IMAV 2026 Competition Rules for Indoor and Outdoor Competitions

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September 21 - 25, 2026

IMAV rules book versions	date	modifications
version V0	March 4 2026	first version
version V1	April 20 2026	modification in red

About

This is the official rule book, originally intended for the IMAV 2026.

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

The General Chair, Renaud Kiefer, of the IMAV 2026 served as Editor of this rule book and its future editions due to amendments.

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1 Foreword

The International Micro Air Vehicle Conference and Competition (IMAV) is a must-attend event for the international community dedicated to autonomous micro-drones. Each year, this unique event brings together researchers, engineers, students, and manufacturers with a common goal: to advance research and innovation in a rapidly changing field.

In September 2026, the 17th edition of IMAV will be held in Strasbourg, in the heart of Europe, with a focus on rescue operations management. Through indoor and outdoor competitions inspired by real-life scenarios, and scientific conferences, IMAV 2026 will highlight the technological challenges related to the autonomy, lightness, navigation, and robustness of small drones.

Supported by INSA Strasbourg and the ICube laboratory, in close collaboration with the SIS67 fire department and the 2nd Hussards Regiment of the army this event aims to be a place for exchange, knowledge transfer, and international cooperation. It offers young researchers and students a unique opportunity to test their work against real-world requirements, while promoting dialogue with the industrial world.

IMAV 2026 thus aims to promote international scientific excellence and actively contribute to the future of autonomous drones serving society.

2 General rules and Safety

Participation in the IMAV 2026 indoor and outdoor competitions is conditional upon obtaining a green card for each of the drones entered. This validation, carried out during the training day, certifies compliance with safety requirements, the proper functioning of the systems, and the teams' operational control of the drones. Each drone must therefore be individually certified in order to be authorized to fly in the competition areas, ensuring the smooth running of the events and the safety of all participants and supervisors.

- The maximum take-off weight of any MAVs must not exceed 5 kg for the outdoor and 3kg for the indoor. These weight limits apply to each drone ready to fly, including batteries and payload.
- A kill switch is mandatory for each MAV on the remote control.
- For the outdoor competition, the maximum flight altitude is 80 m (approx. 262 feet) above Ground
- For the outdoor competition, the maximum number of drones that can fly at the same time will be limited to 5.
- For the indoor competition, drones that can fly at the same time will be limited to 3.
- All flights must be performed automatically for a mission to be validated. An autonomy factor A will be assigned to each mission.
  - $A = 0.4$ if an action is performed during the mission (mode change, action on a switch or on the ground station etc.).
  - $A = 0.7$ If calculations or processing (image processing, flight path planning etc..) are performed remotely on a PC rather than on the drone itself.
  - $A = 1$ if no action is performed during the mission (all computation are done onboard).

- All MAVs must remain within designated flight zones; if a MAV strays beyond these zones, it is required to activate a land measure, and finally, if the drone goes too far, it must cut its engines.
- Failure to comply with any of these safety measures will lead to penalties or disqualification.

All outdoor pilots must complete the AlphaTango online qualification and provide proof of completion before they are allowed to fly. This is a French requirement. https://alphatango.aviation-civile.gouv.fr/login.jsp

2.1 Frequency band

The following frequency bands are allowed in France in table 1:

Frequency Band	Power Limit
26.81 - 27.195 MHz	100 mW
34.995 - 35.055 MHz	100 mW
40.66 - 40.70 MHz	100 mW
41.055 - 41.205 MHz	100 mW
72.2 - 72.5 MHz	100 mW
433.05 - 434.79 MHz	10 mW
863 - 868 MHz	25 mW
2.4 - 2.4835 GHz	25 mW
5.725 - 5.875 GHz	25 mW

Table 1: Frequency band authorised in France

For more detailed information please read:
https://www.anfr.fr/en/home

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

2.2 Competitions format

Participation in the competition is subject to obtaining a mandatory “Green Card” during the training day, certifying compliance with safety regulations and proper operational control of the drones.

During the competition, each team will be required to complete four missions inspired by real-world applications. Teams will have a 30-minute time slot to validate as many missions as possible, with a pause allowed within this period. Each team will have 10 minutes to prepare before their turn begins (while the previous team completes its mission). All flights must be fully autonomous, with the presence of a safety pilot. The use of multiple drones operating in parallel is permitted.

A mission is considered successfully validated once the drone has safely returned to its designated landing area.

Regarding the scoring system, the competitions have been designed so that each mission has the same number of points.

3 Location

IMAV 2026 will take place at several locations in the Strasbourg metropolitan area Fig.1. The outdoor competition will be held on military grounds in Haguenau, while the indoor competition and scientific conference will be held at INSA Strasbourg.

Figure 1: Map of Strasbourg in the heart of Europe and in eastern France

3.1 Indoor event location

The IMAV 2026 indoor competition will take place in the lobby of INSA Strasbourg Fig.2. This central and accessible location will provide the ideal conditions for the smooth running of the events, while also promoting the visibility of the competitions Fig.3.

Figure 2: Facade of INSA Strasbourg

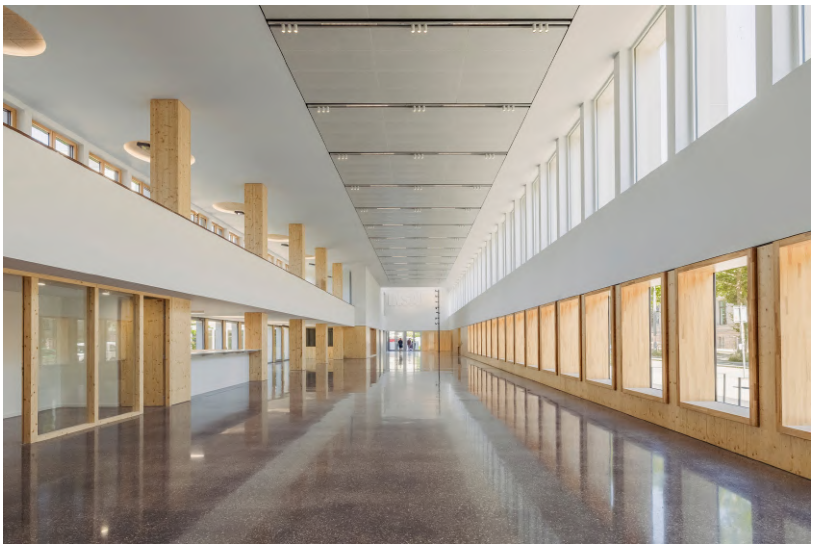


Figure 3: Entrance hall of INSA Strasbourg

Access is easy via the Strasbourg transport network (CTS: https://www.cts-strasbourg.eu/fr/se-deplacer/recherche-horaire/), getting off at the "Université" stop.

