MAV07 Scoring Sheet

Outdoor mission

Levels of autonomy

Only three levels of autonomy are considered for the 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.
Entering new waypoints coordinates through keyboard/mouse is still considered as "hands off mode".
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 outdoor 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 (5 meters x 5 meters),
- occurs on the occasion of the **first** attempt,
- the vehicle achieves sustained flight and a rise in altitude after 5 seconds airborne.

Task 1 *Identify target 1*

$T_1 = 0$ or 2

Target 1 is a 1.2 x 1.5m placard placed horizontally on the ground. Target 1 identification is successful when the symbol placed on target 1 is successfully identified.

Task 2 *Identify target 2*

$T_2 = 0$ or 2

Target 2 is a 1.2 x 1.5m placard placed horizontally on the ground. Target 2 identification is successful when the symbol placed on target 2 is successfully identified.

Task 3 *Locate target 3*

$T_3 = 0, 1, 2, 3$ or 4

Target 3 is an all-terrain military vehicle "P4" (http://en.wikipedia.org/wiki/Peugeot_P4) located within a 300 m-side square zone. The GPS coordinates of target 3 (in WGS84 format) must be passed on to the judges within the working time.
Accuracy of the predicted location will be evaluated by the judges on the following basis:
- within a 3-meter radius circle
  T3 = 4
- from 3 meters to 6 meters around the actual target location :
  T3 = 3
- from 6 meters to 9 meters around the actual target location :
  T3 = 2
- from 9 meters to 12 meters around the actual target location :
  T3 = 1
- above 12 meters from the actual location :
  T3 = 0

Task 4 *Drop sensor*

$T_4 = 0, 2, 3$ or 4

The drop zone is a circle of radius 20 meters which center is located by GPS coordinates. If sensor is dropped :

- within 5 meters from the drop zone center : T4 = 4
- from 5 meters to 10 meters around the drop zone center : T4 = 3
- from 10 meters to 20 meters around the drop zone center : T4 = 2
- above 20 meters from the drop zone center : T4 = 0

Task 5 *Fly through arches 1 and 2*

T_5 = 0, 1, 2 or 4

Balloons arches are 6m x 6m arches distant from each other by 100 m. Since the balloons arches simulate an urban canyon, both arches will be aligned and should be flown through, in any order, on the occasion of a single attempt. However, if only one arch is flown through, 1 point will be granted. If the two arches are flown through on the occasion of two different attempts, 2 points will be granted.

Task 6 *Land and take-off on platform*

T_6 = 0, 2 or 4

Task 6 aims at promoting the capability of micro air vehicles to perch on platforms located outdoor. The platform is a 1.2 m diameter disk placed horizontally at 1.5 m from the ground and located at distance of 100 m from the launch zone. Task 6 will be successful if take-off occurs 3 seconds minimum after landing.
Only 2 points will be awarded if the vehicle fails to take-off after landing (e.g. because of a rough landing or any other reason).

Task 7 *Land in landing zone*

T_7 = 0, or 2

Landing should occur within the prescribed landing zone defined as a 20 m radius circle. “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 a 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.