27th Annual AHS Student Design Competition

2010 Request for Proposal (RFP)

For

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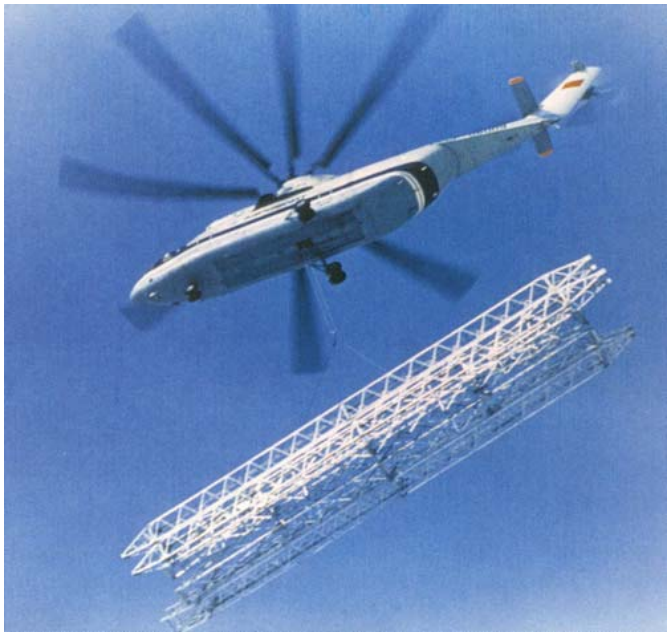

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Section 1 – Basic Proposal Information

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. 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 also evaluated for the overall best "New Entrant" 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. 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 6.6 for a description of the Executive Summary Briefing. Graduate team entries should also include a PC video file of their model test setup and experiment, of not more than 5 minutes duration.

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.

k. For the Graduate Experimentation task, up to $500 will be provided to each of the first five teams that make a request for model helicopter reimbursement.

2. Awards

The Boeing Company is pleased to sponsor the AHS Student Design Competition this year, providing funds for the awards, travel stipend, and graduate entry model helicopter purchases.

The submittals will be judged in 2 primary categories:

Graduate Category:

- 1st place - $1300
- 2nd place - $700

Undergraduate Category:

- 1st place - $800
- 2nd place - $400

In addition, the best New Entrant will be awarded $300.

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, for the Graduate and for the Undergraduate categories will be expected to present a technical summary of their design at the 2011 AHS International Annual Forum. Presenters will receive complimentary registration and will be provided 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).	August 10, 2009
b. Submit Letter of Intent to Participate.	No Later Than (NLT) February 15, 2010
c. Teams submit Requests for Information/Clarification.	NLT February 28, 2010
d. AHS issues responses to questions	NLT March 31, 2010
e. Teams submit Final Proposals.	June 01, 2010
f. The Sponsor notifies AHS of results.	August 1, 2010
g. AHS announces winners.	August 10, 2010
h. Winning teams present Executive Summary at AHS Forum 66.	June, 2011

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, 2010.

4. Contacts

All correspondence should be directed to:

Kim Smith, Deputy Director
AHS International
217 N. Washington Street
Alexandria, VA 22314
Phone: (703) 684-6777
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5. Evaluation Criteria

The undergraduate proposals will be judged based on 4 primary categories, with weighting factors specified below.

The graduate proposals will also be judged based on the 4 primary objectives and factors below, with an overall 67%/33% weighting split for the Design and Experimentation tasks, respectively.

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 system (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 system
- 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 …

- System 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

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 graduate entry must also describe the RC helicopter experiment design, test, and results. 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.

6. An 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.

7. Graduate Teams must provide a PC video file of their model helicopter experimentation task, not to exceed 5 minutes in duration, showing their understanding and approach in conducting an experimental test program.

Section 2 – System Objectives

1. Operating Concept

Vertical Lift provides the key dimension for delivering people, cargo, and equipment to sites that are otherwise inaccessible due to embarkation or debarkation selections, or natural and/or human-made obstacles. Yet, there is a recognized cost impact for this vertical lift/runway independence capability as compared to a conventional fixed-wing aircraft. Without it, delivering people, cargo, or equipment the "last mile" can be an overwhelming obstacle for civil and military transport operators.

