

# **2017 INTERNATIONAL UAV TURKEY COMPETITION**

## **COMPETITION RULES MANUAL**

### **PARTICIPANTS INFORMATION**

**Updated:29.03.2017**

The rules manual contains binding technical rules issued by UAV DDK (State Supervisory Council); and relevant Head of Department's/Directorate's administrative principles that shall be followed up to the end from announcement of the competition. All participating teams are deemed to have agreed to comply with these rules in advance. The Scientific and Technological Research Council of Turkey (TUBITAK) retains the right to make amendments to these rules, if required.

The rules; aims to motivate the teams in order to conduct an event in the "fair play" and entertaining context and in safety, in particular. UAV Turkey Competition is desired to be held with High School/University teams in the fighting spirit however against the unfair competition.

In order to ensure the competition to achieve desired objective all precautions have been taken and all kinds of work to protect the rights of all competing teams, in depth, (sufficient number of expert referees, binoculars, radio, etc.) have been carried out.

# COMPETITION RULES MANUAL

## CHAPTER ONE

### ADMINISTRATIVE PRINCIPLES FOR THE PARTICIPANTS

#### Objective

**ARTICLE 1 – (1)** Unmanned Aerial Vehicle Competition aims to raise social awareness about the unmanned aerial vehicles, increase cooperation regarding this field between the industries and universities and promote R&D activities.

**(2)** The objective of Administrative Rules thereof, is to specify the administrative aspects of the competition to be held under the Unmanned Aerial Vehicle Competition Event.

#### Scope

**ARTICLE 2 – (1)** Administrative Principles thereof, cover the administrative principles concerning technical, financial, administrative rules and processes regarding the applicant teams to be participate the competitions in the scope of the Unmanned Aerial Vehicle Competition Event, TUBITAK support for competing teams, planning, holding and rewarding the competition organizations.

#### Legal Basis

**ARTICLE 3 - (1)** Administrative Principles thereof, amended pursuant to the Article 2 of the Regulation on the Establishment of the Scientific and Technological Research Council of Turkey dated 17/07/1963 and numbered 278 and the Directive on Activities to be carried out by the Directorate of Science and Society of the Scientific and Technological Research Council of Turkey.

#### Definitions and Abbreviations

**ARTICLE 4 - (1)** Notwithstanding that the terms and definitions in the Directive are valid in the framework of the Administrative Principles, thereof, some definitions that specific to this program may have a detailed description or different name in accordance with the general definitions given in the Directive. Definitions of the Administrative Principles are given below:

**a) Presidency:** Presidency of Scientific and Technological Research Council of Turkey,

**b) Scientific Board:** Scientific Board of Scientific and Technological Research Council of Turkey defined by Regulation No. 278,

**c) Announcement of Events:** Announcement text describing the event, scope, submission conditions, amount of support and event schedule, determined by the Presidency, and specifying the special aspects of the event, or exceptional aspects for the articles subjected in the procedures and principles, where necessary,

**d) Advisory and Evaluation Board:** Renders its services in the related directorate and established by the TÜBİTAK Presidency in order to benefit from the opinion on issues related to the Unmanned Air Vehicle Competition Event,

**e) Support Program:** Unmanned Aerial Vehicle Competition Event,

**f) Directorate:** Directorate of Unmanned Aerial Vehicle Competition Event

**g) Team:** Group comprises of academic advisor, team captain and team members,

**h) Team Leader:** The person who is responsible for the communication with TUBITAK determined by the team in accordance with its needs and who is obliged to be in the competition venue in registration and technical controls during the competition week,

**i) Academic Advisor:** An academician working full-time in the university, and consults the team in the scope of the competition, takes responsibility for the administrative and financial aspects of the team,

**j) Academic Custodian:** A full-time teacher, authorized by the academic advisor for high school teams and obliged to be present in the competition venue with the team members during the competition week,

**k) Application File/Documents:** Files and documents submitted to TUBITAK between the announced dates and prepared in accordance with the content and form determined by TUBITAK,

**l) Letter of Undertaking:** Written agreement and annexes signed after the support decision of TUBITAK, between TUBITAK with executive institution/organization and project coordinator pursuant to the Procedures and Principles, thereof,

**m) TÜBİTAK:** The Scientific and Technological Research Council of Turkey,

**n) Directive:** Directive on Activities to be carried out by the Directorate of Science and Society of the Scientific and Technological Research Council of Turkey.

