



北京航空航天大学
BEIHANG UNIVERSITY

Beihang Global Science and Innovation
Competition: Student Group
Competition Details
(2024)

Beihang University

2024.06



Notice on Hosting Beihang Global Science and Innovation Competition Student Group Competition

In order to further enhance the depth and breadth of students' scientific and innovative cultivation, strengthen their influence in science and technology innovation, and deepen international exchanges and cooperation in this field, Beihang University will host the first Beihang Global Science and Innovation Competition for Students in 2024. The relevant details are notified as follows:

1. Organizer

Beihang University

2. Purpose of the Competition

The competition focuses on the intelligent, green, and diversified design of future aircraft. It aims to gather cutting-edge ideas in global aircraft design, empower and incubate more innovative forces in future aircraft design, and cultivate top-notch innovative talents in the fields of aviation and aerospace.

3. Competition Tracks

(1) Open Track: Creative Design of Future Aircraft

The open track is aimed at innovative and creative designs of the overall or key core parts of future aircraft. Based on the basic principles of flight and design concepts, innovative conceptual designs for the overall or key parts of aircraft will be conducted. Under the premise of reasonable and feasible basic principles, participants can boldly break through some existing



technological constraints, innovate in imagination and design, and provide original and disruptive ideas and inspiration for future aircraft. Participating teams must produce physical design works scaled in proportion for the competition.

(2) Task Track: Digital Design of Future Aircraft

The task track targets the multidisciplinary comprehensive design of aircraft's overall design. Based on existing flight design and virtual simulation software platforms, participants will conduct application scenarios of, and conceptual designs of advanced aircraft, with a focus on the mission requirements of future mid-size passenger aircraft (refer to the competition rules). The aircraft design requirements will be clearly defined, and based on this, an overall solution that meets the requirements will be developed.

4. Participants

Full-time undergraduate students (excluding adult education programs) from domestic and foreign higher education institutions are eligible to participant. Team participation is encouraged, with a maximum of 5 members per team (including guiding teachers) .

5. Competition Schedule

The competition consists of preliminary rounds and finals. Preliminary rounds will be conducted through online reviews, and the final rounds will include on-site defense, physical exhibition displays, and digital aircraft challenge. key dates are



as follows:

1. Start of Registration: June 2024
2. Registration Deadline: September 30, 2024
3. Evaluation of Preliminary Works: October 2024
4. Online Finals: November 2024
5. Award Ceremony (Offline): December 2024

6. Awards

The competition sets up gold, silver, and bronze awards for participating works in each track. The expert committee of each track will comprehensively consider the forward-looking, feasibility, innovation, and other factors of the works, and award the participating works accordingly. Silver and bronze award projects are generated through evaluation of preliminary works, and gold award projects are generated through online finals. The competition also includes special awards for the most popular work, it does not conflict with other awards. For international teams, the bonus will be converted at the exchange rate between CNY and the country currency of the participating team on the date of award announcement.

Gold Award: CNY 30,000; one certificate of honor, one trophy

Silver Award: CNY 10,000; one certificate of honor, one trophy

Bronze Award: one certificate of honor, one trophy



Most popular work Awards: CNY 10,000; one certificate of honor

The competition will select potential aircraft design projects for key cultivation. For students who receive the gold and silver awards, welcome to pursue a graduate degree at Beihang University .

7. Registration and Submission of Entries

Participating teams must complete registration and submit their works on the competition's official website by September 30, 2024, as required. Simulation videos, photos of physical objects, test flight videos, and other materials related to the entries can be submitted as supporting materials.

The competition does not accept confidential or intellectual-property-disputed works . If such works are submitted, the participating teams will bear the corresponding responsibilities for any adverse consequences.

8. Other Matters

1. Competition Website: www.future-aircraft-design.com
2. Competition Email: fad_2024@126.com
3. For matters not covered by the competition, please follow the updates on the official competition website.
4. The final interpretation right of the competition belongs to the Organizing Committee of the Beihang Global Science and



Innovation Competition Student Group Competition.

Attachment: Competition Rules for Beihang Global Science
and Innovation Competition Student Group Competition

Organizing Committee of Beihang Global Science and
Innovation Competition

June 2024



Beihang Global Science and Innovation Competition: Student Group Competition **Detailed Rules for the Future Aircraft Creative Design Track**

I. Track Overview

The “Future Aircraft Conceptual Creative Design Track” focuses on the integrated design of the overall or critical core components of future aircraft. It is based on the most fundamental principles of flight and design ideas, initiating conceptual creative designs for the overall aircraft or critical components. Under the premise that the basic principles are viable, participants are encouraged to boldly break through existing technological constraints and innovate in both imagination and design, providing original and disruptive design ideas and inspiration for future aircraft. Participating teams must create scaled physical models of their design for the competition.

