

 HAW  
HAMBURG

 NF  
Neues Fliegen e.V.

 NFC  
NEW FLYING COMPETITION

2022

## Competition Task

**Version 1.1 (07.02.2022)**

[www.newflyingcompetition.com](http://www.newflyingcompetition.com)

Organizer

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## **1. Introduction**

The scientific model flying competition „New Flying Competition“ was created by the registered student association „Neues Fliegen e.V.“ in 2015. The competition is characterized by applying real world industrial aircraft design criteria and real world 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

## **2. Jury**

The jury consists of seven representatives of the aviation industry.

- Head of Jury Dr. Christoph Heß, Center of Applied Aeronautical Research GmbH
- Bernd Trahmer, Airbus Operations GmbH
- Joachim Kienzler Cleuvers, Lufthansa Technik AG
- Boris Wechsler, Center of Applied Aeronautical Research GmbH
- Dr. Gunnar Haase, Airbus Operations GmbH
- Maximilian Lintl, Pilot Flight Center
- Uwe Maurer, Lufthansa City Line

### **3. Participating in the Competition**

#### **3.1 Prerequisites**

Further details can be found in document “Rules of the New Flying Competition 2022“ at:

<https://www.newflyingcompetition.com/downloads/>

Please note the registration steps listed on that webpage.

The teams need to register via the given online-application-form. The official deadline for the registration is November 30th 2021, 23:59 CET. Once the deadline has passed it is only possible to request a participation directly via E-Mail to [contact@newflyingcompetition.com](mailto:contact@newflyingcompetition.com). This application needs to be approved by NFC which is represented by the Head of Competition, Ajla Osmanović. In case the application is permitted, the team is obliged to comply with the regulatory deadlines for the reports and payments.

The application form can be found at:

<https://www.newflyingcompetition.com/apply-1/>

The registration is officially completed as soon as:

- The team captain has fully filled in the application form
- The applying team has received a confirmation E-Mail from NFC
- The team has paid the starting fee within four weeks after receiving the confirmation E-Mail

#### **3.2 Registration Fee**

For participating in the competition there are two fees to be paid: The starting fee is 1.000 Euros per team, regardless the number of team members plus a fee for meals and transportation in Hamburg which is 125 Euros per attendee. For the participants, who can not attend the entire competition, the member fee is 25 Euros per person per day.

The starting fee needs to be paid within four weeks after receiving the registration confirmation E-Mail. The fee for meals and transportation needs to be paid three months in advance of the competition until 22<sup>nd</sup> June 2022.

## 4. Challenge

The competition's goal is to design, build and successfully fly an aircraft model, capable of the defined mission. Based on typical reports from the aviation industry, the competitors must keep a record of their development progress.

### 4.1 The task

#### **Objective:**

The NFC2022 invites academic teams to help advance 'digital UAS' solutions. The academic teams must fulfill the minimum requirements in order to participate and demonstrate the current state of academic UAS VTOL concepts.

#### **Mission:**

The idea of our competition is to expand the search radius of on the mainland with the help of a flying eye. The use of UAS for critical missions – reliably, promptly and can be used under Nordic weather conditions. We challenge the participants of the New Flying Competition 2022 to:

- Flying off a distance route of 10.000m
- Provide location coordinates of five land-based targets covering around 1.200m x 400m of search area that is around 350m from the starting point on the airfield, then return and land safely.
- The team who:
  - identify the most targets within the search area and fly a given distance route
  - provide the lowest overall energy consumption
  - deliver a quick post flight data analysis
  - wrote excellent reports and show a convincing presentation

will be the NFC2022 winner

#### **Annotation:**

In general, the aircrafts configuration is not predetermined and is therefore left to the team's discretion. Note that the aircraft needs to be entirely designed and built by the teams. Modifying a commercially available aircraft or involving a non-academic third-party is not permitted.

### 4.2 Design Reports & Presentation

Each team must submit two design reports, presentation and flight test video until the given deadlines. Submission of all design reports is a prerequisite for the competition flights. The presentation must be hold during the competition days. Design reports and presentation must comply with the guidelines given later on:

[www.newflyingcompetition.com/download](http://www.newflyingcompetition.com/download)

| <b>Report</b>   | <b>Deadline for submission</b>    |
|---|-----------------------------------|
| Preliminary Design Report – PDR                         | February 28 <sup>th</sup> , 2022  |
| Final Design Report – FDR                               | July 31 <sup>st</sup> , 2022      |
| Submission of presentation slides and flight test video | September 15 <sup>th</sup> , 2022 |

