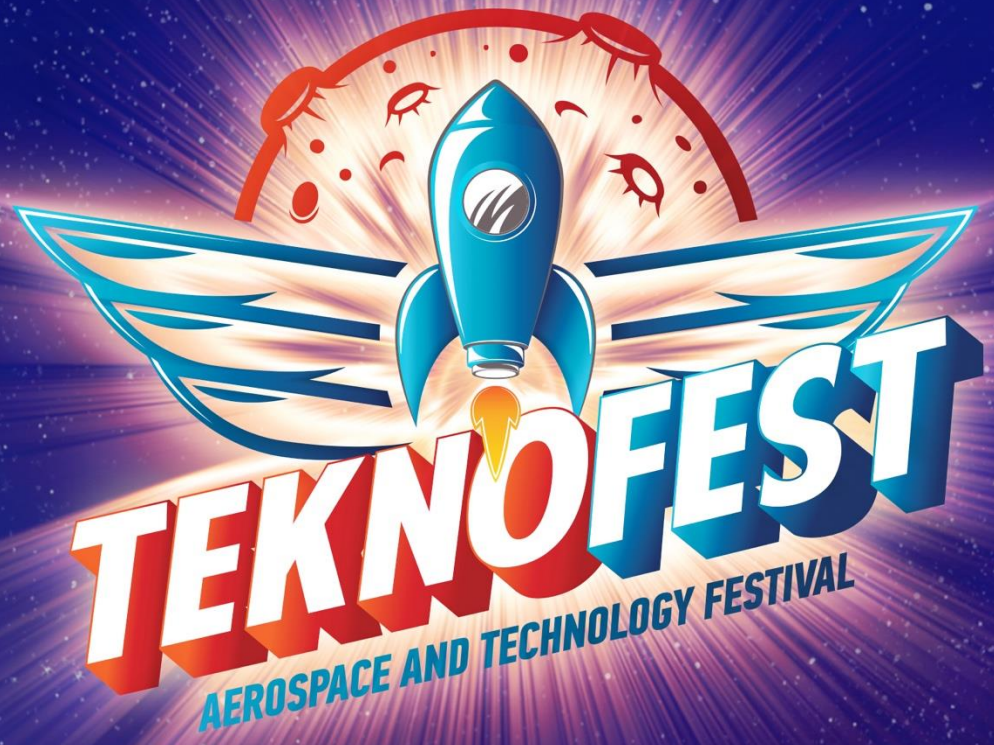
7th YEAR

#MİLLİ TEKNOLOJİ HAMLESİ



UAV
COMPETITIONS
SPECIFICATION

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DEFINITIONS

- **Advisor Teacher:** A teacher/instructor who advises the team established by students of high school and equivalent school from all over the world, students of BİLSEM, Youth Centers, Experimental Technology Workshops (DENEYAP), Science Centers and Science Workshops in Türkiye and works in these schools/institutions and takes responsibility for the administrative and financial issues of the team and is called the Team Responsible in the competition,
- **Advisor:** Any person who has academic knowledge or experience in UAV Technologies and advises associate, undergraduate and graduate students and mixed teams from all over the World and is a member of the International UAV Competition teams,
- **Advisor Awards:** Awards given to first, second, and third place winners' Advisors (if any) and Advisor Teachers,
- **Advisory and Assessment Committee (AAC):** The committee appointed by TUBITAK to benefit from its opinions on the subjects regarding the UAV Competitions,
- **Announcement:** Announcement texts defining the competition subject, scope, application conditions, and competition schedule determined by TUBITAK and TEKNOFEST,
- **Application Documents:** Documents prepared in accordance with the content and format determined by TUBITAK and submitted to TUBITAK officials in the competition area such as Letter of Commitment, Letter of Consent etc.,
- **Autonomous Flight:** Flight managed by software capable of making its own flight decisions without the need for any UAV pilot,
- **BITO:** Presidency of Science and Society,
- **CMS:** Corporate Management System used for application, report/video submission etc.,
- **Competition / Competitions:** 9th International Unmanned Aerial Vehicles Competition and 5th Inter High School Unmanned Aerial Vehicles Competition,

- **Ethical Violation:** Unethical situations such as plagiarism etc., (for example, quoting from another team's report/video or the same/very similar reports/videos of 2 or more teams),
- **Fail-Safe System:** The system that guarantees a safe landing in any emergency during the flight and must be located on the control system,
- **Fixed Wing UAV:** Aircraft that take all or a significant part of its carrying force from the wing system that does not move,
- **Flight Referee:** A person responsible for flight missions,
- **Fly zone:** The area where all flight missions take place and is limited by the coordinates to be announced before the competition horizontally and 120 meters vertically,
- **Letter of Commitment:** Legal document signed by the team Responsible stating that all the responsibilities and rules of the competition have been accepted by all team members and submitted to TUBITAK officials during the registration in the competition area,
- **Letter of Consent:** Permission and rules acceptance document signed by parents/legal guardians for the participation of each team member under the age of 18,
- **Management:** Directorate of Activity and Organisation where the Unmanned Aerial Vehicles Competitions is conducted,
- **Manuel Flight:** The flight is completely under the control of the UAV pilot,
- **Mission Video:** Video recording with mission performance and preliminary information parts required for the election of teams to be invited to the competition areas,
- **Mixed Team:** Team applying for the International UAV Competition and consisting of high school students and associate, undergraduate and graduate students from all over the world and where the Team Responsible is a university student,
- **No Fly Zone:** The area outside the buffer zone where the team will be deemed

unsuccessful in that flight in the competitions,

- **Performance Award:** Award given to the teams that participated in the competition without taking any financial support from TUBITAK and couldn't receive a ranking award but with more than 55 points in the competition area,
- **Project Presentation Report:** Report prepared according to the descriptions given in "Guide for Project Presentation Report" with technical information regarding how to carry out the plans for design, production, mission requirements and information on the budget,
- **Ranking Awards:** Awards given to first, second, and third place winners with top scores for missions executed in the competition areas,
- **Regulation:** Regulation on Activities to be carried out by TUBITAK Science and Society Department,
- **Rotary Wing UAV:** Aircraft such as helicopters and quadrotors, which have more than one rotor and take all or a significant part of the carrying force from the rotor system and have the ability to rotate their wings,
- **Team Member:** Each person who takes an active role in the team and registered in the KYS,
- **Team Responsible:** The person who takes the whole responsibility of the team and is a teacher of the high school and equivalent school students from all over the world, a teacher of Youth Centers and BİLSEM students in Türkiye, an instructor of the high school-level students of Experimental Technology Workshops (DENEYAP), Science Centers and Science Workshops in the Inter High School Competition, and an university-level student in the associate, undergraduate and graduate degree teams or in the mixed teams in the International UAV Competition,
- **Team:** A group consisting of team responsible, members, and advisor, if any,
- **TEKNOFEST:** Aerospace and Technology Festival,
- **TUBITAK:** The Scientific and Technological Research Council of Türkiye,
- **UAV Pilot:** The student controlling the UAV,

- **UAV:** Unmanned Aerial Vehicles produced and/or developed by the competitors in accordance with the competition rules,
- **VTOL UAV:** Combined unmanned aerial vehicles capable of both vertical landing and take-off like helicopters and horizontal flight like fixed-wing aircraft.

