



# New Flying Competition 2025

## Competition Task

Version 1.3  
September 20<sup>th</sup>, 2024



## Change Log

Version	Release Date
1.0	January 15 <sup>th</sup> , 2024
1.1	March 19 <sup>th</sup> , 2024
1.2	June 9 <sup>th</sup> , 2024
1.3	September 20 <sup>th</sup> , 2024

Section	New Version	Old	New
4.6.3	1.1	$\frac{Ah}{kg}$	$\frac{Ah}{km \cdot kg}$
4.6.4.6	1.1	$EC_{specific} = \frac{EC}{m_{payload}}$	$EC_{specific} = \frac{EC}{x_{EnduranceFlight} \cdot m_{payload}}$
3.1	1.2	-	The list with names of all team members is provisional. The final list must be submitted with the payment of the member fee (April 30 <sup>th</sup> , 2025).
3.3	1.3	-	A team can consist of any number of team members as long as they all comply with the requirements (see general rules section 4). Due to limited space in some areas, the team size in the competition week in Hamburg is limited to a maximum of 16 members.
4.6.4.4	1.3	-	For aircraft with vertical propulsion (such as VTOLs), hovering is not permitted during this maneuver and thrust must not contribute significantly to the lift force. Thrust vectoring is permitted. For 4+1 configurations the following applies: Vertical thrust is not allowed to be generated on both sides of the aircraft simultaneously. For all other configurations, the jury decides whether the vertical thrust has a significant share of the lift force.

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## 1 Introduction

The scientific model flying contest New Flying Competition (NFC) was created by the student association Neues Fliegen e.V. in 2015. The competition is characterized by applying real-world industrial aircraft design criteria and aircraft design processes to model aircraft design. During the competition the participating university teams apply scientific rationale and methods which are to be documented in design reports.

Following aspects play a major role:

- Apply a real-world aircraft design process and real-world design criteria to a model aircraft.
- Apply knowledge and competences acquired at university in practice.
- Improve the competitors' soft skills
- Encouraging interactions between students and Hamburg's aviation industry

The tasks of the NFCs are based on the current problems of commercial aviation and this time the NFC25 is dedicated to the topic of environmentally friendly flying. The participating aircraft should be characterized by two core aspects in order to provide relevant solutions for aviation. Firstly, efficient aircraft with electric propulsion systems should be developed and secondly, the aircraft should have a large payload volume. For manned aviation, this volume could represent passengers or large hydrogen tanks, for example. Both are characterized by a high volume rather than a high load.

The aim of the NFC25 is to allow as many teams as possible to participate and to encourage a wide variety of aircraft concepts and configurations. For this reason, there are only a few restrictive requirements in the task definition. For example, the aircraft configuration, the aircraft size and the geometry and mass of the payload can be chosen freely.

## 2 General Remarks

The rules and regulations for the New Flying Competition 2025 (NFC25) consist of two parts. The first part is the "Rules of the New Flying Competition 2025" with the general rules. These rules are independent of the flight task. The second part is the "Competition Task" (this document) with all the rules that are specific to the NFC25. The latest versions of both documents are available at <https://neuesfliegen.de/competition/nfc-2025/>.

The following applies to all deadlines (submissions, payments, etc.). The submission, payment, etc. must be made by the end of the specified day. The end of the day is defined as 11:59 p.m. CET.

## 3 Participating in the Competition

### 3.1 Registration

The teams need to register by email: [neuesfliegen.ev@haw-hamburg.de](mailto:neuesfliegen.ev@haw-hamburg.de). The competition is limited up to 12 teams. Registration takes place on a first come, first serve basis. In exceptional cases, more than 12 teams may be admitted. In such cases, the decision is made by the organizing team. The official deadline for the registration is October 31<sup>st</sup>, 2024. No team will be accepted after the deadline.

The registration is official if all the following points have been fulfilled:

- The team representative has sent an application mail with following information:
  - Name of team in subject line (e.g. Team XYZ-NFC25 application)
  - Names of all team members
  - Copies of documents proving that all team members are students (exceptions: see general rules section 4)
- The applying team has received a confirmation email from the NFC-Team.
- The team has paid the starting fee within four weeks of receiving the invoice.

The registration will be cancelled if the fees are not paid on time. Fees can be refunded if cancellation is made before the deadline.

The list with names of all team members is provisional. The final list must be submitted with the payment of the member fee (April 30<sup>th</sup>, 2025).

### 3.2 Registration Fee

There are two fees to enter the competition: The starting fee is 1.000 Euros per team, regardless the number of team members. The member fee for meals and transportation in Hamburg is 100 Euros per attendee. The starting fee needs to be paid within four weeks of receiving the invoice, which will be sent together with the confirmation email. The member fee needs to be paid until April 30<sup>th</sup>, 2025.

Table 1: List of fees

<b>Fee</b>	<b>Amount to be paid</b>	<b>Deadline</b>
Starting fee	1,000 Euros	within four weeks after receiving the invoice
Member fee	100 Euros per team member	April 30 <sup>th</sup> , 2025

### 3.3 Team size

A team can consist of any number of team members as long as they all comply with the requirements (see general rules section 4). Due to limited space in some areas, the team size in the competition week in Hamburg is limited to a maximum of 16 members.