### 4.3 Model Specification

| <b>Item</b>   | <b>Specification</b>   | <b>Remark</b>  |
|---------------|--|--|
| Aircraft type | Aircraft of any configuration with VTOL capability   |  |
| Airframe      | Wingspan must not exceed 3m, fuselage length is not specified by the regulations   |  |
|               | Max. take-off weight < 15kg  |  |
|               | Structural strength to withstand 2,5g-forces according to flight patterns, static load test and landing on solid runway. |  |
|               | Plate must be fixed to the airframe with information on: Name, address, country  | German law, we will specify this on the NFC FAQ      |
| Propulsion    | Electric propulsion  |  |
|               | Multi rotor  | Propeller/Impeller                                   |
|               | Battery: Li-Po of your choice with XT connector  | Detachable for recharge                              |
|               | The battery / batteries powering the propulsion unit must not power any other electrical components                      |  |
|               | Physical safety switch (circuit breaker) to prevent unintended engine start  | Mandatory  |
| Electronics   | Standard radio control system 2,4GHz   | Certified for use in Germany, with max. EIRP = 100mW |
|               | GPS-Logger for ground speed and distance.  | 6 mm gold plug, we will specify this on NFC FAQ      |
|               | Autopilot systems  | Mandatory  |

#### 4.4 Payload

The model must be capable to carry a payload with a mass of 2 kg. The payload is of box-form with dimensions given below and will be supplied by the organizer on the day of flight display.

| <b>Payload bloc (PLB)</b> |                    |                     |
|---------------------------|--------------------|---------------------|
| Length<br>[mm] L          | Width<br>[mm]<br>W | Height<br>[mm]<br>H |
| 400                       | 200                | 180                 |

PLB must be fully enclosed by the fuselage and cannot be attached to the fuselage. The fuselage has to be designed in such way that the PLB can be removed. The PLB must be fixed during flight. The PLB must be horizontal positioned.

#### 4.5 Mission sensor

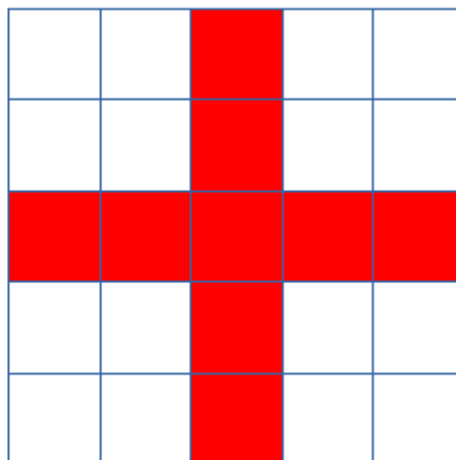
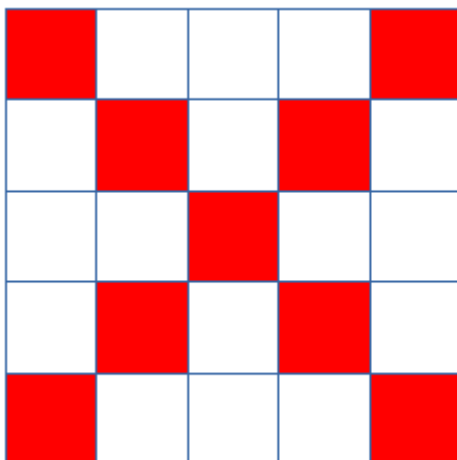
The corresponding images of the search area are created with the mission sensor. The mission flight is defined by the team. This affects the number of images, among other things, overlap and recording is determined by the teams themselves.