Address :

INSA Strasbourg

24 boulevard de la victoire 67000 Strasbourg

Map: https://maps.app.goo.gl/ag7SHYZeh5VR9mwb7

3.2 Outdoor event location

The IMAV 2026 outdoor competition will take place on the Haguenau military training ground under the supervision of the 2nd Hussards Regiment Fig.4a. This terrain offers ideal conditions for implementing forest fire and rescue response scenarios in collaboration with the SIS67 fire department Fig.4b .

(a) Emblem of the 2nd Hussards Regiment

(b) Emblem of the SIS 67 firefighters

The military training ground is located next to the town of Haguenau, about 45 minutes by car from Strasbourg Fig.5. A bus will be available for participants on the test and competition day, departing from INSA Strasbourg.

As the training ground is military property, access to the flight zone and the field will be regulated and monitored. Soldiers may carry out equipment checks.

Address :

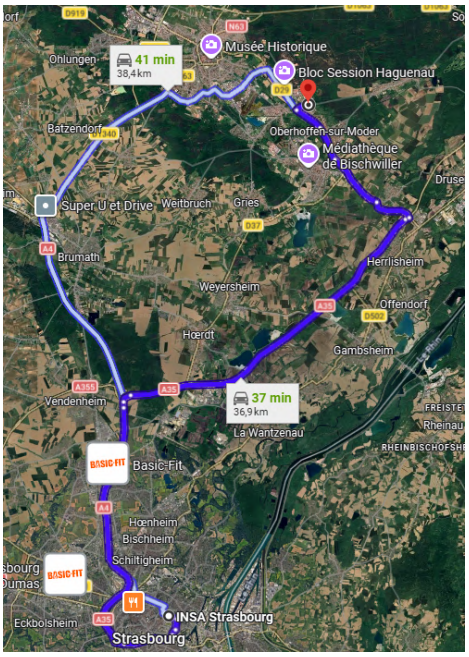


Figure 5: Map showing how to get from Strasbourg to the Haguenau military camp

Haguenau military camp
Quartier Estienne, Rue Kaltenhouse, 67500 Haguenau
Map: https://maps.app.goo.gl/rZncjcu7rvbdzWq36

4 Indoor Competition rules

4.1 Context - Indoor Competition

The indoor competition events are inspired by firefighters' training courses. We have added a building inspection event, a hot spot search event, a small parcel delivery event and a wind turbine compliance check event. The aim is to assess the ability of drones to operate in confined and congested spaces by combining inspection and surveillance missions.

The indoor missions simulate different phases :

1. Navigating an obstacle course, representing entry through a window and progression through a damaged environment.
2. Dropping a specific object into a box representing a hot spot area.
3. Inspecting a closed room and identifying the number of babies inside.
4. Inspecting a wind turbine blade to make ground contact, illustrating a technical inspection mission in a complex environment.
5. Precision landing on fixed or moving platform.

Through these scenarios, IMAV 2026 highlights the importance of the autonomy, precision, and adaptability of drones, while strengthening the link between scientific research and concrete applications in the service of civil security.

A Self-made factor drone design points will be added for drones with more than 50% of their design (mechanical and/or electronic) completed. These points will be awarded based on the technical document submitted by each team.

4.2 Field - Indoor Competition

The indoor competition will take place in the main entrance hall of INSA Strasbourg, ensuring high visibility for the event. This central location will allow both staff and students to engage with and enjoy the competition.

The entrance hall has a ceiling height of 7.90 m (Fig. 3). A flight arena measuring 14 m in length, 7 m in width, and 4 m in height will be installed, allowing drones to operate safely within a controlled environment (Fig. 6).

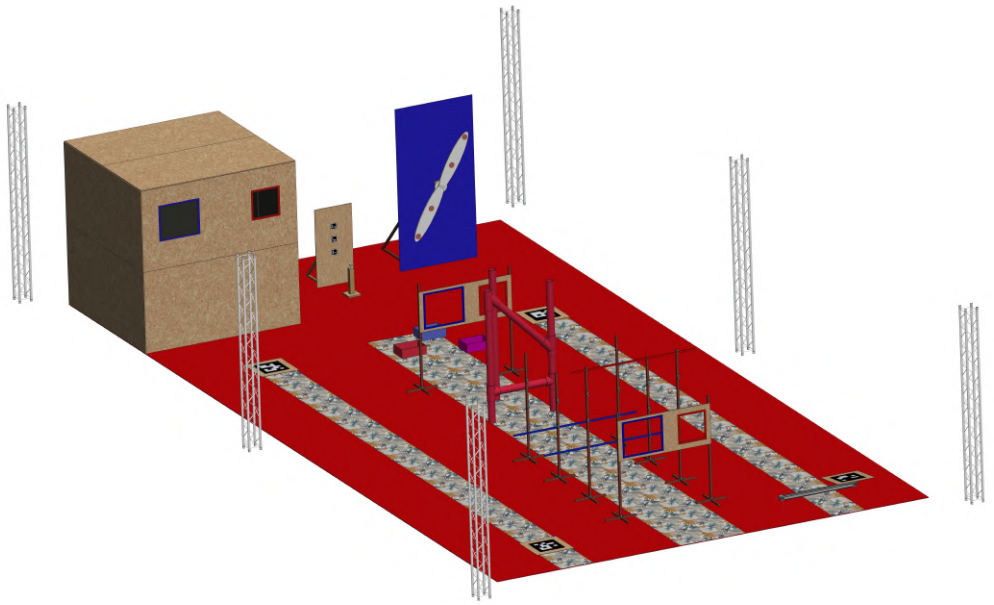


Figure 6: Reproduction of the flight cage for indoor competition

The top view layout is shown in Fig. 7.

To improve navigation, textured flooring (flower wallpaper) is added under the obstacle course and under the two side passages. The photo of the wallpaper is shown in the Fig.8.