## 4 Challenge

### 4.1 Flight Goal Overview

The aim of the competition is to design and build an aircraft with the most efficient electric propulsion system possible. At the same time, the aircraft must be able to carry the heaviest possible payload in the largest possible volume during the competition flights.

Each team has to compete against a reference aircraft. The reference aircraft is designed and built by the organizing team (Neues Fliegen e.V.). For the flight tasks in the competition, each team that performs better than the reference aircraft will receive positive points and each team that performs worse will receive negative points. The scoring system is explained in detail in section 4.6.

### 4.2 Model Specification

#### 4.2.1 Lift Generation

The aircraft may not be lighter than air. Otherwise, all configurations are allowed. The entire propulsion system must be powered by a battery pack. No additional power supply (e.g. launch catapult, rocket booster) is allowed.

#### 4.2.2 Take-Off

The aircraft must take off completely under its own power, no assistance by touching the aircraft (e.g. keeping the wings straight during acceleration or even hand-launching) is allowed. No part of the aircraft may remain on the ground during take-off, otherwise the flight will not be scored.

The take-off mass must not exceed 15 kg.

#### 4.2.3 Structural strength

The aircraft must withstand 3g flight maneuvers without suffering a structural failure. For this purpose, calculations or experimental verifications must be included in the FDR.

#### 4.2.4 Aircraft ID

A valid e-ID of the remote pilot must be attached to the aircraft in accordance with the EU regulation for unmanned aerial vehicles of the "Open" category.

#### 4.2.5 Propulsion System and Battery

The propulsion of the aircraft must be electric. Any kind of combustion engine, whether as a direct drive or in a hybrid system, is not allowed. Fuel cell systems may be used, but their use must be approved in advance by the organizing team.

Only batteries with LiPo, Lilon, LiPo-HV or LiFePo cells are permitted as power source. The batteries must have an XT60, XT90 or AS150 connector for the main power and a standard JST-XH connector for balancing. The batteries must be removable from the aircraft and may consist of connected individual battery packs. During the competition, each team is required to hold a secure container for safely storing the batteries when not in use.

The individual battery packs must not exceed of 6S. The entire battery pack must not weigh more than 3kg.

The battery for the drive must only supply power to the drivetrain and no other electrical components in the aircraft. Accordingly, an additional battery ("receiver battery") must be used to power the remaining electrical components such as the flight controller, servos, sensors, RC equipment and other actuators and peripherals.

The electric motors, motor controllers and the propulsion battery may be designed and manufactured by the participating team. However, functional proof must then be provided in both calculational (FDR) and experimental form (video of full throttle test) with the exact same components.

It is mandatory to have a physical safety switch to isolate the propulsion batteries from the other electrical components.

### 4.2.6 Radio Control

The radio system and the receiver battery must be commercially available, unmodified "off-the-shelf" components. The radio system must be approved and certified for use in Germany.

An emergency function must be implemented and approved by the organizing team in the event of a radio link failure. The emergency function must be described in the FDR and will be discussed during the safety check. If during the contest it is found that the emergency function is inadequate, the team will not be allowed to take part in any contest flights on that day.

Only 434 MHz, 868 MHz and 5.8 GHz may be used for the radio link, telemetry and possible FPV video connection.

### 4.2.7 Autopilot

An autopilot or other stabilization systems may be used. If the flight is to be automated, the planned flight route must be approved by the organizing team before the flight. Autonomous flying is not permitted.

### 4.2.8 Measuring Equipment

The aircraft must be able to accommodate a flight logger box with measurement electronics. This box does not require power from the aircraft and is self-contained. The exact dimensions can be found in [Appendix A](#) (CAD and drawing). The position of the box must be on the top side of the aircraft. The box must be able to be bolted with standard M3 fasteners to the aircraft at the locations indicated.

The box may only be enclosed (on the starboard and port side) and covered towards the sky using radio frequency permeable materials, i.e. wood, fiberglass, fabric, foil, plastic. For optimal live telemetry reception, it is recommended to incorporate a 45-degree cut into the starboard and port sides of the mounting location, an example is provided in the CAD document.

For the competition the box will be provided by the organizing team.

### 4.2.9 Stability Margin

Calculational evidence must be provided showing the stability margin for the center of gravity range that is intended for the competition flights. Flights may only be conducted with a center of gravity that lies within the calculated range and provides a sufficient stability margin. These calculations may be performed using XFLR5, FLOW5, OpenVSP or based on wind tunnel measurements. The calculations must be included in the FDR.

### 4.2.10 Manufacturing

The wings, tailplane and fuselage have to be manufactured by each participating team. For this purpose, pictures and videos of relevant construction steps have to be submitted with the FDR (more details in Section 4.5.2).

A proof-of-flight video must be provided at least one week before the competition. Without this proof-of-flight there is no right to a competition flight. This video must be provided in the same way as the manufacturing images and videos.