1. PURPOSE AND SCOPE OF THE COMPETITIONS

The competitions aim to direct students of high school and equivalent school from all over the world, high school students of BİLSEM, Youth Centers, Experimental Technology Workshops (DENEYAP), Science Centers and Science Workshops in Türkiye, associate, undergraduate and graduate students from all over the world to the UAV technologies, to encourage them to conduct scientific and technical studies, to raise awareness in the society on the UAVs and to create a meeting point for talented and ambitious national and international students. The Competitions allow for the flights based on any science and technology implementation and ability with different kinds of UAVs such as fixed-wing, rotary wing, hybrid and flapping wing, etc., without any category or mission restriction.

The competitions are organized by TUBITAK BITO Directorate of Activity and Organisation within the scope of TEKNOFEST. The creation, implementation, and supervision of technical rules are made by the Advisory and Assessment Committee (AAC).

The Rules Booklet covers the rules and obligations for the competitions to be held.

2. COMPETITIONS SCHEDULE

Online Application Submission of Project Presentation Reports	December 2023 – 29th February 2024
Posting the Results of Project Presentation Reports	22nd March 2024
Deadline for Withdrawal from the Competitions and Team Member Changes	29th April 2024
Submission of Mission Videos	1st May - 30th June 2024
Posting the Results of Mission Videos	15th July 2024
Posting the Mission&Flight Order Lists	20st July 2024
Competitions Week and Award Ceremonies	August 2024
TEKNOFEST Award Ceremony	September 2024

3. OUTPUTS OF THE COMPETITIONS

In order to serve TUBITAK's mission of "Qualified Knowledge and Qualified People";

- Creation of more experienced and self-confident teams,
- Development of more technological and capable UAVs, and
- Performing more efficient missions are defined as outputs.

All kinds of gains that will serve these outputs are encouraged and included in the scoring.

4. OBJECTIVES OF THE COMPETITIONS

It is aimed that all kinds of gains in terms of the specified targets should be enhanced with respect to the previous years. The objectives can be summarized as follows:

4.1. Objectives for Teams

Ergonomics and Human Factors: A simple definition is the indicators such as engineering, quality, functionality, effort, diligency, etc.

Experience: This expresses the successes and gains achieved by the team or team members in previous competitions or projects.

Opportunity: As expected, participating in these competitions provides networking and cooperation with other teams as well as the companies.

Motivation: Knowledge and experience owned by the university teams motivate the high school teams. Moreover, participating in these competitions organized by TUBITAK, the leading science and technology institution in Türkiye, and gaining awards are also motivation sources for all teams.

Team Awareness: The competitions aim at not only the technical gains but also the social progress. These progresses are considered under the ability of joint success, sustainability, social responsibility, and ethics, which can be listed as:

- Multidisciplinary working,
- Ensuring sustainability due to the cooperation of juniors and seniors,
- Process discipline in reports, presentations and competition areas,
- Honesty,
- Clearness and transparency,

- Helpfulness,
- Respecting others' successes and rights,
- Attitude and manners which do not violate the flexibility during the preparation and mission duration in the competition areas in addition to the urge for starting the mission flight.

All of the above is observed and evaluated by the Advisory and Assessment Committee (AAC) members.

4.2. Objectives for the UAVs to be Developed

Originality: It is expected that some parts of the UAV are based on domestic sources and/or are self-produced equipments.

Examples: The development of hardware or software or an accessory using domestic facilities and/or self-produced equipments is an indicator for originality.

- Original hardware
- Original software
- Original (and effective) design
- Domestic production

Innovation: The development of new hardware or new software or an accessory equipment is an indicator for the innovation.

Examples:

- An alternative engine
- An alternative power source
- An alternative software or controller
- An alternative field
- An alternative design
- Alternative use of devices
- etc., provide innovative approaches.

Parts and elements explained under the headings of Originality and Innovation are expected to be used during the flight. Otherwise, points will be deducted from the Originality and Innovation scores.

Affordability and Simplicity: It is expected that teams achieve a mission at a lower cost using a non-expensive configuration as well as a non-complex design. A design which provides saving from both time and cost without decreasing the performance or increasing the performance due to the weight reduction are examples for this subject.

Stability: It is expected that an UAV, whatever its class is, should achieve a stable flight during taking-off, climbing, cruising, performing the mission, descending, and landing on.

Example: An UAV which flies in a non-equilibrium state means an unstable air vehicle.

Ability: An UAV, whatever its class and mission are, should have an ability to achieve its mission in addition to the difficulty level of this mission. If the UAV(s) achieve(s) a difficult mission in an easy way, this means that the ability is high.

Example:

- Agile motion
- High maneuverability
- Small dimensions
- Effective capacity
- Precise positioning
- Good decision making
- Precise shooting
- Precise image processing
- UAVs in swarm

are examples for ability indication.

4.3. Objectives for the Missions to be Performed

Usefulness: It is expected that this mission to be performed should have a potential for humanity and community benefit.

Example:

- Search and rescue
- Fire extinguishing
- Use of a gun for military purposes (the use of firearms is prohibited)
- Effective service of transportation
- Intelligence

- Assessment and evaluation
- Track, trace, and control
- Formation

are some examples of useful missions to be performed for either civil or military purposes and therefore indicators for usefulness.

Unsimilarity: It is expected that the mission should be different from previous missions taking the humanity and community benefits into consideration.

Mission Challenge: The teams to select challenging missions are encouraged and scoring is performed according to the mission selected.

Autonomy: It is expected that the flights should be performed in an autonomous way. A flight totally controlled by a remote system doesn't get any score for this part.

Mission Success: It is expected that the mission should be completed regardless of UAV's ability.

