Deutsches Zentrum
DLR für Luft- und Raumfahrt

DLR Design Challenge 2026

Dr. Markus Fischer, Divisional Board Member for Aeronautics at the German Aerospace Center (DLR), invites students to engage intensively with future aviation technologies – this year through the design of a small aircraft as a research demonstrator. The objective is to develop an innovative yet practical concept for a demonstrator that could be realistically designed, built, and tested in the coming years. Instead of modifying an existing aircraft, the emphasis is on developing a completely new design with a primary focus on the validation of forward-looking technologies.

Introduction

The simultaneous pursuit of seemingly contradictory goals such as climate compatibility, economic efficiency, safety and passenger comfort requires the rapid development of radically new technologies. By 2050, the generation after next of commercial aircraft is expected to enter service. Among the greatest challenges are the choice of aircraft configuration, the design of innovative propulsion systems and the integration of environmentally friendly energy carriers. Innovations in the areas of materials, manufacturing and aerodynamics promise further efficiency gains.

Many of the technologies required for this are already being researched or tested on the ground. However, the step from successful laboratory testing to real-world flight operations, known as the "valley of death", involves considerable technical, regulatory and economic challenges. In aircraft development, these challenges are further intensified by long development, certification, and testing cycles. Crucially, it is not only the development of individual technologies that matters, but also their systemic integration and the interaction of all subsystems under real operational conditions.

To increase technological maturity and enable integration into future aircraft, testing under real flight conditions is essential. For this purpose, the use of small aircraft as flying demonstrators is particularly well suited:

- System and technology integration can be tested safely and cost-effectively.
- Simpler certification processes enable faster test cycles.
- Historically proven approach: technologies are first validated on smaller platforms before being transferred to large aircraft.

And this is precisely where this year's DLR Design Challenge comes in.

Task Description

The DLR Design Challenge 2026 calls for the development of an innovative and feasible concept for a test aircraft. This demonstrator is intended to test aviation technologies that are planned for series application in commercial aircraft from around 2050 onwards. An adaptable and modular design should allow multiple technologies to be tested using a single aircraft. In order to obtain reliable data for both the overall aircraft design and the interaction of all components as a whole, the aim is not simply to convert an existing aircraft, but to rethink the overall design from scratch.

As part of the DLR Design Challenge 2026, participants are expected to systematically investigate various propulsion technologies based on sustainable energy carriers. The aim is not to develop new propulsion systems, but to integrate them into a holistic demonstrator concept. In particular, the combination of (hybrid)-electric hydrogen powertrains with other technologies will be considered. A test vehicle the size of a small aircraft will then be designed to test and evaluate their interaction.

Furthermore, the design must be tailored to address a clearly defined research question. This question forms the central starting point of the concept and determines the choice of propulsion technology, the mission definition, and the system architecture.

Design Requirements

The aircraft is intended to demonstrate a combination of novel propulsion systems as well as technologies from other disciplines. The following requirements for the aircraft design must be taken into account:

1. Based on the following list of permitted propulsion building blocks, at least two fundamentally different powertrain architectures must be developed and compared with each other. For both architectures, at least part of the power must be transmitted electrically.

<u>Permitted propulsion building blocks</u>

- Liquid hydrogen storage
- Cylindrical compressed gas storage
- Spherical compressed gas storage
- Cryogenic compressed hydrogen storage
- Batteries

- Shaft power turbine
- Fuel cell
- Piston engine
- Electric motors/generators

The developed propulsion architectures are to be evaluated in terms of system integration, scalability, suitability for demonstration and future potential. The selection of technologies must be justified qualitatively, for example through a comparison of Technology Readiness Levels (TRL), an analysis of synergies between the technologies, or the exclusion of certain options based on the defined research question(s) (for more information, see the section Scientific Research Question(s)).

2. The only permitted energy sources are electricity and hydrogen.

3. In order to maximise the value of the technology demonstrator, at least two additional technologies from the following list should also be demonstrated with the aircraft:

Technologies

- Distributed propulsion systems
- High-aspect-ratio wings
- Wingtip devices
- Boundary-layer technologies
- High-lift systems (e.g. for STOL capability)
- Active maneuver or gust load alleviation (e.g. through flight control intervention)
- Morphing structures
- Fly-by-wire flight control systems
- De-icing systems

The selection of additional technologies must be justified, taking into account their interaction with the overarching research question, the propulsion concept and the aircraft design.