#### 4.2.11 Payload

The aircraft must be capable of carrying a payload with a mass of at least 1kg. The payload may be divided into 5 payload pieces (PLP). The PLP may have a cylindrical and cuboid shape. Other shapes are not permitted. All edges for the cuboid payload and all the diameters and edges for the cylindrical payload design must have a minimum length of at least 100mm.

All PLP must be fully enclosed by the fuselage. The fuselage must be designed in such a way that the PLP can be removed. The PLP must be securely fixed during the flights. The PLP must be detachable in a reasonable amount of time and is not allowed to destroy the fuselage during the disassembly process. As an example, the payload is not allowed to be bonded to the fuselage preflight, only to be detached in a destructive process after landing.

#### 4.3 Safety Check

At the start of the competition, each aircraft will be subjected to a safety check. The points listed in Table 2 are checked by the officials.

Table 2: Checklist for Safety Check

Subject of the Audit	Description	Check
General Check for Airworthiness	Experts check the aircraft for proper cable connections, functional servo motors and control linkages, ...	
Structural Test	The aircraft must be lifted with the planned take-off mass at both wings at 2/3 of the wingspan.	
Motor Test	The motors must run at full throttle for a few seconds with the propellers mounted. If this cannot be done safely by one person holding the aircraft due to the aircraft configuration, the organization team must be informed prior to the competition.	
Safety Switch Test	It must be shown that the motors do not start while the switch is in the off position.	
Test Fit Flight Logger box	The flight logger box must be installed as a test.	
Stability Margin	The team must show that the center of gravity is within the calculated range by lifting the aircraft.	

In addition to the points mentioned above, the officials may ask questions about the aircraft based on the FDR in case of any uncertainties (e.g. about the emergency function).

During the safety check, all payload pieces are measured and weighed. All checked parts are then given a "checked" sticker with the corresponding data.

#### 4.4 Competition Flights

The competition consists of up to five flights per team, including four maneuver flights and one endurance flight. The same task will be flown four times during the maneuver flights. The teams can choose to adjust the payload configuration, including mass, volume, and position, for the maneuver flights within the guidelines outlined in section 4.2.11. However, one of the four payload configurations used during the maneuver flights must also be used during the endurance flight. Please refer to Table 3 for a complete list of flight tasks for both maneuver and endurance flights.

Table 3: Flight Tasks for Maneuver and Endurance Flight

<b>Flight</b>	<b>Task</b>	<b>Monitoring</b>
Maneuver Flight	Take-off and climb to 100m	Position (GPS)  Speed (GPS)  Maneuver Load (Acceleration)
	360° left and 360° right turn circle	
	One high g maneuver (sinus flight, looping or barrel roll)	
	Gliding flight	
	Flight at maximum speed	
	Flight at minimum speed	
	Landing	
Endurance Flight	Fly as far as possible	Position (GPS)

The aircraft must be leveled at an altitude of 100-110m between flight tasks before proceeding to the next maneuver. After each flight task, except for take-off, a 180° turn must be executed to remain within the flight area during the maneuver.

It cannot be guaranteed that there will be a live evaluation of the altitude and flight loads during the flight with the flight logger box. If feedback of the flight data during the flight is preferred, each team must take care of this themselves.

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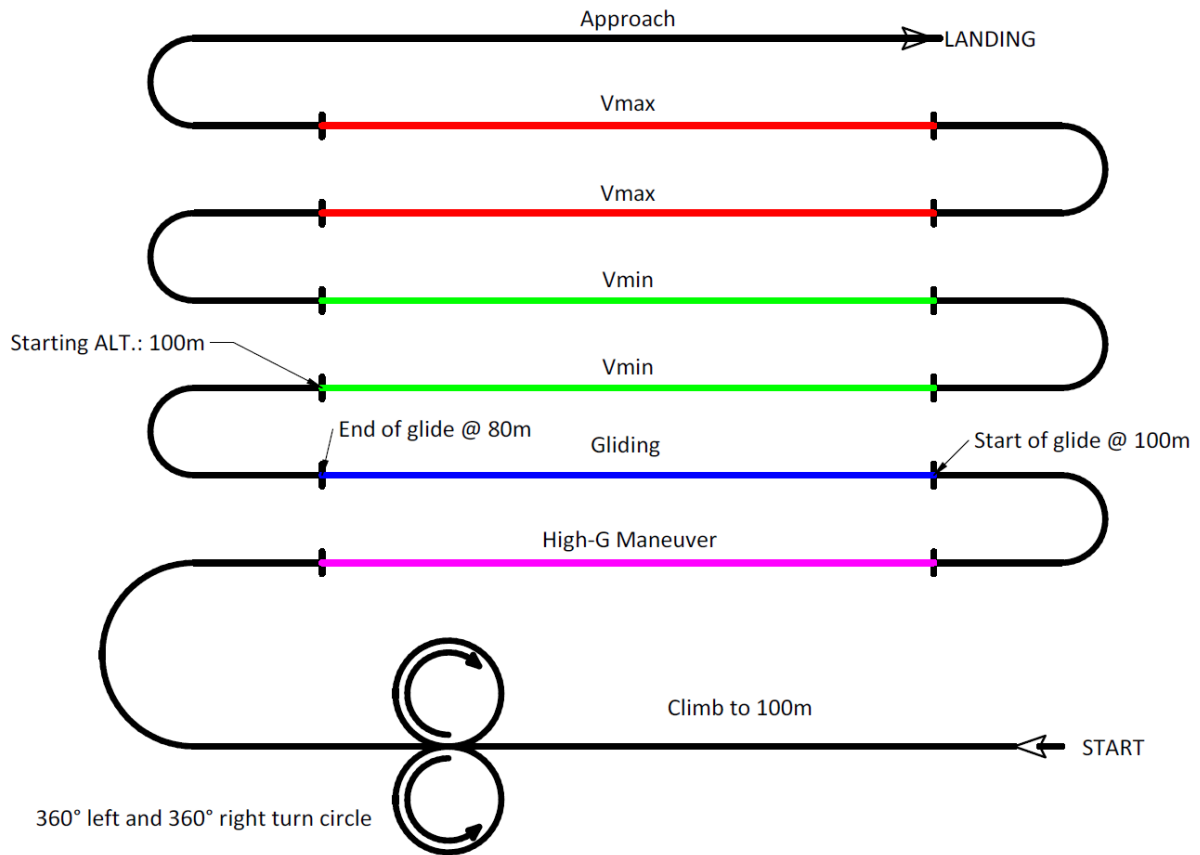


