26th Annual AHS Student Design Competition

2009 Request for Proposal (RFP)

For

Non-conventional rotor drive

Sponsored by

AgustaWestland
A Finmeccanica Company

and

AHS INTERNATIONAL

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Section 1 – Basic Information

1. Rules

a. Competition categories include:

- Graduate Student Category
- Undergraduate Student Category
- New Entrant Category

  The "New Entrant" category is open to all schools (graduate and undergraduate) that have not participated in at least 2 of the prior 3 competitions.

b. All undergraduate and graduate students may participate in this competition. Schools are encouraged to form project teams. The maximum number of students on each team is 10.

The development of multi-university cooperative teams is strongly endorsed, for the added educational and project management experience. For multi-university teams, the maximum number of participants is equal to 12. This is in order to allow one equivalent project coordinator for each university. To prevent fragmentation of tasks, the maximum number of universities on a cooperative team is 2. Regardless of the nationality of the participant teams, all submittals and communications to AHS shall be in English

c. The classification of a team is determined by the highest education level of any member of the team. Part-time students may participate at the appropriate graduate or undergraduate level.

d. "New Entrant" team proposals will be judged at the appropriate graduate or undergraduate level, and evaluated for the best "New Entrant" category from the group of all New Entry teams.

e. Only one design proposal may be submitted by each student or team; however a university or college may enter multiple teams, each with its own individual proposal.

f. Final proposals must be submitted to AHS International in digital format readable using Adobe Acrobat (requests for exceptions will be considered in advance). All documents submitted shall use a font size of at least 10 point and a spacing that is legible and enhances document presentation.

g. Graduate category submissions shall be no more than 100 pages and undergraduate submissions shall be no more than 50 pages (including all figures, drawings, photographs, and appendices). The cover page, table of contents, lists of figures/tables, nomenclature, and references are not to be considered part of the page limit. Pages shall be 8½ x 11 inches, with the exception that 8 pages may be larger fold-out pages up to a maximum size of 11 x 17 inches. Penalties will be applied if the page limit is exceeded.

h. The Final Submittal shall be a single PDF file composed of a self-contained Executive Summary Briefing, limited to no more than 20 pages and the Final Proposal, limited to 50 or 100 pages as appropriate for the category. The Executive Summary Briefing is not to be considered part of the page limit. No additional technical content can be included in the executive summary. This is to prevent improper use of this medium to exceed the previously stated submission size. The executive summary can take the form of a viewgraph-style presentation, but will be part of the .pdf file. The reader is referred to section 6.5 for a description of the Executive Summary Briefing.

i. For all submittals, an inside cover page must include the printed name, educational level and signature of each student who participated. Submittals *must* be the work of the students, but guidance may come from Faculty Advisor(s), and must be acknowledged on this signature page. Design projects for which any student receives academic credit must be identified as such on this signature page.

j. If any student or design team withdraws their project from the competition, the student or team leader must notify the AHS National Headquarters Office immediately in writing.

2. ***Awards***

The submittals will be judged in 2 primary categories:

Graduate Category:

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

Undergraduate Category:

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

In addition, the best new entrant 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 a team representative, in each category will be expected to present a technical summary of their design at the 2009 AHS International Annual Forum. Presenters will receive complimentary registration and Eurocopter will reimburse up to $1000 in expenses to help defray the cost of attendance.

3. Schedule

Scheduled milestones and deadline dates for submission of the proposal and related material are as follows:

a. AHS Issue of Request for Proposal (RFP).	September 1, 2008
b. Submit Letter of Intent to Participate.	February 16, 2009
c. Teams submit Requests for Information/Clarification.	February 28, 2009
d. AHS issues responses to questions	March 31, 2009
e. Teams submit Final Proposals.	June 01, 2009
f. The Sponsor notifies AHS of results.	August 10, 2009
g. AHS announces winners.	August 20, 2009
h. Winning teams present Executive Summary at AHS Forum 66.	May, 2010

All questions and requests for information/clarification that are submitted by teams to AHS will be distributed with answers to all participating teams. The proposal must be postmarked by June 01, 2009.

4. Contacts

All correspondence will be directed to:

Kim Smith, Deputy Director
AHS International
217 N. Washington Street
Alexandria, VA 22314
Phone: (703) 684-6777
Fax: (703) 739-9279
Email: kim@vtol.org

5. ***Evaluation Criteria***

The proposals will be judged based on 4 primary categories, with weighting factors specified in brackets:

a. Technical Content (40 points)

The Technical Content of the proposal requires that …

- The design meets RFP technical requirements
- The assumptions are clearly stated and logical
- A clear understanding of design tools is evident
- Major technical issues are considered
- Appropriate trade studies are performed to direct/support the design process
- Well balanced and appropriate substantiation of the complete system is presented
- Technical drawings are clear, descriptive and accurately describe the complete aircraft (including relevant subsystems)

b. Organization & Presentation (15 points)

The organization and presentation of the proposal requires …

- A self-contained Executive Summary that contains all pertinent information and makes a compelling case why the proposal should win
- An introduction that clearly describes the major features of the proposed aircraft
- A well organized proposal that makes all pertinent and required information readily accessible and presents this information in a logical order (continuity of topics)
- Figures, graphs and tables that are uncluttered and easy to read and understand
- All previous relevant work be cited
- Professional quality and presentation of the proposal

c. Originality (15 points)

