier.

Jose Martinez-Carranza
Editor and General Chair
IMAV 2025

Introduction

Mexico is a beautiful country that has natural landscapes as well as big cities that give a home to millions of people. In 1985, Mexico lived one of its biggest tragedies so far, an earthquake that destroyed many cities around the country. People armed with hope and brotherhood were able to overcome the tragic moment and move on.



Earthquake, Sep 19 1985. Taken from
https://www.bbc.com

However, even when measures are taken, natural disasters are prone to happen and therefore, people need to be prepared in the case of a contingency.

Motivated by the above, the 16th International Micro Air Vehicle competition will focus on the use of Micro Air Vehicles (MAVs) to provide aid and assistance in a disaster zone scenario.

Furthermore, by addressing the missions described in this year's competition in both indoor and outdoor categories, teams are encouraged to propose and present:

- Aircraft efficiency and innovative designs
- Light and small MAVs.
- Low-noise MAVs
- Multimodal perception capabilities i.e.: visual and auditory perception.
- Stability in turbulence.
- Onboard processing capabilities.
- Flight endurance (autonomy).
- Robustness against weather conditions i.e.: rainy or foggy weather.
- Multi-MAV cooperation.

General

The following frequency bands are allowed in Mexico:

Frequency Band	Power Limit	Notes
902 – 928 MHz	3 milli Watts (0.003 W) EIRP	RFD900 Radio Modems are highly recommended.
2.4 GHz – 2.4835 GHz	1 Watts EIRP	
5.725 GHz – 5.850 GHz	4 Watts EIRP	
3.4 – 3.5 GHz 10.15 – 10.65 GHz	* See detailed requirements in related UIT-R decisions (UIT-R F.1568)	

NOTE: 698 – 806 and 1755 – 1850 MHz is not permitted to be used in Mexico.

Operation of FPV equipment in the 410 – 430 and 806 – 869 MHz is strictly prohibited. This band is utilized by Aeronautical Radio Navigation Services, public security and government which includes aircraft collision avoidance radar systems, security federal and state.

Failure to abide by the boundaries and frequencies will lead to a severe penalty and disqualification.

Safety

To comply with Mexican MAV regulations:

- The maximum take-off weight of any MAVs must not exceed 5 kg.
- A kill switch for each MAV is mandatory and the remote for it should be handed over to the IMAV judges when the teams are performing the outdoor mission.
- For the outdoor competition, the maximum flight altitude is 400 ft (approx. 120m) above Ground Level (AGL), however, the ceiling has been reduced to comply with competition rules. This is 100 m.
- All MAVs should stay inside the designated flight areas; if a MAV strays beyond these areas, the MAV is required to land immediately.
- Please ensure to follow these safe working practices while working with MAVs.
- Failure to comply with any of these safety measures will lead to penalties or disqualification.

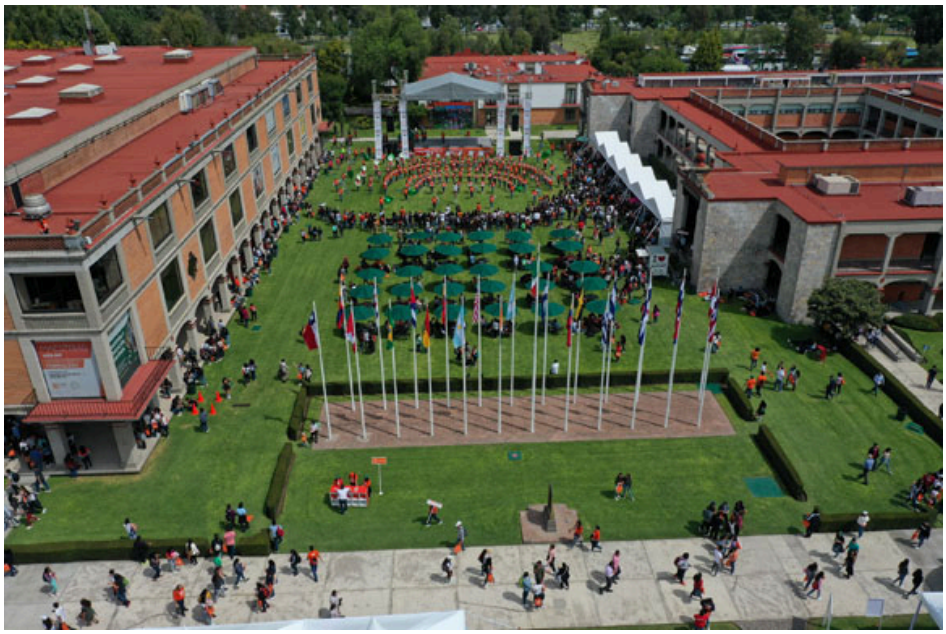
Location

Indoor Event

The indoor event will be held at the Universidad de las Américas Puebla (UDLAP) located in San Andrés Cholula, approximately 20 minutes from Puebla downtown and 30 minutes from the Hermanos Serdán international airport.

Address:
Universidad de las Américas Puebla
Ex-Hacienda Santa Catarina Mártir S/N
72810 San Andrés Cholula, Puebla, Mexico.

Map: https://goo.gl/maps/2iAh2UQoGJAD3gJU6



Outdoor Event

The outdoor event will be held at the Bicentenario Park located at the outskirts of the Puebla city and 30 - 40 min away by bus from UDLAP.

Address:
Bicentenario Park.
6 Sur Street. Predio Arenillas,
San Francisco Totimehuacán, Puebla.

Map: https://maps.app.goo.gl/8uyfWKrAQn5R6aYE7





Presentation Points

The team is rewarded when a team member presents the tasks and actions currently performed. The goal is to make the demonstration of each team more **lively and accessible to the public**. A video feedback of the ground station is also possible and is strongly recommended (standard VGA cable or HDMI).

The presentation factor will be determined according to the description of:

- The MAV system and its design
- The initial plan to perform the mission elements
- The tasks actually performed
- The level of autonomy of each task / MAV

NOTICE: Teams will be required to submit a technical description paper for registration and bring a poster to be presented in a poster session during the two-day conference of the IMAV. This is mandatory as it improves the exchange of knowledge and experiences between all the teams and the conference visitors.

- Note that a ***Best Technical Description Paper Award*** and a ***Best Competition Poster Award*** will be granted.

Indoor Competition

Thirty-two years after the 1985 earthquake in Mexico, in 2017, on the same date, another earthquake occurred in Mexico. The contingency plans for disasters were activated immediately, as well as the recognition of disaster zones. Many buildings were destroyed, making it difficult to identify people injured or trapped in the rubble. Due to the danger of unstable structures, small remote control vehicles were employed in addition to rescue dogs to support the search for people to aid.



Earthquake, Sep 19 2017. Taken from https://www.milenio.com



Earthquake, Sep 19 2017, "binomio canino". Taken from http://gruporivas.com.mx

We know we can be better prepared for future natural disasters with intelligent technology such as autonomous vehicles that aid in rescue tasks in dangerous zones. It is for this reason that the objectives of the indoor competition are the search and rescue in an emulated disaster zone.