II. Competition Requirements

The event does not distinguish between the types of participating teams. Each team may have no more than 5 members, including students from different stages (bachelor's, master's, doctoral) and regions (domestic, international). Cross-regional team formation, especially including lower-year



undergraduates, is particularly encouraged. The competition primarily consists of preliminary and final rounds. Teams are required to create physical designs of equal scale for the competition. In the preliminary round, the evaluation is organized by the Expert Committee for the Future Aircraft Creative Design Track of the competition (hereinafter referred to as the Track Expert Committee). This committee is composed of specialists who assess all team submissions. Based on the final rankings, they determine the entries that will advance to the finals.

III. Scoring Details

(I) Preliminary Round Scoring

The preliminary evaluation is conducted online by the Track Organizing Committee, with a total of 100 points distributed across the following four criteria:

1. Scientific Basis (20 points): Innovative designs and outcomes must adhere to fundamental principles and methods of flight, maintaining a degree of scientific validity without completely deviating from existing principles and methods.

2. Innovation and Breakthrough (60 points): The design proposals, methods, and means should exhibit significant innovation. Specific design plans may break through some existing technological constraints.

3. Team Collaboration (10 points): Teams should demonstrate rational division of labor and efficient organization



and collaboration.

4. Expressiveness and Standardization (10 points): Teams should effectively use various means to present their proposals and adhere to standard reporting protocols.

Specific scoring for each category is as follows:

Table1: Specific Scoring for Scientific Validity and Feasibility

Level	Score	Description
Excellent	16-20	The submission fully demonstrates scientific validity and feasibility
Good	11-15	The submission shows good scientific validity and feasibility
Fair	6-10	The submission has minor issues with scientific validity and feasibility
Poor	0-5	The submission has significant issues with scientific validity and feasibility

Table2: Specific Scoring for Innovation

Level	Score	Description
Excellent	45-60	The work is highly innovative, either in the overall/part of the proposal, or in the design analysis methods/approaches
Good	30-44	The work is quite innovative in the overall/part of the proposal, or in the design analysis methods/approaches.
Fair	15-29	The work has some innovative aspects in the overall/part of the proposal, or in the design analysis methods/approaches
Poor	0-14	The work lacks innovation in the overall/part of the proposal, or in the design analysis methods/approaches.

Table 3: Specific Scoring for Team Collaboration

Level	Score	Description
Excellent	9-10	Excellent team collaboration, high project management level, clear division of responsibilities, high member engagement
Good	7-8	Good team collaboration, relatively high project management level, basically clear division of responsibilities
Fair	5-6	Average team collaboration, average project management level, fairly clear division of responsibilities.



Level	Score	Description
Poor	0-4	Poor team collaboration, low project management level, work predominantly completed by the team leader or a few individuals.

Table 4: Specific Scoring for Expressiveness and Standardization

Level	Score	Description
Excellent	9-10	Utilizes digital prototypes, simulations, and other formats to present solutions and analysis results comprehensively; the report is well-formulated
Good	7-8	Solutions and analysis results are fairly comprehensive; the report is generally standardized
Fair	5-6	Solutions and analysis results have average expressiveness; the report has average standardization
Poor	0-4	Solutions and analysis results lack expressiveness; the report format is disorganized

Each participating team's submission for the preliminary round should include three components: a brief introduction of the creative concept (300-500 words), images of the scaled physical model, design drawings, and a competition design report. The report should cover requirement analysis and overall description of the creative concept, main innovation and breakthrough points, and analysis and evaluation of future application prospects, all within a 30-page limit. The preliminary submissions are evaluated online by the Track Expert Committee. The number and ratio of teams advancing to the finals are determined by the competition's organizing Committee and Track Expert Committee based on the actual competition circumstances and will be announced in due time.

(II) Final Round Scoring Details



The finals primarily assess the overall design proposals, completion of scaled models, main innovative breakthroughs, and future application prospects through presentations and defenses. The total score is 100 points, distributed across the following four aspects:

1. Scientific Basis (20 points): Innovative designs and outcomes must adhere to fundamental flight principles and design methods, maintaining a degree of scientific validity without completely deviating from existing principles and methods.

2. Innovation and Breakthrough (60 points): The design proposals, methods, and means should exhibit significant innovation. Specific design plans may break through some existing technological constraints.

