



## **FIGHTER UAV COMPETITION**

### **COMPETITION TERMS AND CONDITIONS**

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## 1 Purpose

In parallel with the developments in technology, Unmanned Aerial Vehicles (UAV) develop its fields of activity day by day and gain more and more autonomy. Another application area that requires high autonomy and is one of the trending research areas around the world is to gain the ability to make dog fight with UAVs just like fighter jets. Since the UAVs, which have already taken the observation activities worldwide from manned platforms, cannot approach the level of human intelligence in subjects such as high environmental awareness, decision-making ability and planning ability in dynamic environments, air-to-air combat maneuvers between fighter aircraft can only be performed with manned aircraft. The main purpose of the Combat Unmanned Aerial Vehicle (UAV) competition is to create such an air-air combat scenario between UAVs in a controlled environment and to direct young people who can achieve success in this field in the future, to gain experience and improve their skills.

## 2 Participation Conditions and Details

High School and University students or graduates can participate in the competition individually or as a team.

Teams must consist of a maximum of 10 people. Teams can only take 1 person as a consultant.

For consultants, a certified document showing that they are a faculty member / lecturer, research assistant or teacher must be submitted.

A member of a team cannot be found as a member of another team.

A consultant can only advise one team.

The application form must be filled until **15.03.2021**.

Applications can be submitted on the official Teknofest Aerospace and Technology Festival (TEKNOFEST) Technology Competitions website under the Technology Competitions section ([www.teknofestistanbul.org/en](http://www.teknofestistanbul.org/en)).

### **3 Competition Categories**

The competition will consist of two categories as rotary wing and fixed wing.

If the UAV provides the force required for its flight with the wings, this vehicle is considered in the fixed category, and if it provides the necessary force for its flight from the rotating propellers, this vehicle is considered in the rotating category.

UAVs that carry out vertical landing and take-off and providing the necessary lift for flight through wings are also considered in the fixed category.

### **4 Details of the Competition Area and Team Workshop Areas**

For the competition, an air space will be allocated in an area, approximately 500m length and 350m width, that will be announced later by the Teknofest competition committee. In this area, there will be a 20m wide and 200m long field that can be used as a runway for landing and take-off. Also, entry to the competition area is forbidden except for: three members during test, four members during pre-flight preparations and three members (including one pilot) during the flight. Access to electricity in the competition area will be provided. A common tent area will also be provided in order for the teams to prepare for the competition and to display their vehicles. Access to electricity in the tent area will also be provided.

## **5 UAV Technical Specifications and Limitations**

UAV's will be generally subjected to technical evaluation by the competition committee before the competition for security reasons. Approval for the team to enter the competition will be determined according to the evaluation result. Teams that cannot pass the technical evaluation will not be able to compete. The technical evaluation area will stay open throughout the competition. Teams that have crashed or could not pass the evaluation in their previous try, can be evaluated by request at any time, except during competition rounds.

The UAV's must have a fail-safe mode for communication loss (for details, see Security Necessities Article.10). UAV's can be controlled autonomously or manually. Teams can use ready-made products including platform (frame, wing, motor etc.) subsystems while designing and producing the UAVs.

UAVs' thrust system must be electrical motors that works with battery.

There should be a fuse on the UAVs that cut-off the engine power line. This fuse can be blade type or button type. Fuses made by using 'jumper' cable connector on the motor power line will not be accepted.

### **5.1 Physical Limitations of the UAVs**

The weight of the fixed wing and rotary wing vehicles that will enter the competition cannot be more than 10 kg. There are no limitations regarding the size and number of engines.

### **5.2 Limitations of the UAV Batteries**

Vehicles that are going to enter the UAV competition must use well-known and safety proven fuel and battery technologies. Also, the batteries must be safely placed in the vehicle. Batteries must be brightly colored to be noticed easily in case of an accident. Vehicles that are decided to have a dangerous power source by the jury will be forbidden to fly. In the case of an accident, teams are responsible for carrying out their batteries outside of the competition area.

## **6 Competition Details**

Every UAV entering the competition of the related category is going to be in the air at the same time and compete with each other during the competition. Limitations on how many UAVs can be on air at the same time can be established by competition committee during the competition depending on the circumstances.

Each UAV will target another and try to lock-on over image. The camera to be used while trying to lock must be fixed to a forward looking position and angle on UAV. The "shooting" operation will be performed virtually, not physically; so it is not possible for the targeted UAVs to be damaged physically.



Goal of the competition is to lock on the opponent UAVs successfully as much as possible and avoid being locked on by performing aggressive maneuvers.