5. TERMS OF APPLICATION AND PROCEDURE

- Teams consisting of the students of high school and equivalent school from all over the world, high school students of BİLSEM, Youth Centers, Experimental Technology Workshops (DENEYAP), Science Centers and Science Workshops in Türkiye can apply to the **Inter High School UAV Competition**. Associate, undergraduate and graduate students from all over the world can apply to the **International UAV Competition**. Mixed teams consisting of the students in both high school and university levels can apply to the **International UAV Competition** if the team has at least one university level student as Team Responsible.
- The teams must have at least five (5), maximum twenty-five (25) members including the Team Responsible and Advisor, if any.
- A maximum of ten (10) members of the finalist teams will be able to come to the competition area.
- A member (including Team Responsible and Advisor) cannot be a member in more than one team simultaneously within the International and Inter High School UAV Competitions. If determined otherwise, the teams where the member is in are eliminated from the Competition.

- A member cannot apply and participate in another UAV Competition (International UAV Competition and Inter High School UAV Competition) organized by TUBITAK. If determined otherwise, the teams where the member is in are eliminated from both Competitions.
- No team member, as a pilot, flies the UAV of another team during the competition week.
- Team Responsible is obligatory in each team. The Team Responsible must be a university student in the International UAV Competition and an Advisor Teacher in the Inter High School Competition.
- Processing all competition processes including the team registration, and providing the coordination together with the responsibility of the students both in the preparatory stage and competition areas is the task of the Team Responsible.
- The teams of International UAV Competition can have one (1) “Advisor”. The Advisor might be an academician or an UAV expert. If the team has an Advisor, his/her registration to the system must be made while applying. Registered Advisor is also a team member.
- On the date of application, team members must hold the student title except for the Advisor Teacher and the Advisor. If otherwise detected, the team is eliminated from the competition.
- Application is made online on www.t3kys.com/en/. No printed document is requested during the application process.
- The Team Responsible registers during the application period through the online system, makes the correct and complete registration of the team members together with the Advisor (if any), and also sends the invitation e-mail to them. The registration is completed after accepting the invitation coming from the “Team Information” part in the online application system. Otherwise, the registration is not completed.
- When the Team Responsible adds a member, he/she should assign himself/herself as the communication responsible. This is done through the “Add Communication Responsible” button in the application system.
- Any class of UAV (fixed wing, flapping wings, rotary wings, VTOL, hybrid, etc.) is welcome for the application to the competitions.

- Two teams can not have the same team name. It is not suggested to select typical words for team names. TUBITAK might request the name change if two teams have the same name, according to the application date.
- The team member change including the Advisor (if any) must be performed before the 29th of April 2024 through the “Discard a Member” option in the application system. The member change takes place if all the team members approve.
- The change of the Team Responsible, the Advisor (if any), and the members can not make after the given deadline.
- Selecting the team members from different institutions and levels is highly suggested since it is believed that this preference might provide an enhancement in the scientific and technological gains of the students together with the team sustainability for next years, in addition to the encouragement of the collaborative team works.
- Teams apply with the Project Presentation Report on the dates specified in the competition calendar. Teams at or above the passing score determined according to the results of the Project Presentation Report are selected eligible and a Mission Video is requested from these teams.
- As a result of the Project Presentation Report evaluation, financial project support is provided to a certain number of teams determined by TUBITAK taking into account the opion of Advisory and Assessment Committee (AAC). Teams that are at or above the passing score but are not entitled to receive project support can upload the Mission Videos they prepared using their own UAVs that they develop or renew with their own means without receiving financial project support from TUBITAK and continue the competition. Teams that do not upload Mission Video will be eliminated from the competition.
- Team Responsible must fill and sign the Letter of Commitment, stating that all the responsibilities and rules of the competition have been accepted, and submit the document to TUBITAK officials during the registration in the competition area. In additon, for each team member who is under the age of 18 on the 15th of July 2024 (born on or after the 16th of July 2006), the Letter of Consent filled and signed by the parents/legal guardians must be submitted during the registration in the competition area, as well. The templates of the Letter of Commitment and the Letter of Consent are sent to Team Responsible via e-mail.

6. PROJECT PROCESS

6.1. Project Presentation Report

- It is a report in which the brief information on team and on UAV, mission description, how to perform the mission and all other requested information about the processes are presented in detail.
- The project presentation report is prepared in line with the “Project Presentation Report Template” announced on the www.teknofest.org page.
- It can be prepared in Turkish or English. Teams that do not upload reports are eliminated from the competition.

  - **Team Information**

    The competitions or projects the teams have participated in before, the awards or degrees the teams have received show teams’ experience and competence in carrying out this project. Does the team have a workspace? Does it have any tool and machinery sources? How and to what extent does team’s institution support the team? Are there any other teams under the same institution? Are there any official who coordinates the teams? This type of information refers to the background of teams to carry out the projects. In addition, teams are expected to use their own financial resources and/or cooperate with private sector organizations or other institutions to find sponsors.

  - **Mission Information**

    The definition, original aspects and scope of the flight mission should be mentioned. It should be clearly stated what kind of a mission will be performed with what kind of UAV. Factors such as the difficulty of the mission, originality, functionality, strategic importance, being eye-opening, offering visual pleasure, inspiring or contributing to the audience and amateurs, and being realistic are effective in scoring. This is the main title on which the referees will give points. Some missions such as firefighting, military operations, search and rescue etc. can be performed in the competition area with a similar or demo version as a necessity instead of the same mission. However, in this case, unrealistic or non-real-life missions may arise. In this section, how the mission will be performed in the competition area should be explained clearly and briefly.

- **Information on UAV**

  In this section, teams must provide necessary information about the design, hardware, software, innovation and originality of the UAV they will design/renew within the scope of the competition. There is more detailed information about this section in the Project Presentation Report Preparation Guide.

- **Budget**

  Teams clearly state how much budget they need with realistic figures and justifications. International teams also add their transportation expenses (round-trip transportation between Türkiye and their country) to be covered with the project support provided by TUBITAK in the event that international teams become finalists.

- The report is evaluated by three (3) referees who are experts in the field and the scores are averaged. Project Presentation Report evaluation criteria and score ranges are specified in the Project Presentation Report Preparation Guide.
- In case of detection of ethical violations such as plagiarism etc., the report will not be evaluated and the team is eliminated from the competition.
- Teams at or above the passing score according to the evaluation are announced on the www.teknofest.org page.
- Evaluation results can be appealed by the Team Responsibles of the teams under the passing score through the application system within three (3) working days from the date of the announcement. Objections submitted through channels other than the application system (e-mail, etc.) will not be accepted. Objections are evaluated by the Advisory and Assessment Committee, and the results are notified to the teams by e-mail. The results cannot be appealed for a second time.
- Teams at or above the passing score determined according to the results of the Project Presentation Report continue the competition. Financial project support is provided to a certain number of teams determined by TUBITAK taking into account the opion of Advisory and Assessment Committee (AAC). Other teams that are at or above the passing score but are not entitled to receive financial project support from TUBITAK can continue the competition without receiving project support.