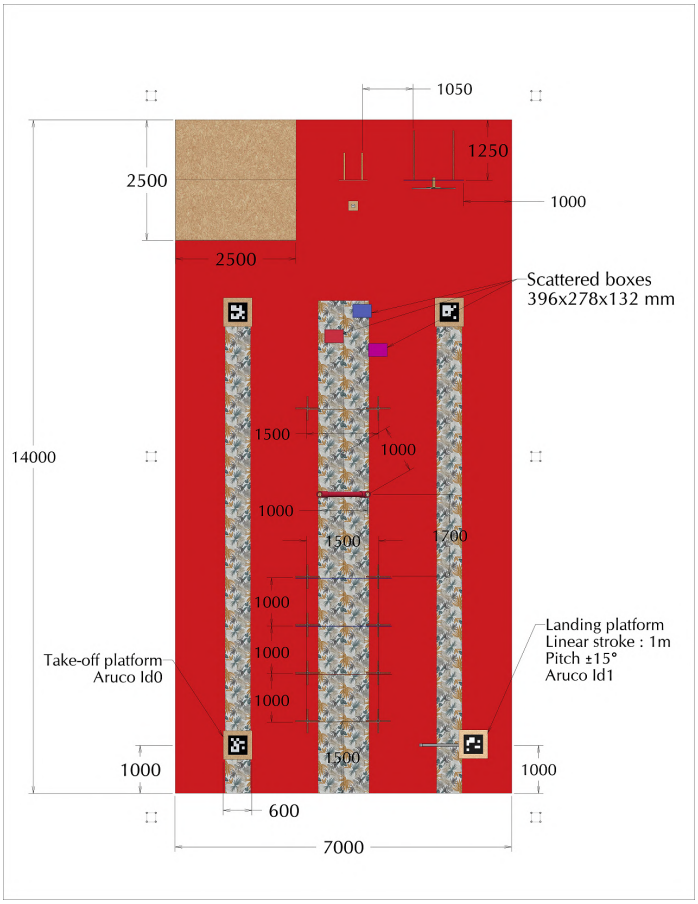


Figure 7: Reproduction of the flight cage for indoor competition from above

Figure 8: Wallpaper used for the ground texture

4.2.1 Precision landing, Accumulation of missions

The precision landing mission is not mandatory but will earn points for missions 1 to 3: Each time one of these missions ends with a precision landing (on a fixed or mobile platform , depending on the competitors' choice), points will be added to the mission in question.
Similarly, points will be awarded for completing multiple missions (this does not apply to mission 4). Points will be added for each set of successfully completed missions.
In the case of multiple missions, if the drone lands on the target at the end of the combined missions, the precision landing points will be awarded for all missions in the combination.

Fig.9 is an example of an Aruco Marker 5x5 with ID 0. You can generate them on the website: https://chev.me/arucogen/

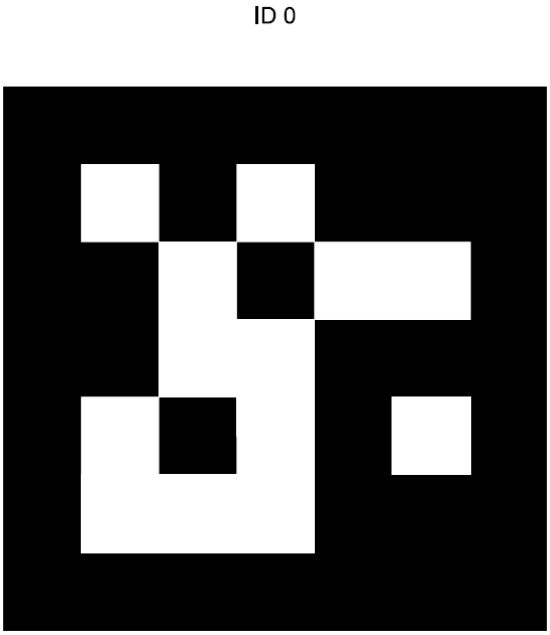


Figure 9: Aruro Marker 5x5

4.3 Scoring - Indoor Competition

Each of the four missions has a maximum score of 20 points, divided into the following components:

4.3.1 Mission Completion Score (up to 7 points)

Points are awarded based on successful completion of the mission. Some parameters are multiplied by an autonomy factor:

- 1.0 for fully autonomous operation
- 0.7 for off-board calculations
- 0.4 if any manual intervention occurs : Manual flight control is prohibited; only occasional interventions (switch changes, mode changes, etc.) are permitted.

4.3.2 Mass Factor (Capable of doubling the 7 points)

A mass factor coefficient, ranging from 1.13 (for 3 kg) to 2.0 (for 0.1 kg), is applied to the Mission Completion Score (after autonomy factor). This multiplication allows the mission score to reach up to a maximum of 14 points. The mass factor rewards lighter drones.

4.3.3 Landing Bonus (up to 2 points)

- **2 points** for landing on a moving platform
- **1 point** for landing on a static platform

If multiple missions are completed during a single flight, the landing bonus is applied to each corresponding mission score.

4.3.4 Multi-Mission Bonus (up to 2 points)

- **2 points** for completing 3 missions in a single flight
- **1 point** for completing 2 missions in a single flight

When missions are combined within a single flight, the multi-mission bonus is counted for each mission involved.

4.3.5 Self-Made Drone Factor (up to 2 points)

Up to 2 additional points are awarded based on the level of in-house design. Points are granted to drones with more than 50% of their mechanical and/or electronic design developed by the team. Evaluation is based on the technical documentation submitted by each team

4.3.6 Clarification on Bonus Accumulation

A single flight achieving multiple missions and a successful landing allows teams to maximize their score:

- If 3 missions are completed in one flight and the drone successfully lands on the platform, both the multi-mission bonus and the landing bonus are awarded to each of the three mission scores

This design is intentional to encourage efficient mission chaining and maximize scoring opportunities.

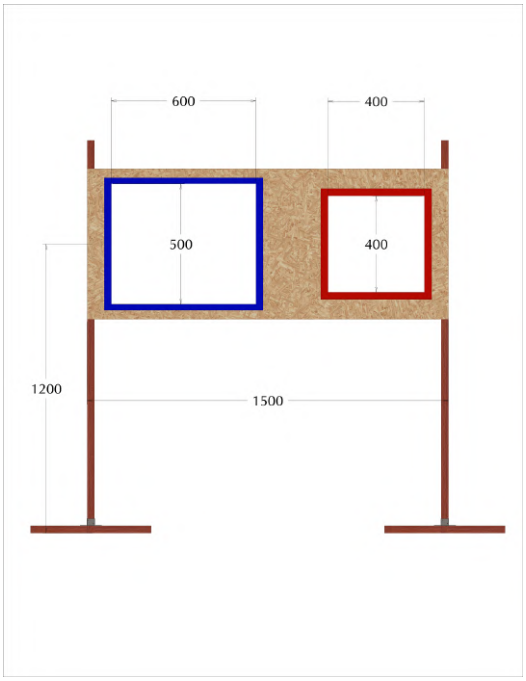
4.3.7 Additional Information

Detailed scoring criteria for each mission are provided in the individual mission scoring tables.