Figure 1: Flight Pattern for Maneuver Flights

Figure 1 shows the flight pattern and all subtasks for clarification. The route is represented as a serpentine line for visual clarity, but circles are flown during the flight, with only right turns apart from the 360° turns. The landing occurs on the same runway as the take-off.

The mandatory tasks include the 360° turns and the high g maneuver. These tasks are evaluated as pass or fail. Failing to pass a task means the attempt does not count towards the score. If a team fails to achieve at least one scored flight from the 4 maneuver flights, they will be excluded from the competition. This team will then not be allowed to participate in the endurance flights.

### 4.4.1 Take-off and Climb Angle

For take-off, the aircraft is positioned a specific distance in front of a designated line. The aircraft must have taken off before crossing the line. Each team chooses the run-up distance to the line to their discretion.

After take-off, the aircraft must climb as steeply as possible to an altitude of 100m.

### 4.4.2 Left and Right Turn Circle

To perform this maneuver, execute a 360° left turn followed by a 360° right turn.

If both turns cannot be completed successfully, the flight attempt must be aborted, and the pilot must land the aircraft immediately in the designated area.

#### 4.4.3 High-G Maneuver

To perform the high-g maneuver, you must complete one of the following flight tasks with a maneuver load of at least 3g:

- Sinusoidal flight
- Looping
- Barrel roll

There are three attempts per maneuver flight to reach the 3g flight load. If the 3g is reached on the first attempt, you can continue directly with the next maneuver. It cannot be guaranteed that there will be an evaluation of the flight loads during the flight with the flight logger box. If feedback of the flight data during the flight is preferred, each team must use their own system.

#### 4.4.4 Gliding flight

To score the gliding flight, the distance travelled by the aircraft between 100m and 80m altitude is measured. All propulsion systems must be turned off above 100m and can only be turned on again below 80m.

#### 4.4.5 Flight at maximum / minimum Speed

This flight task consists of four individual maneuvers. A distance of 200m must be flown for each maneuver. In order to minimize the influence of the wind, the high-speed flight is flown twice in opposite directions. The average of the two flights is noted in the scoring matrix. The same applies to the low-speed flight. Each of the four maneuvers must be performed at a constant altitude. The aircraft must not deviate more than 5m for the starting altitude over the 200m distance. The low-speed flight must be demonstrated without a stall.

#### 4.4.6 Landing and Descend Angle

The landing procedure requires the aircraft to be at a flight level between 100m and 105m before the approach can begin.

The objective is to achieve a steep approach and a short landing distance, with the angle of descent determined between the initial altitude and an altitude of 5m.

A line on the runway indicates the landing area. The aircraft should not touch the line or the area in front of it. The landing distance is the distance between the aircraft and the line.

#### 4.4.7 Endurance Flight

The objective of endurance flight is to fly as far as possible with a high level of energy efficiency. Each team is assigned a specific flight area and altitude range. After take-off, the aircraft is directed to the designated area. Once within the area, each team can fly a route of their choice to fly as far as possible.

To land, teams must notify the designated member of the organizing team in order to avoid collisions. Once the organizing team has cleared the runway, the team can begin the landing approach.

It is the responsibility of each team to ensure that the aircraft has sufficient battery life to land at all times.

It must be noted that the endurance flight must be flown with the same payload configuration as the scored maneuver flight.

## 4.5 Design Reports

Each Team is required to submit two design reports, a Preliminary Design Report (PDR) and a Final Design Report (FDR).