### **Competition Announcement**

**ARTICLE 5 - (1)** Announcement will be done after the approval of the work schedule, budget design, event rules manual, application form, and the contract, by the Presidency. The applications will be made within the framework of the procedures and principles specified in the announcement.

**(2)** The application file/documents prepared in the framework of the announcement text shall be submitted to TUBITAK in full within the specified period together with the application form and its annexes prepared by TUBITAK.

## **Application Requirements**

**ARTICLE 6 - (1)** The terms and conditions of application will be indicated in the announcement text within the scope of the support program. Competition can also be participated by friendly and allied foreign country teams. TUBITAK has the right whether to accept the submissions, team captains, and some of the members of the teams applying for the competition. In case of academic advisor, captain, one or more members of a team are rejected by TUBITAK; the team may still apply by superseding the rejected members.

The announcement for the submission will be published on the web site. Online submission will be received over the specified link. However, the original signed Letter of Undertaking will be delivered to the Directorate of Science and Community Programs.

**(2)** Academic Advisors of Turkish Teams who will take part in the application must be resident in Turkey and must be the permanent staff of the applicant organization/institution.

## **Letter of Undertaking**

**ARTICLE 7 – (1)** Advisory and Evaluation Board will review the applicant teams; and submit the list of teams meeting the conditions to the head of department. Head of Department will present the list of eligible teams to the Presidency. Accepted teams will be announced following the Presidency approval.

**(2)** Teams that decided to be supported will be notified by mail to the Academic Advisor.

**(3)** The support and support amounts to be given to the accepted teams will be finalized by the approval of the President, taking into consideration the budgets and assessment scores that are assigned for the support.

**(4)** The agreement determine the administrative, financial, technical and legal provisions of the teams that are decided to be supported and the liabilities of the parties will be signed between the academic advisor on behalf of the university that local teams are belong and the team advisor of the foreign teams with TUBITAK.

**(5)** A Letter of Undertaking along with the Conceptual Design Report will be requested from the approved teams. The teams submit Conceptual Design Reports without a letter of undertaking will not be included in the evaluation.

## **Competition Organization**

**ARTICLE 8 – (1)** Vehicles belong to the team will be subjected to a technical control by the Advisory and Evaluation Board as specified in the event guide before the competition and the teams will be requested to submit conceptual and detailed design reports. Teams who receive required score (50 points or more) from the reports will be invited to participate the competition. Teams who pass the technical control will be entitled to participate in the flight stage of the competition.

## **Evaluation**

**ARTICLE 9 - (1)** The performances of the vehicles participating in the competition are evaluated by the Advisory and Evaluation Board according to the criteria previously determined by the Advisory and Evaluation Board.

**(2)** As a result of the evaluation made by the Advisory and Evaluation Committee, the teams are ranked according to their scores in different categories and presented to the head of the department. The teams deemed worthy of an award by the head of department will be awarded.

## **Financial provisions**

**ARTICLE 10 - (1)** The support items included in the regulations of the teams to be supported will be indicated in every event announcement made within the scope of this program. TÜBİTAK has the right whether to accept the awarded teams to receive prize from other institutions.

## **Support Amount**

**ARTICLE 11- (1)** The upper limit of the amount of support that can be given to the teams covered by this event schedule will be determined by the Scientific Board. For each announcement, the amount of support will be determined by the Presidency provided that not exceeding the upper limit determined by the Scientific Board, and is stated in the event announcement.

**ARTICLE 12 - (1)** In cases where there is no provision in the Regulation on the Establishment of the Scientific and Technological Research Council of Turkey dated 17/07/1963 and numbered 278 and the Directive on Activities to be carried out by the Directorate of Science and Society of the Scientific and Technological Research Council of Turkey for the support of the participating teams, action will be taken in accordance with the decision of the Scientific Board.

