2nd INTERNATIONAL FREE MISSION

UNMANNED AERIAL VEHICLE COMPETITION

DETAILED DESIGN VIDEO PREPARATION GUIDE

Deadline: 7 June 2022

TEAM NAME:		
VEHICLE TYPE: ☐ **Fixed-wing** ☐ **Multicopter** ☐ **Hybrid** ☐ **Flapping Wing** ☐ **Other**		
VEHICLE DEVELOPMENT	☐ **New Vehicle**	☐ **Current Vehicle**
SCHOOL / INSTITUTION / UNIVERSITY:		
TEAM RESPONSIBLE NAME/SURNAME:		

The detailed design of the TÜBİTAK International Free Mission Unmanned Aerial Vehicles (UAV) Competition, which is the next stage of the conceptual design stage, will be prepared and presented only as a video. The features of the detailed design video are given below.

- Detailed design video should be a maximum of fifteen (15) minutes and should be prepared as a single video.
- The first part of the video is the Flight Section (maximum 5 minutes), and the second part is the Presentation Section (maximum 10 minutes).
- Detailed design video;
  - It should be in HD resolution, mp4 format in a high light environment.
  - The video must be uploaded to an online video platform.

- In video shooting, attention should be paid to the location of the light source and high-resolution quality video shooting is expected. Thus, the videos will be evaluated more objectively.

1. FLIGHT SECTION

The Flight Section, which is the first part of the Detailed Design Video, should be prepared for a **maximum of five (5) minutes** under the conditions and specifications given below. The teams that pass this section successfully will be scored out of 100 in the "Presentation Section".

- *Video starts:* At the beginning of the video, for a maximum of two (2) minutes, at least one (1) team member introduces himself/herself with his/her UAV, with his/her name, surname, and team name.
- ***Flight evidence:*** Video of the UAV at take-off, flight maneuvers, and landing are recorded uninterrupted (take-off, flight, and landing must be in a single flight attempt). This part should be no more than three (3) minutes.
- Flights are recorded from a distance where the design of the UAV can be easily distinguished.
- The UAV in the flight video and the UAV introduced in the detailed design video must be the same vehicle.
- Video shooting is performed in a safe area where there is no risk and danger. The responsibility belongs to the team leader.
- The detailed design video of the teams that do not have the part of the take-off, flight maneuvers, and landing images in the video prepared in accordance with the rules and/or the UAV exhibited an unsuccessful flight or did not properly fly in the flight video will not be evaluated and the team will be eliminated from the competition.

2. PRESENTATION SECTION

After the flight evidence video of the UAV to be used in the competition is properly proven, the second part of the detailed design video, the "Presentation Section",

should be prepared according to the following headings (Presentation Section Headings). The Presentation Section should be prepared for a **maximum of ten (10) minutes**. The following points should be considered while preparing this section.

- In the video, each title should be explained in the order given in the "Presentation Section Titles". When the related titles are being explained, they must be indicated with **subtitles**.
- There is no time limit for each title. Total time (10 minutes) will be taken into account.
- The minimum requirements expected from the contents of the titles that need to be explained are written under the relevant part, and the important issues in the video can be determined by the team and explained in the video.

Presentation Section Headings

A. Team Organization (5 Points)

In this section, general introductory information about the applicant team leader and members as well as the team's abilities should be presented. The task distribution of the team members in the design process of the UAV should be shown on an organizational chart, and information should be given to introduce each member of the team. The experience and, if any, achievements of the team members or team in the field of aviation should also be mentioned. This section is expected to be a maximum of one (1) minute.

B. Detailed Content of the Design (30 Points)

In this section, information should be given about the detailed sizing, detailed design and configuration of the UAV, the aerodynamic characteristics and stability, capability, usefulness, innovation, locality, and simplicity of the UAV, and the original aspects of the design. This section is expected to be a maximum of two (2) minutes.