3. Team Collaboration (10 points): Teams should demonstrate rational division of labor and efficient organization and collaboration.

4. Presentation and Defense (10 points): Materials presented during the defense are comprehensive, reports are of high quality, and responses to questions are accurate.

The scoring details for Scientific Basis, Innovation and Breakthrough, and Team Collaboration are consistent with the preliminary round. The specific scoring criteria for Presentation and Defense (10 points) are as follows:

Table 5: Specific Scoring for Presentation and Defense



Level	Score	Description
Excellent	9-10	Presentation materials are comprehensive, the quality of the report is high, and responses to questions are accurate
Good	7-8	Presentation materials are basically sufficient, the quality of the report is relatively high, and answers to questions are generally correct
Fair	5-6	Presentation materials are average, report quality is mediocre, and there are minor errors in responses
Poor	0-4	Presentation materials are poor, report quality is low, and there are many errors in responses

Beihang Global Science and Innovation Competition:
Student Group Competition
Expert Committee for Future Aircraft Creative Design Track
June 2024



Beihang Global Science and Innovation Competition: Student Group Competition **Digital Design Track for Future Aircraft**

I. Track Overview

The “Digital Design Track for Future Aircraft” focuses on the multidisciplinary integrated design of aircraft, utilizing existing flight design and virtual simulation software platforms. This track involves the development of advanced overall aircraft solutions and conceptual designs tailored to the operational scenarios of future medium-sized passenger aircraft. It specifies the design requirements for the aircraft and, based on these, conducts comprehensive design of the overall aircraft solution, resulting in a cohesive solution that aligns the requirements with the design.

II. Competition Requirements

The event does not distinguish between the types of participating teams. Each team may have no more than 5 members, including students from different stages (bachelor's, master's, doctoral) and regions (domestic, international). Cross-regional team formation, especially including lower-year undergraduates, is particularly encouraged. The competition primarily consists of preliminary and final rounds. In the preliminary round, the Future Aircraft Digital Design Track



Expert Committee (hereinafter referred to as the Track Expert Committee) organizes experts to review all team submissions. Teams are ranked based on their final scores to determine which entries will advance to the finals.

All teams participating in this track must submit a 3-5 minute short video detailing the creation process of their entries, as per the uniform requirements of the Track Organizing Committee for micro-videos. This serves as evidence of the team's independent design and as promotional material.

III. Scoring Details

(I) Preliminary Round Scoring

The preliminary evaluation is conducted online by the Track Organizing Committee, with a total of 100 points distributed across the following five criteria:

1. Scientific Validity and Feasibility (40 points): The design work and outcomes must be supported by clear, scientific reasoning and evidence, with engineering feasibility for the proposed solutions.

2. Innovation (30 points): The design proposals, methods, and means should exhibit innovation;

3. Comprehensiveness (15 points): All design requirements and criteria should fully cover the detailed project requirements listed in Annex 1;

4. Team Collaboration (10 points): Teams should



demonstrate rational division of labor and efficient organization and collaboration.

5.expressiveness and Standardization (5 points): Teams should effectively use various means to present their proposals and adhere to standard reporting protocols.

Specific scoring for each category is as follows:

Table3: Specific Scoring for Scientific Validity and Feasibility

Level	Score	Description
Excellent	31-40	The submission fully demonstrates scientific validity and feasibility
Good	21-30	The submission shows good scientific validity and feasibility
Fair	11-20	The submission has minor issues with scientific validity and feasibility
Poor	0-10	The submission has significant issues with scientific validity and feasibility

Table4: Specific Scoring for Innovation

Level	Score	Description
Excellent	20-30	The work is highly innovative, either in the overall/part of the proposal, or in the design analysis methods/approaches
Good	19-24	The work is quite innovative in the overall/part of the proposal, or in the design analysis methods/approaches.
Fair	13-18	The work has some innovative aspects in the overall/part of the proposal, or in the design analysis methods/approaches
Poor	0-12	The work lacks innovation in the overall/part of the proposal, or in the design analysis methods/approaches.

Table5: Specific Scoring for Comprehensiveness

Level	Score	Description
Excellent	12-15	The submission covers most of the requirements listed in Annex 1
Good	10-12	The submission covers many of the requirements listed in Annex 1
Fair	7-9	The submission covers the main requirements listed in Annex 1



Level	Score	Description
Poor	0-6	The submission covers a few of the requirements listed in Annex 1

Table6: Specific Scoring for Team Collaboration

Level	Score	Description
Excellent	9-10	Excellent team collaboration, high project management level, clear division of responsibilities, high member engagement
Good	7-8	Good team collaboration, relatively high project management level, basically clear division of responsibilities
Fair	5-6	Average team collaboration, average project management level, fairly clear division of responsibilities.
Poor	0-4	Poor team collaboration, low project management level, work predominantly completed by the team leader or a few individuals.