### 6.1 Shooting Detection

Shooting is performed when the UAV captures the image of target UAV in its camera Field of View (FOV). In order to achieve a lock, the image of the target moving UAV must be held inside the square area in the center of the camera sight for 10 seconds for rotary wing class and 4 seconds for the fixed wing class. If referee committee detects any lock which is arranged by agreement, the team who tries to lock and the team who is being locked will be banned from the competition. The size of this square area is as shown in Figure 1. In addition, the image of the target UAV must cover at least 5% of the screen image, in at least one of the horizontal or vertical axes (Figure 1). Definition and rules of the parameters described in Figure 1 are mentioned below.

**A<sub>C</sub>**: Camera Field of View

**A<sub>S</sub>**: Target Shooting Area (The area that the target area must be held inside)

**A<sub>T</sub>**: Target Area

**T<sub>A</sub>**: Target Air Vehicle

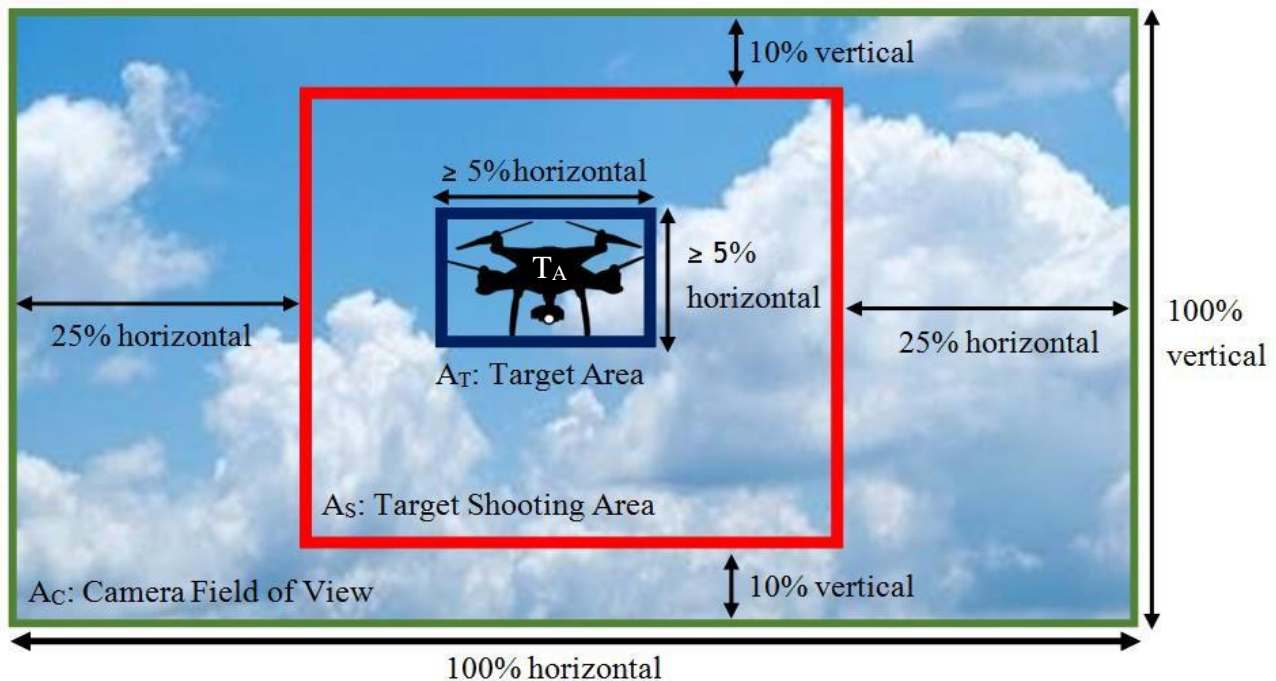


Figure 1: Example Locking Area

For autonomous locking, the UAV must be flying on autonomous mode. Locking detection must be made automatically by the system, without any user intervention. During a manual lock, the user can control the UAV manually. If a UAV enters the Target Shooting Area and shooting detection is made automatically while the user controls the UAV manually, it is counted as a

manual shooting. The user can also perform manual shooting by determining the shooting detection and Target UAV Area manually.

Each UAV is obligated to document the image during the locking by presenting it to the referee committee after the competition round with video footage. The refereeing committee will confirm the hits after each competition round by examining the videos and the lock-on data sent to the server. Teams that do not submit the relevant videos to the referees cannot leave the competition area. If for any reason the video is not delivered, corresponding team will be considered as not participated in the competition round. In order to vacate the competition area, video delivery must be provided within the given 20 minutes. If this period is exceeded, the relevant team will be considered as not participating in the competition round.