For the indoor category, the scenario consists of a room of 10 m. x 10 m. inside a disaster area, where an autonomous intelligent MAV has to navigate seeking to solve five main tasks: enter the room through a tunnel-like made of gates, fly around the room without colliding with the poles inside of it, draw a line on a whiteboard on the wall, find a location within the room where a cry for help is produced, and once found, deliver on the spot a med-kit and finally, return to a moving landing platform where some smoke will be emitted on it, thus reducing visibility.

We encourage participants to present novel designs seeking to perform full autonomous navigation, robust to dynamic obstacles and collision avoidance. In this sense, ***the best design prize will be granted*** as well. Extra points will be given if all processing runs on board; the built map is shown in real time on a screen; the location of the sound asking for help is indicated in the map as well.

Indoor Competition Rules

- All participants are required to be familiar with the contents of the document and comply with it.
- For this competition, **manual flight will not be allowed.** This includes take-off and landing, meaning that all flights from takeoff *to landing must be completely autonomous.* ***(The action to trigger the take-off can be done manually. You can turn on your drone, arm the motors, and manually press a key or a stick/button on your RC for the drone to take off.*** **Manual piloting to take off will not be permitted as per the text above.** ***The same applies for landing. If the drone has completed a mission and you do not want it to land on the landing zone, you can manually trigger a landing action, which means that the drone has to perform an autonomous landing somewhere in the arena.*** **No manual piloting for landing will be allowed*.)***
- **For this competition, drones should not exceed 1 meter in size, measured diagonally from the tip of one propeller to the tip of the opposite propeller.**
- If the MAV has to land outside the landing platform, manual landing will be allowed; however, to continue with the mission or another mission, take-off has to be performed from the take-off zone.
- *Teams will be allocated from 20 to 30 minutes, depending on the number of participating teams, to attempt the indoor missions.* However, teams can use a "Wild Card" to pause their participation.
- The "Wild Card" may only be used to pause the competition time slot once.
- The MAV's diameter must be less than 0.7 m.
- Multiple MAVs are allowed as long as the weight of each MAV is less than 300 grams. Otherwise, only one MAV will be allowed to fly at the same time.
- Extra points will be awarded only if the mission produces points.
- **A mission can be attempted as many times as possible, but only the one with the maximum number of scored points will be assigned, even when using multiple drones to solve the same or different missions.**
- All flying MAVs need to stay within the designated flight area.
- All MAVs will be checked before flight and must be airworthy.
- All MAVs have to be in sight of at least one team member.
- Only the competing team may fly their MAV during their competition slot.
- All batteries must have appropriate storage when not in use (e.g. LiPo safe bags) and be taken to the designated charging station for charging. Teams will be allowed to bring their chargers.
- The team is always responsible for the safety of its MAV and is liable for any accidents caused by their aircraft.
- A human pilot must be able to take over manual control of the MAV at all times in case of an emergency.
- Instructions given by IMAV staff shall be followed without argument.
- Decisions made by the IMAV judging panel are final.
- You must always communicate your intentions with the organizers before flying any MAV and comply at all times with the safety instructions given by them.
- If a MAV crashes, hits a pole, structure or any other element within the arena, the judge may ask the teams to land the MAV. Only one team member will be allowed to enter the arena to pick the MAV and bring it to the take-off zone. Only then the team members will be able to touch the MAV. **(Diameter of the poles is 30 cm and their height is 2.7 metres).**
- Failure to follow these rules may result in penalty or disqualification.

Description of Missions

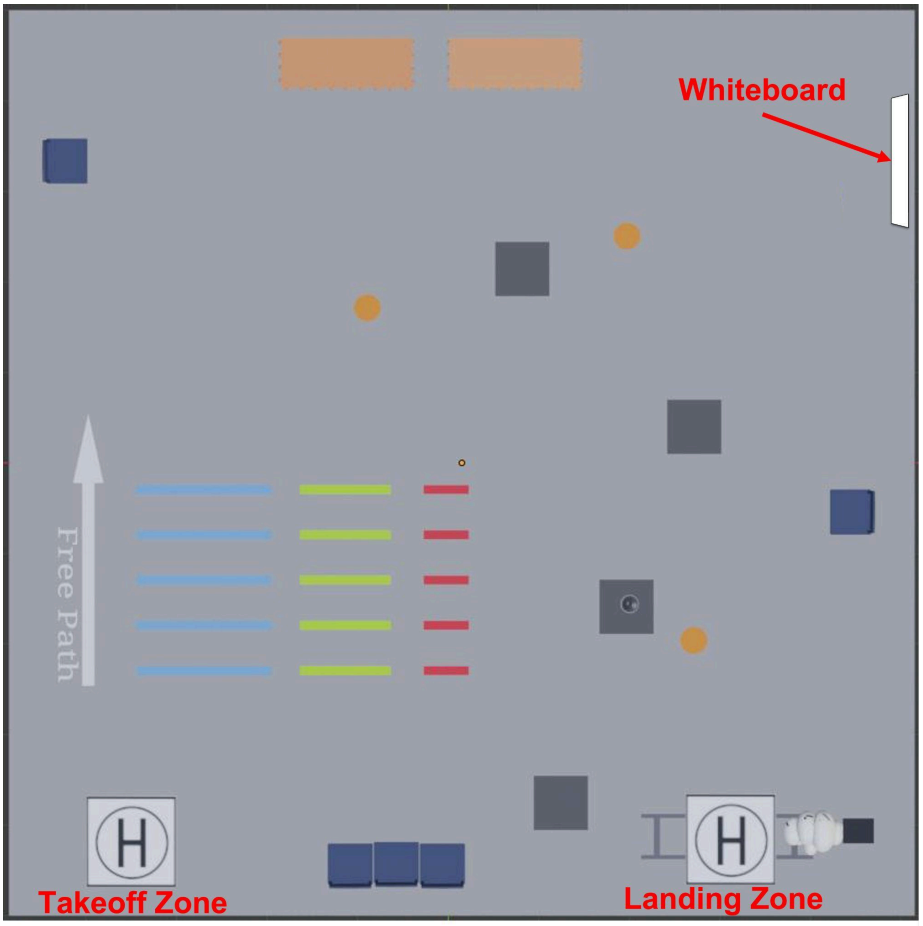
The IMAV 2025 indoor mission is targeted towards the application of MAVs for search and rescue. The indoor event consists of 4 mission elements. Teams must attempt to complete as many of these mission elements as possible to achieve the maximum number of points.