- Teams that are at or above the passing score but are not entitled to receive financial project support from TUBITAK can develop or renew the UAVs with their own means and continue the competition by uploading the Mission Videos.

6.2. Mission Video

- It is a video in which the same mission is to be performed beforehand, together with the explanation of the design, project design, and production processes of the UAV, by both the teams that have received a project support and the teams that participate directly in the competition without requesting project support. The video is recorded and uploaded to the system between the specified dates.
- Teams that are at or above the passing score but are not entitled to receive financial project support in the Project Presentation Report (except those eliminated for ethical violations such as plagiarism, copying, etc.) can continue the competition by designing their own UAVs or developing their existing UAV, if any, and uploading a Mission Video at the Mission Video stage. Teams eliminated due to ethical violations cannot continue competing.
- The teams prepare the mission video within the scope of the stated purposes and rules, upload it to an online platform and add the video link to the application system on the specified dates.
- Evaluation is carried out only on video, no written report is required.
- In the preparation of the Mission Video, attention is paid to the following points:
    - **Performing the Mission**

      With the voice of the team pilot or one of the other members, the scenes of the performing the mission part are presented. It is expected to perform the same mission to be performed in the competition area, without any interruptions, including the take-off and landing images. The video cannot be cut or cropped in the performing the mission section. The video should have natural and real images. However, for some missions, it may not be right to expect a completely realistic mission. For example, missions such as kamikaze flights, use of expensive ammunition. In this case, a real-like performance is determined, and these shootings are made after the approval of Advisory and Assessment Committee.

- **Information Section**

  Team Responsibles in International UAV Competition teams and the responsible students in the team in Inter-High School UAV Competition convey a short briefing and time-lapse video clip, not exceeding two (2) minutes, following the mission section. Here, the referee has the information under which conditions the team has prepared their vehicle. In this chapter, the followings are presented: sections of experience, background, possibilities of team, details of mission, why they choose this mission, the development stages of the vehicle, and the preparation process.

- Video should be shot in HD resolution and in mp4 format in a high-light environment.
- It can be prepared in Turkish or English. Video shooting is done in a safe area where there is no risk and danger. Responsibility belongs to the Team Responsible.
- The video is uploaded to an online platform and its link is added to the application system on the dates specified in the schedule. Teams that do not upload videos are eliminated from the competition.
- The mission video is evaluated according to scientific criteria determined by three (3) referees who are experts in their fields and the scores are averaged.
- While the referees are watching the video, they watch it as if the mission performed in the competition area and score by evaluating how successful the team can be in the competition area. Therefore;
  - It is important for teams to review the “Evaluation Criteria”.
  - Information about the evaluation criteria should be provided in the video content.
  - It is important that the video is clear and understandable.
- Videos that are not prepared in accordance with the rules are considered unsuccessful by AAC, and the team is eliminated from the competition.
- In case of detection of ethical violations such as plagiarism etc., the video will not be evaluated and the team is eliminated from the competition.
- Teams that are successful according to the evaluation are announced on the www.teknofest.org page.

- Evaluation results can be appealed by the Team Responsibles of the teams under the passing score through the application system within three (3) working days from the date of the announcement. Objections submitted through channels other than the application system (e-mail, etc.) will not be accepted. Objections are evaluated by the Advisory and Assessment Committee, and the results are notified to the teams by e-mail. The results cannot be appealed for a second time.

7. FINANCIAL SUPPORT

7.1. Project Support

- It is the financial support requested by the teams in the Project Presentation Report stage and paid in cash to the Team Responsible by TUBITAK officials in the competition area in line with the evaluation of Advisory and Assessment Committee provided that teams are successful in all stages, entitled to receive financial project support and invited to the competition area.
- The upper limit of project support is 80,000 TRY. Teams determine their budgets in the Project Presentation Report, provided that they do not exceed the upper limit. The determined budgets are evaluated by TUBITAK and AAC and if approved, the amount approved by TUBITAK in line with the evaluation of AAC is paid in cash to the Team Responsible in the competition area if the team become a finalist.
- While determining the budget in the Project Presentation Report for project support, transportation expenses (round-trip transportation between Türkiye and their country) for the team members who will come to the competition area, not exceeding 2,000 TRY per person, should also be added to the budget.
- Financial project support is provided to a certain number of teams determined by TUBITAK taking into account the opion of Advisory and Assessment Committee (AAC). Other teams that are at or above the passing score but are not entitled to receive financial project support from TUBITAK can continue the competition without receiving project support.
- Teams at or above the passing score but are not entitled to receive financial project support will not be provided with additional transportation support.

- In order for the project support to be paid, Team Responsible must fill and sign the Letter of Commitment, stating that all the responsibilities and rules of the competition have been accepted, and submit the document to TUBITAK officials during the registration in the competition area.
- For each team member who is under the age of 18 on the 15th of July 2024 (born on or after the 16th of July 2006), the Letter of Consent filled and signed by the parents/legal guardians must be submitted during the registration in the competition area, as well.
- The templates of the Letter of Commitment and the Letter of Consent are sent to Team Responsible via e-mail.

7.2. Cooperation Incentives

Teams can cooperate with the public and private sector companies before and during the competition week in order to increase their opportunities and success.

8. COMPETITION AREAS

- The competitions are held simultaneously in two (2) different areas as the International UAV Competition and Inter High School UAV Competition.
- For each competition, a 150 m x 250 m flight area and also a 50 m buffer zone are planned.
- Each competition includes a runway with a minimum length of 150 m for take-offs and landings.
- The province and competition area where the competitions will be held will be announced later.

9. COMPETITIONS WEEK

- Before the competitions week; for reasons such as area security, competition schedule, and minimizing the preparation time of the teams; grouping and flight order are made by the Advisory and Assessment Committee (AAC), taking into account the flights of the teams. It is announced on the dates specified in the schedule. Teams cannot object to grouping and flight order.
- It is the team's responsibility to supply all kinds of materials and equipment to be used for the mission to be performed.