4. It must be possible to switch between propulsion variants with minimal effort, for example through modular interfaces and suitable system architectures. The necessary steps and estimated time frame should be presented.

5. For technologies that are not fully covered by current regulations, assumptions regarding adapted or future certification requirements may be made. These must be discussed and justified to a sufficient extent.

6. It is assumed that once the demonstrator has received initial certification, re-certification will not be required after modifications.

7. The design must enable safe, efficient and rapid loading and unloading of test and measurement equipment.

8. A typical mission profile for the test campaign of a powertrain must be designed, considering only the period from departure from the parking position to return.

9. The safety of persons on board or on the ground must not be endangered at all times.

Aircraft Requirements

The following TLARs (Top-Level Aircraft Requirements) must be met:

Table 1: General Design Requirements

MTOM	< 5700 kg
Pilot	1
Certification Basis	CS-23
Maximum Takeoff and Landing Runway Length	< 800 m
Mass of Test Equipment and Flight Test Engineer(s)	250 kg
Minimum Flight Duration	> 1,5 h
Flight Altitude	> 1500 m
First Flight of the Demonstrator	innerhalb nächster 3 Jahre

1. The demonstrator is to be designed as a single unit (quantity = 1).

2. The basic framework conditions for regional aircraft certified under CS-23 apply.

3. The aircraft must be designed for operation at the Würselen Aachen research airfield, taking into account the maximum runway length of < 800 m.

4. Based on a 9-seater aircraft, the fuselage must provide a usable space of 4.2 × 1.5 × 1.3 m³. At least 1/3 of this volume must be reserved for carried test equipment and flight test engineer(s), with a combined mass of 250 kg. The remaining space may be freely used for technology demonstration purposes.

5. The minimum flight duration is 1.5 hours. Of this, 30 minutes may not be used as a reserve for the regular mission. The minimum test duration is 30 minutes.

6. Since hydrogen is a less-proven and therefore higher-risk energy carrier, the design must ensure that in the event of a total failure of the hydrogen-based power supply, the aircraft can still cover at least 25 km with a 1000 m altitude reserve.

Scientific Research Question(s)

When planning future flight testing activities, the following guiding question should always be asked:

What additional knowledge and value does a flight test provide that cannot be achieved in the laboratory or on the ground (test bench)?

The task is to develop one or more research questions that the designed aircraft is intended to answer. Please address at least the following points:

- What is to be demonstrated and tested with the aircraft?
- Why is the question relevant (from a technical or scientific point of view)?
- How does the research question influence the choice of technologies and the aircraft concept?

The focus should be on ensuring that the chosen question can be answered safely, in compliance with regulations and with sufficient performance capability.

Evaluation Focus: Concept

The aim is to develop a fully functional aircraft that balances technical feasibility, certification aspects, safety and test effectiveness. The submitted designs will be evaluated in particular on the basis of the following criteria:

- Explanation of the relevance of the scientific research question
- Realism and comprehensibility of the assumptions made, supported by calculations and scientific literature
- Selection and presentation of the methods used
- Quality of system and propulsion integration, including modularity and convertibility
- Suitability of the design to meet the requirements of the planned test mission
- Suitability of the demonstrator to enable the technological transition from ground-based testing to flight testing, thereby addressing the scientific research question
- Consideration of certification and safety

The specific evaluation criteria for the task and their weighting are as follows:

- Aircraft design: 35%
- Justification of technology selection: 25%
- Scientific research question and operational concept: 25%
- Safety and certification: 15%

Written Report, Presentation, and Video

Technical Report

The report is limited to 25 pages. The minimum font size is 10 point and the minimum line spacing is 1.0. All page margins must be 2.5 cm. The page number should be located in the lower right corner. All tables, photos and illustrations must be provided with appropriate, clear captions. References must be provided in a citation format commonly used in scientific publications. The report must be written in English.