Table7: Specific Scoring for Expressiveness and Standardization

Level	Score	Description
Excellent	5	Utilizes digital prototypes, simulations, and other formats to present solutions and analysis results comprehensively; the report is well-formulated
Good	4	Solutions and analysis results are fairly comprehensive; the report is generally standardized
Fair	3	Solutions and analysis results have average expressiveness; the report has average standardization
Poor	0-2	Solutions and analysis results lack expressiveness; the report format is disorganized

Each participating team must submit materials for the preliminary round that include a design proposal summary (500-800 words), images (transparent background design drawings and team photos), and a design report. The report should cover requirement analysis and design requirement validation, selection of overall parameters, overall scheme description, performance analysis and evaluation, spanning 60-80 pages, and include



demonstrations of digital prototypes and simulation analysis (supporting materials such as digital models, animations, and videos may be attached). The preliminary round is evaluated online by the Track Expert Committee. The number and proportion of teams advancing to the finals are determined by the Organizing Committee and the Track Expert Committee based on the actual competition conditions and will be announced in due time.

(II) Final Round Scoring Details

The finals primarily focus on the presentation and defense of design proposals (based on digital prototypes), key scenario simulations, and comprehensive performance analysis. The total score is 100 points, distributed across the following five aspects:

1. Scientific Validity and Feasibility (40 points): The design work and outcomes must be supported by clear, scientific reasoning and evidence, with engineering feasibility for the proposed solutions.

2. Innovation (30 points): The design proposals, methods, and means should exhibit innovation;

3. Comprehensiveness (15 points): All design requirements and criteria should fully cover the detailed project requirements listed in Annex 1;

4. Team Collaboration (10 points): Teams should demonstrate rational division of labor and efficient organization



and collaboration.

5. Presentation and Defense (5 points): During the defense, the presentation materials should be comprehensive, the quality of the report high, and the responses to questions accurate.

The scoring details for Scientific Validity and Feasibility, Innovation, Comprehensiveness, and Team Collaboration are consistent with the preliminary round. The specific scoring criteria for Presentation and Defense (5 points) are as follows:

Table8: Specific Scoring for Presentation and Defense

Level	Score	Description
Excellent	5	Presentation materials are comprehensive, the quality of the report is high, and responses to questions are accurate
Good	4	Presentation materials are basically sufficient, the quality of the report is relatively high, and answers to questions are generally correct
Fair	3	Presentation materials are average, report quality is mediocre, and there are minor errors in responses
Poor	0-2	Presentation materials are poor, report quality is low, and there are many errors in responses

Beihang Global Science and Innovation Competition:
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Expert Committee for Future Aircraft Digital Design Track
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Annex: Detailed Requirements for the Future Aircraft Digital Design Track Project

Detailed Requirements for the Future Aircraft Digital Design Track Project

This project focuses on the conceptual design of a future mid-size passenger aircraft, aiming to bridge the market gap between existing narrow-body and wide-body airliners. The design should feature cutting-edge advancements over the next 30 years, incorporating advanced aerodynamic layouts, high-efficiency wing design technologies, advanced material technologies, and mature, advanced engine technologies. If opting for electric propulsion, the feasibility and rationality of core technical indicators must be demonstrated. The target market entry is projected around 2035, supported by demonstrations of current technological feasibility; a model-based systems engineering (MBSE) development framework is recommended. Operational, environmental, and airworthiness requirements must be met and reflected throughout the design process.

(I) Operational Scenario Definition

1. In the context of global development trends, analyze existing routes to identify potential market demands for mid-size aircraft;

2. Based on the forecasted route demands for mid-size aircraft by 2035, define the operational scenarios for future mid-size passenger aircraft.