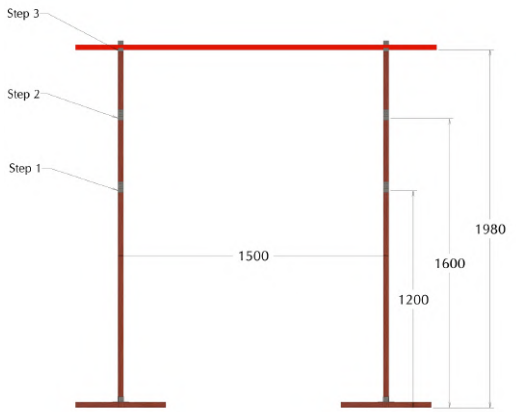
4.4 Missions - Indoor Competition

4.4.1 Mission 1 - Obstacle course - Indoor Competition

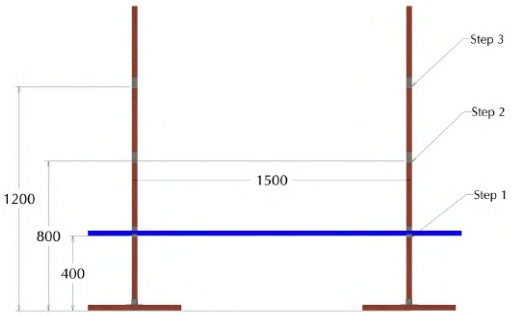
This mission will consist of completing an obstacle course: passing through two areas with two types of windows Fig.10a, flying over a fixed red bar at an adjustable height Fig.10b, under two fixed blue bars at an adjustable height Fig.11a, and through a pipe passage Fig.11b. PVC pipe diameter is 10cm.
Points will be awarded based on the size of the window passed through (surrounded by a red or blue border) as well as the height of the bars chosen.



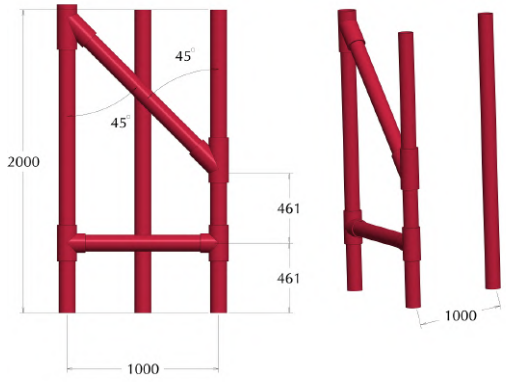
(a) Two types of windows



(b) Go over the red bar



(a) Go under the two blue bars



(b) Overcoming the obstacle of tubes

4.4.2 Scoring - Mission 1 - Obstacle course - Indoor Competition

Tab.2 provides a detailed breakdown of the scoring system.

Description	Parameter	Values		
Windows crossed	Win	... 1 pt per red window and 0.5 pt per blue window		
Red bar crossed	$BarR$	... 0.25 pt low bar 0.5 pt middle bar 0.75 pt high bar)		
Blue bar crossed	$BarB$	... 0.25 pt high bar 0.5 pt middle bar 0.75 pt low bar		
Tubes crossed	Tub	... (0.5 pt)		
Cumulative mission bonus	$B1$	... (0 pt for one mission 1 pt for two missions 2 pts for three missions)		
Drone mass mission 1	$WUAV$	... (Max 3 kg)		
Weight factor	$W1$	$W_1 = 2 \cdot \left(1 - e^{\frac{-W_{max}}{1.2 \cdot W_{uav}}}\right)$		
Landing on platform	$La1$	... 2 pts land on moving platform 1 pt land on fixed platform		
Autonomy factor	$A1_i$	0.4 if manual actions occur	0.7 if computations are off-board	1 if fully autonomous
Self made points	$SF1$	... (Max 2 pts)		
Total score mission 1	S1	$S1 = \frac{7}{4} \cdot (Win \cdot A1_1 + BarR \cdot A1_2 + BarB \cdot A1_3 + Tub \cdot A1_4) \cdot W1 + B1 + La1 + SF1$		

Table 2: Scoring mission 1 - Indoor competition

4.4.3 Mission 2 - Inspect a dark room - Indoor Competition

This mission will consist of inspecting a dark room (2.5 m cube) Fig.12. There will be two types of windows (circled in red or blue) through which to enter the room. The number of babies present in the room must be assessed. The number of babies in the room must be determined automatically and the value displayed on a screen.

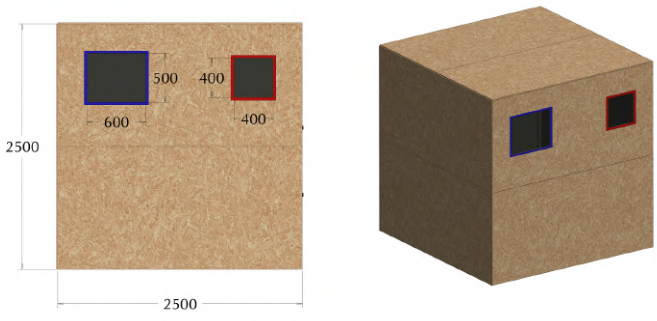


Figure 12: view of the room

4.4.4 Scoring - Mission 2 - Inspect a dark room - Indoor Competition

Tab.3 provides a detailed breakdown of the scoring system.

Description	Parameter	Values		
Flying in the room	Fin	... 0.5 for blue window 1 for red window		
Flying out the room	$Fout$	... 0.5 for blue window 1 for red window		
Number of babies counted	$Counted$	... (If $Counted > Nba_{max}$ then 0 pt)		
Actual number of babies	Nba_{max}	... (selected by the organization)		
Counting babies	Ba	$Ba = 3 \cdot \left(\frac{Counted}{Nba_{max}}\right)$		
Cumulative mission bonus	$B2$	... (0 pt for one mission 1 pt for two missions 2 pts for three missions)		
Drone mass mission 2	$WUAV$	... (Max 3 kg)		
Weight factor	$W2$	$W_2 = 2 \cdot \left(1 - e^{\frac{-W_{max}}{1.2 \cdot W_{uav}}}\right)$		
Landing on platform	$La2$	... 2 pts land on moving platform 1 pt land on fixed platform		
Autonomy factor	$A1_i$	0.4 if manual actions occur	0.7 if computations are off-board	1 if fully autonomous
Self made points	$SF2$	... (Max 2 pts)		
Total score mission 2	$S2$	$S2 = (Fin \cdot A2_1 + Fout \cdot A2_2 + Ba \cdot A2_3) \cdot W2 + La2 + B2 + SF2$		

Table 3: Scoring mission 2 - Indoor competition

4.4.5 Mission 3 - Dropping on hot spot - Indoor Competition

For this mission, a cone must be dropped into a box containing a hot spot (temperature between 70°C and 100°C). There will be three boxes close to each other Fig.13. The drone must drop the cone into the box that contains the hot spot.