Each team must transmit the camera records with minimum PAL and NTSC resolution to their ground station simultaneously. Competition judges retain the right to demand to watch these records from the ground stations.

Although streaming live to the competition server is not a necessity, the teams that do this will gain extra points. These videos resolutions standard will be announced later on another document.

A square area to include the target UAV during locking must be defined. This area must be marked as a red rectangle on top of the captured image while UAV is locked and the coordinates of this area must be transmitted in the defined communication protocol. The record that will be analyzed by the jury must include the locking rectangle and the server time.

Videos that are going to be submitted by the team and that are subjected to evaluation are required to adhere to specific standards. These standards are;

- The minimum resolution of the videos must be 720\*576 px (PAL) or 640\*480 px (NTSC).
- Video naming should not contain special ([\*], [,], [!], [:] etc.) and non-English characters.
- Video naming must be in the form of "[Category] \_ [Competition Number] \_ [Team Name] \_ [Date (dd / mm / yyyy)]". For example; "FixedWing\_2\_TKNFST-IHA-Team\_11\_07\_2020.mp4" or "RotaryWing\_3\_TKNFST-IHA-Team\_12\_07\_2020.mp4"
- Videos that will be given to referee must be playable by the open-source program "FFPLAY". Videos that have problems or cannot be played by FFPLAY will not be evaluated.
- Videos that are send to referee cannot be captured other that native video. (Ex: Screen recording, cropped video, etc.)
- Teams are responsible for saving their recordings to given flash memory.
- Videos must be given to the referee with or without contain locking.
- Videos must have Target area and server clock must be shown on the top-right corner of the videos.

The whole locking rectangle and the whole target( $T_A$ ) must be inside the target shooting area mentioned above, but the target UAV( $T_A$ ) must not necessarily be present inside the locking rectangle completely.

In case of a lock, if there is a distance between the center of the locking rectangle and the center of the UAV more than 12% of the video width horizontally or 5% of the video height vertically, it is counted as incorrect locking.

To gain points, when there is a locking, teams must send data to the competition server in the defined communication protocol format successfully.

Teams will lose points when they send “Locked on Target” data while there is no locking and send area information with the wrong targets. If the  $A_T$  does not cover all of the  $T_A$ , jury will decide the acceptance of the locking.

For the autonomous locking, the UAV must switch to autonomous mode before the locking sequence starts and before the target UAV enters the locking area and must stay in autonomous mode during the locking sequence. If the target UAV is inside the locking area but the size is smaller than %5, it will be considered as the target UAV is not inside the locking area. But switching to autonomous mode after the target UAV is visible on the image but outside the shooting area does not prevent counting a lock as autonomous.

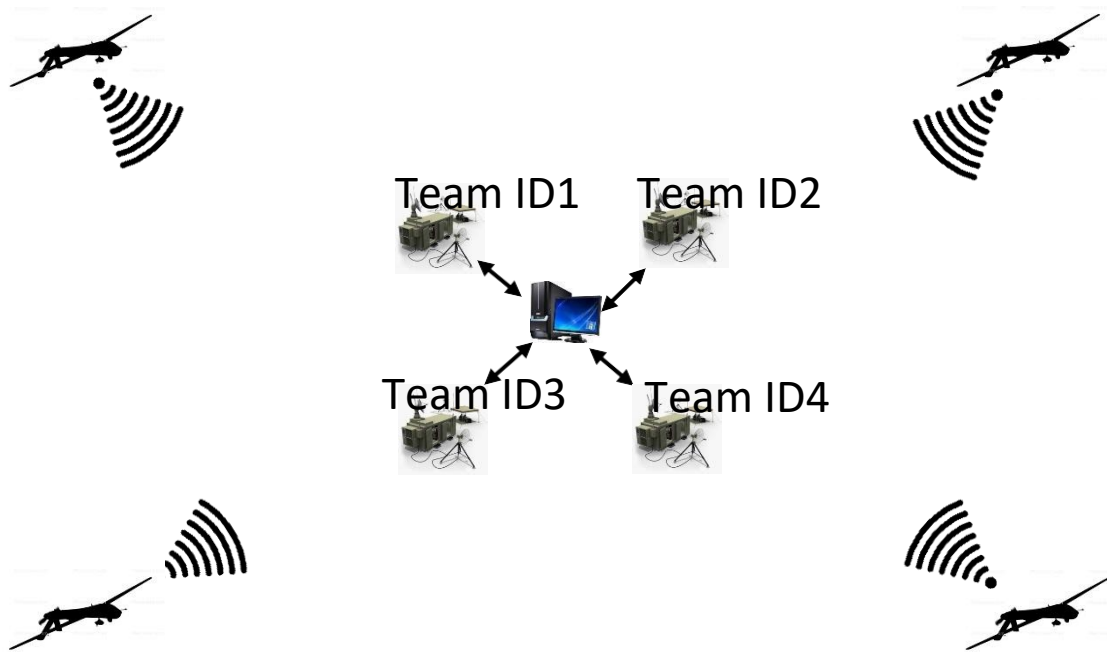
Teams cannot lock on to the same UAV repeatedly. After locking on to a UAV, at least one other UAV must be locked on before locking on the same UAV again.