## **Validity**

**ARTICLE 13 – (1)** These Administrative Principles are valid for the competitions within the period in which they are published.

## **Implementation**

**ARTICLE 14 - (1)** The provisions of these Principles will be executed by the UAV Advisory and Evaluation Board.

## **OBJECTIVE**

The objective of the UAV TURKEY Competition is to demonstrate the availability of Unmanned Aerial Vehicles (UAVs) to be used in civilian and military applications to help people and protect environment using techniques of autonomous flight, image recognition, etc.

## **SCOPE**

High school/University students will design and manufacture UAVs and will demonstrate the autonomous flight, image capture and recognition skills of their vehicles in the specified missions. All these processes will be evaluated during the competition schedule.

Teams are free to receive financial and / or in-kind support sponsorship from the companies. No separate venue will be allocated for sponsors; mass use areas shall not be used for advertising purposes. Sponsor materials can be placed on the tables allocated to the teams and the vehicles.

### **Competition Categories:**

#### **UAV Group 1**

Electric motors UAVs with fixed wing

#### **UAV Group 2**

Electric motors UAVs with rotary wing

#### **UAV Specifications**

**Weight:** Maximum 4kg including total load.

**Battery type and capacity:** No limitation.

**Radio control:** There is no limit for frequency. However, in case of signal loss it should be capable of switching to fail-safe mode automatically.

**Autonomous:** The aerial vehicle can make manual take-off and landing maneuvers, but the mission flight shall be carried out autonomously. Within 10 seconds after the take off, the vehicle must switch to autonomous flight. Teams can autonomously perform all phases of the flight mission, including landing and take-off.

**Load:** For the second mission, a 50gr solid cube shaped (3cmx3cmx3cm) object with 3 different colors and a parachute for each cubes will be used. Prior to the flight mission teams will be given the loads by TUBITAK and they will be taken back after the flight. The loads will be mounted on the vehicle, in a way to be dropped down during the flight mission. No

components or parts from the vehicle must fall during the flight. Mission attempt will be considered unsuccessful at any loss of a part or load or deformation on the vehicle.

UAVs must have original design and built. The authenticity of the vehicle will be disclosed in the reports and the referees will take this into account when evaluating the reports. In addition, the authenticity will be checked at technical controls before the competition.

**Safety Fuse:** A safety fuse must be mounted outside the vehicle to shut down the electrical system in case of any emergency. In other words, the fuse should be mounted on the exterior surface of the vehicle and should be easily accessible.

### **Technical Control**

UAV should remain the same as described and defined in the reports as much as possible. After the presentation of the reports, minor corrections to improve the flight performance of the vehicle are allowed. During the control, compliance of the UAV -given in the report- with the design will be examined. It is mandatory for each team to have a hard copy of the Detailed Design Report submitted to TUBITAK before the competition. Design Reports will be checked during registration and teams that do not submit a hard copy of their reports will not be registered and will not be able to enter technical control. The hard copy of the Detailed Design Report will be used during the technical control. Any objections made directly to the Technical Control Jury or Referee during the Technical Control will not be assessed.

### **Safety Control**

All UAVs will be subjected to the safety control prior to trial or competition flights.

The decisions of the safety inspectors are final. The team that fails to pass the safety control cannot fly.

The following are the minimum inspections that will be made during safety controls:

- Determining whether the vehicle is compatible with the technical drawings shown in the team's final report of the competition;
- Inspection of the vehicle safety in terms of structural/visual integrity;
- Determining that all components are safely installed in the UAV. Detection of all connections fixed tight with safety seal, liquid adhesive and/or nuts. Connection materials should be selected so that the connection fails will be prevented during the flight;
- Detection of structural and connection integrity of the propeller;
- Inspection of all electronic wiring to ensure that wires and connectors are used of sufficient thickness;
- Radio signal range control, engine on and off;
- Detection of whether all control mechanisms of the UAV have sufficient sensitivity;