A take-off zone will be indicated before the competition begins, and it will be the same for all the teams. Taking off from the ground is mandatory and can be performed automatically or manually. ***No other zone will be used for take-off.***

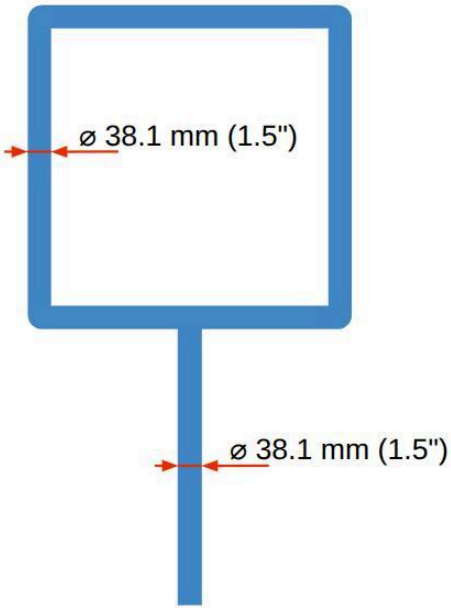
Mission 1: Enter the room

In this mission, the MAV has four options to enter the room:

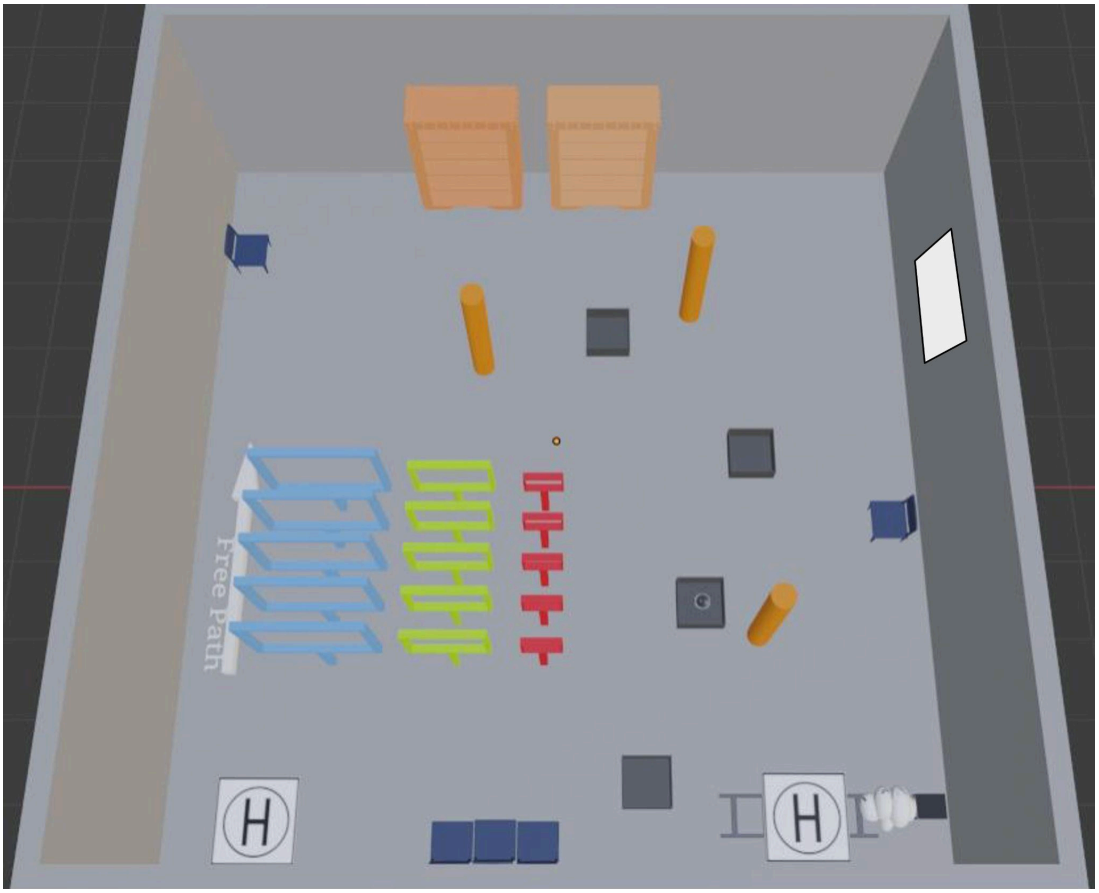
1. Free passage: A free path can be followed to enter the navigation area. **The width of the free path is 1 m.**
2. Three tunnel-like spaces are formed by aligning five square gates horizontally, each creating a tunnel **2m in length and 2 m in total height.** Each gate consists of two parts: a lower base and an open window. **The sum of both is always 2 m in height**. The three tunnels differ only in the size of the square window, which are:
    a. Wide tunnel: window size 1.5 m x 1.5 m, with a base of 0.5 m.
    b. Medium tunnel: window size 1 m x 1 m, with a base of 1 m.
    c. Small tunnel: window size 0.5 m x 0.5 m, with a base of 1.5 m.



Top view of the 10 m x 10 m indoor arena.



Square gate tube diameter: ∅ 38.1 mm (1.5"). All gates use the same tube diameter.



3D view of the 10 m x 10 m indoors arena. Tunnel-like spaces are formed by the gates in blue, green and red.









Black Boxes 57 cm x 78 cm x 36 cm.



Poles with a diameter of 30 cm, 2.7 metres in height.

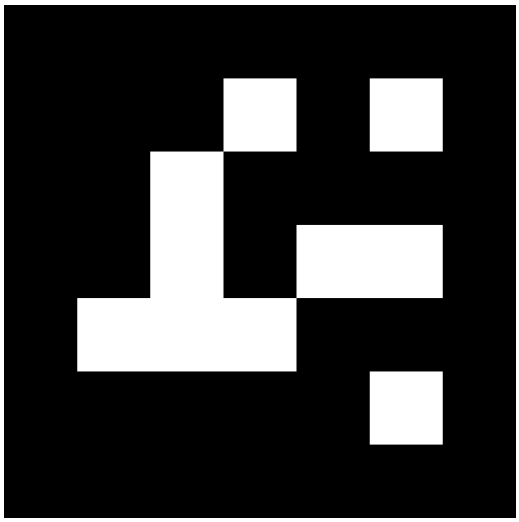
Mission 2: Draw on the whiteboard

To emulate the interaction of the MAV with the environment, for instance, if the MAV had to touch a surface, in this mission, **a whiteboard of 1.2 m x 1.5 m** will be laid horizontally on one of the walls at a height of 1 m from the floor to the center of the plate. **The MAV should approach this board and touch it in order to draw a horizontal continuous line**. The exact coordinates of the whiteboard will be disclosed at the beginning of the competition. The line does not have to be horizontally perfect, but it has to be continuous. More points will be awarded depending on the length of the drawing on the horizontal axis. Every additional 20 cm of the horizontal line will grant points.