For large transport deliveries, use of an aircraft's full space and/or weight capacity is generally seen as the most cost-effective operation. And the legacy of various cargo loads is such that current rotorcraft cargo fleet has evolved to a maximum payload capacity of about 20-30,000 lb. (i.e. H-47 or H-53 Heavy Lift helicopters.) Occasionally there is a desire to move heavier equipment that cannot affordably be broken down to these levels, and other innovative means are devised for transport where ground systems cannot readily accommodate them.

A significant portion of the commercial surface transportation system relies on 20 foot and 48 foot ISO containers. A new design rotorcraft that could lift full-load ISO containers for occasional peak loads could well be oversized and underutilized for 'normal' operations.

In the 1960's, 70's, and 80's, various research efforts were conducted on the means of using two or more rotorcraft to combine their lift capability in order to provide an infrequent "Multi-Lift" capability. These systems did not have the necessary maturity and economic payoff to make it into production. In the meantime, advances in design and analysis of structures, control systems, communications, and sensor systems have advanced to such an extent that the Multi-Lift concept may yet be viable for unusually large vertical lift transport jobs.

2. Specific Objectives

There are two tasks as part of this year's competition – a design task for both undergraduate and graduate teams, and an experimentation task for graduate teams only.

a. Design Task: All Teams.

A technology demonstrator multi-lift system is to be designed such that two rotorcraft can be cooperatively operated to lift 75% more Payload than either aircraft alone could lift. Enough fuel needs to be aboard at takeoff for a 100nm delivery distance, mid-point hover capability for 10 minutes, and return without the payload.

The focus is to be on the system concept – load lifting device(s), control scheme, and multi-aircraft system stability - rather than a particular aircraft or payload. Therefore, a current, in-service rotorcraft should be selected as the baseline aircraft to design the concept and technologies involved. The baseline aircraft should have at least 5,000 lb useful load capability at Sea Level/ISA+20°C conditions.

Design and analyses must address the load handling device/structure, load sharing between the aircraft, multi-aircraft stability, Takeoff and Landing techniques, and aircraft control coordination. Any mechanical or electronic modifications necessary for the baseline aircraft, system redundancy, and other safety considerations should also be addressed.

A production Heavy Multi-Lift load handling system would be able to accommodate 20' and 48' ISO containers, various wheeled or tracked vehicles, and large construction machinery. Dependent on the baseline aircraft chosen, a proportionally sized load handling device should be defined for perspective payloads.

b. Experimentation Task: Graduate Teams only.

Conduct of your Technology Demonstration Multi-lift Load Handling System would eventually involve design and conduct of a flight test program. To demonstrate an understanding of some of the needs of such a test program, graduate teams must design and conduct a hover lift test and analysis effort with a remote control helicopter.

The performance objectives of this task are not directly related to the Multi-Lift Design task, other than the general need for more efficient lift. An off-the-shelf (OTS) remote control helicopter is to be tested and then modified to provide 5% or more additional hover lift.

An OTS helicopter kit of at least 30" rotor diameter should be used. Either gas/nitro or electric powered is acceptable. Major components of an OTS model helicopter can be used instead of the full flying kit if this better fits the experimental design. A test is to be devised and conducted to measure the lift-to-power capability of the baseline helicopter. Analysis should be conducted, and correlated to this test data. Then a modification to the helicopter is to be made which is predicted to provide at least 5% additional lift for a given power setting, the modifications made, and testing to be conducted to determine the actual change in performance.

The judging evaluation will concentrate on the test methods including safety procedures and analyses, and accuracy of associated analyses. The amount of improvement is not a significant factor.

Up to $500 will be provided to each of the first five teams that make a request for reimbursement of funds used to purchase of an off-the-shelf RC helicopter kit and associated flight electronics.

Good luck, be safe, and have fun!