2008 – 2009 AIAA Foundation Undergraduate Team Aircraft Design Competition

I. RULES

1. All undergraduate AIAA branch or at-large Student Members are eligible and encouraged to participate.

2. An electronic copy of the report in MS Word or Adobe PDF format must be submitted on a CD or DVD to AIAA Student Programs. Total size of the file(s) cannot exceed 60 MB. **A "Signature" page must be included in the report and indicate all participants, including faculty and project advisors, along with their AIAA member numbers**. Designs that are submitted must be the work of the students, but guidance may come from the Faculty/Project Advisor and should be accurately acknowledged.

3. *Design projects that are used as part of an organized classroom requirement are eligible and encouraged for competition.*

4. The prizes shall be: First place-$2,500; Second place-$1,500; Third place-$1,000 (US dollars). Certificates will be presented to the winning design teams for display at their university and a certificate will also be presented to each team member and the faculty/project advisor. One representative from the first place design team may be expected to present a summary design paper at an AIAA Conference in 2009.
Reasonable airfare and lodging will be defrayed by the AIAA for the team representative

5. More than one design may be submitted from students at any one school. Projects should be *no more than 100 (total) double-spaced typewritten pages and typeset should be no smaller than 10pt Times* (including graphs, drawings, photographs, and appendix) on 8.5" x 11.0" paper. Up to five of the 100 pages may be foldouts (11" x 17" max).

6. If a design group withdraws their project from the competition, the team chairman must notify AIAA Headquarters immediately!

7. Team competitions will be groups of not more than ten AIAA branch or at-large Student Members per entry. Individual competitions will consist of only 1 AIAA branch or at-large Student Member per entry.

II. COPYRIGHT

All submissions to the competition shall be the original work of the team members.

Any submission that does not contain a copyright notice shall become the property of AIAA. A team desiring to maintain copyright ownership may so indicate on the signature page but nevertheless, by submitting a proposal, grants an irrevocable license to AIAA to copy, display, publish, and distribute the work and to use it for all of AIAA's current and future print and electronic uses (e.g. "Copyright © 20__ by _____. Published by the American Institute of Aeronautics and Astronautics, Inc., with permission.).

Any submission purporting to limit or deny AIAA licensure (or copyright) will not be eligible for prizes.

III. SCHEDULE AND ACTIVITY SEQUENCES

Significant activities, dates, and addresses for submission of proposal and related materials are as follows:

A. Letter of Intent – 13 Mar 2009
B. Receipt of Proposal – 12 June 2009
C. Announcement of Winners – Aug 2009

Groups intending to submit a proposal must submit a one page Letter of Intent along with the signed attached Intent Form (Item A) on or before the date specified above, at the following address:

AIAA Student Programs
1801 Alexander Bell Drive
Suite 500
Reston, VA 20191-4344

The CD containing the finished proposal must be received at the same address on or before the date specified above for the Receipt of Proposal (Item B).

IV. PROPOSAL REQUIREMENTS

The technical proposal is the most important factor in the award of a contract. It should be specific and complete. While it is realized that all of the technical factors cannot be included in advance, the following should be included and keyed accordingly:

1. Demonstrate a thorough understanding of the Request for Proposal (RFP) requirements.

2. Describe the proposed technical approaches to comply with each of the requirements specified in the RFP, including phasing of tasks. Legibility, clarity, and completeness of the technical approach are primary factors in evaluation of the proposals.

3. Particular emphasis should be directed at identification of critical, technical problem areas. Descriptions, sketches, drawings, systems analysis, method of attack, and discussions of new techniques should be presented in sufficient detail to permit engineering evaluation of the proposal. Exceptions to proposed technical requirements should be identified and explained.

4. Include tradeoff studies performed to arrive at the final design.

5. Provide a description of automated design tools used to develop the design.

V. BASIS FOR JUDGING

1. Technical Content (35 points)
This concerns the correctness of theory, validity of reasoning used, apparent understanding and grasp of the subject, etc. Are all major factors considered and a reasonably accurate evaluation of these factors presented?

2. Organization and Presentation (20 points)
The description of the design as an instrument of communication is a strong factor on judging. Organization of written design, clarity, and inclusion of pertinent information are major factors.

3. Originality (20 points)
The design proposal should avoid standard textbook information, and should show the independence of thinking or a fresh approach to the project. Does the method and treatment of the problem show imagination? Does the method show an adaptation or creation of automated design tools.

4. Practical Application and Feasibility (25 points)

The proposal should present conclusions or recommendations that are feasible and practical, and not merely lead the evaluators into further difficult or insolvable problems.