Notes:

- **If the position of the whiteboard is to be found visually instead of geometrically, an ARUCO marker of 20 cm x 20 cm will be placed next to the left border (outside the whiteboard) at a height of 1.6 m.**
- **The drawing will not be considered valid if it is the result of the MAV crashing into the whiteboard.**

The ARUCO marker of 5 x 5 binary patterns has been coded to represent the number 100 with the following appearance:



Mission 3: Find the cry for help sound and deliver a med-kit

Inside the room, in a random location, a black box of 57 cm x 78 cm x 36 cm will be placed on the floor. Inside it, there will be a speaker producing the sound of somebody crying out for help. **This sound is expected to reach at least 70 dB** (measured from 1 m from the top of the upwards facing speaker). The MAV must locate this box and throw a med-kit inside it. The med kit will be a box of 20 cm x 10 cm x 5 cm with a weight of 30 g. ***Teams can bring their med kit as long as these dimensions are followed***. *It does not matter if the MAV carries the med-kit on top of it or underneath, with a suspended cable or a clamp.*

Notes:

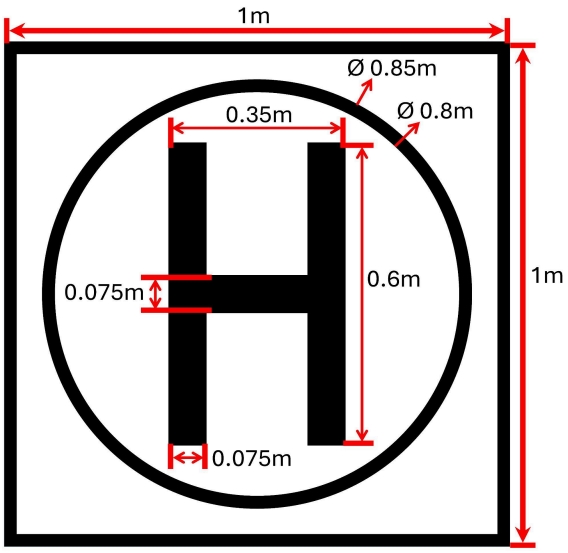
- **The team can opt out of searching the box, instead, the approximate location of the box to deliver the med-kit will be given, but points will be given only if the delivery is successful.**
- **More than one box like the one containing the speaker will be placed on the floor. Up to 5 boxes will be located on the floor in random positions. The box and the speaker would be the same color. Additional points will be awarded if this level of difficulty is chosen.**

Mission 4: Land on a moving platform with smoke

The MAV must land on a moving platform positioned at a fixed location within the room. This platform will be a 1 m x 1 m rectangular board that moves laterally, sliding up to 1 m sideways at a speed of 0.5 m/s **(this speed is expected at average, but very importantly, it will not be faster than this)**. A smoke machine will be placed next to the platform to produce smoke, partially obscuring it.

Note: Teams may choose not to use the smoke machine. They may also request a stationary platform instead of a moving one. However, higher scores will be awarded if the MAV successfully lands on the moving platform and/or while smoke is present.

The visual appearance of the take-off area and landing platform is given in the figure below:



Visual appearance and dimensions of the take-off zone and landing platform.

Scoring

Mission 1: Enter the room					
Task	Free path	Tunnel 1.5 m	Tunnel 1 m	Tunnel 0.5 m	
Pts	0	1	2	3	
Mission 2: Draw on the whiteboard				**Extra Pts**	
Task	No drawing	Continuous line (min. of 20 cm).		**For every additional 20 cm of continuous line**	

Pts	0	3		**+1**	
Mission 3: Find the cry for help sound and deliver a med-kit					
Task	Box not found	Box Found	Med-kit delivered		
Pts	0	3	2		
Mission 4: Land on a moving platform with smoke				**Extra Pts**	
Task	No landing	Landing		**Landing with the moving platform**	**Landing with smoke**
Pts	0	2		**+3**	**+3**
Single MAV Onboard Processing			**Final Score x 1.5**		
Swarm Solution Offboard Processing			**Final Score x 2.0**		
Swarm Solution Onboard Processing			**Final Score x 3.0**		
Presentation during participation			**Final Score + 3 x (0…10)***		

* **Judges will grant a score between 0 and 10 upon the team presentation. The final score from judges will be the average after removing the highest and lowest scores.**

Indoor Noise-Free Challenge

MAVs have become significantly useful in civilian applications. However, in a disaster scenario, the arrival of one or two MAVs could increase stress or provoke anxiety/fear in those people trying to deal with the situation.

Motivated by the latter, this challenge encourages teams to present novel MAV designs to achieve noise-free flight operation.

For this challenge, the MAV must take off from a designated area, be loaded with a 500g package, and fly over a microphone placed on the ground in the middle of the arena.

Once the MAV is over the microphone, the MAV has to remain in hover for 1 minute. Meanwhile, the audio signal of the flight will be recorded with the microphone. The height range in which the MAV must be kept close to the microphone can be between 1 m and 2 m.

Teams have two options for carrying the load: 1) a package slung underneath the MAV, in which case the MAV and the package will have a separation distance of 0.5 m; 2) placing the package on the top of the MAV.

The winner will be the MAV with the minimum noise level.

MAV restriction:

- Only multi-rotor MAVs will be allowed in this challenge.
- MAV diameter <= 0.7 m.

Size of package: 0.30 x 0.30 x 0.15 m (length x width x height)

For this challenge, the scoring is based on the amount of noise produced by the MAV that will be measured with the Sound Pressure Level (in dB).

The challenge will be carried out the same day as the indoor competition in the same arena, but after the indoor competition concludes.

Teams participating in the indoor or outdoor categories are welcome to participate in this challenge as well.

Total Scoring for the Noise-Free Challenge:

Total Score = $P_{exp} - P$

$P = 20 \cdot log_{10}(E)$

$P_{exp} = P_{ref} - 20 \cdot log_{10}(D)$

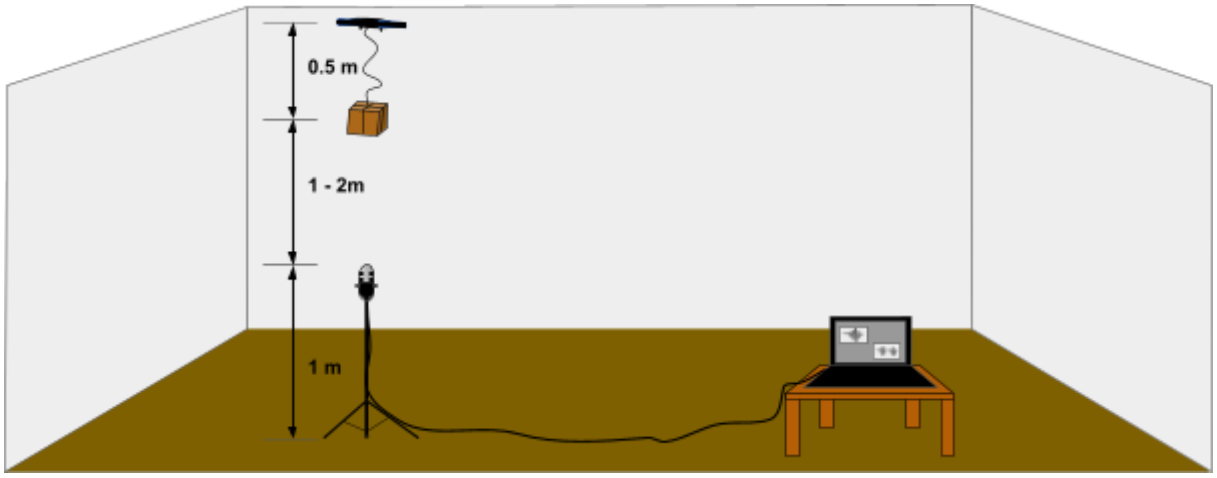
$P_{ref} = 20 \cdot log_{10}(E_{ref})$

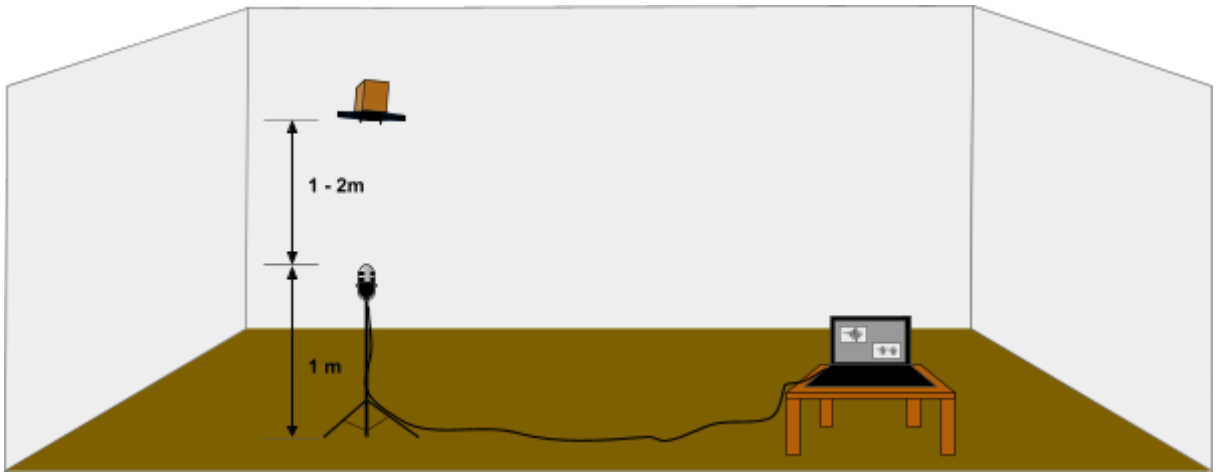
Where:

E: $RMS\ emitted\ by\ current\ drone.$

D: $distance\ of\ current\ drone\ from\ microphone$

E_{ref}: $RMS\ emitted\ by\ a\ reference\ drone\ at\ 1\ m\ from\ microphone$





Outdoor Competition

For this competition, we continue with the disaster zone scenario where buildings have collapsed. Motorways and main roads are either damaged or clogged as people are trying to flee. However, not everybody may have managed to flee, some people may be injured and unable to move away from the disaster zone, hence requiring urgent medical attention, water, and food.

Under the scenario described above, MAVs may prove useful to get access to the disaster zone remotely in a rapid manner and without compromising more human lives. In addition, equipped with sensors, MAVs may be used to generate a map representing the affected area, which is useful to assess the zone. MAVs could be used to rapidly locate people, either by looking for them based on a simple textual description or to detect people who could be shouting out for help. Furthermore, a group of MAVs could be used to transport a small person to a target destination.



Earthquake, Sep 19 2017, aerial photo. Taken from https://www.univision.com/

We encourage participants to present novel designs seeking to perform full agile autonomous navigation. In this sense, ***the best design prize will be granted*** as well. Extra points will be given if the built map is shown in real time on a screen and if the missions are performed as quickly as possible.

Outdoor Competition Rules

- All participants are required to be familiar with the contents of the document and comply with it.
- *Autonomous take-off is not mandatory.*
- *After take-off and before landing, manual flight during a mission will not be allowed.*
- *Manual landing will be permitted if the mission allows it. Otherwise, autonomous landing is mandatory.*
- *Teams are allocated from 20 to 30 minutes to attempt the outdoor missions,* depending on the number of participating teams. However, teams can use a “Wild Card” to pause their participation.
- The “Wild Card” may only be used to pause the competition time slot once.
- There is no limit to the number of MAVs that can be used in this competition.
- Extra points will be awarded only if the mission produces points.
- Some missions can accumulate points as tasks in the mission are performed successfully.
- A mission can be attempted as many times as possible, but only the one with the maximum number of scored points will be assigned.
- 1 pilot per MAV is required so that he/she can land and shut down any MAV of the team at any time.
- All flying MAVs need to stay within the designated flight area.
- All MAVs will be checked before flight and must be airworthy.
- All MAVs have to be in sight of at least one team member.
- All MAVs should take off from the designated take-off zone.
- Only the competing team may fly their MAV during their competition slot.
- All batteries must have appropriate storage when not in use (e.g. LiPo safe bags) and be taken to the designated charging station for charging. Teams will be allowed to bring their chargers.
- The team is always responsible for the safety of its MAVs and is liable for any accidents caused by their aircraft.
- A human pilot must be able to take over manual control of the MAV at all times in case of an emergency.
- Instructions given by IMAV staff shall be followed without argument.
- Decisions made by the IMAV judging panel are final.
- You must always communicate your intentions with the organizers before flying any MAV and comply at all times with the safety instructions given by them.
- Failure to follow these rules may result in a penalty or disqualification.

Description of Missions

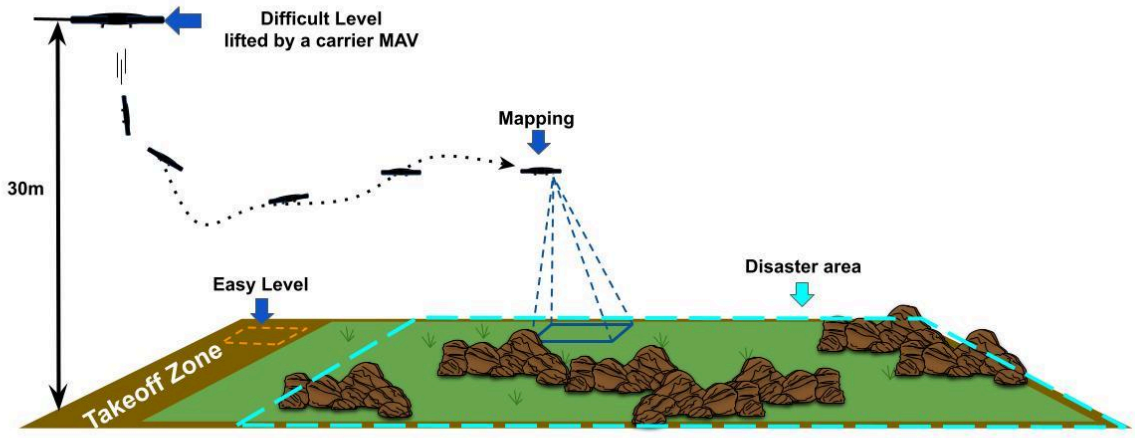
This competition will be carried out in a wide open area where 4 missions will be faced by the teams. For the missions, teams are allowed to use any type of MAV, that is, multi-rotors, hybrids, VTOLs or fixed wings.