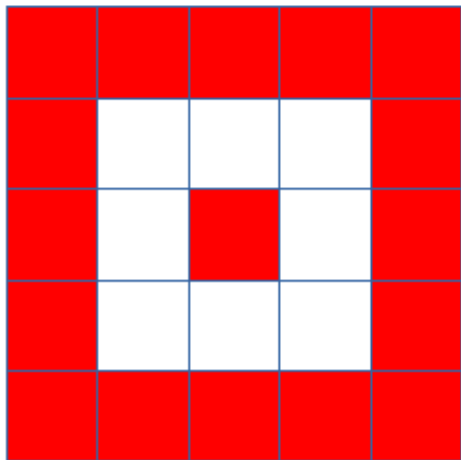
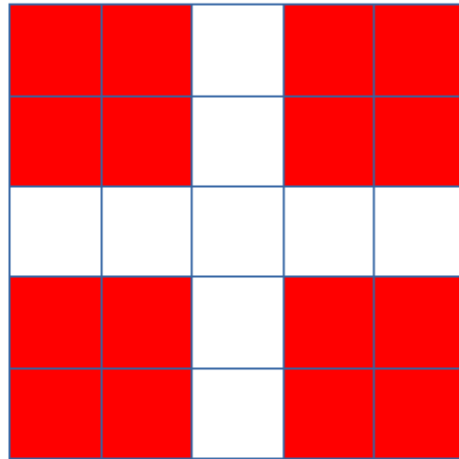
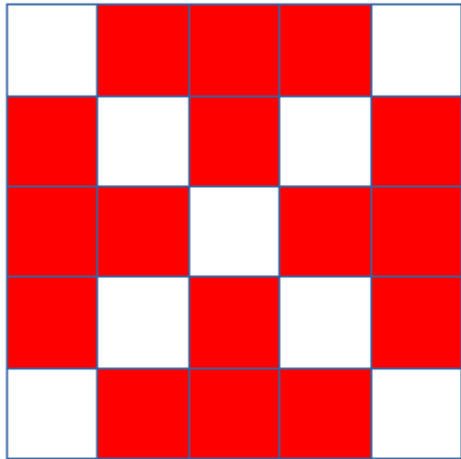
#### 4.6 Targets

The following graphic shows five different targets to be found – based on red and white squares with 100mm by 100mm. The dimensions are the:

Length: 500mm

Width: 500mm





#### 4.7 Competition Flight

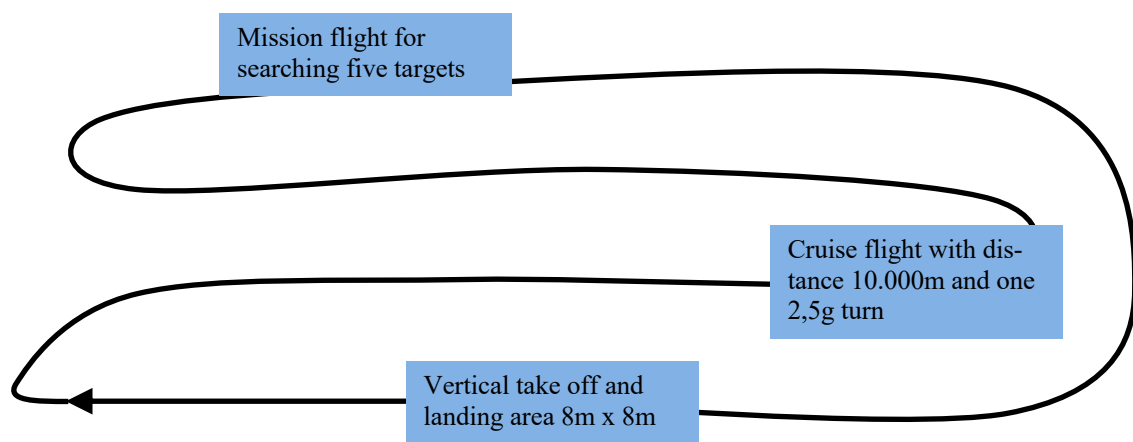
All procedures must be in compliance with mandatory checklists which each team creates itself and apply for competition:

- a. Outside check
- b. Preflight check
- c. Take-off check
- d. Cruise check
- e. Landing check After landing check
- f. Post flight data analysis
- g. Special procedures (malfunction, crash)



| Phase  | Task  | Monitoring                  |
|--|---|-----------------------------|
| Charging   | Charge battery with balanced charger  | By team                     |
| Preparation  | All flight preparation measures (i.e. install payload box, programming the autopilot, check camera system, ...) must be finished before the given time slot will start. | By team                     |
| Flight   | Note: information of distance route, search area and targets will be given in the NFC FAQ. Time slot duration for flight is 30 minutes                                  | By team                     |
|  | Vertical take-off within a given area (8m x 8m), minimum vertical height (10m) minimum transition height of 50m. Flight time starts                                     | By team and jury            |
|  | Transition to horizontal cruise flight and outbound   | By jury                     |
|  | Cruise flight for distance route 10.000m and during flight at least one 2,5g turn has to be performed and logged in flight data   | Maximum wind speed < 10 m/s |
|  | Mission flight of the search area with 1.200m x 400m. Five different land-based targets will be placed within the search area   |                             |
|  | Inbound and transition to vertical landing above landing area and minimum transition height of 50m  |                             |
|  | Vertical landing in given area and flight time ends   | By team and jury            |
| Post flight (including data analysis)  | Note: pay attention to NFC FAQ regularly  | By team                     |
|  | Damage check (aircraft must be fully functional after landing)  | By jury                     |
|  | Extract SD card from UAS  | By team and jury            |
|  | Analysis time start (max. 10 minutes) for geo-localization in agreement with NFC Jury   | By team and jury            |
|  | Load images from SD card  | By jury                     |
|  | Save geo-tagged images on SD card/workstation   |                             |
|  | Analysis (find land-based targets and provide geo-localization)   |                             |
|  | Save analyzed data (csv. file with targes with X/Y) on USB Stick<br>(Example – target1_ X=53.453762770; Y=7.902969941)  |                             |
|  | Analysis time stop (your time in minutes) for geo-localization  | By team and jury            |
| Deliver USB-Stick to jury which includes: <ul style="list-style-type: none"> <li>Flight data: mean voltage, mean current, mean flight speed, maximum G-forces</li> </ul> | By jury   |                             |