Teams cannot lock on a UAV that is on the ground.

## **6.2 Communication**

Each UAV must have a point to point communication with its own ground station as shown in Figure 2. For this purpose, a communication format compatible to the Bilgi Teknolojileri Kurumu (Information Technologies Institution, BTK) must be used. Wi-Fi, spread spectrum encrypted communication protocols are recommended. Before the competition rounds, the teams whose signals are interfering with each other will be found and necessary actions will be taken by jury. In addition, the UAVs which will be used in the competition will be checked by the jury inside the inspection area 1 day before the competition. Teams which fail to pass the inspections are allowed to fix their problems during the competition and request to enter the inspection again. Team which cannot fix their communication status will not be included in the competition. The communication frequency and telemetry ID determined for each team before the flights should not be changed until the end of the competition. In addition, teams in the common tent are prohibited from turning on video transceiver electronics during the competition.

Teams cannot communicate with their UAVs' via internet.



*Figure 2 : General Communication Diagram*

### **6.3 Competition Server**

Each ground station must communicate with the competition server as shown in Figure 2. This communication will be established by an ethernet network switch locally.

In order to enable data transfer between competitor's ground stations and the referee server, a system, that's document will be released later, will be used.

Competitors must transmit data such as UAV GPS coordinates, altitude information, locking status and locking area location over this system to the referee server with at least 1 Hz (1 data per second).

System server will also share the telemetry information received from each team with other teams in real time (1Hz).

System time will be shared with all teams over the referee system. Competitors must add the system time to all data that will be transmitted to the server. With this feedback, delay between the competitor systems and competition server will be calculated.

All the data transmitted by the competitors over this system is recorded and the competitors are responsible to check the correctness of all the data they transmit. If any team send incorrect telemetry data during the competition, penalty points will be added to that team.

## **6.4 Telemetry Data**

The telemetry data transmitted to the server must be directly generated by the autopilot in the aircraft; This data must not be processed, such as any interpolation, extrapolation or duplication. Otherwise, the teams will be counted as not transmitting data to the ground station.

Detailed information on telemetry data is available in the 2021 Teknofest Fighting UAV Competition Communication Document.

## **6.5 Locking Data**

In case of a lock, information related to the lock must be reported to the server with locking package.

Detailed information on locking data is available in the 2021 Teknofest Fighting UAV Competition Communication Document.

## **6.6 Competition Timeline**

The competition will be a total of 5 days, 1 day of technical examination and 4 days of flights.

Taking into account weather conditions and availability of the flight zone, competition rounds can be held 2 flights before noon (one fixed wing, one rotary wing) and 2 flights in the afternoon (one fixed wing, one rotary wing). The exact times of the flights will be determined according to the availability of the conditions and the competitors are expected to be ready to fly when requested.

Teams that pass technical controls can make test flights during lunch breaks, between matches and technical controls. They must coordinate themselves by requesting test flight from the relevant field referee. Since the flight zone in the competition area will be permitted at certain hours, it is forbidden to try a test flight without consulting the referees.

During the competition, a maximum of 7 competition rounds for both fixed wing and rotary wing will be held. Each round will be 15 minutes long. The number of competition rounds may be less due to unsuitable flight zone or for unforeseen reasons. Teams take off one by one and land in the order they take off after 15 minutes of flight time. The 15-minute flight time starts after the last team takes off.

Teams must finish the competition round time in air in order to get point from this round. If an accident or collision was happened, teams don't lose points that they earned. If an emergency occurs in air, jury will decide the landing and last decision will be given by jury about the round points.

Teams cannot takeoff or land during competition round. Competitors are responsible to design their UAVs for maintain the flight during competition round.

Teams are free to participate in all or any of the 7 competitions at most. Total competition score is the sum of points collected by the teams in the competitions they participated in.