A take-off zone will be indicated before the competition begins, and it will be the same for all the teams. ***No other zone will be used for taking-off.***

Mission 1: Mapping of a disaster area

A MAV should be used to map an area defined by GPS points under the following conditions:

- Autonomous landing will award extra points.
- A 3D model or a 2D panoramic image (mosaic or orthophotography) of the disaster area has to be generated.
- The area will be defined by a rectangle, with each vertex corresponding to a GPS coordinate. These coordinates will be provided to the team in advance.
- There are two levels of performance for this mission:
    - Easy: the MAV takes off from the take-off zone and flies over the disaster area, recording images or video to generate the map. Take off can be manual. Autonomous take off will not award extra points.
    - Difficult: The MAV will be lifted with a second “carrier” MAV. In this case, the MAV computer and electronics have to be on; however, the motors should be off. At a height of 30 m, the MAV will be released from the external aircraft. The MAV will have to turn on its motors in order to recover from the free fall and then fly toward the disaster zone to carry out the mapping. Both MAVs have to be provided by the team.
- After enough data has been collected, deemed by the team, the MAV must return to the take-off zone and perform landing. If the MAV lands somewhere else, then landing is not considered valid.
- Extra points will be awarded if the mapping is carried out in real time and transmitted to the ground control station for the public to watch.
- If the map is generated offline, the team has 30 min. after its participation time is over to show the map to the judges. This includes exiting the arena after using the wildcard.



Difficult level where the explorer MAV is released from another larger MAV

Mission 2: Find a person

In this mission, a textual description of a person will be provided to the team. This text will describe a person who will be fully visible and located somewhere in the flight area. The description will include the GPS position where the person is likely to be.

The following are examples of textual descriptions:

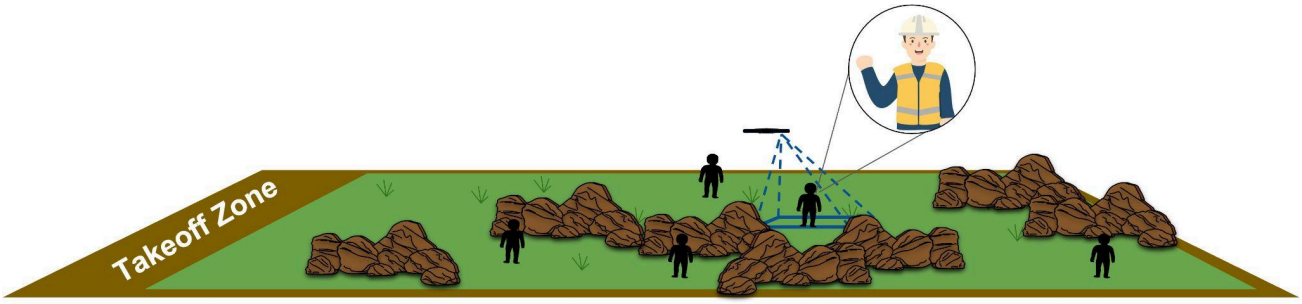
- *"Find the person with an orange jacket and a yellow construction helmet".*
- *"On the grass, there will be a person with red trousers, with glasses, and holding a suitcase".*
- *"There will be a person sitting on a bench holding an umbrella with a computer next to her".*

Points will be given if:

- The MAV arrives at the GPS target location autonomously.
- **The MAV finds the person described in the textual description. As evidence of this, the drone has to land autonomously near the person within a radius of 2 m.**

Notes:

- **The person will be a mannequin dressed up accordingly**.
- **The MAV has to fly from the take-off zone to the GPS target location.**
- **The distance to travel from the take-off zone to the target location will be at least 150 m.**
- **The described person will always be present around the GPS target location within a 20 m radius.**
- **There will not be more than one person fitting the same description.**
- **Other persons may be around the area as well.**
- **The described person will not be occluded by other persons or objects.**
- **The landing will not be valid if it hits the person (mannequin).**



A textual description given by the team to identify a person in the arena. Example of textual description: "Find the person with a white helmet, a yellow jacket, and a blue T-shirt."

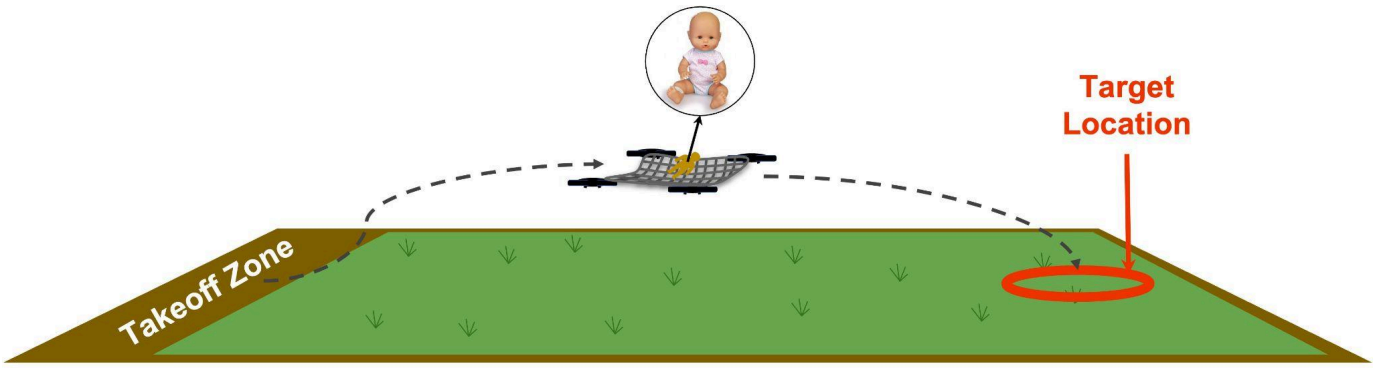
Mission 3: Transportation Challenge

In this challenge, teams are tasked with developing an autonomous multi-MAV system capable of collaboratively transporting an object. The mission requirements are as follows:

- Each team must deploy a minimum of three MAVs to perform the transport task.
- Teams may use additional MAVs, and bonus points will be awarded for doing so.
- The object to be transported is a 3 kg dummy, simulating the weight and dimensions of a baby.
- All MAVs must take off and land autonomously.
- MAVs must depart from a designated take-off zone and navigate to a target destination, which will be defined by a randomly selected GPS coordinate within the flight area.
- The object must be carried using a net, suspended cooperatively by the MAVs.
- The net radius must not exceed 1 m., ensuring a coordinated transport approach.
- Teams may manually place the dummy into the net before take-off, but all MAV motors must be powered off during this loading procedure. The mission will be invalidated if the dummy falls out of the net at any point during flight or landing.
- Upon reaching the target location, MAVs must autonomously land within the designated area within a radius of 2 m.