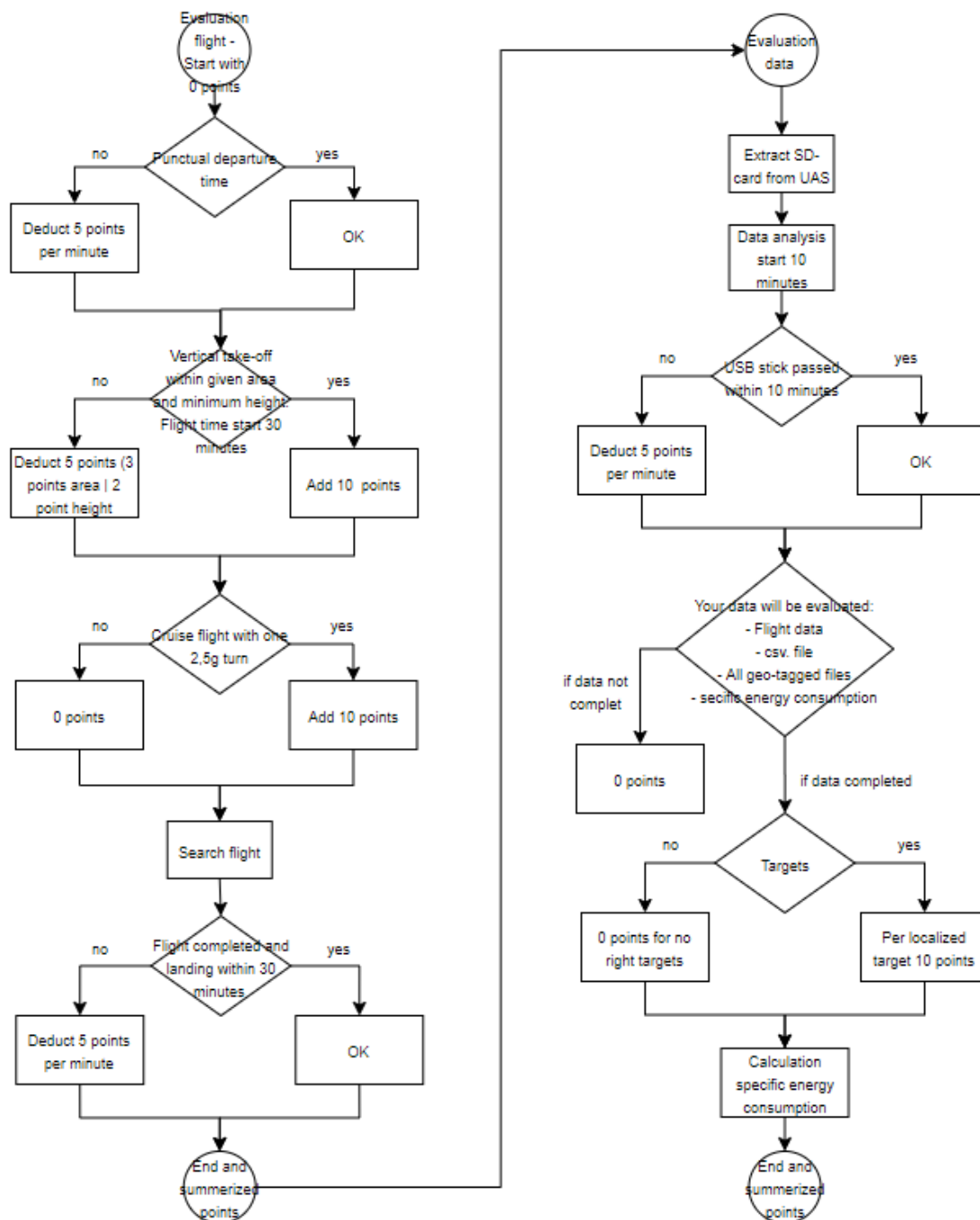
|  |   |  |
|--|---|--|
|  | <ul style="list-style-type: none"> <li>• Summarized csv. file with geo-localization of the targets</li> <li>• All geo-tagged images with notation and without order: target1 image, target2 image,...</li> <li>• Specific energy consumption calculated of your flight:<br/> <math display="block">\frac{\text{total consumed energy}}{\text{total ground distance (GPS) flown}}</math> </li> </ul> |  |
|--|---|--|