The .STL file for the indoor competition cone is available for download on the website under : *Competitions/IMAV2026CompetitionRulebook* at the bottom of the page. The cone weighs 7g and is filled with 15% PLA.

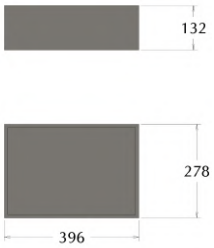


Figure 13: Box dimensions

4.4.6 Scoring - Mission 3 - Dropping on hot spot - Indoor Competition

To confirm that the drone has successfully detected a hot spot, the drone must be equipped with a red LED that flashes visibly when the drone is directly above the relevant box (before or during the release of the cone). Hb (hot box detected) points will be awarded based solely on this criterion.

Tab.4 provides a detailed breakdown of the scoring system.

Description	Parameter	Values
Cone dropped in box	Dr	... (4 pts cone dropped in hot box 2 pt cone dropped in other box)
Hot box detected	Hb	... (3 pts if the red led blink)
Cumulative mission bonus	$B3$	... (0 for one mission 1 pt for two missions 2 pts for three missions)
Drone mass mission 3	$WUAV$	... (Max 3 kg)
Weight factor	$W3$	$W_3 = 2 \cdot \left(1 - e^{\frac{-W_{max}}{1.2 \cdot W_{uav}}}\right)$
Autonomy factor	$A1_i$	0.4 if manual actions occur | 0.7 if computations are off-board | 1 if fully autonomous
Landing on platform	$La3$	... 2 pts land on moving platform 1 pt land on fixed platform
Self made points	$SF3$	... (Max 2 pts)
Total score mission 3	$S3$	$S3 = (Dr \cdot A3_1 + Hb \cdot A3_2) \cdot W3 + La3 + B3 + SF3$

Table 4: Scoring mission 3 - Indoor competition

4.4.7 Mission 4 - Wind turbine inspection - Indoor Competition

The purpose of this mission is to simulate the inspection of wind turbine blades. Wind turbine blades are equipped with a grounding system to prevent damage from lightning strikes.
To test the continuity of the grounding system, the drone must retrieve a copper ring with a diameter of 8 cm and then point it at conductive copper discs Fig.14. Electrical contact between the ring and the disc will activate a buzzer. The contact system will be developed freely by each team.
The copper ring will be equipped with a 4m long, 0.1mm enamelled copper wire, which will be connected to the continuity test electronic system. At the end of the mission, the drone must land near the base of the wind turbine to avoid any braking of the copper wire. The ring will be placed 50 cm high on a support as shown in the image in Fig.15. Aruco markers will be placed to assist with the drone's automatic positioning on the ring.
The copper ring may be manually placed on the drone before takeoff at the base of the ring mount, but no "grabbing" points will be awarded in this case.

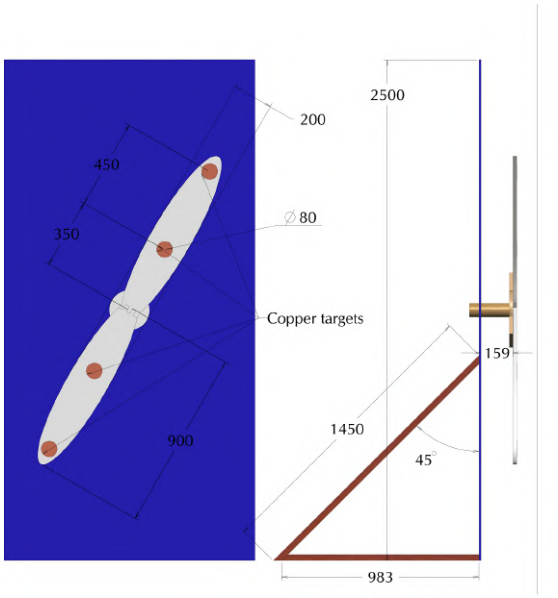


Figure 14: Wind turbine blade

4.4.8 Scoring - Mission 4 - Wind turbine inspection - Indoor Competition

This is the only mission that cannot be combined with the others and does not require landing on the landing pad.

Tab.9 provides a detailed breakdown of the scoring system.

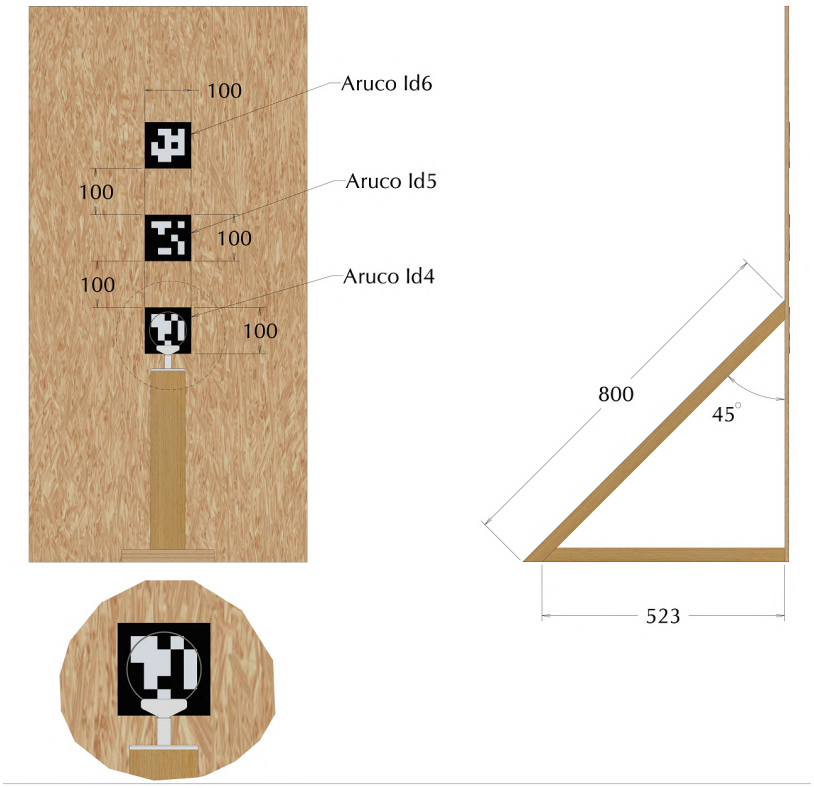


Figure 15: Support of the ring

Description	**Parameter**	**Values**		
Catch the ring	$grabRing$	... (4 pts)		
Touch one copper disc	$touchWind$	... (5 pts)		
Drone mass mission 4	$WUAV$	... (Max 3 kg)		
Weight factor	$W4$	$W_4 = 2 \cdot \left(1 - e^{\frac{-W_{max}}{1.2 \cdot W_{uav}}}\right)$		
Autonomy factor	$A1_i$	0.4 if manual actions occur	0.7 if computations are off-board	1 if fully autonomous
Self made points	$SF4$	... (Max 2 pts)		
Total score mission 4	$S4$	$S4 = ((grabRing \cdot A4_1 + touchWind \cdot A4_2) \cdot W4 + SF4)$		

Table 5: Scoring mission 4 - Indoor competition

5 Outdoor Competition rules

5.1 Context - Outdoor Competition

The outdoor competition focuses on forest fires, which are becoming increasingly frequent and intense in France. Early detection of a fire outbreak is now a major challenge in order to enable rapid intervention and limit the spread of flames. The missions proposed reproduce the different phases of a reconnaissance and first response operation, from mapping the area to providing direct assistance to ground crews.