Notes:

- **Teams must bring their net made of any material suitable for the task.**



In the Free-Fall Rescue Challenge, teams must develop an autonomous multi-MAV system capable of detecting and rescuing a falling object in midair.

Mission 4: Load and Release

For some disasters, water has to be taken with urgency and released in a given zone. This operation is usually carried out with a helicopter that carries a container as suspended cargo, submerges it in a pool, and then takes it to an area to release the contents over it.

This mission offers the opportunity to perform the same operation but using one or more MAVs. To this end, two GPS positions will be given in advance. The first one will indicate the position of a **circular pool with a diameter of 3 m and a height of 0.76 m.** The second will indicate a zone where the water has to be released.

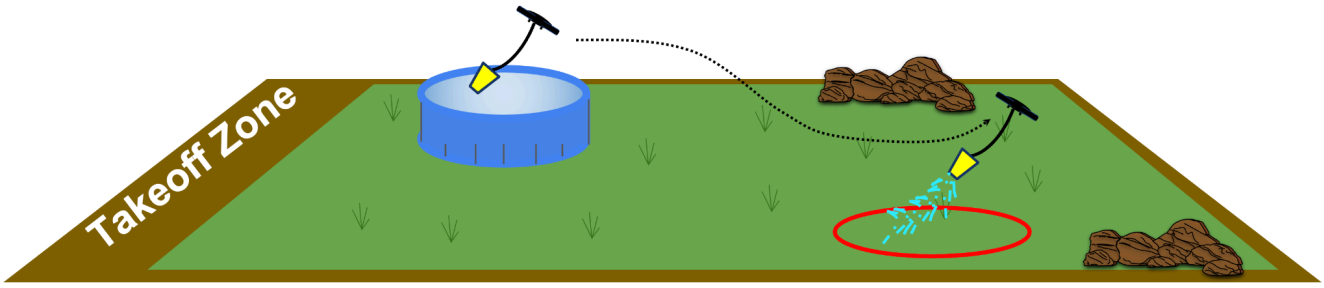
Points will be given if the MAV loads water successfully. This means that the amount of loaded water should be at least 2/3 of its container's capacity. Points will be given if the water is released within a radius of 3 m around the GPS location of the release zone.

After the release, without landing, the MAV or MAVs can return to the pool to reload more water and then fly back to the release zone to release the water *in order to accumulate more points.*

Teams may bring their own container (one for each MAV used in this mission), but it must be transparent to allow visibility of the amount of water being loaded. For this purpose, the water will be dyed blue. Teams are free to design their own release mechanism. However, **the container must be attached to the MAV using a suspended cable or thread that is at least 2 meters long. The container should have a minimum volume of 0.5 litres at least. More points will be given if the container holds more litres.**

Notes:

- **Take-off, water loading and release must be fully autonomous.**
- **The distance to travel from the pool to the release zone will be at least 150 m.**
- **If the team decides to end the mission, the MAV may be manually landed either within the flight zone or back at the take-off zone.**
- **Multiple MAVs may be launched, with each MAV performing its own loading and release operations.**
- **Multiple MAVs can be used collaboratively to load a single container with a larger capacity.**



Water should be loaded from a pool located in a certain GPS location, and after that, the water should be released in another GPS location as illustrated in the red ellipse.

Scoring

Mission 1: Mapping of a disaster area					**Extra Pts**		
Task	No map	2D map	3D Map point cloud with no texture or color	3D Map with texture or color	**Autonomous Landing**	**Shown on the screen in real time**	**Difficult Mode**
Pts	0	1	2	3	**+1**	**+2**	**+4**
Mission 2: Find a person							
Task	MAV does not arrive at the given GPS location	MAV arrives at the given GPS location	MAV finds the person by landing successfully				
Pts	0	1	4				
Mission 3: Transportation Challenge					**Extra Pts**		
Task	Object falls	Successful transportation	Successful landing		**For each additional cooperative MAV**		
Pts	0	3	3		**+1**		
Mission 4: Load and Release							
Task	Manual Flight	MAV loads water successfully.	MAV releases water successfully.	C: is the capacity of the container in liters.			
Pts	0	0.25 x C	0.25 x C	**Note: points accumulate for this mission for every successful load, adding up every successful release.**			
Presentation during participation			**Final Score + 3 x (0…10)/10***				

***Judges will grant a score between 0 and 10 upon the team presentation. The final score from judges will be the average after removing the highest and lowest scores.**

Outdoor Surveillance Challenge

A special challenge is proposed to be run alongside the outdoor competition. It is inspired by the scenario where a disaster zone may need to be monitored for long periods. This challenge has been created to encourage teams to present novel MAV designs. The MAVs should be able to fly surveillance laps within a defined area ***for as long as possible.***

MAVs will be allowed to lap in an area of 500 m x 250 m, with vertical variations of up to 25 m. **The maximum height for this mission will be up to 100 m. Teams are encouraged to present designs based on pure fixed-wing or any other hybrid configuration such as tailsitters, tiltwing or tiltrotor designs that can be operated from small spots**.

The winner team will be the one presenting the MAV with the smallest size (measured by wing-span) that can endure the longest flight. Thus, the score will be:

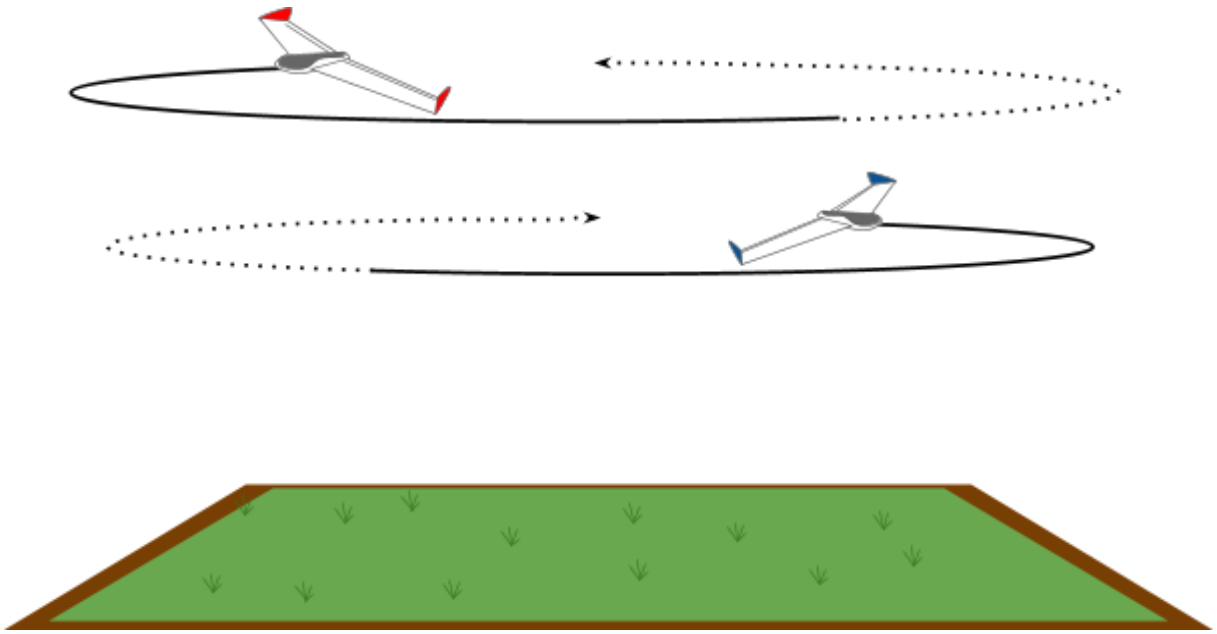
Score = flight time / wing-span

This challenge does not have a time limit. It will take place in the location of the outdoor competition, but in a different area from where the outdoor missions will be carried out.