### 4.5.1 Preliminary Design Report (PDR)

The preliminary design phase concludes once a feasible baseline design layout has been identified. Unlike previous competitions, the PDR does not require a traditional report, but rather the content is presented on a poster. The posters must be submitted as a PDF file. Please note that the posters will be printed by us in DIN A2 format and the content must be readable from a distance of 1m. In addition to the task, an example PDR is provided as a guide. The required contents for the PDR are shown in the checklist (Table 4).

Table 4: Checklist for PDR contents

Content		Check
List of considered aircraft configurations including their "pros" and "cons" with respect to the mission profile		
First estimates for the selected aircraft configuration	Weight	
	Wing and thrust loading	
	Center of gravity calculations	
	Maximum and minimum flight speed	
	Maximum flight distance	
	Preliminary wing and empennage design	
	Manufacturing costs	
Project schedule		
3-view drawing of the baseline design		
Rendering of the baseline design		

Section 4.6.2 describes how the PDR is included in the scoring. Section 0 indicates the submission date for the PDR.

### 4.5.2 Final Design Report (FDR)

The FDR contains a detailed description and detailed technical specifications of the aircraft. The FDR also indicates the method of construction of the various parts of the aircraft and is supplemented by a 3-view drawing.

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Table 5: Checklist for FDR contents

Chapter Title	Content	Check
Introduction	Brief description of the aircraft	
PDR Changes	Overview of changes from the aircraft design in the PDR to the final design	
Aircraft Configuration	Explanation of the aircraft configuration in relation to the flight mission	
Design Details	Description of the individual aircraft components <ul style="list-style-type: none"> <li>• Fuselage*</li> <li>• Wing*</li> <li>• Tail-Unit*</li> <li>• Gear*</li> <li>• Motor-Propeller-Combination**</li> <li>• Electrical Systems (selected components and interconnection diagram)</li> <li>• Flight Controller (selected components)</li> </ul>	
Specification Details	<ul style="list-style-type: none"> <li>• Calculation of weight</li> <li>• Calculation of wing-lift</li> <li>• Calculation of thrust loading</li> <li>• Calculation of center of gravity</li> <li>• Calculation of stability margin</li> <li>• Calculation of maximum and minimum flight speed</li> <li>• Calculation of maximum flight distance</li> </ul>	
List of Costs	Overview of project costs in the form of a table	
Adapted Project Schedule	<ul style="list-style-type: none"> <li>• Comparison between planned project schedule (PDR) and actual project progress</li> <li>• Brief description of the problems encountered</li> </ul>	
Flight Testing	<ul style="list-style-type: none"> <li>• Type and number of flight tests</li> <li>• Preparation of flight tests</li> <li>• Results of the flight tests</li> </ul>	
Drawing	3-view drawing of the baseline design	
Manufacturing	Pictures or videos showing that the fuselage, wings and tail unit were made by the team themselves***	

\* Section must include component material, description of relevant design decisions and all relevant calculations (especially those mentioned in Section 4.2).

\*\* Section must contain selected model and power specification. If components are manufactured by the team, all relevant calculations must be included, and a video of the test run must be provided with the FDR (see section 4.2.5).

\*\*\* Manufacturing images and videos do not have to be integrated into the PDF file of the report. Instead, all images and video parts can be combined into one video (for images as a slideshow) and uploaded to YouTube. The link to access the video must be specified in the FDR.

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Table 5 shows the basic contents of the FDR. It is possible to add further information. If a section is required for a component that does not exist in the aircraft (e.g. flight controller), then write a brief explanation in this section as to why this component is not used.

Section 4.6.2 describes how the FDR is included in the scoring. Section 0 indicates the submission date for the FDR.

### 4.5.3 Formatting of the FDR

*Table 6: Format Regulations for the Final Design Report*

Report Language	English
General Report Content	<ul style="list-style-type: none"> <li>a) Cover Page</li> <li>b) List of Contents</li> <li>c) List of abbreviations and symbols</li> <li>d) Your text including pictures, charts and tables</li> <li>e) Attachments</li> <li>f) Bibliography</li> </ul>
Header	<p>On each page except cover page:</p> <ul style="list-style-type: none"> <li>• Left hand side: name of university</li> <li>• Right hand side: team name</li> </ul>
Footer	<p>On each page except cover page:</p> <ul style="list-style-type: none"> <li>• Left hand side: Date of submission</li> <li>• Right hand side: page number/total number of pages</li> </ul>
Max. no. of pages	<ul style="list-style-type: none"> <li>• 25 for content (d)</li> <li>• 10 for attachments (e)</li> </ul>
Cover page must state:	<ul style="list-style-type: none"> <li>• Type of report (Final Design Report)</li> <li>• Name and address of your university and model flying club (if applicable)</li> <li>• Team name</li> <li>• Name of team captain (first name, family name, e-Mail address)</li> <li>• Names of team members (first name, family name, e-Mail address)</li> <li>• Name of supervising faculty member (if applicable)</li> <li>• Date of submission</li> </ul>
Paper Format	DIN A4 or letter (8.5" x 11"), portrait
Font and Font size	<ul style="list-style-type: none"> <li>• Text: 11pt, Arial, block formatted</li> <li>• Heading: 13 pt, bold, Arial</li> <li>• Sub-header: 12pt, underlined, Arial</li> <li>• Header: 8pt, Arial</li> <li>• Footer: 8pt, Arial</li> </ul>
Line spacing within text	single
Line spacing before and after paragraphs	double
Line spacing between paragraphs	double
Page margins	Top: 2,5 cm; Bottom: 2 cm, Left: 2,5 cm, Right: 2,5 cm
Report format(digital)	PDF