- Examination of the overall integrity of the load system;
- All vehicles must be capable of switching automatically to fail-safe mode in the case of signal loss;
- The fuse must be placed at the external surface of the UAV that can be easily accessed;
- All aircraft radios must have a fail-safe mode that is automatically selected during loss of radio signal. The fail-safe will be demonstrated on the ground by switching off the transmit radio. During fail-safe the aircraft receiver must select:

#### **Vehicle with fixed wings:**

- Throttle closed
- Full-up altitude
- Full-right rudder
- Full-right (left) aileron
- Fully closed ailerons

#### **Vehicle with rotary wings:**

- Controlled landing with half throttle
- Throttle closed (in the case of the referee's order)
- Radio Fail Safe mode is absolutely mandatory.

Fail Safe mode is explained clearly and while the inspection any protest and excuse will not be accepted. Vehicles that cannot pass the fail-safe inspection will not be accepted to flight mission line.

### **Missions**

Fixed wing UAVs and rotary wings-UAVs will perform the same missions. Each vehicle will be evaluated in its own category as fixed wing or rotary wing.

#### **Mission 1:**

In this mission autonomous flight and image-processing capabilities of the UAV will be tested.

In the course of the mission flight, UAVs will fly over a pattern with 16 (1m x 1m dimensions) cells in the form of a 4x4 matrix. Each cell can take 3 different colors. UAVs must have a system that can determine and record the colors of the cells. This process will be done three times and for each step the pattern cell colors will be changed randomly. For each step the colors of the cells will remain stationary for 10 seconds and time interval between steps is 5 seconds. While the time interval the color of the all cells will be same. (RGB and corresponding cell codes will be published on the web site).

The colors of the cells for each step must be recorded to the SD card circuit that will be given by TÜBİTAK before the mission flight. The SD card will be taken after the mission flight by the judge and the mission score will be determined after the reading of the cell color records. After the mission flight the weight of the UAV will be determined by using a scale.



Flying zone boundaries, runway and pattern positioning are shown below. Detailed measurements of the competition area will be published on the web site in future.



**Flying Zone:** Space required for all flight tasks, from 100 m x140 m horizontal to 50 m from ground level.

**Buffer Zone:** The area which surrounds the Flying Zone from both sides at a distance of 8 meters and lies horizontally at a distance of 50-70 m. Teams can enter only once in this area at one sortie. If a team enters in this area more than once, the team will be deemed unsuccessful from that mission.

**No Fly Zone:** Area 116 m X 156 m horizontally and 70 m vertically. If a vehicle enters in this area, the team will be deemed unsuccessful from that mission.

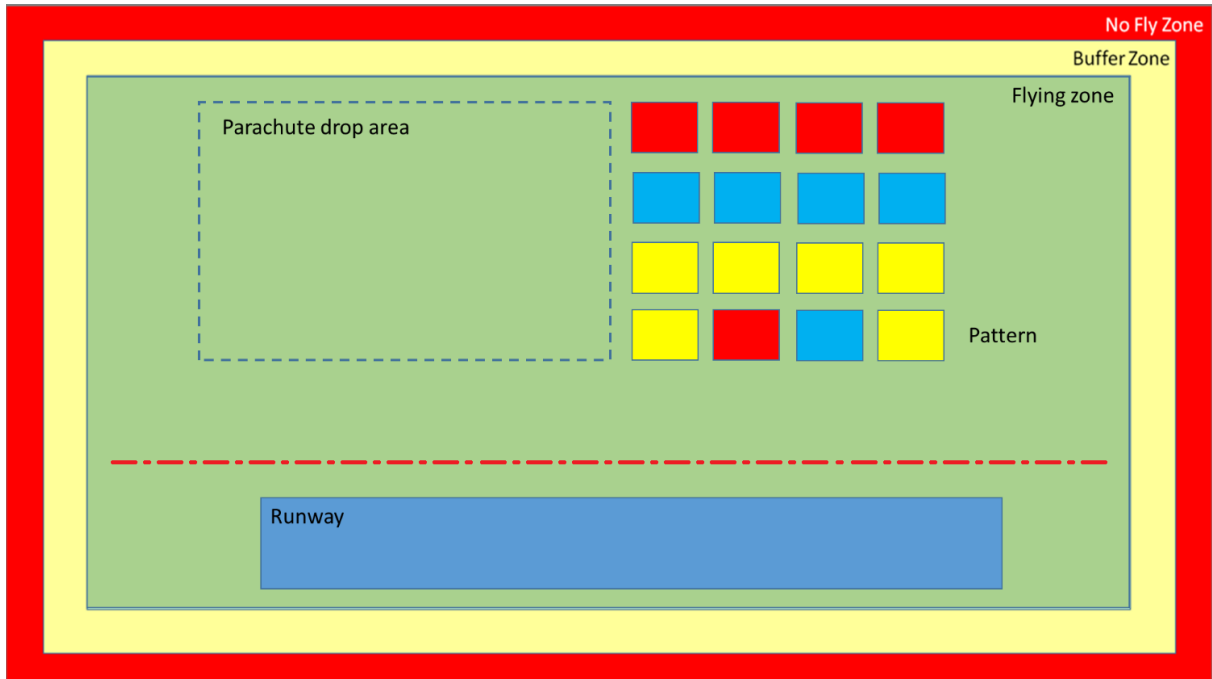
The minimum flight altitude will be 5 meters, the maximum flight altitude will be 50 meters. However, in all cases, the authority can terminate the flight for safety reasons.