The challenge will run in parallel with the outdoor competition.

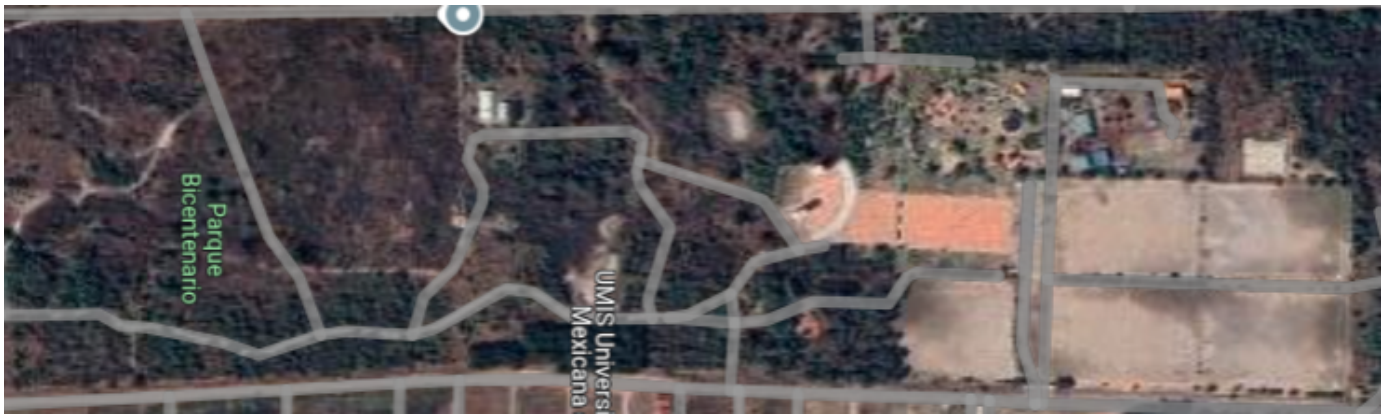
Depending on the number of teams, two or three MAVs may fly at the same time, although at different heights. The time to reach the assigned height will be considered part of the flight time. Time will be measured from the time the MAV takes off until it lands due to low battery or a predefined battery status. ***Manual take-off and landing are permitted for this challenge.***

Teams participating in the indoor or outdoor categories are welcome to participate in this challenge as well.



Outdoor Area

The Bicentenario Park will be the designated area for the IMAV 2025 Outdoor Competition. Below, there is a top view of the full area that will be used for the missions of the outdoor competition and the special challenge.



The next figure shows the designated areas for the missions:

In red: The work area where tables, electricity, and a tent will be located for teams to set up their MAVs.
In green: The take-off area for the outdoor missions, flying towards the purple area.
In purple: The flight area. MAVs can land anywhere inside this area.



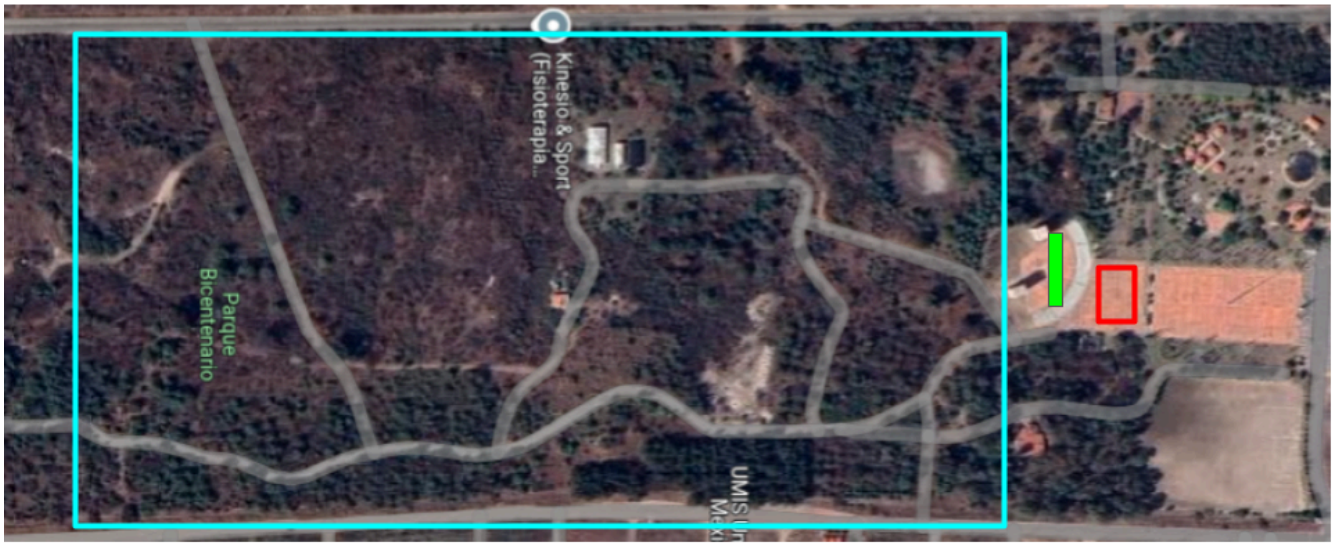
Work, take-off, and flight zones for the IMAV 2025 outdoors competition. From the take-off zone (in green), MAVs should fly towards the flight zone indicated in purple. The flight zone has an approximate length of 350 m and a width of 250 m.

The GPS coordinates for the flight area are as follows:

- 18.942704, -98.190489
- 18.945763, -98.190441
- 18.945665, -98.188110
- 18.942670, -98.188203

For the Special Challenge, the next figure shows the designated areas for the Surveillance Challenge:

In red: The work area where tables, electricity, and a tent will be located for teams to set up their MAVs.
In green: The take-off area for the outdoor missions, flying towards the turquoise area.
In turquoise: The flight area. MAVs can land anywhere inside this area.



For this Special Challenge, the take-off zone is indicated in green, from which MAVs have to take off and fly towards the flight zone indicated in turquoise. The latter has an approximate area of 500 m x 250 m.

The GPS coordinates for the flight area are as follows:

- 18.941848, -98.190861
- 18.941883, -98.188128
- 18.937369, -98.188127
- 18.937295, -98.190757