- Teams must register in the competition area on the first day of the competition week. Except for the first day due to force majeure, registration is subjected to the permission of TUBITAK and the AAC. It is obligatory to have a Team Responsible during the registration. Valid passport of each member is required during the registration.
- A maximum of ten (10) members of the finalist teams will be able to come to the competition area.
- Since it is planned to complete the scoring in areas such as Technical Inspection, Design Ergonomics, Innovation and Originality to be completed after the registration on the first day of the competition, the teams must have completed all their preparations in advance. Teams that could not complete their preparations due to force majeure, submit their excuses to uavturkey@tubitak.gov.tr with a petition. If AAC deems the excuses appropriate, technical inspections and scoring can be done for other days.
- In technical inspection, the UAV is checked by experts in the field in terms of weight components, structural strength, mechanical movement ability, and safety of electronic equipment.
- It is forbidden for the teams that are successful in the technical inspection to disassemble or change the parts of the UAV before the flight in terms of flight safety.
- Teams that are successful in the Technical Inspection appear before the Referee Committees on the first day of the competition to receive the “Design Ergonomics”, “Innovation” and “Originality” points. They disclose information such as “Originality” and “Innovation” that they have declared before. Teams that cannot declare and/or present this information or necessary document cannot get full points from the relevant criteria.
- Before flight order, teams are responsible for registering and passing technical inspection, and obtaining a sticker. Since the UAVs that are not found safe in the technical inspection is not provided with a sticker, it is recommended that they come to the inspection at an earlier hour and gain time to make the necessary improvements.
- The times of the competition are announced at least one (1) day before the competition. Due to force majeure, TUBITAK may change the competition hours.

- The competition is organized as two (2) rounds and teams are given the right to perform one mission in each round. The use of two (2) rights is not mandatory. The higher scores of the teams using both (2) rights are taken into consideration.
- Teams use their rights starting from team one (1) in order of flight.
- On the first day, it is planned that the 5 - 10 teams in the first place will perform their first mission. However, considering the intensity and constraints of the first day, it is confirmed in advance whether the teams are ready for the flight or not.
- It is the teams' responsibility to follow the flight order. The reasons for 'not being ready' or 'not passing the technical inspection' are not accepted.
- Teams are called to the flight area with the text “Waiting for the Field” on the screen. After the call is made, the teams must report that they have gone to the call desk with their UAVs within 30 minutes at the latest and be ready in the Queue Waiting Tent after making sure that their status on the screen changes to "On the Field".
- Each team is allowed one (1) time delay in total. The right to postpone the flight order can be used in the first or second round. Teams that are not present despite their order will be deemed to have used their postponement rights, if any, and will be transferred to the end of the list in the same order.
- Teams that do not arrive on time when called (if they do not have the right to postpone their order) are deemed to have used their right. Teams cannot appeal the decision. Teams whose order has been postponed are indicated by the phrase “Postponed”.
- Teams whose postponement right has expired or that have been postponed but whose order is over lose their right to fly if they do not get on the runway. The fact that the teams did not pass the technical inspection for any reason cannot be given as a reason for this.
- Teams are directed to different areas according to the International UAV Competition and Inter High School UAV Competition and different “Queue Waiting Tents” according to the vehicle types.
- Teams having been called to “Queue Waiting Tents” wait in a ready state by attaching their propellers after making the final checks of their vehicles. It is at the discretion of the relevant referee to observe the readiness of the teams in the

queue waiting for tent when they are called to the track. The objection is not accepted.

- Teams take to the track are indicated on the screen with the phrase “Flying”.
- Advisors, if any, and Advisor Teachers are not allowed into the Technical Control and Interview Tent, where Innovation and Orginality checks are carried out and also into the flight area.
- Teams cannot perform any other mission other than the mission defined in the report and video.
- The UAV that only carries a camera and flies in the area to take images by TUBITAK and TEKNOFEST always has the right to take images.
- When there is a possibility that the flights may not catch up due to weather conditions or other reasons that may be experienced during the competition week, another team may make preparations in another part of the flight area by taking the necessary security measures. Team to be disturbed by the other team due to reasons such as signal interference or visual pollution, notify the coordinator of this situation on the first day of the competition. Otherwise, excuses will not be accepted.
- The teams are requested to start the flight within five (5) minutes from the moment the flight permit is given by the Referee Committee. Teams that have not gotten coordinates and made other preparations beforehand are warned for not using the time correctly and points are deducted from the "Team Awareness" heading in the scoring. Teams that fail to take off within eight (8) minutes are given a second warning and one right is considered used. Teams that fail to take off despite making a take-off attempt may try again within eight (8) minutes (if any).
- In order to avoid wasting time, teams whose flight order is approaching during non-flight hours should make preparations such as getting coordinates from the flight area and placing/creating the needed auxiliary platforms. The time of preparatory work can be announced. It is the responsibility of the teams to follow the announcements.
- Depending on the number of teams to compete, flight times may be updated and announced by TUBITAK in advance. It is the team’s responsibility to follow the updates.

- Due to the unusual missions to be performed, these times may need to be updated specific to the team, but this is announced before the competition week with the decision of AAC and its justifications.
- Since the mission to be performed by the teams are different, it is under the authority of AAC to determine the flight time of the mission.
- During the first flight, the teams that did not experience an accident can use their second rights without entering the technical inspection again provided that the competitors does not change their UAVs.
- In cases where the continuation of the competition is difficult due to force majeure such as heavy rain, fast wind, etc., AAC may stop the competition. In case these reasons disappear, AAC restarts the competition. The threshold value for the wind speed was determined as 25 km/h.
- It is essential that the teams perform their flights within the determined area. It is forbidden to leave the specified area for safety reasons.
- In the event that the UAV passes into the buffer zone, the Referee Committee (or the person authorized by the committee) may request the flight to be stopped if it senses a safety hazard. In this case, the vehicle is requested to land safely by switching to FAIL-SAFE mode.
- Flight altitude is maximum of 120 meters in the competitions. However, it is recommended the flights not to go up to this altitude for safety and accurate observation.
- Teams cannot fly with biological, chemical etc. materials which are harmful and endangers human health and safety in the competition areas. Any flight that may endanger human or environmental health, like huge explosion, is prohibited. Instead of these situations, materials and equipments such as paint or bead gun etc. can be used.
- It is the team's responsibility to convince the Referee Committee that adequate safety has been taken for the materials, equipment, and flight techniques to be used during the competition week. It is checked by the Referee Committee the necessary measures have been taken.
- Flights are managed by expert AAC and auxiliary staff in the area. The Referee Committee makes the mission flight evaluation of the UAV according to the determined scientific criteria. Auxiliary staff help expert referees make the right

decision using their field competence within the scope of the rules. No verbal or physical intervention can be made to TUBITAK and TEKNOFEST officials, the AAC members and auxiliary staff during the flights. Otherwise, the team may be eliminated from the competition by TUBITAK.

- The pilot of the team can be one of the students in the team. It cannot be carried out by the the Advisor, if any, and Advisor Teacher. A pre-flight document is requested from the member who will be pilot for the flights. For safety reasons, THK pilots may be present during the competition, but this does not give the teams the right to receive piloting support.