**Mission 2:**

In this mission, the aerial vehicle will be tested for autonomous flight, image-processing and orderly load-releasing capabilities.

In the course of the mission flight, UAVs will fly over a pattern in the form of a 4x4 matrix and that can take 3 different colors for each cell. The first 3 rows on the pattern will be painted in 3 different colors, providing that each row has a single color, and the last row will be scrambled (RGB and corresponding cell codes will be published on the web site). UAVs are required to determine the color of the pattern rows and drop the parachutes in the drop area with at least 5 seconds intervals based on the recognized color sequence. Loads dropped less than 5 seconds after the previous drop will be considered as not dropped.

Flying zone boundaries, runway, load drop zone and pattern positioning are shown below. Detailed measurements of the competition area will be published on the web site in future.



There is no predefined route constraints for Mission 1 and Mission 2.

Each team has the right of 3 sorties for all flight missions, in total. Namely, the take-off of the aerial vehicle for the mission flight means using one of these rights.

The flight orders of the teams will be determined according to the score they receive from the detailed design report.

The team with the highest score will fly first. The team that cannot take-off within 5 minutes will lose their turn. Each mission must be completed within 6 minutes after the take-off.

Time elapsed between Start and Finish lines will be flight time.

The second mission flight cannot be performed unless the first mission is successfully completed.

The UAV Pilot must be a team member and a student. If needed, a pilot will be provided in the competition time. Student certificate will be requested from team members and team's pilots. When registering for the competition, students must present their student certificates (original signed and sealed by the Student Affairs or School Administration). The statement of studentship will be based on the application date. Teams of which any of the members are found not to be a student, including the pilot, will be disqualified from the competition.

In addition, UAV and the pilot must be registered at <http://iha.shgm.gov.tr/index.html> web address. Applications of the teams that do not have approved pilot registration in the subscription process will be considered invalid. The teams must register their vehicles on the relevant website of Directorate General of Civil Aviation (SHGM) and receive approval by 9 July 2017. In case of problem originated from SHGM in approval process TUBITAK Jury will decide on team's status. Applications of the teams without UAV registration approval

will also be considered invalid; they will not be able to participate in the competition and they will be requested to refund the support amount. Teams are fully responsible for unapproved UAV registration until the specified date. Teams are liable to take the necessary precautions. TUBITAK takes approval date into consideration for the registration instead of the application date. During registration on the day of the competition, the teams must submit documents from the SHGM indicating the Pilot and the UAV registration approval. Teams with no document or missing documents will not be registered and therefore will not be able to compete. Hence, TUBITAK has the right to demand support refund from teams that cannot participate in the competition.

