



2016 Competition Rules

Version: 2
Date: 03 February 2016

NOTICE TO COMPETITORS

This document is subject to change by the UAV TURKEY competition committee. The current version of this document will be available from the UAV TURKEY [website](#). Registered participants will be notified of any changes.

The rules have been designed to address safety and motivate and encourage teams for "fair play" and enjoyment. There is an expectation that **High School/University** teams will participate in the UAV TURKEY with a desire or passion to compete within the spirit of challenge and not to exploit loopholes for an unfair advantage. It is possible for the participating teams to notify the competition committee in case they observe any inconsistency and risk in the rules.

GLOSSARY

Geofence: A specified boundary in the airspace that must not be crossed by a competing UAV.

Flying Zone: The horizontal and vertical area up to 300 feet above ground level (AGL) of the course in which all flying must occur.

Buffer Zone: The horizontal and vertical area between 300-400 feet AGL of the course in which flying is not desired, and each team's UAV may only enter once during each race, two or more violations result in disqualification of the flying team from that race.

No Fly Zone: The horizontal and vertical area above 400 feet AGL which if entered by a flying UAV will result in disqualification of the flying team from the competition.

Fail-Safe System: A mandated system on-board all UAVs that guarantees that UAV will not fly outside a Geofence boundary and land in case of any emergency.

Competition Committee: The committee managing the UAV Competition.

Flight Coordinator: The member of the Competition Committee in charge of the flight operations.

Judges: The members of the Competition Committee in charge of evaluation of the flight operations.

Team: The group consisting of up to 10 undergraduate and graduate students from high schools and universities at any level.

Team Advisor: The academician from the applying university (at any level) or teacher from the high school who represents the team.

Team Captain: The team member who represents the team.

UAV Pilot: The team member in command of the UAV.

OBJECTIVE

The goal of the UAV TURKEY competition is to demonstrate the utility of Unmanned Aerial Vehicles (UAVs) for civilian applications, particularly in the applications that will help people in any emergency such as fire or accident. In this competition, participating teams will develop a UAV (either fixed or rotary wing) that possibly helps people in any emergency case by quickly and accurately transporting equipment to predetermined places in the competition area.

SCOPE

High school/University teams will design and fabricate UAVs, and demonstrate the flight capabilities of their vehicles in the specified missions. All these processes will be evaluated throughout the competition schedule. Teams may solicit and accept sponsorship in the form of funds, materials and components from companies.

COMPETITION CATEGORIES

UAV Group 1:

Fixed wing electric powered UAVs

UAV Group 2:

Rotary wing electric powered UAVs

UAV REQUIREMENTS

Weight: Maximum 4 kg take-off gross weight including payload

Battery type and capacity: No restriction

Radio control: There is no restriction for frequency, but it must have a fail-safe mode that is automatically selected during loss of the communication signal.

Payload: A rigid object with minimum 100 gr mass in cubic (5 cm x 5 cm x 5 cm) shape.

- The vehicle will carry 4 objects at the same time. So, the total payload will be equal to or heavier than 400 gr. No structure or component may be dropped from the aircraft during flight. Any loss of item or change in the form of vehicle and payload objects will result in failure of the trial.

UAVs must have genuine design and fabrication. The genuineness of the vehicle will be explained in the detailed design report and the judges will consider it during the evaluation of the report. Also, it will be checked throughout the technical inspection before the competition.

The Fuse: There must be a fuse outside the UAV in order to turn of the electric propulsion system in any

case of emergency.

TECHNICAL INSPECTION:

The UAV must remain substantially the same as described and explained in the report. You may necessarily make small modifications in the design to enhance flight performance after the report submission. The design of the UAV given in the report will be controlled and verified during the inspection.

Safety:

All UAVs will undergo a safety inspection prior to the competition or practice flight. All decisions of the safety inspector are final.

Safety inspections will include the following as a minimum.

- Physical inspection of vehicle to insure structural integrity.