VI. REQUEST FOR PROPOSAL

Advanced, Environmentally Compatible, 150 Seat Commercial Transport

Background

There is increasing pressure on the aviation industry for ever more efficient, environmentally responsible, transport aircraft. There have already been significant advancements in aircraft materials, systems designs and propulsion, as evidenced by the Boeing 787 and Airbus A350. Further advancements may be at hand. The middle of the next decade will see large numbers of 737NG and A320s exceeding 20 years in airline service. The age of these aircraft, combined with environmental pressures and increasing fuel costs, has motivated the airline industry to push for a next generation airplane family, centered around replacing this class of aircraft.

Project Objective

This RFP asks for a new commercial transport design that seats 150 (dual class) passengers with US transcontinental range capability. The aircraft will show significant improvements in fuel burn (with associated CO_2 reduction), reduced community noise, while maintaining or improving productivity and passenger comfort standards. Key elements are to determine the appropriate technology balance, estimate the size, weight and performance and operating cost of the proposed design. The airplane acquisition cost must be competitive with the airplanes it will replace. Net productivity on a fleet basis will be equal to, or better than the fleet it replaces (e.g. mission availability per year, hence, the cruise speed and average trip times shall be similar to existing airplanes for fleet sizing purposes, and will not have a negative impact on crowded air traffic control (ATC) space by slowing other aircraft in the system). The aircraft is to operate within the current infrastructure (ATC, airports, Fuels), compatible with an introduction into service in the later half of the next decade.

General Design Requirements:

Capacity: 150 seats, dual class (~12 seats, 36" pitch first class, ~138 seats @ 32" seat pitch economy class). Capability for seating one class, 30" pitch seating without exit limitations.
Cargo capacity: >7.5 ft^3/passenger, bulk loaded.
Maximum payload capability to carry full, single class 30" pitch passenger capacity, at 185 lbs/passenger, plus full cargo hold at 8 lbs/Ft^3.
Maximum Landing Weight (MLW) is operations with Maximum Zero Fuel Weight, plus fuel reserves for maximum range mission at that Payload.
Maximum Range: 2800 nm with typical mission reserves with full dual class passenger load, assuming 225 lbs/passenger.
Typical mission (average) Ranges: 500 nm 50% of missions, 1000 nm for 40% of missions, 2000 nm for 10% of missions.
Cruise speed Requirement: .78 Mach (Long Range Cruise – LRC). Objective: .80 Mach (LRC).
Initial Cruise Altitude Capability at MTOW: > 35,000' ISA + 15 C degrees
Maximum operating altitude: 43,000'
Maximum landing speed (at Maximum Landing Weight): 135 knots
Takeoff Field Length (TOFL), MTOW: 7000' sea level, 86 deg F

Community Noise shall be ICAO Chapter 4 level minus 20 db cumulative
Fuel burn block Fuel/seat 500 nm mission shall be requirement: $\leq$ 41 lbs/seat. Objective: $\leq$ 38 lbs/seat.

The airplane shall be certifiable to appropriate FARs for approximately 2018 entry into service.

Operating costs: requirement 8% or better (reduction); objective 10% or better per seat operating cost economics (Crew, Maintenance, Fees and Fuel – at $2.50/US gal) than current, comparably sized commercial transports in typical US major airline type operation.

Potential powerplant concepts that may be considered vary from P&W geared turbofan (as proposed for Bombardier C- Series and Mitsubishi Regional Jet), or advanced direct drive high bypass ratio turbofans, or unducted fan (open rotor) concepts.