9.1. Technical Inspections

- It is obligatory to comply with the decisions of Advisory and Assessment Committee (AAC) in technical inspection.
- All registered teams must go for a pre-flight technical inspection.
- Teams must participate in the competition with the UAV they defined in the Project Presentation Report and Mission Video.
- All equipment that the UAV will carry during the flight must be brought to technical inspection.
- The UAV is brought to the technical inspection with its propellers removed and all of its parts with connection mechanisms.
- Batteries to be used are brought to technical inspection together with spare batteries.
- Technical inspections continue throughout the competition days for the UAVs that are damaged/broken during the mission flight among the teams that pass the first technical inspection successfully.
- The “Radio Fail Safe System” (FAIL-SAFE) mode which definition and technical specifications clearly defined is mandatory. At the technical inspection stage, any other justification is not accepted. UAVs that cannot pass the radio fail-safe system (FAIL-SAFE) control can not fly.

9.2. Flight Safety Control

- All UAVs pass a pre-flight safety check. A team that does not pass the safety check can not fly.

In flight safety control, the following points are especially checked:

- Compliance with the technical drawings of the UAV presented in the project presentation report,
- The reliability of the UAV in terms of structural integrity, electrical and mechanical systems, and thrust systems,
- All components are securely mounted on the UAV,
- All connections must be made with safety wire, liquid adhesive and/or nut in quality, and form to prevent breakage,
- Structural and connection integrity of the propeller is provided, the motor and the rotation direction are compatible,
- Use of wires and connectors of sufficient thickness,
- The radio control range is sufficient for remote controlled operations such as the control of the UAV and engine on / off,
- The radio control system has end-to-end encryption against the interference of the radio signals of the teams,
- All control mechanisms of the UAV are sufficient and in a way that does not impair flight safety,
- Radios are capable of automatically switching to fail-safe system (FAIL-SAFE) mode in case of signal loss.

Fail-safe system (FAIL-SAFE) mode is tested on the ground by turning off the radio transmitter. When the fail-safe system (FAIL-SAFE) is activated, the UAV receiver (if applicable) selects the following configuration:

In Fixed Wing UAV:

- Cutting the gas,
- Full up altitude,
- Full right rudder,
- Full right eleron,
- Flaps all the way down.

In Rotary Wing UAV:

- Half throttle - controlled descent (return-to-home mode (RTL) cannot be selected),
- Cutting the throttle (in case the referee gives a command).

In Vertical (VTOL) UAV:

- UAV switching to rotary wing mode,
- Half throttle - controlled descent,
- Cutting the throttle (in case the referee gives a command).

In the absence of any of the above-mentioned safety control systems, the technical inspection referee must be satisfied that the UAV can perform the required fail-safe system (FAIL-SAFE) function, otherwise the UAV cannot fly.

9.3. UAV Specifications

9.3.1. Weight

- Total take-off weight of the UAV must be under 25 kg in the competitions.

9.3.2. Radio Communication

- UAV must have end-to-end encryption in order to avoid environmental factors.
- Radio control unit must switch to fail safe mode automatically (at the latest in 5 seconds).
- The team streams the competing UAV during the competition, which will be disqualified.

9.3.3. Design

- The design of the UAV is not mandatory to be original. However, all ready to use and original parts must be declared. Spare parts for the competition product UAV can be brought.

9.3.4. Current Breaker

- In case of emergency, there must be a current breaker that can cut off the current (in 2 seconds latest) placed between the + pole of battery and the UAV. Teams do this process by switching on/off a button. Otherwise, UAV may not get a take-off permission. If the UAV is put powered on before the referees arrive in the flight deck, the UAV may get disqualified.
- Features and integration of the current breaker are explained in the video.

- There must be a current breaker (figure 1) in order to provide safety in the competition.

Figure 1. Current Breaker

9.4. Rules to Follow During Flight

- Teams are responsible for providing and bringing the auxiliary platform and special equipment.
- Helmets that are provided by TUBITAK must be worn during the competition.
- Telemetry usage is not mandatory during the flight. In case of usage, all responsibility belongs to the team. There is a risk of effecting other UAVs if the telemetry doesn't have end-to-end encryption. Therefore, telemetry must have end-to-end encryption.
- Telemetry and FPV systems must be tested before one week from the competition.
- Referees have a right to end the flight under any circumstances. Technical inspection is mandatory in case of pre-flight or during flight incidents or crashes. There won't be flight permission for the UAVs that cannot pass the technical inspection.
- Objections won't be accepted if a flight is not permitted or cancelled due to safety reasons.

10. MISSIONS

- There is no mission definition in the Rules Booklet. The mission is completely determined by teams and it is performed in the competition areas the same as it is in the mission videos.
- The mission which will be performed in the area is crosschecked with the project presentation report and mission video. Different mission is not accepted.

- Flights can be manual or autonomous. Autonomous flights will be scored higher.
- In the competitions, it is essential to determine different and challenging missions and to achieve them. Similar and already presented missions will affect teams' success negatively.
- Teams determine the mission flights aiming to gain the most points regarding the headings specified in the evaluation criteria. However, ACC may refuse the application of some teams or demand alteration of mission definition taking into account
  - Safety,
  - Limitations of Flight Area,
  - Limitations specified in the competition procedure (e.g., using a paint gun to shoot instead of a real gun mechanism, or setting some limitations for safety for a team that will perform some high-speed acrobatics).

11. RATING

It is essential to measure the work and achievements of the teams in the most accurate and objective way. The flights are evaluated and scored according to the 'Evaluation Criteria' specified below by AAC members. Any discourse or action that could affect or mislead the referees is prohibited.

11.1. Evaluation Criteria

	Main Criteria	Sub-criteria and Description	Maximum Score	
			International UAV Competition	Inter High School UAV Competition
1	Stability and Autonomy	***Stability***	8	9
		Autonomy	8	9
2	Ability and Mission Success	***Ability***	8	10
		Mission Success	8	10
3	Usefulness and Mission Challenge	***Usefulness***	7	9
		Mission Challenge	8	9

4	**Innovation** [1]	• A different engine • A different energy source • A different software or controller • A different area • A different design • Usage of different auxiliary equipment	15	9
5	**Originality** [2]	• Original (Self designed – produced) hardware • Original (Self designed – produced) software • Original (Self designed – produced) and effective design • Domestic production High scores cannot be obtained from productions made with a known design or common production methods.	15	9
6	**Design Ergonomics**	***Affordability and Simplicity***	5	6
		Ergonomics and Human Factors	10	12
7	**Team Awareness**	In order to increase the quality of the competition, it is aimed to have more conscious teams in the competition. It is evaluated by taking into account the criteria specified in the “Team Awareness” section of the “Competition Goals” heading. Scores belonging to these criteria are completely dependent on the referee's impression, objections are not accepted.	8	8
	TOTAL SCORE		**100**	**100**

[1] Any information, certification, and obligation to convince the referees concerned with the innovation belongs to the competitors.
[2] Any information, certification and obligation to convince the referees of any information concerning the originality belongs to the competitors. Especially originality about software must be documented. Innovations and originality properties must not be declared in another competition previously.