 - Verification of all components are adequately secured to UAV. Verification of all fasteners are tight and have either safety wire, adhesive (fluid) or any lock nuts. Clevises on flight controls must have an appropriate safety device to prevent their disengaging during the flight.

 - Verification of propeller structural and attachment integrity.

- Visual inspection of all electronic wiring to assure adequate wire gauges and connectors in use.

 - Radio range check, motor off and motor on.

 - Verification of all controls can move in the proper sense.

 - Inspection of general integrity of the payload system.

All aerial vehicle radios must have a fail-safe mode that is automatically selected during loss of communication signal. The fail-safe will be demonstrated on the ground by switching off the RC transmitter radio. When fail-safe is engaged, the aerial vehicle receiver must select the configuration (if so equipped):

For the **Fixed Wing** Vehicle:

 - Throttle closed Full

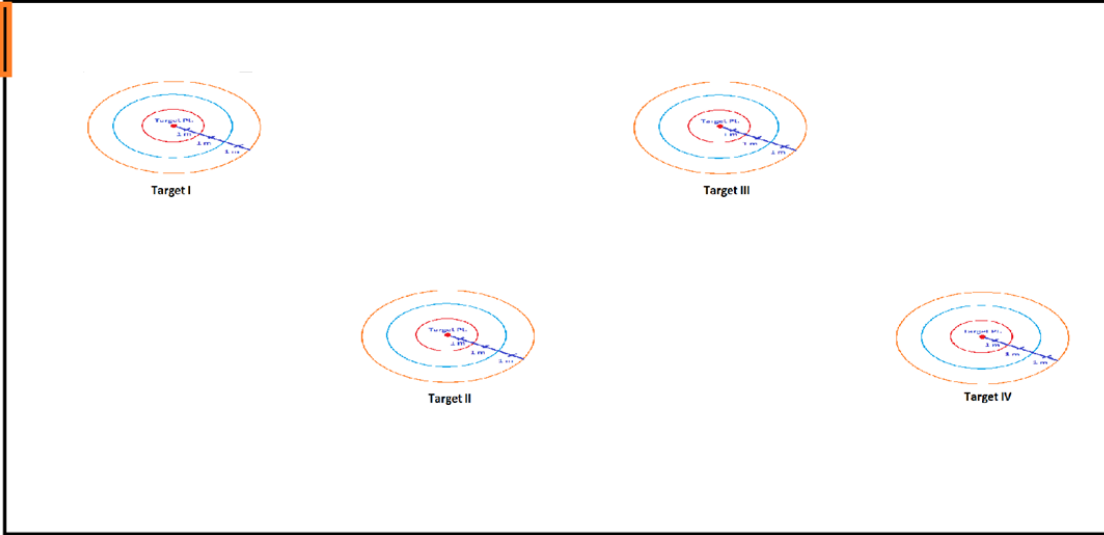
 - up elevator Full

 - right rudder

 - Full right (or left) aileron

 - Full flaps down

Start/Finish Line



*Dark blue circles with 3 m radius represent the area where the target points are the center points.

** Red points represent the 5 m tall masts which are 4m away from the target points.

General Rules for the Missions:

All flight modes are accepted for takeoff and landing. Visual flight is not allowed in the mission phases. In other words, excluding takeoff and landing phases, video piloting (FPV) and/or autonomous flight techniques should be used during the mission phases.

Each team has totally 3 rights to fly for all the Missions. Take off means the usage of one right.

Flight orders of teams will depend on the rank of points teams have in detailed design report evaluation.

The team with maximum report point will fly first. Any team that cannot take off in 5 minutes loses its order and can fly after the last team in order, if there is enough time during the competition.

Each mission must be finished in 6 minutes after taking off. The time difference between passing the start and finish lines will be the flight time. In this time interval, UAV must fly higher than 5 meters above the ground. Flying lower than this height means failure in the Missions.

Second mission cannot be flown until the team becomes successful in the first mission.

Protest Procedure:

Teams may lodge protests to the Competition Committee at any time throughout the competition. Protests must be lodged on written documents that are signed by the team advisor. In case the team advisor is not present at the competition area physically, s/he may email a signed protest to the team for them and the team may use it as an approval of their protest.