## 4.6 Scoring

### 4.6.1 Final Score

The total score is the sum of the score for the reports and the score for the flights.

$$S_{total} = S_{flight} + S_{report}$$

The goal of the competition is to get as many points as possible.

### 4.6.2 Report Score

Each team can earn up to 35 points from PDR and FDR combined.

$$S_{report} = S_{PDR} + S_{FDR}$$

To limit the workload of the reports, the PDR will not be scored. As long as the report has been submitted by the specified date and contains the contents listed in section 4.5.1, 10 points will be awarded for the report. The jury decides whether the PDR meets the content requirements. Between 0 and 25 points are awarded for the FDR. The number of points awarded depends on the quality of the report. The jury decides on the quality of the report and thus on the number of points awarded.

### 4.6.3 Flight Score

The score for the flights is the sum of the score of the four maneuver flights and the score of the endurance flight. To avoid negative scores, each team starts with an additional 65 points.

$$S_{flight} = 65 + S_{maneuver} + S_{endurance}$$

Of the four maneuver flights, only one will be scored. Each team can decide for itself which flight is to be scored. It must be noted that the endurance flight must be flown with the same payload configuration as the scored flight.

The scoring of all flights will be based on the reference flight. If the flight performance in a category is better than the reference aircraft, positive points are awarded for it. If the flight performance is worse, negative points are awarded. The points for each flight task are calculated individually with a tangent hyperbolic function and are added up at the end according to the following formula.

$$S_{maneuver} = \sum W_i \cdot \tanh \left( \frac{P_{team,i}}{P_{ref,i}} - 1 \right)$$

$$S_{endurance} = \sum W_i \cdot \tanh \left( \frac{P_{team,i}}{P_{ref,i}} - 1 \right)$$

$W$  represents the weighting factor of the task (cf. Table 7) while  $P$  represents the flight performance of the team or the reference flight. For tasks with positive weighting factors, the goal is to achieve the highest possible value for the flight performance. For negative weighting factors, the goal is to achieve the lowest possible value (e.g. take-off and landing distance). The negative sign means that a low performance value leads to a high score.



Table 7: Evaluated flight tasks with weighting factors

Flight	Evaluation Criteria	Performance Symbol	Unit	Weighting factor
Maneuver flight	Take-off distance	$x_{Take-off}$	$m$	- 4
	Climb angle	$\alpha_{climb}$	$^{\circ}$	7
	Glide ratio	$E$	1	25
	Max speed	$v_{max}$	$\frac{m}{s}$	4
	Min speed	$v_{min}$	$\frac{m}{s}$	- 4
	Landing angle	$\alpha_{Landing}$	$^{\circ}$	5
	Landing distance	$x_{Landing}$	$m$	- 3
Endurance flight	Flight distance	$x_{EnduranceFlight}$	$km$	8
	Specific energy consumption	$EC_{specific}$	$\frac{Ah}{km \cdot kg}$	- 12
	Payload mass	$m_{Payload}$	$kg$	10
	Payload volume	$V_{Payload}$	$m^3$	18

Additional details on assessing flight performance are outlined in the following section. In addition to the task, an Excel file is provided. This file is used in the competition to calculate the points. Until the competition, it is intended to help you understand the scoring system.

Performing a flight task incorrectly or not at all results in the lowest possible score. The calculation function for points indicates that the negative value of the weighting factor for each task is equivalent to the lowest possible score.

#### 4.6.4 Scoring of performance in detail

##### 4.6.4.1 Take-off and Landing Distance

The takeoff distance  $x_{Take-off}$  must be specified prior to the flight. For takeoff, the aircraft is placed in front of a line at the specified distance. The forward most point of the aircraft that touches the ground is used for the measurement. The aircraft must not touch the line or any ground behind the line during take-off. The distance between the take-off position and the line is used for scoring. The real take-off point is not relevant for scoring if it is in front of the line. If the aircraft touches the line, or the area beyond the line, the task is marked as incomplete.

During landing, the aircraft must not touch the ground before crossing the designated line. The scoring will be based on the distance between the line and the point where the aircraft comes to a complete stop ( $x_{Landing}$ ). The aftmost point of the aircraft that touches the ground will be used for measurement.

The actual landing point is not considered for the evaluation as long as it is beyond the designated line. If the aircraft touches the line or the ground in front of it, the task is marked as incomplete.

During take-off and landing, a member of the organization team monitors the line to make sure the rules are being followed.