The originality of the proposal will be judged on …

- Vehicle aesthetics
- How much the solution demonstrates originality and shows imagination

d. Application & Feasibility (30 points)

The proposals will be judged on how well current and anticipated technology levels are applied to the problem, and how feasible the solution appears to be. Specifically, the proposals must …

- Justify and substantiate the technology levels that are used or anticipated
- Identify and discuss the high risk technological areas
- Discuss the influence of affordability considerations on the design process
- Discuss the influence of reliability and maintainability on the design process, including life cycle support
- Discuss how the manufacturing methods and materials were considered in the design process, including modularity and lean implementation
- Demonstrate an appreciation of how the vehicle will be used by the operator
- Identify a path to production-ready technology

In addition, the proposal should consider additional applications other than those specified in the RFP.

6. Proposal Requirements

The proposal response needs to communicate a description of the design concepts and the associated performance criteria (or metrics) to substantiate the assumptions and data used and the resulting predicted performance, weight, and cost. The following should be used as guidance while developing a response to this Request for Proposal (RFP):

1. Demonstrate a thorough understanding of the RFP requirements.

2. Describe how the proposed technical approach complies with the requirements specified in the RFP. Technical justification for the selection of materials and technologies is expected. Clarity and completeness of the technical approach will be a primary factor in evaluation of the proposals.

3. Identify and discuss critical technical problem areas in detail. Descriptions, method of attack, system analysis, sketches, drawings, and discussions of new approaches should be presented in sufficient detail in order to assist in the engineering evaluation of the submitted proposal. Exceptions to RFP technical requirements must be identified and justified.

4. Describe the results of trade-off studies performed to arrive at the final design. Include a description of each trade and a thorough list of assumptions. Provide a brief description of the tools and methods used to develop the design.

5. The data package that must be provided in the proposal is described in Section 1.h. The Executive Summary Briefing should present a compelling story why your design concept should be selected. The Executive Summary Briefing should highlight critical requirements and the trade studies you conducted, and summarize the aircraft concept design and capabilities.

Section 2 – Design Objectives

1. Design Concept

The rotor/drive system is the core of the helicopter and the subsystem that provides the unique capabilities of a rotorcraft. By rotor/drive system, in this RFP it is meant the combination of rotors, rotor control systems, drivetrain and engines.

Over the years countless versions of rotor/drive systems for helicopters have been proposed and, in some instances, tested up to actual flight.

However today only a few of these architectures have gained acceptance by operators and manufacturers and led to successful aircraft produced in significant numbers and operated in the field; specifically, the main-tail rotor (including NOTAR© and Fenestron©), tandem rotor, coaxial rotor and intermeshing rotor (synchropter) configurations, all connected through one or more gearboxes to one or more engines.

Benefitting from the advance in design analysis and the improvement in materials, the purpose of this year's SDC it to design a new, non-conventional rotor/drive system for a helicopter, using as a starting point an existing design in terms of size, weight and performance.

2. Design Objectives

Starting from a current, in-service design, the team shall develop an alternative, non-conventional rotor/drive system, including all necessary subsystems that will endow the new design with improved performance in terms of speed, range, payload, endurance and noise signature. By non-conventional rotor/drive system it is meant any system to power the helicopter that does not fall within the abovementioned configurations.

Switching from a conventional tail rotor to NOTAR© or Fenestron© will not be considered adequate, as it is also obvious that a straight increase in size and/or power of an existing design will not be considered technically adequate as it does not add anything to the existing technology. Additionally the resulting rotorcraft will have to retain all the typical flight characteristics of rotorcraft (hovering flight, flight in any direction and capability to perform power-off autorotation landings).

The design will need to be detailed enough to substantiate clearly any performance improvement statements.

The rotorcraft should be designed using as a reference a 14CFR PART29 (or equivalent) certified helicopter of MTOW over 3500 Kgm and not exceeding 5500 Kgm. This is to provide a common reference point for all entrants.

This freedom does not allow using physically impossible solutions including but not limited to:

- Materials endowed with exceptional mechanical characteristics that are not currently available ("Unobtainium" or composites so advanced and performing that no one has seen anything such yet).
- Engines or drivetrain with mechanical or thermal efficiencies not in line with the laws of thermodynamics and the manufacturing capabilities of current industry.
- Designs where functions are not clearly defined (we want to see all pieces of the system, with enough detail that it can be understood what does what!). As a

benchmark, it should be understood that the final design should be capable of undergoing a certification process with an Aviation Authority and, therefore, should meet the requirements of a consistent set of certification rules.

As an additional clarification, the teams are not expected to design an “upgrade kit” for a current airframe, but to design a derivative version of a complete aircraft with a focus in describing the new rotor/drive system to substantiate performance claims and clarify functions and construction details.

For this year there will be no additional task for the Graduate teams with respect to the Undergraduate entrants, considering that each team is expected to perform as thorough an analysis as the level of understanding of the subject will allow, still remaining within the maximum page number limitations for the submittals.

Let your fantasy roam and amaze us!