Protests and penalties (up to disqualification from the competition for deliberate attempts to misinform officials, violate the contest rules, or safety infractions) will be decided by the Competition Committee.

COMPETITION AIRFIELD

It will be announced later. We try to arrange a place in or close to Istanbul city.

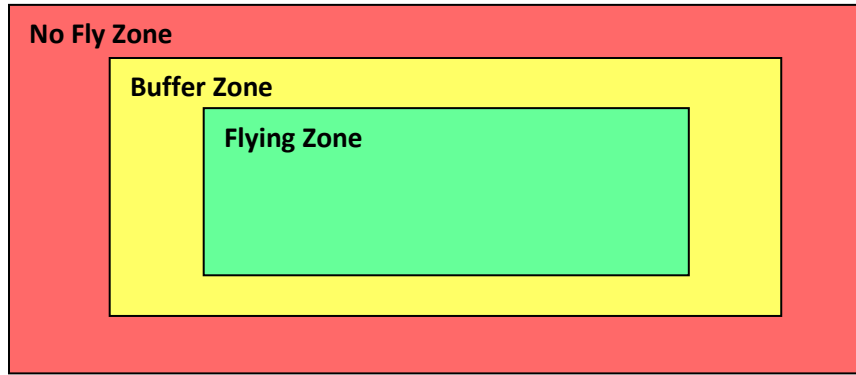
Facilities:

Parking lots

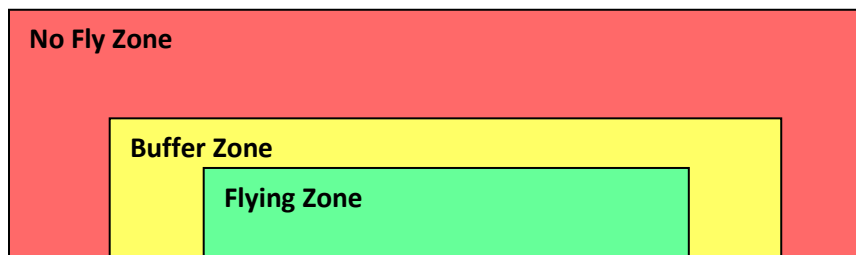
Electric-power

Cafeteria (and free lunch)

Description of the flight zones:



Horizontal



Vertical

CONCEPTUAL/DETAILED DESIGN REPORT

FORMAT Writing format: 10-pt Arial font in pdf.

Electronic reports must be less than **15 MB** in size (including encoding for e-mail transmission) The main document will not exceed **60 pages****, including all the report documents.

The Rubric: (Totally 100 points)

1. Executive Summary (10 points)

Describe your key mission requirements and design features relevant to those requirements.

Document the performance/capabilities of your system solution.

2. Management Summary (5 points)

Describe the organization of the design team.

Provide a diagram of design personnel and assignment areas.

Provide a timetable showing planned and actual timing of the design/fabrication/testing processes.

3. Conceptual Design (15 points)

Describe mission requirements (problem statement).

Translate mission requirements into design requirements.

Review solution concepts/configurations considered.

Describe concept weighting, selection process and results.

4. Preliminary Design **(20 points)**

Describe design/analysis methodology.

Document design/sizing trades.

Describe/document mission model (capabilities and uncertainties).

Provide estimates of the UAV lift, drag and stability characteristics.

Provide estimates of the UAV mission performance.

5. Detail Design **(30 points total. 15 points for discussion items, 15 points for drawing items)**

Document dimensional parameters of final design.

Document structural characteristics/capabilities of final design.

Document systems and sub-systems design/component selection/integration/architecture.

Document Weight and Balance for final design. Must include a Weight & Balance table for the empty aerial vehicle and with each of the possible payloads.

Document flight performance parameters for final design.

Document mission performance for final design.

Drawing Package, 3-View drawing with dimensions.

Structural arrangement drawing.

Systems layout/location drawing.