(II) Overall Design Requirements

1.The design should identify stakeholders and user needs, initially completing the definition of top-level design requirements for the aircraft and proposing verification methods;

2.Propose the aircraft product architecture, identify key technologies, and develop a technological roadmap;

3.Based on the defined operational scenarios, set overall design parameters for the aircraft, including commercial range, cruising speed, and flight altitude;

4.Stability Characteristics: Within the flight envelope, under icing and non-icing conditions, and across all weight and center of gravity configurations, lateral-directional static stability is required; closed-loop characteristics must meet Type I stability quality;

5.Cockpit: The cockpit layout should consider human-machine ergonomics, comfort, accessibility, and comply with relevant airworthiness requirements; conduct feasibility studies on new cockpit technologies (e.g., shared control with AI, remote operations) and assess the benefits of these innovations;

6.Cabin: Determine the seating capacity and cabin layout plans. The cabin design should prioritize comfort, safety, and other airworthiness requirements;

7.Cargo Hold: The cargo hold's loading capacity shall not be inferior to that of competitor aircraft of the same class, and its



loading and unloading operations should be capable of being conducted concurrently with any other ground service activities;

8. Airport Adaptability: The aircraft's dimensions shall not exceed the requirements for Category E airports as stipulated in ICAO Annex 14; its ACN value on rigid pavements with medium-strength subgrades shall not exceed 67; operations should be permissible under tailwind conditions of up to 15 kts for takeoffs and landings; the design should facilitate rapid loading and unloading of cargo, equipped with necessary tools;

9. Crosswind Requirements: The aircraft should be capable of takeoff and landing under steady crosswind conditions of up to 35 kts;

10. Turnaround Requirements: The minimum time from the aircraft's arrival at the apron to its next takeoff should not exceed 80 minutes;

11. Environmental Requirements: Consider the latest noise and emission standards, ensuring performance not below that of leading competitors and maintaining a competitive edge for the next 30 years.

(III) Aerodynamic Design Requirements

Calculate and assess the takeoff and landing characteristics and low-speed stall behavior of different configurations based on theoretical shapes and three-view drawings; the aircraft's open-loop control characteristics must meet airworthiness requirements,



and if not, proposals on how to compensate with equivalent safety measures should be made. Evaluate the high-speed lift-to-drag characteristics and basic flight performance, providing preliminary load distribution for different operational conditions. The methodologies employed may include engineering estimates, CFD, among others.

(IV) Structural Design Requirements

Design the primary structural stations, load paths, and connection types based on load considerations. Select materials, perform strength checks, and estimate weight. Structural design should take interchangeability requirements into account.

(V) Systems Design Requirements

Thoroughly analyze the advanced technologies of current mainstream competitive aircraft models and conduct feasibility studies on these technologies. For example: More Electric Aircraft technology, load alleviation technology, 5000psi hydraulic energy systems (or higher), etc. Define the stability requirements that the flight control system must meet under closed-loop conditions, and conduct preliminary functional failure safety analyses.

(VI) Airworthiness Requirements

In the design phase, clearly define the airworthiness certification benchmarks, considering and complying with the airworthiness regulations of the CAAC, FAA, and EASA.



Initially decompose the relevance of airworthiness provisions to each component and subsystem.

(VII) Economic Usability Requirements

Identify the main competitive models, estimate the cost per aircraft, and analyze market size.

(VIII) Design Outcome Requirements

The design outcomes should be reflected in a design report, which must include relevant digital models, two-dimensional drawings, aircraft characteristics, performance parameters, and analysis processes. At a minimum, the following content needs to be submitted:

1. Aircraft Design Technical Requirements should encompass overall aircraft specifications, aerodynamic indices, performance indices, and system indices;

2. The comprehensive technology of the aircraft should include three-view drawings, layout designs of the aircraft (fuselage, wing, tail, landing gear, and engine nacelle layouts), overall arrangement design (cockpit, cargo hold arrangement, entire aircraft compartment opening frame spacing, preliminary system layouts, etc.), aerodynamic design (nose, wing, strake, tail section, movable surface design), complete structural design, engine and main systems design, and considerations for modular design (modular strategies, main modular design parameters, etc.);

3. Complete aerodynamic selection and trade-off design



(high-speed design, low-speed design, static aeroelastic design, etc.) as well as analysis of aerodynamic indices;

4. Selection of structural materials, main structural layout design, and analysis of structural load path design;

5. Engine selection analysis, and analysis of the application of new technologies in systems.

6. Aircraft Characteristics Analysis (including performance analysis, stability and control characteristics analysis, etc.);

7. The main systems equipment list of the aircraft, such as avionics, electromechanical systems, etc.;

8. Characteristic weight substantiation, weight index decomposition, and preliminary analysis of weight and center of gravity;

9. Economic, environmental, and adaptability analysis;

10. Necessary explanations for meeting airworthiness requirements;

11. Other analyses and demonstrations that prove the advancement of the proposal (text, PowerPoint presentations, videos, etc.).