### **Objection Process**

Teams may object to the Competition Committee at most within an hour after the incidence is ascertained during the competition.

Objections must be made in written documents signed by the team's Academic Advisor and Team Captain.

Objections and penalties (actions that may cause disqualification such as misinforming the officials, violation of competition rules or safety, etc.) will be taken under review by the Competition Committee.

Each team has maximum of 3 rights of objection. Non-ethical behaviors will be taken into consideration according to the letter of undertaking.

Objections from the teams without their Academic Advisor present in the competition venue will not be evaluated, and no objection will be accepted by e-mail.

Objections will be evaluated and declared as soon as possible. Objection results will be disclosed by the Management/Registration Office. It will not be delivered additionally via email.

Objections can be made until the evening of last day of the competition. No objections will be accepted on the day of award ceremony.

### **Competition Venue:**

Competition area dimensions and location will be posted later on the website.

### **Other:**

Team members who exhibit any verbal or written unethical behavior in such a way to disrupt the comfort of the competitors or competition officials before, during and after the competition may cause his team to be disqualified.

The Conceptual Design Report and the Detailed Design Report submitted after the last announced deadline will not be admitted and these teams will not be able to participate in the competition.

Academic Advisors of the teams have to be full-time faculty members of the university they are affiliated with. When registering for the competition, they must submit their documents (originally signed and sealed by the Rector's office). Teams of which academic advisors do not submit their documents during registration will be disqualified from the competition. Advisory by proxy will not be accepted during registration. Teams registering with proxy advisor instead of the Academic Advisor will not be allowed into the competition. Being an Academic Advisor of more than one team is not allowed.

The Academic Advisor of the high school teams must be a full-time faculty member of a university. Only high school teams are allowed to attend competition with Academic Custodian or with the Academic Advisor. Academic Custodians of the high school teams must be full-time teachers of the applicant high school. They must submit their documents (with original sign and seal of the province/district Directorate of National Education (MEM)) while registering for the competition.

Technical controls will be carried out before and after each flight. Accordingly, the vehicle, which damaged or lost its parts (UAVs with compromised integrity) during the flight, will be assessed by the referee group.

The referee group will decide whether the mission is completed successfully and the participation in the following flights.

Air Vehicle's empty weight will be weighed before and after the mission flight. 10gr margin of error can be accepted. Mission will be deemed unsuccessful for the weight more than 10gr.

On 13<sup>th</sup> of July, 2017 at 9:30 am before the competition the team pilots will be given briefing.

The number of student team members should be 2 at least and 10 at most.

Teams will not be allowed to add members after the application finalized. One person can only be a member of one team. As proven otherwise, the related teams will be disqualified from the competition.

The teams who are not present in the competition venue from the beginning until the end of the Award Ceremony **will not be given** Participation Certificates, Plates, Medals and Awards. Team members must be present at their assigned tables at the competition venue one hour before the Award Ceremony. Teams that are not in the competition area until the end of the Award Ceremony will not receive Participation Certificates, Plates, Medals and Awards via cargo or mail. Their relevant requests will not be considered. TUBITAK has the right to demand support refund from teams who left the venue before the award ceremony.

Academic Advisors must be present with their teams during the registration before the competition and in the course of the competition. Otherwise, teams without an Academic Advisor will not be registered and will not be able to enter technical control, therefore they will not be able to compete.

During the competition, each team will have a right for maximum 3 test flights.

**Facilities:**

Parking place

Electricity (power outlet)

Cafeteria (free lunch)

**Flight Zone:**

Information will be provided after the Competition Runway is assigned.

**Conceptual / Detailed Design Report Format****Print format: 10-pt Arial, PDF.**

The size of electronic reports should be less than 20 MB total. Each report must not exceed 60 pages. Reports must be prepared in English due to the international nature of the competition.

The reports of the teams that do not send the flight video along with the Detailed Design Report will not be included in the evaluation.

The Conceptual and Detailed Design Report titles and the evaluation chart will be also posted on the website, as attachment.

Detailed Design Report score rating will be announced in the first day of the competition before the flights.