In this context, teams will have to complete four complementary missions:

1. Map the area to identify and locate firefighting and military vehicles.
2. Detect two hot spots and provide their precise GPS coordinates.
3. Collect water and drop it on a target, simulating an initial firefighting action.
4. Drop a first aid kit near a mannequin, with a bonus if the drop is made directly on the mannequin equipped with a "dead man" device.

A Self-made factor drone design points will be added for drones with more than 50% of their design (mechanical and/or electronic) completed. These points will be awarded based on the technical document submitted by each team.

All pilots must complete the AlphaTango online qualification and provide proof of completion before they are allowed to fly. This is a French requirement. https://alphatango.aviation-civile.gouv.fr/login.jsp

5.2 Field - Outdoor Competition

The outdoor competition will take place at the Haguenau military training ground at the following GPS coordinates: 48.806567024502456, 7.852133729228434.

Supervision and logistics will be organized by the 2nd Hussards Regiment. As this is an active military site, security checks may be carried out by military personnel if deemed necessary.
All persons present on the site must have their identity card (or passport).

The different areas are described on this map Fig.16

The competition area will include:

- A living area with tents for lunch service and sanitary facilities.
- A team area equipped with tents and electrical power supply.
- A designated waiting area for both spectators and teams before their flight slots.
- A geofence defined by the following four corner coordinates:
  - 48.80570456695289, 7.84961762660713
  - 48.810842794362294, 7.847237082007214
  - 48.81380786901547, 7.861214602971546
  - 48.80863939598765, 7.864039635567677

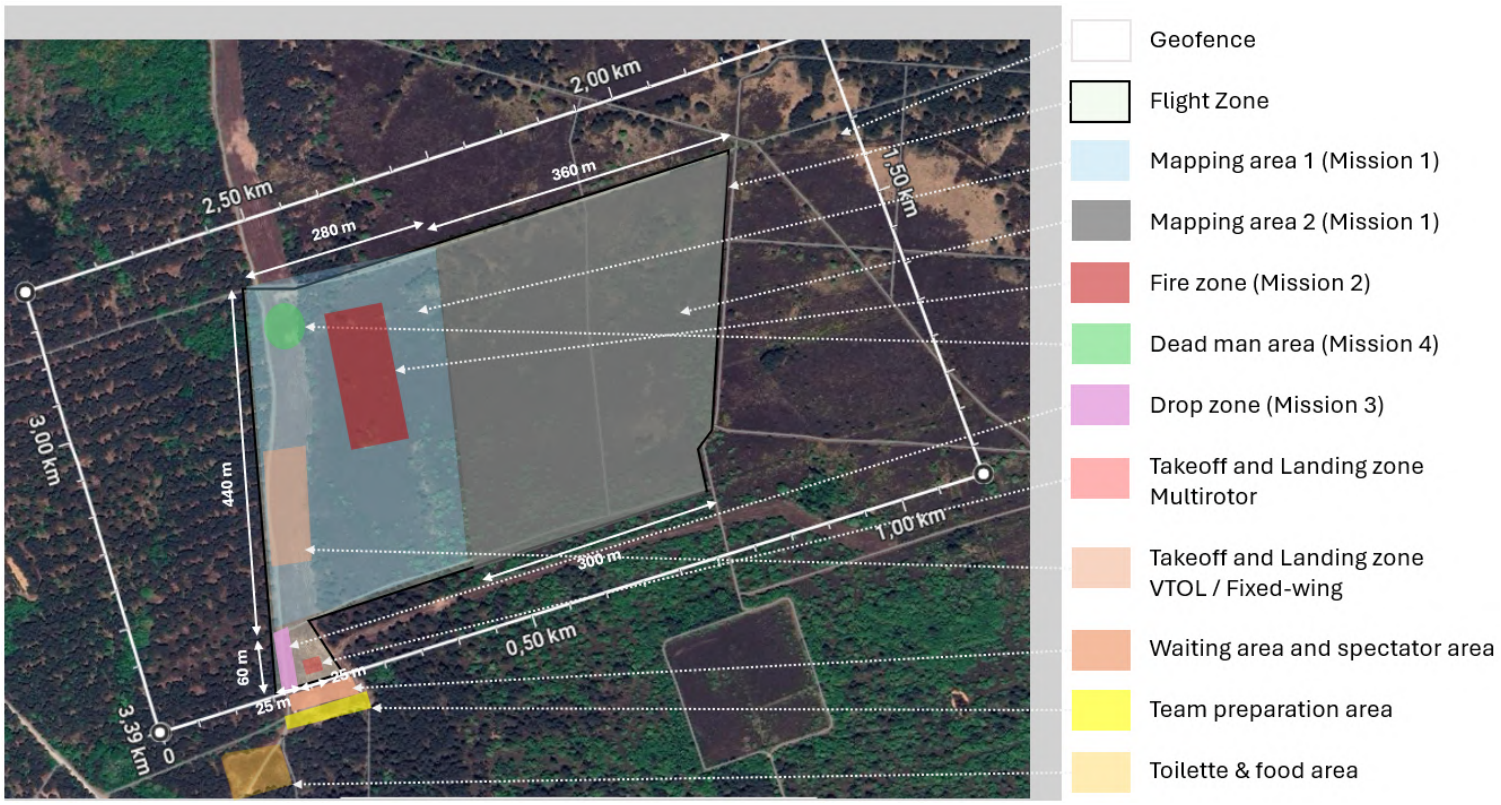


Figure 16: Outdoor competition area with description of the different zones

- A flight area delimited by a black boundary line.
- A dedicated take-off and landing zone suitable for all drone configurations.The GPS positions of the landing zones for the different types of drones will be defined at a later date, taking into account the wind conditions during the competition. The exact GPS coordinates for each zone and specific points will be provided on the day of the competition.
- A specific area for Mission 3, including a water tank and, 25 meters away, a funnel represented from above as a $1,5 \times 1,5m^2$ red square target.
- Mapping Area 1 (Mission 1).
- Mapping Area 2 (Mission 1).
- Fire detection area (Mission 2).
- A search area for locating a mannequin equipped with a dead-man switch device (Mission 4).