The work should meet the standards of a technical report and be clearly structured, with headings and subheadings providing a logical and traceable outline. Transitions between sections should be logical. The text should be precise and easy to understand. Appendices are not permitted; all relevant information must be fully contained within the report.

The report should contain a detailed discussion of the derived design requirements. This includes all specific requirements for the aircraft subsystems. A thorough literature review is required to integrate existing knowledge and relevant technologies. The dimensions, masses and essential performance parameters of the aircraft should be presented clearly and precisely.

All tools and methods used to design and analyse the concept should also be briefly described. This includes the validation of the tools used as well as the verification of the results. This verification should be carried out through plausibility checks, handbook methods, historical data, or other appropriate procedures.

A systematic approach must be chosen to ensure that the final concept is comprehensible, well-founded, and logically justified.

The following data should be provided as a minimum:

- Three-sided view of the designed aircraft, including dimensions
- Justification for the selection of technologies
- Description of what is to be tested with the research aircraft
- Explanation of the basis for the assumptions made regarding the technologies
- Table summarizing compliance with the design specifications
- Tables showing the mass breakdown of the concept, including the mass of the structure (wings, fuselage, empennage, etc.), propulsion system mass, energy storage, etc. The table should also include the empty weight and MTOM.
- Tables and/or figures showing the key mission parameters of the concept. These include climb and descent rates, cruise speed and altitude, aerodynamic and propulsion characteristics (e.g. lift-to-drag ratio, energy consumption).
- Tables and/or figures showing the aerodynamic characteristics of the concept. This includes an L/D-CL trade-off and a breakdown of the total drag into its components.
- Explanation and graphical representation of the loads and structural concept
- List of energy requirements and energy supply.
- (Research) operational concept
- Presentation of the conversion between propulsion architectures

Structure of the Technical Report

- Introductory Material: This material is required but does not count toward the 25-page limit.
    - Title page: Project name, name of the sponsoring organization or institution, name of the supervisor(s), leader of the student team, submission date
    - Summary/Abstract: 1 page, written in both German and English
    - List of student team members including semester number (Bachelor's or Master's program)
    - Letter from the supervisor confirming that the students have completed the work independently
    - Table of contents and nomenclature
- Main Body: The main body (maximum 25 pages) must include:
    - Introduction and brief overview of the underlying literature
    - Presentation of the developed flight demonstrator concept
    - Detailed specification of the aircraft based on the requirements outlined in the Task Description and Technical Report sections, including all necessary tables and figures
    - Conclusion and recommendations for further research
- Supplementary Material: This material is required but does not count toward the 25-page limit.
    - Bibliography
- Optional Additional Material: This section does not count toward the 25-page limit.
    - Photo of the submitting student team and/or images of participants
    - List of the students' postal addresses.

Please note: Appendices will not be evaluated. Ensure that all essential information is included within the main body of your report.

OnePager

A digital document, limited to a single DIN A4 page (portrait format), that presents the design along with its key characteristics. The file must include the following elements:

- At least one view of the aircraft. The team is free to choose the configuration(s) in which it is shown. The interchangeability of components and modularity should be illustrated.
- Explanations of the aircraft concept and its special features. The choice of technologies and the answers to the scientific research question(s) should also be shown.

Presentation

The results will be presented during the final event of the DLR Design Challenge. Each team will have a total of 30 minutes for their presentation, comprising a 20-minute presentation followed by a 10-minute Q&A session. Both the slides and the presentation must be prepared in English. Further details regarding the presentation and the event will be provided after the report submission deadline. The presentation slides must be submitted to DLR no later than two days before the final event.

Video
Teams are also required to create a pitch video in English with a maximum duration of three minutes. The content of the video can be freely designed by the participants. The video must be produced exclusively by members of the respective team. The required file format is .mp4 with the H.264 video codec. The resolution should be at least 1080p in 16:9 video format. The video must be submitted to the DLR together with the presentation slides no later than two days before the final event.

Evaluation Concept
The submitted reports will be evaluated by an independent internal DLR jury based on various criteria, which are outlined in the sections "Evaluation Focus: Concept" and "Technical Report, Presentation, Video".