The Detailed Design Report of the team with the highest score will be announced on the website.

**Financial Supports**

For teams from out of Turkey (foreign teams):

Each team who entitled to participate and attend the competition will be given TRY 5,000.00 as travel and accommodation support. This amount will be delivered by hand after the award ceremony.

TUBITAK is not responsible for foreign teams' accommodation, transportation and possible customs procedures.

**For Turkish teams:**

Each team that continues to competition as a result of the evaluation of their Conceptual Report will be given an incentive award of TRY 1,500.00 for the purpose of constructing their vehicles.

Each team that entitled to participate in the competition as a result of the evaluation of their Detailed Design Report will be given an incentive award of TRY 2,500.00 in order to make improvements on their vehicles. Rotary and Fixed Wings will be evaluated separately.

Each team participating the competition will be given TRY 2,500.00 support for the travel and the accommodation.

The Incentive Awards for the construction and improvement of the vehicle will be deposited into the accounts of the teams' university. Invoicing is imperative in the event of the use of the given support.

Teams do not submit their Detailed Design Report after submitting Conceptual Design Report will be requested to return TRY 1.500,00 of Incentive Award.

Teams do not register into the competition after submitting their Detailed Design Report will be requested to return TRY 5.000,00 (Detailed Design support and Transportation/Accommodation support) of Incentive Award.

#### Awards

The following prizes will be awarded to teams rank in their own category:

#### Ranking Prizes (TRY)

1. TRY 10,000.00 TRY
2. TRY 7,500.00 TRY
3. TRY 5,000.00 TRY

Up to 10 of all teams will be awarded TRY 2,500.00 of Mention Award in line with the selections of the jury. In addition, two teams with the highest score in the Detailed Design Report (one for Fixed Wing Category and one for Rotary Wing category) will be rewarded for Best Detailed Design Report with TRY 2,500.00 TRY.

#### **Competition Calendar**

December 1, 2016 - January 20, 2017 Receipt of Applications

January 28, 2017 Announcement of Approved Applications

January 28 - February 27, 2017 Conceptual Design Report and Letter of Undertaking Delivery

March 27, 2017 Announcement of the Results for Conceptual Design Reports

March 27 - April 28, 2017 Deadline for the Detailed Design Reports (

March 27 - May 10, 2017 Deadline for Flight Videos Delivery

May 12, 2017 Announcement of the Results for Detailed Design Reports

## **WEEKLY PROGRAM**

### **REGISTRATION DAYS AND HOURS:**

**DAY 1** (Registration, Technical Control and Flights All Day) - **July 13, 2017**

**09:00-12:30/13:30-17:00** Registration, Technical Control and Flights

**DAY 2** (Registration till noon, Technical Control and Flights All Day) - **July 14, 2017**

**09:00-12:30** Registration

**09:00-12:30/13:30-17:00** Technical Control and Flights

**DAY 3** (Registration till noon, Technical Control and Flights All Day) - **July 15, 2017**

**09:00-12:30** Registration

**09:00-12:30/13:30-17:00** Technical Control and Flights

**DAY 4 - July 16, 2017**

**12:00** Announcement of temporary results

**13:00-14:00** Flight Shows

**14:00** Announcement of Final Results and Award Ceremony

Participants will be allowed to conduct their trial flights between 17:00 to 19:00 every day during the competition. It is strictly forbidden to make a test flight at other times (lunch break etc.). Teams flying in the prohibited hours will be disqualified.

TÜBİTAK reserves the right to make amendments in the Competition Rules Manual and Missions. These changes will be announced on the web page. The latest released version of Competition Rules Manual will be valid in the Competition.

### **Transportation**

It is planned to have Shuttle services from the designated areas of the city to the competition site.

Departure points will be announced before the competition.