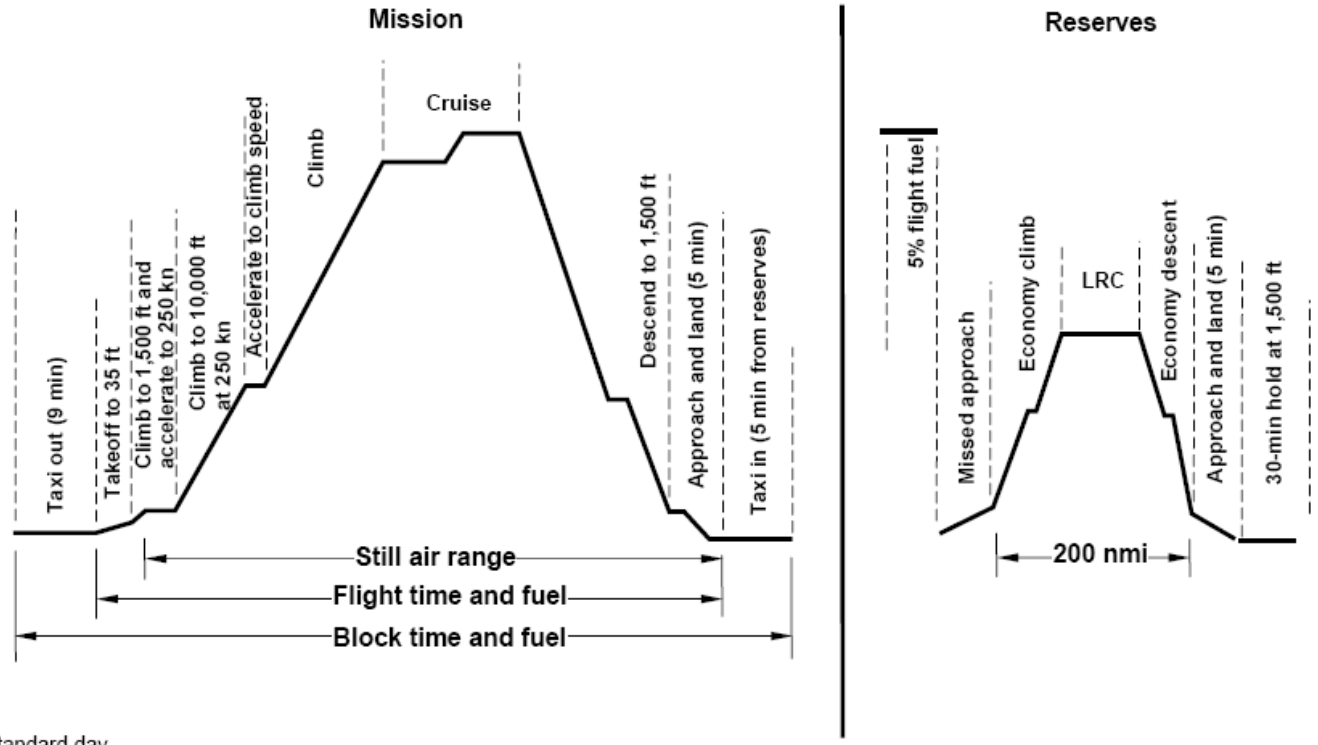
Airplane acquisition cost shall be commensurate with current 150 seat category transports.

Supporting Data

The technical proposal must convincingly demonstrate that the design can satisfy the fuel efficiency targets, and the community noise requirement, all while coming in at empty weights that will meet the payload requirements. The proposal should satisfy the following tasks to show how the design would be developed.

1. Justify the final design, and describe the technologies, engine selection and technical approach used to meet the mission requirements
2. Provide carpet plots used to finalize the final selected design
3. Include a dimensioned 3-view general arrangement drawing
4. Include an inboard profile showing the general internal arrangement
5. Include an illustrated description of the primary load bearing airframe structure, and state rational for material selection
6. Show an estimated drag build-up and drag polar for the cruise configuration, the take-off configuration, and the landing configuration
7. Show a weight breakdown of the major components and systems and center of gravity travel.
8. Provide performance estimates, and a community noise evaluation.
9. Demonstrate aircraft stability for all flight and loading conditions.
10. Describe any advanced technologies or design approaches and their relative benefits as used to obtain performance improvements. Address risk mitigation if these technologies fail to materialize, including cost increase and performance decrements.
11. Provide flyaway cost and life cycle cost estimate for production run of 500 and 1500 units.

Typical mission rules



- Standard day
- 6.7 lb per U.S. gal fuel density
- Nominal performance

Intent Form

2008/2009
AIAA Foundation
Undergraduate Team Aircraft Design Competition
Request for Proposal:
Advanced, Environmentally Compatible, 150 Seat Commercial Transport

Title of Design Proposal: _____

Name of School: _____

Designer's Name	**AIAA Member #**	**Graduation Date**	**Degree**
_____	_____	_____	_____
Team Leader			
_____			
Team Leader E-mail			
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
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_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

In order to be eligible for the 2008/2009 AIAA Foundation Undergraduate Team Aircraft Design Competition, you must complete this form and return it to AIAA Student Programs ***before 13 March 2009***, at AIAA Headquarters, along with a one-page "Letter of Intent" as noted in Section III, "Schedule and Activity Sequences." For any nonmember listed above, a student member application and member dues payment should also be included with this form.

Signature of Faculty Advisor	Signature of Project Advisor	Date
Faculty Advisor – Printed	Project Advisor – Printed	Date