Teams have 40 minutes prior to each competition to set up their systems and prepare aircraft for flight. Teams that are not ready for flight within this period cannot participate in the related competition.

At the end of the flight time, the teams will be given 20 minutes to clear the flight area and collect their systems, and the time-out penalty points will be added to the teams that do not clear the flight area during this period.

Teams cannot make arbitrary landing and taking off during the competition round. The team that lands arbitrarily is deemed to be eliminated from that competition.

### **6.7 Manual Mode Switching**

The limit for switching to manual mode for a team within a competition round is 3. Teams exceeding this limit will be penalized per each switch.

The situation that the team pilot guides the aircraft with the help of the remote controller is evaluated as manual mode. Semi-auto mode is also considered as manual mode.

Sending a command to the vehicle via the Ground Control Computer (defining the destination point, changing its altitude, changing the cruising speed, giving a descent command) does not impair autonomy and is not considered a transition to manual mode. When the same commands are given by remote control, the autonomy is not broken.

The team pilot must notify the referee when intervenes with the aircraft. In cases where he does not report, the referee may judge this intervene as switching to manual mode.

The numbers of switching to manual mode will be counted by the competition server and the cases of exceeding the limit will be automatically added to the penalty points. Therefore, the correctness of the flight mode information that the teams send to the server is the responsibility of the teams.

### **6.8 Other Rules**

A communication speed score will be added to each team with an amount inversely proportional with their delay of telemetry data transmitted to the server.

Competitors who want to participate in the competition with the vehicles they design will not be given any privileges due to their design.

## **6.9 Special Rules**

### **6.9.1 UAV Registration**

Pilots of the teams joining the competition are required to apply from the "UAV Pilot Registration Application" at <https://iha.shgm.gov.tr/> address and their application must be approved. In this system, teams without a piloting authorization will not be allowed to fly.

Members who have a pilot authorization are required to register their UAV from the "UAV Manufacturing - Import Registry" at <https://iha.shgm.gov.tr/> address. UAVs that do not have an approved registry will not be allowed to fly.

Delays caused by the approval time will not be taken into account.

Teams are required to bring their documents related to their UAVs registry with them on the competition day.

### **6.9.2 Technical Inspection**

The UAV must remain the way it is defined and described in the report. After presenting the report, minor changes to improve flight performance and safety will be inspected by the judges. During the inspection, consistency between the actual UAV and the design from the report will be examined. Direct objections to the Technical Inspection judges during the inspection will not be taken into account.

### **6.9.3 Judge Briefing**

Each referee will be informed about the rules beforehand. Before the competition, judges will give a briefing about the competition rules in a meeting where at least one member of each team attends.

### **6.9.4 Cheating Prevention Team and Rules**

Teams that are discovered to be jamming signals will be disqualified from the competition. There also may be hidden jury members or hidden judges among the audience other than the actual jury and judges. Cheating teams will be condemned and banned from the competition indefinitely.

### **6.9.5 Objections**

Each team has the right to object. Objections must be in a written manner, verbal objections are not going to be taken into account. The objection forms will be given by the number of competitions that each team will participate in before the competition. Objection forms are evaluated by the advisory committee. Objections will be delivered to the related judge in the competition area.

## 7 Competition Calendar, Scoring and Evaluation

### 7.1 Competition Calendar

Date	Explanation
15.03.2021	Application Deadline of the Competition
27.03.2021	Pre-Design Report Submission Deadline
19.04.2021	Announcement of the Teams that Have Passed the Pre-Elimination According to Pre-Design Report Results and the Teams that Have Earned the Right to get Financial Aid
23.06.2021	Critical Design Report Submission Deadline
05-12.07.2021	Announcement of the Critical Design Report Results and the Teams that Qualify for Final
01.08.2021	Proof of Flight and System Introduction Videos Submission Deadline
07-10.08.2021	Announcement of Evaluation Results of Flight Evidence and System Identification Videos
05-09 September 2021	Competition Days

*Table 1 : Competition Schedule*

The evaluation will be divided into three segments; Critical Design Report, System Introduction Video and competition scoring. Teams that do not submit their Pre-design Reports, Critical Design Reports and Proof of Flight videos **will not be able to enter the competition.**

#### 7.1.1 Pre-design Report

Teams are responsible for submitting their Pre-design Reports on scheduled date. In the Pre-design Report; competitors must describe the mechanical, hardware and software design of their UAVs. In order to request support for the competition, the Pre-design Report (PDR) must be submitted



and approved. According to PDR results, a pre-elimination will be made. Teams that pass on to the Critical Design Report phase will be announced after the PDR evaluations on the scheduled date. Teams that earned the right for a financial aid among the teams that pass on to the CDR phase will also be announced on same date. PDR template and scoring content will be announced to the teams after the competition application deadline.