The results are included in the evaluation as follows:

- Concept: 65% (distributed as described in the evaluation focus)
- Written report: 20%
- Presentation: 10%
- Video: 5%

It is important to ensure that the technical report includes all the data required in the corresponding section.

Mentoring
Experienced specialists from DLR will be available to advise the student teams on the design process as part of an optional mentoring. The mentors provide technical feedback and guidance but do not make decisions and are not part of the evaluation jury. Further details will be provided at the kickoff event.

Response to Emerging Questions
Questions during the Design Challenge will be addressed both at the kickoff event and in a separate Q&A session. These can be submitted in advance by email to DesignChallenge@dlr.de. Any additional questions that are relevant to all participants, along with their answers, will be collected and published.

Participation Requirements
All participants must be enrolled at a German university, college or technical university. The maximum team size is six students, with several teams from each university allowed to participate. Registration for participation in the competition and for the kick-off event is done through the supervising chair. For inter-departmental teams, registration is done by the chair of the team leader. Applications and documents must also be submitted via the supervising chairs.

Participants must agree that all submitted documents, illustrations and diagrams may be used for publication on the DLR website or for other types of public relations work, with proper credit given to the authors. This consent must be received by the DLR before the kick-off event.

Timeline

01.12.2025 **Announcement** of the DLR Design Challenge 2026.

01.03.2026 **Registration** must be submitted by the supervising faculty member via email to DesignChallenge@dlr.de.

12.03.2026 **Kickoff event** for all participating teams and potentially interested faculty members. It includes an explanation of the task and a tour of the DLR facility.

- Location: Braunschweig
- Costs: Travel expenses (second-class train fare and overnight stay the night before) will be covered by DLR for all participating teams and one faculty supervisor per team. Additional faculty members are welcome to attend at their own expense.

17.04.2026 **Q&A Session**, online

12.07.2026 **Electronic Submission** of the written report by 23:59 CEST via email to DesignChallenge@dlr.de

20.08.2026 **Final event** takes place at DLR for all participating teams, their supervising professors, and one faculty member per team. It includes the presentation of the projects and the announcement of the winning team(s).

- Location: Hamburg-Finkenwerder (ZAL)
- Costs: Travel expenses (second-class train fare and overnight stay the night before) will be covered by DLR for all participating teams and one faculty supervisor per team. Additional faculty members are welcome to attend at their own expense.

08.-10.09.2026 **Presentation** of the top three projects at the **German Aerospace Congress 2026 (DLRK 2026).**

- Location: Aachen
- Costs: Travel expenses (second-class train fare, meal allowance, accommodation, and conference fees) will be covered by DLR for the awarded teams and one faculty member per team.

27.-30.10.2026 **Presentation** of the winning team at the **16th EASN International Conference**.

- Location: Toulouse, Frankreich
- Costs: Travel expenses (economy flight, meal allowance, accommodation, and conference fees) will be covered by DLR for the winning team.

Submission Guidelines

The following conditions of participation and format requirements apply to all submitted works: Entries must be submitted in English. Participants place no restrictions on the use, reproduction, or publication of the content by DLR.

Under no circumstances may wording or ideas from other authors be used without correct citation. If statements or ideas are used, these must be clearly indicated as quotes and the source must be named in the footnotes. Submitted works that contain **plagiarism** will **be disqualified**. The paper, presentation and video must be created **independently** and **exclusively by team members**. The use of AI is generally permitted, provided that it is clearly indicated.

All entries must be received by 23:59 CEST on 12 July 2026; entries received after this time will not be considered. Therefore, please do not wait until the last minute to check the file size and reduce the resolution of integrated graphics, tables or images if necessary. All documents must be written in **English**. Files should be saved and **submitted as a .pdf**; other file formats will not be accepted.

All contributions must be submitted electronically via email to:

- **Email address:** DesignChallenge@dlr.de
- **Subject line:** DLR Design Challenge 2026 [Team Name]

All entries must include the attachments specified below. If your email server has a size limit, the attachments may be split across multiple emails, but all emails should be sent on the same day. Alternatively, for large files, submission via **GigaMove** at https://gigamove.rwth-aachen.de is preferred, with the download link included in the email.