Payload(s) accommodation drawing(s).

6. Manufacturing Plan and Processes **(5 points)**

Document the process selected for manufacture of major components and assemblies of the final design.

Detail the manufacturing processes investigated and the selection process/results.

Include a manufacturing timetable showing scheduled and actual event timings.

7. Testing Plan **(5 points)**

Detail testing objectives, schedules, and check-lists.

8. Performance Results **(10 points)**

Describe the demonstrated performance of key subsystems and compare it to predictions stated in 5.

Explain any differences and improvements made.

Describe the demonstrated performance of your UAV solution and compare it to predictions stated in 5.

Explain any differences and improvements made.

*Report scores will not be available until the pilot briefing at the beginning of the competition.
 **The reports exceeding 60 pages will get -10 points.

The Conceptual Design Report includes the first 3 subjects (Executive Summary, Management Summary and Conceptual Design). The Detailed Design Report includes all the subjects.

SCORING

Report	Mission 1	Mission 2	Total
30	30	40	100

Mission	Formula
I	$20x(t_{min}/t_{tm}) + 10x(G_{tm}/G_{max})$
II	$10x(t_{min}/t_{tm}) + 15x((W_{pl}/W_0)_{tm}/(W_{pl}/W_0)_{max}) + 15x(T_{tm}/T_{max})$

t_{min} : The time of the team finished the course in the shortest time. t_{tm} : The time of the team.

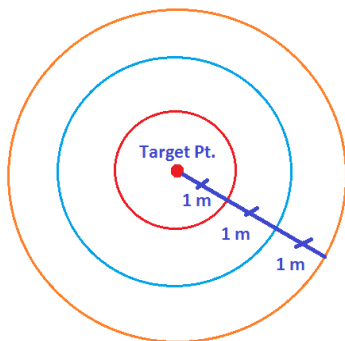
G_{tm} : Number of the gates the team passes properly.

G_{max} : Number of the gates the team passes maximum number of the gates properly. W_{pl} : Weight of the payload the UAV has.

W_0 : Empty weight of the UAV.

T_{tm} : Total point the team has from the target points.

T_{max} : Total point of the team having maximum point from the target points.



Distance(D) to the target point (meter)	Mission II Target Point
$D \leq 1$	15
$1 < D \leq 2$	12
$2 < D \leq 3$	9
$3 < D$	3

TIMETABLE

Activity	Deadline
Application(starts 25.01.2016)	29 February 2016
Submission of conceptual design report	26 March 2016
Announcement of the qualified teams	15 April 2016
Submission of detailed design report and flight video	22 July 2016
Announcement of the qualified teams for the competition	18 August 2016
Competition	21-25 September 2016

FINANCIAL SUPPORTS

For the Teams from out of Turkey:

After the evaluation of the Detailed Design Report, the names of the teams that are invited to the competition will be announced. The teams who attend to the competition will get 5,000 TRY as a travel and accommodation support.

For Turkish Teams:

After the evaluation of the Conceptual Design Reports of teams, the teams accepted to prepare Detailed Design Report will get 2,500 TRY in order to build their vehicles.

After the evaluation of the Detailed Design Reports of teams, the teams invited to the competition will get 1,500 TRY in order to improve their vehicles.

The teams who attend to the competition will get 2,500 TRY as a travel and accommodation support.

*The money for building and improving the vehicle will be transferred to the Team Advisor's bank account.

REWARDS

There is performance cash prize for each category:

Rank	Prize (TRY)
1st	20,000
2nd	15,000
3rd	10,000

Up to 9 teams among all teams can get **Honorarium**, 2,500 TRY. The team that gets the maximum point from the Detailed Design Report will be awarded 2,500 TRY cash prize.

ACCOMMODATION

There are many hotels nearby the airfield.

TRANSPORTATION

There will be shuttle between some main points of the city and the airfield. The points will be announced before the competition.

COMMUNICATIONS

Point of contacts: uavturkey@tubitak.gov.tr

Website: uavturkey.tubitak.gov.tr