### **7.1.2 Critical Design Report**

Teams that pass on to the Critical Design Report (CDR) phase are responsible for submitting their Critical Design Reports on scheduled date. Critical Design Report is for properly documenting teams' works. Hardware and software design of the UAVs are required to be described in the CTR. Quantity and specifications of the devices used in the vehicles must be included in the CTR. Templates of the CTR are going to be released on the Teknofest website after the application deadline. Teams that qualify for the finals according to CTR results will be announced on scheduled date.

### **7.1.3 Proof of Flight Video**

The Proof of Flight video is an approximately 5-minute video showing that the UAV that will participate in the competition safely performs landing, take-off and cruise missions. In this video, take-off, flight and landing of the UAVs' must be shown without cut. At least, 3 minutes of this video has to be in autonomous mode. There should be a HUD image on a specified area of the screen so that the mode change is visible. In the video, the take-off, landing and cruise should be clearly visible. The UAV shown in the proof of flight video and the UAV brought to the competition area must be the same, except for the changes mentioned in section 6.9.2.

Teams that send the videos taken from the camera on the UAV as Proof of Flight video are required to show the vehicle in the video.

In order to participate in the competition, it is required to send a Proof of Flight video. Deadline for submitting proof of flight videos is described on competition calendar.

Teams should upload the Proof of Flight Video to the team's own YouTube channel and send the link to the referee via the communication channel to be specified later. The related video does not have to be public on YouTube. However, videos that cannot be accessed via the link will not be evaluated. The video must be at least 720p quality.

### **7.1.4 System Introduction Video**

In this video, vehicles should be introduced under the main headings of mechanical, electronic and software. Engineering calculations should also show that they are ready to compete. The prepared video should not exceed 7 minutes.

**System Summary:** In this section, the general characteristics of the vehicle (Ex: flight time, weight, etc.) should be mentioned and detailed explanations should be avoided.

**Development Tests:** Separate tests of the mechanical, electronic and software sub-parts developed for the UAV should be shown in this section. (Ex: wing load test, flight time, thrust calculation, communication distance test, simulatios, etc.). Each test should be supported by data and graphics.

**All Mission Test:** In this section, tests of autonomous flight and lock-on missions should be shown. It should be shown how the information coming from the server is evaluated and how the autonomous locking software works. In this test, it should be explained that vehicles are ready compete, supported by data.

Teams should upload the System Introduction Video to the team's own YouTube channel and send the link to the referee board via the communication channel to be specified later. The related video does not have to be public on YouTube. However, videos that cannot be accessed via the link will not be evaluated. The video must be at least 720p quality.

## 7.2 Competition Scoring

Scoring of the competition consists of two parts. The first part is report scoring, and the second part is mission scoring.

### 7.2.1 Report and Video Scoring (30%)

On the table below, scoring types and point amounts are specified.

Scoring Type	Score
Critical Design Report	% 15
System Introduction Video	% 15

*Table 2 : Report Scores*

### 7.2.2 Mission Scoring (70%)

On the table below, scoring types and point amounts are specified. After the competition, score of the team that has the most points will be scaled to 100 and the scores of the other teams will also be scaled with the same scale.

Scoring Type	Score
Successful autonomous lock	600
Successful manual lock	200
Being locked by a competitor	-100
Not transmitting a telemetry package in a second (for each second)	-1
Autonomous flight	100
Autonomous landing	100
Autonomous take-off	100
Real-Time Video Transfer	50
Incorrect hit detection	-30
Manual Mode Limit Exceeding	-10

*Table 3 : Mission Score Types and Amounts*

The score is determined by lock quantity, not by second. Vehicles have to track another vehicle for a minimum of 4 seconds (10 seconds for rotary wing) in order to successfully lock. Before the

hunter can lock on to the same vehicle again, it has to lock on to a different vehicle.

Choosing among several alternative targets that are automatically determined on the image during autonomous locking does not disrupt the autonomy of the UAV to follow a certain target. However, manually marking and tracking a region on the image will not count as autonomous locking. Competitors are responsible for notifying the referee board of the methods they will use for locking before the competition. The referee board reserves the right to consider the methods used as valid or not. By participating in this competition, the competitors are deemed to have undertaken to accept the decisions of the referee board.

During autonomous locking, following one target among many other will not disrupt autonomy. Also, targeting with manually selected area will not count as autonomous locking. Competitors are responsible for stating their methods for locking to jury. Jury hold the right to decide if the method for autonomous locking is acceptable. By joining this competition, competitors are consenting the judgements of the jury.