5.2.1 Precision landing

The sizes of the precision landing zones are as follows:

- multicopters : precision 1x1m^2 ; zone 3x3m^2
- VTOL : precision 2x2m^2 ; zone 5x5m^2
- fixedwing : precision 20x3m^2 ; zone 50x5m^2
  This means that to earn landing points, you must land in these areas. If you land outside of these areas, you will be awarded 0 landing points.
  A target in the form of a 5x5 Aruco marker measuring 60 cm x 60 cm will be used for precision landing of multicopters and VTOLs.

Fig.17 is an example of an Aruco Marker with ID 0. You can generate them on the website: https://chev.me/arucogen/

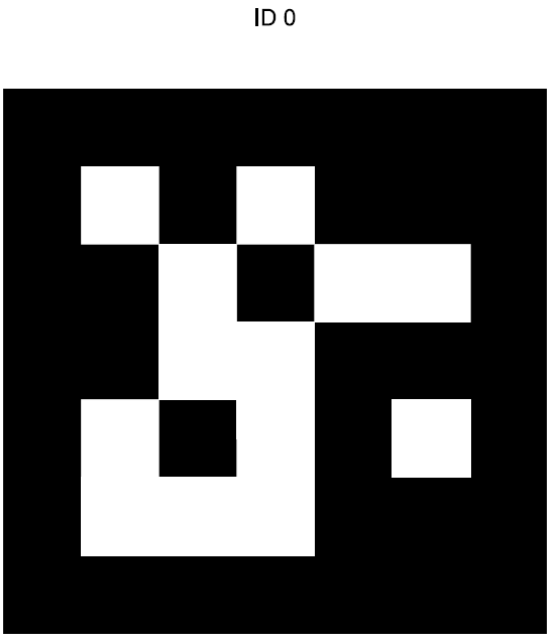


Figure 17: Aruro Marker 5x5

5.3 Scoring - Outdoor Competition

Each of the four missions has a maximum score of 20 points, divided into the following components:

5.3.1 Mission Completion Score (up to 8 points)

Points are awarded based on successful completion of the mission. Some parameters are multiplied by an autonomy factor:

- 1.0 for fully autonomous operation
- 0.7 for off-board calculations
- 0.4 if any manual intervention occurs : : Manual flight control is prohibited; only occasional interventions (switch changes, mode changes, etc.) are permitted.

5.3.2 Mass Factor (Capable of doubling the 8 points)

A mass factor coefficient, ranging from 1.02 (for 5 kg) to 2.0 (for 0.3 kg), is applied to the Mission Completion Score (after autonomy factor). This multiplication allows the mission score to reach up to a maximum of 16 points. The mass factor rewards lighter drones.

5.3.3 Landing Bonus (up to 2 points)

- **2 points** for precision landing
- **1 point** to land in a specific area

If multiple missions are completed during a single flight, the landing bonus is applied to each corresponding mission score.

5.3.4 Self-Made Drone Factor (up to 2 points)

Up to 2 additional points are awarded based on the level of in-house design:

- Points are granted to drones with more than 50% of their mechanical and/or electronic design developed by the team
- Evaluation is based on the technical documentation submitted by each team

5.3.5 Additional Information

Detailed scoring criteria for each mission are provided in the individual mission scoring tables.

5.4 Missions - Outdoor Competition

This year, four missions are proposed under the theme of forest fires and search and rescue. The objective will be to successfully complete as many missions as possible within a 30-minute time slot.

5.4.1 Mission 1 - Mapping and vehicule identification - Outdoor Competition

In the context of a wildfire, having an accurate map of the operational area, including the location of intervention teams, is essential. The objective of this mission is to generate a map of the area and to identify both the position and the designation of the emergency vehicles deployed on the field.

Two mapping areas are proposed for this mission. The first one (Mapping Area 1) covers a restricted zone of 440 m $\times$ 280 m. An extended area (Mapping Area 2) increases the coverage by an additional 440 m $\times$ 320 m.

Within these areas, a number of fire brigade and military vehicles will be positioned (the exact distribution between fire and military vehicles will be specified on the day of the competition).

Teams will be required to deliver a map that allows clear visual identification of the different vehicles. Points will be awarded if GPS positions are provided with an accuracy of within 5 meters and if the vehicle will correctly be identified. GPS coordinates must be provided in decimal degrees (for example, lat.: 48.62977 and long.: 7.78916). The GPS coordinates must be provided no later than 5 minutes after landing.

Firefighter's vehicle registration numbers will be visible from an aerial perspective Fig.18.

Figure 18: trucks "CCF" of fire brigade vehicles seen from above.

For the fire brigade vehicle identification we will need to know whether it is a truck (CCF) or a light off-road vehicle (VLTT) and specify the brigade concerned (last 3 letters). For example, 67-CCF M ING means that it is a truck from the INGwiller brigade. The roofs may be white (older vehicles) or yellow.

To identify military vehicles, please specify their type (VT4, GBC 180, or VBL). See photos of these different vehicles.

Figure 19: VLTT: light off-road vehicle seen from above.

Figure 20: trucks "CCF" of fire brigade vehicles with white roof.

Figure 21: 4x4 VT4 model.

Figure 22: light armored vehicle (VBL).

Figure 23: Truck(GBC 180).

5.4.2 Scoring - Mission 1 - Outdoor Competition

The Tab.6 provides a detailed description of the scoring system.

Description	Parameter	Values		
Mapping area surface	Z	2 pts map 1		4 pts : map 1 + map 2
Time to submit the map and the vehicles positions and identifications	R	1 pt submission 30 min after flight		2 pts immediate submission after flight (5 min max)
Number of vehicles detected with identification and GPS positions	nV	... 0.375 pts per vehicle (8 vehicles)		
Drone mass mission 1(kg)	$W_{UAV}(kg)$	... (Max 5 kg)		
Weight factor	$W1$	$W_1 = 2 \cdot \left(1 - e^{\frac{-W_{max}}{1.4 \cdot W_{uav}}}\right)$		
Autonomy factor	$A1$	0.4 if manual actions occur	0.7 if computations are off-board	1 if fully autonomous
Landing on platform	$La1$	... 2 pts for precision landing 1 pt in the landing zone		
Self made points	$SF1$	... (Max 2 pts)		
Total score mission 1	$S1$	$S_1 = \frac{8}{10} \cdot (Z + nV \cdot R \cdot A_1) \cdot W_1 + La1 + SF1$		

