23rd Annual Student Design Competition

2006 Request for Proposals

2-Place Turbine Training Helicopter

Sponsored by

and

Bell Helicopter
A Textron Company

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1. Participation

All graduate and undergraduate students may participate in this competition. Part-time students may participate at the appropriate graduate or undergraduate level. Schools are encouraged to form project teams, although individual entrants may participate. The highest education level of any member on the team will determine the classification of the design team. The maximum number of students on a team is 9. Each individual or team may submit only one proposal, however, any number of proposals may be submitted from any school.

Air vehicle designs *must* be the work of the students. Guidance may be provided by faculty advisors and should be acknowledged. Air vehicle design projects used as part of organized curriculum requirements or class work are eligible and encouraged to enter this competition.

The AHS must be notified of the intent to submit a proposal in accordance with the schedule in section 4. If any student or team wishes to withdraw from the competition, they must notify the AHS National Headquarters immediately in writing.

2. Awards

The submittals will be judged in 2 categories:

Graduate Category:

- 1st place - $1300
- 2nd place - $650

Undergraduate Category:

- 1st place - $700
- 2nd place - $350

In addition, the best new entrant (school which has not participated in at least 2 of the prior 3 competitions) will be awarded $500.

Certificates will be presented to each member of the winning team and to their faculty advisors for display at the school. The 1st place winner, or one representative if a team, in each category will be expected to present a technical summary of their design at the 2007 AHS Annual Forum. Presenters will receive complimentary registration to the 2007 AHS Annual Forum, and Bell Helicopter will reimburse up to $1000 in expenses to help defray the cost of attendance.

3. Evaluation Criteria

The proposal will be judged in 4 categories with the following weighting factors:

A. Technical Content (40 points)

- Design meets RFP requirements
- Assumptions are clearly stated and logical
- Thorough understanding of tools is evident
- All major technical issues are considered
- Appropriate trade studies are performed to direct the design process
- Well balanced and appropriate substantiation of complete aircraft and subsystems
- Technical drawings are clear, descriptive, and represent a realistic design

B. Application & Feasibility (25 points)

- Technology levels used are justified and substantiated
- Appropriate emphasis directed to critical technological issues

- Affordability considerations influenced the design process
- Reliability and maintainability features influenced the design process
- Manufacturing methods and materials are considered in the design process
- Proposal shows an appreciation for the operation of the aircraft

C. Originality (20 points)
- Aircraft concept shows innovative solutions to problems
- Concept demonstrates originality
- Consideration of vehicle aesthetics

D. Organization & Presentation (15 points)
- Meets all format and content requirements
- Self-contained Executive Summary contains all pertinent information and a compelling case as to why the proposal should win.
- Proposal is well organized so that all information is readily accessible and in a logical sequence
- Clear and uncluttered graphs and drawings

4. Schedule

Issue of RFP ..... August 5, 2005
Request for information and clarification ..... Up to February 17, 2006
Submit Letter of Intent to Propose ..... February 17, 2006
Submit proposal (postmark date if mailed) ..... June 2, 2006
Bell notifies AHS of winners ..... August 4, 2006
AHS announces winners ..... August 11, 2006
Presentation of winning papers at AHS Forum 63 ..... May 2007

5. Contacts

All correspondence will be mailed to the following address:

Deputy Director
AHS International
217 N. Washington St
Alexandria, VA, 22314

Telephone number: (703) 684-6777
Fax number: (703) 739-9279
Email kim@vtol.org

6. Proposal Requirements

Final proposals must be submitted (either on disk or electronically) to the AHS in digital format readable with Microsoft Word 2000 or Adobe Reader. Pages shall be 8½ x 11 inches, with type 1½ - spaced with a font of at least 11 point. Graduate category submissions shall be not more than 80 pages. Undergraduate category submissions shall be not more than 40 pages.