Competitors must fly autonomously for at least 75% of the duration of the competition round in order to receive autonomous flight points. During the competition round, it is possible for them to switch to manual and return to autonomy with a total autonomous flight time of 75%.

During autonomous flight, it is possible to send UAV to a specific location or change mod of the vehicle without disrupting the autonomous flight. Controlling UAV with joystick or similar device will not be counted as autonomous flight. Competitors are responsible for informing the referee board about the commands and methods they will use. The decision whether the use in question violates autonomy will be made by the referee board. When a control method not approved by the referee board is detected, they have the right to cancel the points received.

According to timestamps from the data sent by the teams to the competition server, transmission delays of the data sent by the teams to the judge computer are calculated. After each competition round, average data transmission delay in terms of seconds is calculated for each team (*Team Av. Delay*).<sup>7</sup>

Also, average transmission delays of every team are averaged to calculate General Average Delay. (*Gen. Av. Delay*)

After these calculations; if a team's average delay is less than the general average delay, the team gets positive points. If it is more than the general average delay, the team gets negative points. Scoring is calculated according to the formula below:

$$\text{Communication Score} = (\text{Gen. Av. Delay} - \text{Team Av. Delay}) * 50$$

The calculated communication score is added to the mission score.

### **7.2.3 Total Score**

The maximum score that could be obtained from the competition results is 100. It will be calculated with the formula below.

$$\text{Total Score} = \text{Scaled Total Mission Score} * 0.7 + \text{SIV} * 0.15 + \text{CDR} * 0.15$$

## 8 Prizes

Teams that complete the autonomous take off, landing, flight and autonomous locking successfully in at least one of the 7 competition rounds, will earn the right to enter the prize ranking.

Teams that entered in top three places in their own category (Fixed Wing or Rotary Wing) will be given the prizes listed on the table below. Table indicates the total amount of prize, which will be given to the teams that earn the right to a prize. There will be no individual awards. First, second and third place prizes will be divided among all members of the team and will be transferred to each member's specified bank account.

	<b>Fixed Wing Category</b>	<b>Rotary Wing Category</b>
<b>First</b>	250.000 TL	50.000 TL
<b>Second</b>	150.000 TL	30.000 TL
<b>Third</b>	100.000 TL	20.000 TL

*Table 4 : Prizes*

### 8.1 Minimum Success Criteria for Prize Ranking

Teams that have successfully completed autonomous take-off, landing and flight and autonomous locking missions in at least one of the competition rounds have right to be on prize ranking. Autonomous takeoff, landing, flight and lockout must be shown in the same competition round.

### 8.2 Honorable Mention Prizes

Competitors are required to perform autonomous landing, take-off, flight and manual locking in at least one of the competition rounds. The first three places of the competition are determined among the teams that satisfy the prize criteria. If the teams satisfying the prize criteria are not enough to fill the first three places or none of the teams provide the criteria, teams that do not provide are evaluated for the empty places, regarding their scores. Although the teams not providing the criteria are able to be in the first three places, they will receive an honorable mention prize determined by the T3 Foundation instead of the competition prize.

For example;

If only 2 teams among the 20 teams provide the prize criteria, these two teams will be ranked as first and second place according to their scores. Since there is no other team satisfying the criteria, other teams are evaluated for the third place. The team that has the highest score among other teams is determined as the third place winner. Even if this team has a higher score than the first and second place winners, since it could not satisfy the prize criteria, it is placed after those teams. First and second place teams get the announced first and second place prizes, but the third place team that does not satisfy the criteria gets the honorable mention prize.

## 9 Safety Requirements

All the UAVs will be checked for safety, before test and competition flights. If a team cannot pass the safety check, the team will not be allowed to fly.

Minimum requirements for the safety check are given below:

1. Determination of the vehicles consistency with the technical drawings from the competition final report that the team prepared.
2. Checking the vehicle safety in terms of construction and visual integrity.
3. Determination of whether the components are attached safely to the UAV. Determination of whether all the connections are tight and made with safety wire, liquid adhesive and/or nuts. Connection materials must be selected as to prevent breaking off connections.
4. Determination of the propeller structure and connection unity.
5. Examination of all electronic wiring to ensure that enough connectors and thick wires are used.
6. Radio range control, motor start and stop.
7. Determination of whether all the control mechanism of the UAV have enough sensitivity or not.
8. Examination of the overall integrity of the load system.
9. All the UAV radios must be capable of automatically switching to fail-safe mode during signal loss.
10. The fuse must be mounted on the exterior surface of the UAV, in an easily accessible location.