1. Design, Autonomy and Flight Stability (5 puan)

In this section, it should be explained what kind of studies have been performed

for the UAV to guarantee a stable flight. The level of autonomy should be clearly stated. The equations used in the geometric dimensioning of the UAV, aerodynamic analyzes (with graphics), stability/flight performance calculations, flight, and simulations should be presented. The methods utilized in sizing and configuring the UAV should be briefly mentioned.

2. Ability and Mission Achievement (5 points)

In this section, what kind of capability will be demonstrated for the tasks to be performed should be explained and all studies, calculations, and analyses related to this capability should be revealed. Thrust calculations, payload calculations, aerodynamic analysis, image processing, measurement, recognition, communication software, etc. studies should be explained. Studies, calculations, analyses, simulation results, and claims made according to the type of capability should be presented.

3. Usefulness and Impulsiveness of the Task (5 points)

In this section, it should be examined whether the tasks to be performed is in the interest of society. The challenge of the task to be performed in the competition area should be evaluated.

4. Innovation (5 points)

It should be clearly stated that a new feature of the UAV such as design, performance, hardware or software, etc. will be introduced. Supporting and convincing information, calculations, and analyzes, if any, should be shared.

5. Indigenousness (5 points)

In this section, the UAV's design, performance, hardware or software, etc. native feature, computation, integration, etc. should be clearly stated. Supporting and convincing information, calculations, and analyzes, if any, should be shared.

6. Design Ergonomics (5 points)

In this section, it should be stated which feature (design, hardware, software, propulsion unit, mechanical design, production, etc.) the UAV demonstrates

simplicity or economy without sacrificing other performances.

7. Referee Judgment

If there is an issue other than the above-mentioned items that are expected to be appreciated by the referee, it should be stated. These issues can be technical as well as social behaviors/gains.

C. Detailed Design, Analysis, Manufacturing, Electronic Integration and Mission Evidence Section (65 Points)

The content of this section should consist of sections taken from the following stages (Expected Sections to Take Place in Video). There should be sections that represent the stages of the UAV and the auxiliary equipment specific to the mission to be performed. Different team members are expected to take part in each video and introduce themselves and their duties with their voices. An attendant watching this video must see, listen, and be convinced of all the stages of the work of the vehicle and the team can participate in the competition. This section is expected to maximum of seven (7) minutes.

Expected Sections to Take Place in Video

1. Design Stages

Some visuals from all the design studies (sizing, drawing, mechanical design, geometry determination, airfoil selection, etc.) related to the UAV should be recorded and added to the video. Teams participating with an existing/old vehicle can describe their vehicles.

2. Analysis Stages

Some images/visuals from all analysis studies (Ansys, MATLAB, Simulink, SolidWorks, Xflr5, etc.) related to the UAV should be recorded and added to the video. The results obtained from the analysis should be clearly presented in summary. The current version of the vehicles can be represented by the participating teams and specify their previous analysis if any.

3. Manufacturing Stages

Some visuals from all manufacturing studies and methods related to the UAV (production with a CNC machine, wing production with a hot wire cutting tool,

production with a three-dimensional printer, etc.) should be recorded and added to the video.

4. Hardware Integration Stages

At this stage, some images/visuals showing the various equipment and the results and processes obtained while integrating this equipment into the UAV should be added to the video.

5. Mission Flight

Although this stage is not mandatory, it can be shared if a trial test has been performed so that the envisaged task can be performed. This provides the team with a significant advantage.

Detailed Design Video sections and time periods are given in the table below.

Flight Section		
	Time (maximum)	Points
Video beginning	2 minutes	-
Flight evidence	3 minutes	-
Teams that pass the Flight Section will be evaluated for over 100 points in the Presentation Section.		
Presentation Section		
	Time (maximum)	Points
Team Organization	1 minute	5
Detailed	2 minutes	30
Detailed Design, Analysis, Manufacturing, Electronic Integration, and Mission Evidence Section	7 minutes	65