A. The following 7 items which are not numbered and not included in the page limit -
- Cover page with the name of the school and the judging category

- Page carrying the names, education level, and signatures of all members of the team
- Table of Contents
- List of Figures
- List of Tables
- List of Symbols and Abbreviations
- Proposal Requirements Matrix

B. Table of Physical Data listing -
   - Major dimensions
   - Gross weight, empty weight, and useful load
   - Fuel capacity
   - Engine TO (5 min) and MCP ratings
   - Transmission ratings

C. MIL-STD-1374 Weight Statement

D. Recurring Cost Breakdown

E. Direct Operating Cost (DOC) Breakdown

F. Performance Charts -
   - HOGE altitude vs. gross weight
   - Payload vs. range
   - Altitude vs. maximum continuous speed

G. Drawings –

As a minimum the proposal shall include the following:
   - General Arrangement - 1 or 2 pages (may be 8½ x 11 or 11x17) showing major dimensions
   - Inboard Profile – 1 page (may be 8½ x 11 or 11x17) showing the size and location of major aircraft features and systems
   - Engine Centerline Drawing – 1 page cross-section through the engine centerline showing major features
   - Drive System Schematic – 1 page with gear ratios and shaft speeds

H. A description of the process by which the configuration was selected, a description of the technical approach and the design features of the air vehicle and its major components, and an explanation of the analyses supporting the design data. Special attention will be paid to the proposed manufacturing processes.

The proposal should convey an understanding of the RFP requirements, the significance of the various design features of the air vehicle, and the trade studies and analyses used to select and design those features. The use of 'canned' analytical tools will require an accompanying discussion that illustrates an understanding of the underlying process. Consideration will be given for team-developed tools. The process for establishment of air vehicle and powerplant design parameters beyond those explicitly stated in this document should be explained. It should describe the proposed technical approach to compliance with the requirements. Technical justification for the selection of materials and technologies is expected. The proposal shall identify and discuss critical technical problem areas in detail. Descriptions, design tools and processes, system analysis, sketches, drawings, and discussions of new techniques should be presented in sufficient detail to enable the engineering

evaluation of the submitted proposal. Exceptions to technical requirements, if any, must be identified and justified. All assumptions should be clearly stated.

In addition, an Executive Summary presentation in Microsoft Powerpoint or Adobe Reader format of between 10 and 20 pages shall be provided, which identifies the features and characteristics of the vehicle, summarizes the technical approach, and presents the compelling story of the team.

7. Design Objectives and Requirements

It is apparent that there is a gulf between the operating characteristics of current light piston training helicopters and the fleet of turbine helicopters currently operating in commercial service around the world. The challenge is to build a 2-place training helicopter with operating characteristics representative of the turbine fleet, while being cost-competitive with current training helicopters. While most helicopters rely upon productivity (the movement of payload as rapidly as possible) to achieve cost-effectiveness, a trainer must, above all, be inexpensive to acquire. Operating efficiency is of secondary concern.

The objective of this competition is the design of a two-seat, single-engine turbine helicopter trainer. It is to be assumed that there are no current turbine engines that meet the specific requirements of this project, particularly with regard to cost. The proposal shall include a *conceptual* design for a low-cost turbine engine. Specifically, the engine design shall be detailed enough to illustrate an understanding of the impact of different design features upon the cost, reliability/durability, and efficiency of a turboshaft engine. While the airframe and engine must maintain normal standards of safety and reliability, the primary focus of the proposal will be on innovative manufacturing cost reduction concepts in both designs. Recurring cost analysis should assume a production rate of 300 aircraft per year for 10 years. Non-recurring cost need not be considered.

The operating environment and characteristics that are important to a training helicopter must be considered, particularly with regard to ruggedness and durability, and good autorotative capability. Innovative design concepts to accommodate both *ab initio* and advanced training in the same aircraft may be considered. The aircraft must be capable of lifting two 90 kg people, 20 kg of miscellaneous equipment, and enough fuel to hover out of ground effect (HOGE) for 2 hr, into a HOGE at 6,000 ft on an ISA+20°C day. The aircraft has no specific forward speed requirement, although, in general, performance should be superior to current piston trainers. Any further requirements are left to the team to establish, with accompanying rationale.