For VTOL capable aircraft, no takeoff distance needs to be specified. They automatically get  $x_{Take-off} = 0m$  entered for takeoff. For landing, the airplane must be on or over the line with any part of it after it has come to a standstill in order for a landing distance of  $x_{Landing} = 0m$  to be judged. If this is not the case, the landing distance is measured as described above.

#### 4.6.4.2 Climb and Landing Angle

The angle of climb is determined between 5m and 100m ( $\Delta z = 95m$ ) altitude. For the calculation the flown ground distance ( $\Delta x$ ) between both heights is measured. The angle  $\alpha$  is calculated from the arc tangent of the distance and the altitude difference.

$$\alpha_{climb} = \text{atan} \left( \frac{\Delta z_{climb}}{\Delta x_{climb}} \right)$$

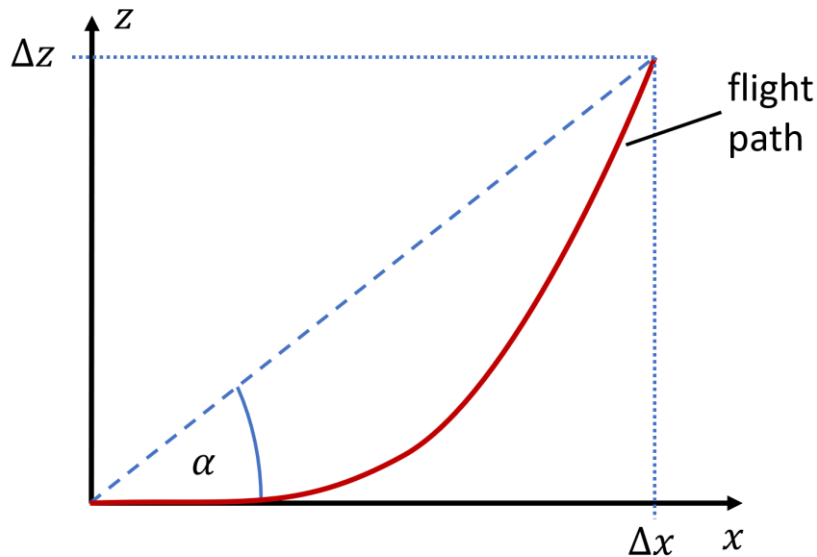


Figure 2: Visualization of the measurement and calculation variables for the pitch angle

The landing angle is calculated in the same way as the climb angle, with the difference that the amount is used for the calculation in order to obtain a positive angle.

$$\alpha_{Landing} = \left| \text{atan} \left( \frac{\Delta z_{Landing}}{\Delta x_{Landing}} \right) \right|$$

The position data measured by the GPS is used to determine the flown ground distance and the altitude.

#### 4.6.4.3 Glide Ratio

For the gliding flight, the distance covered by the aircraft between 100m and 80m altitude is measured ( $\Delta z_{Gliding} = 20m$ ).

$$E = \frac{\Delta x_{Gliding}}{\Delta z_{Gliding}}$$

To be scored for this task, all engines must be shut down above 100m and must not be restarted below 80m. If any propulsion systems are turned on between 100m and 80m altitude, the task will be marked as failed.

GPS position data is used to determine the ground distance flown and altitude.

#### 4.6.4.4 Maximum and Minimum Speed

For the maximum speed, the average value of the maximum speed of the flight in both opposite directions (cf. section 4.4.5) is calculated.

$$v_{max} = \frac{v_{max,1} + v_{max,2}}{2}$$

The minimum speed is calculated in the same way.

$$v_{min} = \frac{v_{min,1} + v_{min,2}}{2}$$

The speed  $v$  of the individual flights is calculated from the time  $\Delta t$  needed to fly the specified distance  $\Delta x$ .

$$v = \frac{\Delta x}{\Delta t}$$

The position data measured by the GPS is used to determine the flown ground distance and the flight controller measures the time.

If the aircraft deviates more than 5m from the initial altitude or stalls during the maneuver, the flight task is marked as failed. The maximum and minimum flight speeds are judged independently from each other.

For aircraft with vertical propulsion (such as VTOLs), hovering is not permitted during this maneuver and thrust must not contribute significantly to the lift force. Thrust vectoring is permitted. For 4+1 configurations the following applies: Vertical thrust is not allowed to be generated on both sides of the aircraft simultaneously. For all other configurations, the jury decides whether the vertical thrust has a significant share of the lift force.

#### 4.6.4.5 Flight distance

In endurance flight, the flight distance is measured as soon as the specified flight altitude is reached. And the measurement ends as soon as the aircraft is outside the specified altitude. The distance flown is determined from the GPS position data.

If the assigned flight area is significantly exceeded, the jury may terminate the flight at its own discretion. In this case, the aircraft must be landed immediately in the landing area and 0m will be recorded for the distance flown.

#### 4.6.4.6 Specific energy consumption

The specific energy consumption is calculated from the energy consumption of the endurance flight, the flight distance, and the payload mass.

$$EC_{specific} = \frac{EC}{x_{EnduranceFlight} \cdot m_{payload}}$$

The energy consumption is determined after the flights by recharging the batteries. The batteries must therefore be handed over to the organization team as soon as possible after the flight.