### **Contact**

E-mail: [uavturkey@tubitak.gov.tr](mailto:uavturkey@tubitak.gov.tr)

Web page: [uavturkey.tubitak.gov.tr](http://uavturkey.tubitak.gov.tr)

## CONCEPTUAL DESIGN AND DETAILED DESIGN TEMPLATE

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

<b>TITLE</b>	<b>Points for Conceptual Design Report</b>	<b>Points for Detailed Design Report</b>
<b>1. EXECUTIVE SUMMARY</b>	<b>15</b>	<b>5</b>
1.1 Design Process		
1.2 Key mission requirements and design features		
1.3 Performance capabilities of the system		
1.4. Format. Completeness, Readability		
<b>2. MANAGEMENT SUMMARY</b>	<b>15</b>	<b>5</b>
2.1 Team Organization		
2.2 Milestone Chart		
2.3 Format. Completeness, Readability		
<b>3. CONCEPTUAL DESIGN</b>	<b>70</b>	<b>5</b>
3.1 Mission requirements		
3.2 Translation into design requirements		
3.3 Configurations considered		
3.4 Component weighting and selection process		
3.5 Final conceptual design configuration		
3.6 Format. Completeness, Readability		
<b>4. PRELIMINARY DESIGN</b>		<b>20</b>
4.1 Describe design/analysis methodology		
4.2 Document design/sizing trades		



4.3 Describe document mission model (capabilities and uncertainties)		
4.4 Provide estimates of the aircraft lift, drag and stability characteristics		
4.5 Provide estimates of the aircraft mission performance		
4.6 Format. Completeness, Readability		
<b>5. DETAIL DESIGN</b>		<b>30</b>
5.1 Document dimensional parameters of final design		
5.2 Document structural characteristics/capabilities of final design		
5.3 Document systems and sub-systems selection/integration/architecture		
5.4 Document Weight and Balance for final design - Must include Weight & Balance table empty and with each possible payload		
5.5 Document flight performance parameters for final design		
5.6 Document Rated Aircraft Cost		
5.7 Document mission performance for final design		
5.8 Drawing package:  - 3-View drawing with dimensions - Structural arrangement drawing - Systems layout/location drawing - Payload(s) accommodation drawing(s)		
5.9 Format. Completeness, Readability		
<b>6. MANUFACTURING PLAN AND PROCESSES</b>		<b>10</b>
6.1 Document the process selected for major component manufacture		
6.2 Manufacturing processes investigated and selection process and results		
6.3 Manufacturing milestones chart: plan and actual		
6.4 Format. Completeness, Readability		
<b>7. TESTING PLAN</b>		<b>10</b>
7.1 Test Objectives and schedule		
7.2 Test and flight check lists		
7.3 Format. Completeness, Readability		
<b>8. PERFORMANCE RESULTS</b>		<b>10</b>

8.1 Describe the demonstrated performance of key subsystems		
8.2 Compare to predictions and explain any differences and improvements made		
8.3 Describe the demonstrated performance of your complete aircraft solution		
8.4 Compare to predictions and explain any differences and improvements made		
8.5 Format. Completeness, Readability		
<b>9. REFERENCES</b>		<b>5</b>

### SCORING

Report	Mission 1	Mission 2	Total
30	30	40	100

Mission	Formula
<b>I</b>	$20(PR_{tm} / PR_{max}) + 10(W_{min} / W_{tm})$
<b>II</b>	$10(t_{min} / t_{tm}) + 15(CP_{tm} / CP_{max}) + 15(PD_{tm} / PD_{max})$

$PR_{max}$ : Maximum number of cells in the pattern entries recognized by any team ( $\leq 48$ )

$PR_{tm}$ : Number of cells in the pattern entries recognized by the team.

$W_{min}$ : The minimum take off weight of any team

$W_{tm}$ : The take off weight of the team.

$t_{min}$ : Minimum time of any team.

$t_{tm}$ : Time of the team.

$CP_{tm}$ : Number of correct coloured parachutes dropped for team.

$CP_{max}$ : Maximum number of correct coloured parachutes dropped for teams.

$PD_{tm}$ : Number of parachutes dropped for team.

$PD_{max}$ : Maximum number of parachutes dropped for teams.

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

Electronic reports must be less than **20 MB** in size.

The main document will not exceed **60 pages**, including all the report documents.

The reports exceeding 60 pages will get -10 points.