Table 6: Scoring mission 1 - Outdoor competition

Vehicle Identification	GPS coordinates
67-CCF-M-ING	48.8095202082736 ; 7.85202741622925
GBC 180	48.8084886157098 ; 7.85187721252441

Table 7: Sample table to submit mission 1

5.4.3 Mission 2 - Fire detection - Outdoor Competition

The objective of this mission is to detect hot spots. The spots will not necessarily be fires but may simply be points with significant thermal radiation. There will be two hot spots to look for in the red area on the map. The objective of this mission will be to determine the GPS coordinates of these heat points in decimal degrees (e.g., lat: 48.62977 and long: 7.78916) with an accuracy of 5 meters. The GPS coordinates must be provided no later than 5 minutes after landing. Additional points will be awarded for the shape factor of the drones (VTOL or fixed-wing drones will be favoured). Energy consumption will also be measured during this mission.
The mission must be carried out by a single drone and its flight will be timed
Time will be taken between take-off and landing: for a fixed-wing drone, between the moment of launch and the moment of landing and stop. The batteries will be recharged by us to their full capacity (charge rate of 1C), and we will calculate the capacity consumed in mAh. Batteries may be LiPo, NiMh, or Li-Ion type. The capacity of the battery value used must be legible on the batteries !

5.4.4 Scoring - Mission 2 - Outdoor Competition

The Tab.8 provides a detailed description of the scoring system.

Description	**Parameter**	**Values**		
GPS Heat point 1	$HP1$	3.5 pts		
GPS Heat point 2	$HP2$	3.5 pts		
Configuration coefficient	CF	0.75 multirotor, 1 pt fixed wing, 1.25 VTOL		
Battery capacity	mAh	...		
Maximum battery voltage after charging	V	...		
Flight time (s)	$Time$	...		
Drone mass mission 2(kg)	W_{UAV}	... (Max 5 kg)		
Power factor	CP	$CP = \frac{Time \cdot 50}{V \cdot mAh}$ (Max 3 pts)		
Weight factor	$W2$	$W_2 = 2 \cdot \left(1 - e^{\frac{-W_{max}}{1.4 \cdot W_{uav}}}\right)$		
Autonomy factor	$A2$	0.4 if manual actions occur	0.7 if computations are off-board	1 if fully autonomous
Landing on platform	$La2$	... 2 pts for precision landing 1 pt in the landing zone		
Self made points	$SF2$	... (Max 2 pts)		
Total score mission 2	$S2$	$S_2 = \frac{8}{11.75} \cdot (CF \cdot (HP1 + HP2) + CP) \cdot W_2 \cdot A_2 + La2 + SF2$		

Table 8: Scoring mission 2 - Outdoor competition

Heat points	**GPS coordinates**
Heat point 1	48.8104811247201 ; 7.85352945327759
Heat point 2	48.8092941076099 ; 7.85393714904785

Table 9: Sample table to submit mission 2

5.4.5 Mission 3 - Collect and drop water - Outdoor Competition

The objective of mission 3 will be to collect water from a basin (size will be given later) and dump it into a red square reservoir measuring 1.5 x 1.5 m^2. The goal of this mission will be to fill a 2-liter bottle placed under the reservoir. Points will be awarded based on the volume of water in the bottle at the end of the flight slot. If the "wild card" is used, the best filling score between the two passes will be awarded to mission points. The water collection system is not specified, but it is mandatory that this water collection system be transparent so that the water can be seen after filling.

5.4.6 Scoring - Mission 3 - Outdoor Competition

The Tab.10 provides a detailed description of the scoring system.

Description	**Parameter**	**Values**		
Water volume	Vol	... (Max 2 L)		
Drone mass mission 3(kg)	W_{UAV}	... (Max 5 kg)		
Weight factor	$W3$	$W_3 = 2 \cdot \left(1 - e^{\frac{-W_{max}}{1.4 \cdot W_{uav}}}\right)$		
Autonomy factor	$A3$	0.4 if manual actions occur	0.7 if computations are off-board	1 if fully autonomous
Landing on platform	$La3$	... 2 pts for precision landing 1 pt in the landing zone		
Self made points	$SF3$	... (Max 2 pts)		
Total score mission 3	$S3$	$S_3 = 4 \cdot Vol \cdot W_3 \cdot A_3 + La3 + SF3$		

Table 10: Scoring mission 3 - Outdoor competition

5.4.7 Mission 4 - Drop a first aid kit on a mannequin with "dead man" device - Outdoor Competition

This mission consists of dropping a first aid kit (size to be defined) next to a mannequin equipped with a dead man's switch emitting a sound of a certain power (to be defined). Dead man system will be a MSA Motion scout KTR
https://www.somatico.fr/materiels-d-intervention/reconnaissance/detecteurs-d-immobilite/detecteur-d-immobilite-motion-scout (Frequency 2.6 – 3.0 kHz, alarm 95 dB at 3 m; 2 ultra bright LEDs) The package may be deposited or dropped at an altitude of less than 2 m for the mission to be validated. The GPS point for the search area will be provided on the day of the mission. There will be three mannequins located within a 25 m radius of this point. Only one of the mannequins will be equipped with a dead man's switch. Points will be awarded based on the distance (d in cm) of the drop or release from the nearest mannequin. For a drop distance of less than 50 cm, the value of parameter d will be 50. The score will be doubled if the drop or release is made next to the mannequin equipped with the dead man's switch. If the drop is made at an altitude greater than two meters (as estimated by the judge), no points will be awarded for the mission.

5.4.8 Scoring - Mission 4 - Outdoor Competition

The Tab.11 provides a detailed description of the scoring system.

Description	**Parameter**	**Values**		
Distance in cm from the navel to the object	d	... (Min 50 - Max 300 cm)		
Drop on dead-man device	DM	0 (wrong mannequin)		1 (mannequin equipped with "Dead Man" device)
Maximum distance in cm from the navel to the object	$dmax$	300 cm		
Drone mass mission 4	W_{UAV}	... (Max 5 kg)		
Weight factor	$W4$	$W_4 = 2 \cdot \left(1 - e^{\frac{-W_{max}}{1.4 \cdot W_{uav}}}\right)$		
Autonomy factor	$A4$	0.4 if manual actions occur	0.7 if computations are off-board	1 if fully autonomous
Landing on platform	$La4$	... 2 pts for precision landing 1 pt in the landing zone		
Self made points	$SF4$	... (Max 2 pts)		
Total score mission 4	$S4$	$S_4 = \frac{8}{5} \cdot (\frac{dmax}{d} - 1) \cdot (1 + DM) \cdot W_4 \cdot A_4 + La4 + SF4$		

Table 11: Scoring mission 4 - Outdoor competition