11.2. Evaluation Method

- The evaluation will be carried out through seven (7) different criteria and each criterion will be evaluated by at least two (2) referees. Each referee makes observations for the "Team Awareness" criterion and gives an opinion to the

scoring referees. These opinions are evaluated by the relevant referees. The sum of the average points received forms the total score of that team.

Example of Scoring for a Team (R: Referee)															
	R 1	**R 2**	**R 3**	**R 4**	**R 5**	**R 6**	**R 7**	**R 8**	**R 9**	**R 10**	**R 11**	**R 12**	**R 13**	**R 14**	**Avg.**
Criterion 1	9	7													8
Criterion 2			7	9											8
Criterion 3					5	9									7
Criterion 4							6	8							7
Criterion 5									9	11					10
Criterion 6											12	14			13
Criterion 7													6	8	7
Total Score:															**60**

- The criteria that the referees will be assigned to evaluate are determined in accordance with their fields of expertise.
- If the difference between the scores given by the referees evaluating the same main criteria is more than four (4) points, the referees who gave points explain the reasons for the points they gave and decide a score again.
- While scoring an institution or at least one of the team members belonging to that institution, a referee from that institution temporarily leaves his/her duty to another referee.
- When the first round is completed, the ranking is made over the total points and the points are announced.
- For the teams exercising their second right, only the first three (3) criteria will be scored and updated. Others remain stationary as they are independent of flight and mission.
- When the second round is completed, the higher total points of the teams exercising their second right are taken as the basis, and the final results are announced by reordering.

11.3. Error Analysis (Uncertainty Analysis)

Necessary measures have been taken in order to carry out the measurement and evaluation process in the most accurate and healthy way and to minimize referee mistakes. These measures can be summarized as:

- Each member of the Referee Committee signs a "Commitment" stating that he/she will perform his/her duties duly and objectively.
- In order to narrow the point of view of the referees, a consensus is reached between the Advisory and Assessment Committee (AAC) before the competition.
- A team's 92-point segment is evaluated by at least 12 of 18 sub-criteria belonging to 6 main criteria and by two referees each. The 8-point part is evaluated by 14 referees. Therefore, the total score of a team consists of the average or sum of 12 x 2 + 14 = 38 different evaluations. This means 76 different evaluations for two rounds. A small mistake in any of these will have a very small effect on the total score.
- The referees evaluating the same criteria compare the score they gave with the other referee, if the difference is high, they evaluate together and justify. In this case, if one of them gives an extraordinary score, the other acts as a safety.
- There is a software limitation when uploading the points to the system. In other words, there is no possibility that a score that should be 8 at the most will be entered as 9 by mistake.
- After the scores are entered into the system, the referees make the final check and approve. Thus, operator error is minimized.

However, it is not possible to avoid so-called random errors. But it is possible to measure and calculate these errors. The uncertainty in our scoring system has been calculated as follows in order to compensate for the loss of rights by our teams with very small points difference.

P: Total Score

Pk: Criteria score given by referees

Pt: Discretion score given by referees

w_{pk_i}: Error or tolerance made by the referees while giving the criteria score

w_{pt_i}: Error or tolerance made by the referees when giving the discretion score

w_p: Total measurement of uncertainty of referees

$$P = \sum_{i=1}^{24} \frac{Pk_i}{2} + \sum_{i=1}^{14} \frac{Pt_i}{14}$$

$$w_p = [\sum_{i=1}^{24} (\frac{\partial P}{\partial Pk_i} w_{pk_i})^2 + \sum_{i=1}^{14} (\frac{\partial P}{\partial Pt_i} w_{pt_i})^2]^{\frac{1}{2}}$$

$$w_p = [\sum_{i=1}^{24} (\frac{1}{2} w_{pk_i})^2 + \sum_{i=1}^{14} (\frac{1}{14} w_{pt_i})^2]^{\frac{1}{2}}$$

Let w_{pk_i}=w_{pt_i} $and\ called\ w_{p_g}$. (In other words, the referees should evaluate with the same error rate when giving criteria score and discretion score.)

$$w_p = [{w_{p_g}}^2 (\frac{1}{4} 24 + \frac{1}{196} 14]^{\frac{1}{2}}$$

$$w_p = 2.464\ w_{p_g}$$

$w_{p_g} = 0.2$ (that is, let's assume that each referee has a 20% margin of error. This figure has been kept high in order to be in favor of the teams.)

$w_p = 0.49$

Error rate for a team with a nominal score of 70 can be calculated as;

$\frac{w_p}{P} = \frac{0,49}{70} x100 = 0.7$. In this case the teams' score will be $70 \pm \%0.7$, as it will be in the range 69.51-70.49.

For a team with a nominal score of 80;

$\frac{w_p}{P} = \frac{0,49}{80} x100 = 0.6125$. In this case the teams' score will be $80 \pm \%0.6125$, as it will be in the range 79,38-80,61.

As a result, the nominal scores are affected by 0.49 points, assuming that all referees can make 20% evaluation errors. If a team misses a project support payment or award opportunity by 0.49 points, the Advisory and Assessment Committee (AAC) will make up for the measurement error by deciding in favor of the team.

12. AWARDS

- All finalist teams participating in the competition will compete for Ranking Awards (First, Second and Third Place Awards).
- In addition, if the finalist teams participating in the competition without receiving

any financial support from TUBITAK and do not receive any Ranking Award, they compete for the Performance Awards calculated in proportion to their flight scores in the competition area. A finalist team that participates in the competition without receiving financial support and receives a Ranking Award cannot receive a Performance Award.

- The awards stated in the table below show the total amount to be given to the teams that are entitled to receive awards. There will be no individual awards. First, second and third place awards will be divided equally according to the total number of team members (excluding the Advisor and Advisor Teacher) and will be paid in the competition area in case of being a finalist. Advisors and Advisor Teachers whose teams are eligible to receive ranking awards cannot benefit from the first, second and third place award amounts below. The awards to be given to the Advisors and Advisor Teachers are also stated in the table below.