1. Technical Report: A **digital document** that includes the following in one (!) file: introduction, title page, main section, references, graphics, figures, scanned letter from the faculty, additional material, etc. The letter from the faculty must certify that the student's contribution has been reviewed and approved by a faculty research assistant and that the submission to the DLR Design Challenge is endorsed. In addition, please note the following:
    - Compress the file size of graphics and images in the report so that the file size remains under **80 MB**.
    - Follow the instructions in key point 7 regarding file naming.
2. Anonymized Technical Report: A **digital document** that includes the following in one (!) file: introduction, title page, main section, references, graphics, illustrations, additional material, etc. The content of this document is identical to the described document in key point 1, but **must not allow any conclusions to be drawn about the name of the university or the participants**. Care must be taken to remove logos, university names, etc. from the illustrations of the aircraft. This document ensures an unbiased evaluation of the design. After reviewing all reports, the file names will be changed to a neutral form (Team A/B/C, etc.) and forwarded to the jury. All other conditions are identical to key point 1.

3. OnePager: A document describing the design with its most important features on **one A4 page** (see explanations above). Submit the document as a **.pdf** file. For further use in print media, images should be saved in the highest possible resolution, preferably with at least **300 ppi**. Follow the instructions in key point 7 regarding file naming.

4. Team photo: A high-resolution **digital photo of the entire team**, if possible in a university setting. Name the photo files with your surname or that of the team leader and submit them as **.png** files. In the text of the email, send us a caption with the names of the students in the photo from left to right. Images **will not be evaluated**; they will only be used to announce the winners and for other public recognition. For use in print media, images should be saved in the highest possible resolution, preferably with **at least 300 ppi** (image format: 4:3). Obtain the consent of the persons depicted in the images for their publication by DLR to announce the winners or for other public relations purposes in advance. Please keep the **declarations of consent** and be able to present them on request; please submit an electronic copy of the declarations of consent with your sumbission; a template for the consent form will be provided to all participating teams via email.

5. Aircraft image: A high-resolution **digital image of the aircraft configuration**. The image should include a corresponding caption stating the name of the students or team leader, the name of the university and, if applicable, the name of the aircraft. The file format is also **.png.** For use in print media, images should be saved in the highest possible resolution, preferably with at least **300 ppi** (image format 4:3). **Consent forms** for the use of the image must be retained and provided upon request. An electronic copy of the consent forms must also be submitted with the submission. A template for the consent form will be provided to all participating teams via email.

6. Save the student release form as a **.pdf** file and send it via email along with the files mentioned above.

7. Naming conventions: Please follow the instructions when naming and saving the files:
    - Technical Report: University name_Draft name_Report.pdf
    - Anonymized Technical Report: University name_Draft name_Report_anonymous.pdf
    - OnePager: University name_Draft name_OnePager.pdf
    - Team photo: University name_Draft name_Team photo.jpg
    - Aircraft image: University name_Draft name_Aircraft.png
    - Student release forms: University name_Draft name_Release.pdf
    - Consent Form: University name_Surname_Consent.pdf

    The terms DLR and competition should **NOT** be used in file names. Abbreviations of university names are accepted. Example: Ludwig Maximilian University of Munich to LMU.

Background Information

DLR Design Challenge:	https://www.dlr.de/de/karriere-und-nachwuchs/angebote-fuer-studierende/dlr-design-challenge
DLR Design Challenge 2026:	https://www.dlr.de/de/karriere-und-nachwuchs/angebote-fuer-studierende/dlr-design-challenge/dlr-design-challenge-2026
Other Information:	https://www.dlr.de/de/forschung-und-transfer/luftfahrt/leitkonzepte

Jury

The jury selects the winners based on independent assessment.

Jury Chair:	Dr. Markus Fischer
Jury Members:	Institute directors from the DLR Aeronautics Research Division

Kontakt

Hannah Hoppe, Ivo Zell, Benedikt Ritterbach, Benjamin Fröhler
E-Mail: DesignChallenge@dlr.de

All information is subject to change. The Federal Travel Expenses Act (Bundesreisekostengesetz) applies. Legal recourse is excluded.

Versionshinweise

Version	Date	Note
1.0	Mid of February 2026	Publication oft he Document