*Schematic flight pattern NFC 2022*

## 5. Scoring

The following graphic shows the evaluation process for each team:



The following explanations show the calculation methods as well as the final achievable points for the NFC2022.

How the target calculation will be done:

- Localized target points per target within 1m of the real target position = 10 points
- Maximum points for 5 right localized targets: 50 points

How the specific energy consumption will be done:

- Calculation:  $\text{energyfactor} = \frac{\text{specific energy consumption best team}}{\text{specific energy consumption team}}$
- Specify energy consumption score: 50 points by energy factor
- Maximum points for specific energy calculation: 50 points

How the reports will be evaluated:

- PDR maximum 25 points
- FDR maximum 25 points

How the business plan and UAS model presentation will be evaluated (one presentation with two topics):

- Business plan maximum 15 points
- UAS 15 points

For the NFC2022 maximum achievable points:

- Flight: 20 point
- Targets: 50 points
- Specific energy calculation: 50 points
- Reports: 50 points
- Presentation: 30 points

Maximum points: 200 points

The reports and the presentation are scored according to the following system by each jury member:

| Letter grade | Grade | $S_{Report, jury member}$ | Meaning     |
|--------------|-------|---------------------------|-------------|
| A+           | 0.7   | 1                         | Outstanding |
| A            | 1     | 0.95                      | Very good   |
| A-           | 1.3   | 0.9                       |             |
| B+           | 1.7   | 0.85                      | Good        |
| B            | 2     | 0.8                       |             |
| B-           | 2.3   | 0.75                      |             |
| C+           | 2.7   | 0.7                       | Acceptable  |
| C            | 3     | 0.65                      |             |
| C-           | 3.3   | 0.6                       |             |
| D+           | 3.7   | 0.55                      | Adequate    |
| D            | 4     | 0.5                       |             |
| F            | 5     | 0                         | Failed      |

## 6. General Time Table of the New Flying Competition

| Date  | Activity   | Remark   |
|---|--|--|
| November 30 <sup>th</sup> , 2021                                | Deadline for registration  |  |
| February 28 <sup>th</sup> , 2022                                | Submission:<br>Preliminary Design Report - PDR   | Send to <a href="mailto:christoph.hess@zal.aero">christoph.hess@zal.aero</a><br><a href="mailto:contact@newflyingcompetition.com">contact@newflyingcompetition.com</a>   |
| June 22 <sup>nd</sup> , 2022                                    | Payment: meal and transportation fee<br>Submission: registration of team members   |  |
| July 31 <sup>st</sup> , 2022                                    | Submission:<br>Final Design Report - FDR   | Send to <a href="mailto:christoph.hess@zal.aero">christoph.hess@zal.aero</a><br><a href="mailto:contact@newflyingcompetition.com">contact@newflyingcompetition.com</a>   |
| September 15 <sup>th</sup> , 2022                               | Submission of presentation slides and record of the flight   | Send to <a href="mailto:christoph.hess@zal.aero">christoph.hess@zal.aero</a><br><a href="mailto:contact@newflyingcompetition.com">contact@newflyingcompetition.com</a><br><br>It is possible, that you get a direct link for data upload |
| Competition September 22 <sup>nd</sup> -26 <sup>th</sup> , 2022 |  |  |
| Thursday  | Registration 2:00 - 4:00 pm<br>Social event afterwards   | At HAW University of Applied Sciences, Hamburg   |
| Friday  | Mandatory model pre-check with respect to: <ul style="list-style-type: none"> <li>• damages</li> <li>• safety and security issues</li> </ul> | By jury member<br>Mandatory: Team captain and model builder have to be present<br>Minor repairs permitted  |
| Saturday  | Competition flights  | Airfield near Hamburg  |
| Sunday  | Competition flights  | Airfield near Hamburg  |
| Monday  | Company visits, award ceremony for all teams   | At HAW Hamburg   |

**Check our document “Rules of the New Flying Competition 2022” for further details.**