Name of Award	Definition	International UAV Competition	Advisor (if any) Awards	Inter High School UAV Competition	Advisor Teacher Awards
Ranking Awards	First Place Award	150,000 TRY	9,000 TRY	100,000 TRY	9,000 TRY
	Second Place Award	120,000 TRY	7,500 TRY	80,000 TRY	7,500 TRY
	Third Place Award	100,000 TRY	6,000 TRY	60,000 TRY	6,000 TRY
Performance Awards	55 points and above	Puan x 700 TRY	-	Puan x 500 TRY	-

- Successful teams will be awarded at the ceremonies in the competition area and/or TEKNOFEST area. Teams entitled to receive Ranking Awards are also awarded with trophies and medals.
- “Certificate of Participation” will be given to the members of the finalist teams which compete in the competition, “Certificate of Achievement” will be given to the members of the finalist teams that receive the Ranking Awards and “Certificate of Appreciation” will be given to the members of the finalist teams that receive the Performance Awards.
- Advisors and Advisor Teachers of the teams that receive Ranking Awards in the

International and Inter High School UAV Competitions receive the Advisor Awards and Advisor Teacher Awards specified in the Award Table.

- Performance Awards will be divided equally according to the total number of team members (including the Advisor and Advisor Teacher) and will be paid in the competition area in case of being a finalist.

12.1. TUSAŞ (TAI) Awards

TUSAŞ-TAI Awards will be announced later.

12.2. Payment of Awards

- Financial Project Support (if any), Ranking Awards (if any) and Performance Awards (if any) of the finalist teams participating from abroad (including Azerbaijan and TRNC) will be paid to the Team Responsible in cash in the competition area or TEKNOFEST area.

13. PRINCIPLES OF REFUNDS

TUBITAK, conferring with the Advisory and Assessment Committee (AAC), may request a full refund of financial project support in the following cases:

- Failure to participate in the award ceremony(s) if the team receives an award.
- Expulsion of the team from the competition by TUBITAK as a result of the evaluation of Advisory and Assessment Committee (AAC) due to ethical violations, technical inadequacy, unsportsmanlike behavior during the competition process,
- Teams not making their flights after registration.

14. OTHER RULES

14.1. Administrative Rules

- During the competition, all participants must follow the announcements made on the www.teknofest.org website and sent to their registered e-mail.
- If deemed necessary by TUBITAK, changes in the Rules Booklet can be made. The most recently announced Rules Booklet is valid in the competitions.

- In the event of a disagreement concerning the technical rules, the decision of Advisory and Assessment Committee will be valid. In cases where there is no provision in the Rules Booklet, the decision of the Directorate will be applied.
- Shipment stuck in customs, delivery delays and likewise problems that could be overcome with precautions, can not be presented as an excuse for not engaging in the competitions.
- There must be no relationship that is considered a first degree relationship or conflict of interest between the team members and the Advisors and Advisor Teachers.
- The accuracy of the information declared during the application can be checked by TUBITAK via online systems. In case of misleading or untrue statements, the responsibility belongs to the declarants.
- The team may be expelled from the competition or may be banned from the competition for at least one (1) year by TUBITAK as a result of the evaluation of Advisory and Assessment Committee in the event that one or more of the team members applying for the competition behave aggressively or rudely towards TUBITAK officials, TEKNOFEST officials, AAC members, the referee committee, other team members or competition officials in writing, verbally or physically before, during or after the competition against including face-to-face, written or online environments.

14.2. Warnings Regarding Test Flights Before Competition Week

For test flights in the preparation process, teams must pay attention to the following rules:

- It is expected that there will be UAV pilots among the members of the teams.

Free (green) flights that are not prohibited by the highest local administrative authority;

- In cases where meteorological conditions are provided only by sight, flights can be made between sunrise and sunset hours and with a viewing angle of at least two (2) km in open weather conditions.
- The UAV must be in the pilot's field of vision, not exceeding 500 meters horizontally.

- Above 400 feet (120 meters) above ground level (AGL) should not be exceeded.
- Flight should be made at least 50 meters away from people and structures.
- Test flights are carried out by individuals who have sportive / amateur pilot authorization in accordance with the class of the UAV.
- Civil administrations may declare a flight ban at various times in some regions for safety reasons. Before the test flight, it should be checked whether there is a flight ban imposed on the flight area. UAV owners are responsible for damages caused by UAVs to third parties according to the legal regulations.

It is the responsibility of the teams to comply with all the rules set by the local authorities during the test flights.

14.3. Safety Rules

Safety measures listed below are required to be obeyed within the context of both health safety and violation of human rights. In the case of violation of these rules, Advisory and Assessment Committee (AAC), conferring it with TUBITAK officials, has rights to impose sanctions.

- Maiden flight in the in the competition area, with no prior flight testing,
- Show up in competion area without some prior testing of flight vehicle, after major changes are carried out on flight vehicle, following initial flights,
- Installation/attachment of propellers and powering of motors, spinning in high speeds, causing threat to nearby people within the closed spaces (like tent etc.) for the whole duration of competition,
- Flight testing of a flight vehicle in the vicinity of competition area while another team is already performing their test/competition, yielding possibility or suspicion of signal interference,
- Manual intervention to crashed flight vehicle, while its propellers are still moving,
- Too late intervention by pilot or responsible member to flight vehicle positioned outside the Fly Zone, after referee notices/decides situation is dangerous/critical.
- Flight test of flight vehicles involved in an accident and have not repeated technical inspections.

15. TRANSPORTATION

- Transportation expenses not exceeding 2,000 TRY can be requested for each team member (a maximum of 10 members are eligible to come to competition area). It should be stated in the budget table in the Project Presentation Report.
- Information for transportation to TEKNOFEST area will be announced in www.teknofest.org web page.

16. RELATED LEGISLATION

- Regulation on Activities to be carried out by TUBITAK Science and Society Department,
- UAV Competitions Rules Booklet,
- In cases where there are no provisions in the relevant legislation, the decisions of the Directorate and the Advisory and Assessment Committee (AAC) are applied.

17. CONTACT

- Application, report and video upload: www.t3kys.com/en/
- Announcements and Information: www.teknofest.org
- For your questions regarding the 9th International UAV Competition: uavturkey@tubitak.gov.tr and https://groups.google.com/u/0/g/uluslararasi-iha-yarismasi?hl=tr
- For your questions regarding the 9th International UAV Competition: uavturkey@tubitak.gov.tr and https://groups.google.com/u/0/g/uluslararasi-iha-yarismasi?hl=tr
- For your questions regarding the 5th Inter High School UAV Competition: ihaliseler@tubitak.gov.tr and https://groups.google.com/u/0/g/-liseler-arasi-iha-yarismasi?hl=tr

7th YEAR

#MİLLİ TEKNOLOJİ HAMLESİ