#### 4.6.4.7 Payload mass and volume

All details are described in section 4.2.11.

## 5 General Timetable of the New Flying Competition

Table 8: Important Dates

Date	Activity
October 31 <sup>st</sup> 2024	Deadline NFC registration
February 28 <sup>th</sup> 2025	Submission PDR
April 30 <sup>th</sup> 2025	2nd Payment (member fee) Submission Team members
June 15 <sup>th</sup> 2025	Submission FDR
August 10 <sup>th</sup> 2025	Submission proof of flight video
August 18 <sup>th</sup> to 24 <sup>th</sup> 2025	New Flying Competition

### Timetable NFC25

Mo 18. August – Sunday 24. August

Table 9: Timetable Competition

Mo	Tu	We	Th	Fr	Sa	Su
Arrival	Safety Check	Competition Flights			Sight-seeing Award Ceremony	Check out

- A more detailed chart will be published shortly before the competition -

Table 10: Timetable Competition flights

Wednesday	Thursday	Friday
Maneuver flight 1 & 2	Maneuver flight 3 & 4	Endurance flight

For competition flights, please note that one or more flight days may be canceled due to weather conditions. There are no replacement flight days. If a flight day is canceled, the number of maneuver flights will be reduced accordingly. The decision as to whether the weather conditions are suitable for flying will be made by the officials at the beginning of the competition week.

## 6 Disclaimer

No set of regulations is flawless. Therefore, corrections and changes may be made even after publication. Any new version of this document will be announced on the website. In addition, every team that is registered at that time will be notified of the change by email.

Appendix A  
Flight Logger

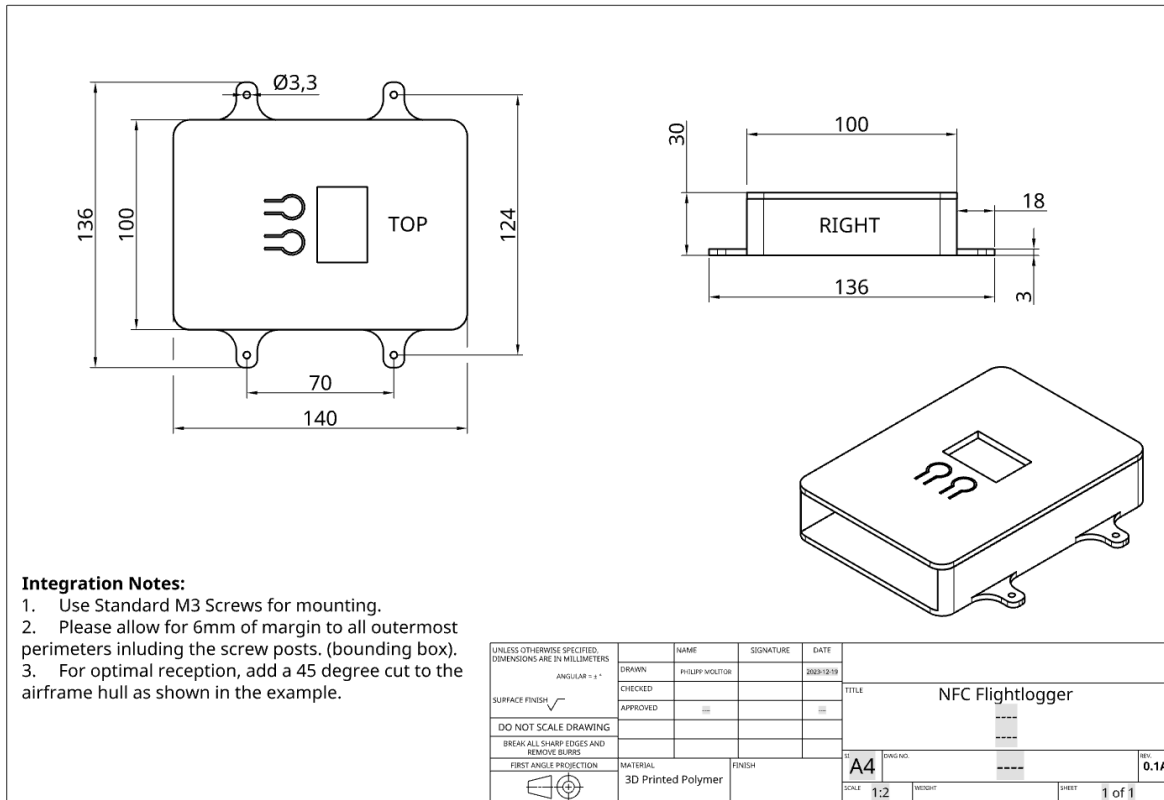


Figure 3: Drawing Flight Logger

The CAD documents, files and other helpful information can be found on onshape:

<https://cad.onshape.com/documents/9d17374e6382a7ac013be55f/w/ea7273c0c1411e7cbe95f4b7/e/7b85528bbf9a35aa5c3ca1b4>