

# MAV07 Scoring Sheet

## *Indoor mission*

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### Levels of autonomy

Only three levels of autonomy are considered for the indoor mission :

- auto 0 : a pilot manually controls the vehicle by direct visual contact ("RC mode").
- auto 1 : a pilot manually controls the vehicle through a remote on-board video camera. ("camera mode").
- auto 2 : no direct manual control is performed ("hands off mode").

Manual control (either 'auto 0' or 'auto 1') can be performed through a radio transmitter or a joystick, keyboard, mouse, etc.

For each task, the level of autonomy will be carefully evaluated by the judges:

- if task K is performed in "RC mode" (auto 0),  $a_K = 1$ ,
- if task K is performed in "camera mode" (auto 1),  $a_K = 2$ ,
- if task K is performed in "hands off mode" (auto 2),  $a_K = 6$ .

### Description of tasks

The indoor mission consists of the following tasks. With the exception of take-off and landing, all tasks can be carried out in any order. Either or all tasks can be performed.

Task 0

*Take-off*

$T_0 = 0$  or 1

Take-off is successful when :

- all team members remain within the launch zone (3 meters x 3 meters),
- occurs on the occasion of the **first** attempt,
- the vehicle achieves sustained flight during at least 5 seconds.

Task 1

*Land on and take-off from platform*

$T_1 = 0$  or 2

Task 1 aims at promoting the capability of micro air vehicles to perch on platforms. The platform will be a 60-cm diameter disk horizontally located above the ground. Task 1 will be successful if take-off occurs 3 seconds minimum after landing.

No points will be granted if the vehicle falls off from the platform or fails to take-off after landing (e.g. rough landing).

Task 2

*Identify target 1*

$T_2 = 0$  or 2

Target 1 is an A4-format white sheet of paper with 3 capital letters written in Arial 300 font size posted on the outer wall of the building. The identification is successful when the text written on target 1 is successfully identified and reported to the judges within the working time. Although target 1 is not visible from the pilot zone, it is in direct line of sight from the platform and can therefore be observed in a perch-and-stare mode before take-off.

Task 3

*Enter building*

$T_3 = 0$  or 3

Building intrusion must be realized by flying through a 1 x 1-meter square window oriented in direct line of sight from the pilot zone. The vehicle must entirely enter the building, no part of the vehicle should remain outside. Crashing the vehicle through the window will not score points.

Task 4

*Identify target 2*

$T_4 = 0$  or 5

Target 2 is an A4-format white sheet of paper horizontally placed on a table with a 8-digit telephone number printed in Arial 72. The identification is successful when the number written on target 2 is successfully identified and reported to the judges within the working time. Target 2 is not in direct line of sight from the pilot zone. Landing on the table to perform target identification is allowed.

Task 5  
*Identify target 3*  
 $T_5 = 0$  or 5

Target 3 is an A4-format white sheet of paper posted on the inner wall of the building and only visible from inside. Target 3 displays a picture showing the portrait of a suspect. The identification is successful when the picture on target 3 is successfully identified from a list of suspects given in advance and reported to the judges within the working time. Target 3 is not in direct line of sight from the pilot zone. Landing on the table to perform target identification is allowed.

Task 6  
*Exit building*  
 $T_6 = 0$  or 3

Building must be left by flying through the 1 x 1-meter square window oriented in direct LOS from the pilot zone. The vehicle must entirely exit the building, no part of the vehicle should remain inside. Crashing the vehicle while leaving the building will not score points.

Task 7  
*Land in landing zone*  
 $T_7 = 0$  or 2

Landing should occur within the prescribed 3 x 3 m square pilot zone. "Landing" means a smooth and safe coming into contact with the ground and the capability to fly again within 1 minute. That capability may be demonstrated on the judges' request. Other forms of contacts to the ground are considered as crashes and return zero. Scoring is done on an in-or-out basis.

### Gross score formula

The overall gross score is calculated through the following relation:

$$S_{tasks} = \sum_{K=0,7} a_K \times T_K$$

$$S_{gross} = S_{tasks} \left[ 2 - \frac{L}{L_{max}} \right]^3$$

where L is the maximum dimension between any two points on the vehicle (flexible antenna not included),  $L_{max}$  is the maximum dimension allowed to enter the competition ( $L_{max} = 500$  mm). In case of several vehicles used during a single working time, L is the largest maximum dimension of all different vehicles.

### Final score

In order to account for certain practical aspects of the system, such as a reduced number of team members, robustness, ease of use, smart packing, etc, 10% of the gross score can be granted by the judges in addition to the gross score to yield the final score. During the award ceremony, justification for those additional points will be given by the judges panel.

### Ranking

In order to clarify the relative ranking between competitors, a normalized score will be recalculated as follows:

$$S_{normalized} = 1000 \times \frac{S_{final}}{S_{best}}$$

where  $S_{best}$  is the final score obtained by the best competitor.