During the competition, team UAVs cannot go out of the specified flight area.

A UAV going out of this area for 10 seconds will result in the team's being disqualified from the related competition round and needs to terminate flight (fail-safe mode).

Judges can disqualify a team that goes out the flight zone multiple times. This only applies to the current competition round.

In case of a communication loss, manually or autonomously flying UAVs must have separate flight safety systems.

If autonomous, in case of a 10+ second communication loss, safety pilot must change UAV's mode to manual and land the UAV. If UAV cannot change its mode to manual, then it must do flight termination.

If manual:

- In case of communication loss for 5+ seconds, the UAV must land safely with a parachute or flight termination(fail-safe).

Flight termination for fixed wings must be performed as described below:

- Throttle cutting

- Full pitch up
- Full right rudder
- Full right or left aileron

Flight termination for rotary wings must be performed by cutting throttle completely.

## 10 General Rules

- Teams have the right to object to the concerned judge through their team leaders. Objections can be made verbally, provided that they are submitted in writing at a later time. Verbal objections must be put in writing within 24 hours. In any case, non-written objections will not be taken into consideration. Objections will be finalized within 24 hours after having examined by the judge panel.
- Each contestant is responsible for taking the necessary precautions and showing the expected attention to his/her peers and the environment.
- The work of ideas that is the subject of the competition is; may produce with member of the team and this idea belongs to the team and the consultant will not be accepted as the owner of the work.
- Our teams that have benefited from the reports of the past years on our website have to include cited phrase after the sentence cited. CITED FORMAT: "Cited Phrase/s (Year, Competition Name, Category, Team Name) EXAMPLE QUOTE: "Failure to determine the location of the earthquake victim in the wreckage is the most important problem that slows down the debris removal and search for the earthquake victim." (2020, Technology For Humanity, Disaster Management, X Team)
- Turkish Technology Team (T3) Foundation and the organization committee reserve the right to make any amendments to the specifications in order for the contest to take place in accordance with the specified impartial criteria so that any violations may result in judicial outcomes, to better meet any sorts of requirements by the contestants, to provide necessary safety precautions and to maintain the functionality of the contest specifications.
- Having made the necessary evaluations following the application deadline, the T3 Foundation and the organization committee reserve the right to cancel the contest given that sufficient number of applications is not reached with the required technical knowledge and skills.
- TEKNOFEST Safety and Security Terms and Conditions will be communicated to all contestants, delegations and concerned parties. All competing teams are responsible for ensuring the safety terms and conditions specific to their respective categories specified in TEKNOFEST Safety and Security Terms and Conditions. In this regard, with the exception of security precautions contained in the aforementioned security instructions, it is the contestants' responsibility to take additional precautions arising from the systems employed.
- The T3 Foundation and the organization committee retain to exclude any and all teams

from the contest who do not fulfill the terms and conditions of TEKNOFEST Safety and Security Terms and Conditions to provide a safe environment for holding the contest. T3 Foundation and organization officials cannot be held responsible for damages arising from the violation of terms and conditions by the contestants, delegations and concerned parties.

- Regarding the competition, the competitor hereby accepts and consents to any kind of written or visual promotion, publication, social media and internet broadcasting to be made by the T3 Foundation and / or TEKNOFEST before or after the competition. In addition, the competitor agrees and submits that any and all intellectual property generated as pertains to the competition, including but not exclusive to designs, code, and manufactured products, belongs exclusively to the T3 Foundation and / or TEKNOFEST and that the competitor does not have any rights to or demands on these artifacts. T3 reserves the right to disclose all intellectual property thereby for public consumption in a manner it deems fitting.
- In the event that a competitor infringes upon the intellectual property rights of any product, and T3 Foundation and/or TEKNOFEST incur damages, the responsibility for such damages will be borne entirely by the relevant participant(s) (including consultant).
- All teams who qualify to compete in the contest will be given a Participation Certificate.

## **11 Statement of Liability**

- The Turkish Technology Team Foundation and TEKNOFEST are in no way liable for any injury or damage caused by any entry, any entrant, or by the disqualification of an entry. The Turkish Technology Team Foundation and TEKNOFEST at large are not responsible for ensuring teams operate their systems within the law of the Turkish Republic. The Turkish Technology Team Foundation and TEKNOFEST, and organization officials cannot be held responsible for the damages inflicted upon third parties by the contestants.

**Turkish Technology Team Foundation has the right to make any amendments to these terms and conditions.**