

**28th Annual American Helicopter Society
Student Design Competition**

**2011 Request for Proposal (RFP)
For**

Multi-Mission Aircraft

Sponsored by



And



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1.0 Basic Proposal Information

Bell Helicopter Textron Incorporated extends greetings and invites you to participate in the 28th Student Design Competition (SDC) of the American Helicopter Society, International (AHS). This Request For Proposal (RFP) is divided into two sections. Section 1 (this section) provides a general description of the competition and the process for entering. This section covers the rules (both general and proposal specific) and schedules that the sponsor requires of the participants. It also describes the awards and provides contact information. Section 2 describes the specific challenge by Bell Helicopter Textron Inc.

1.1 Rules

1.1.1 Who May Participate

All undergraduate and graduate students from any school (university or college) may participate in this competition, regardless of nationality. A student may be full-time or part-time; their education level will be considered in the classification of their team (see 1.1.3).

1.1.2 Team Size and Number of Teams

We encourage the formation of project teams. The maximum number of students on a team is ten (10). Schools may form more than one team, and each team may submit a proposal, but each team is limited to a maximum of ten students. A student may be a member of one team only.

We look favorably upon the development of multi-university teams for the added experience gained in education and project management. The maximum number of students for a multi-university team is twelve (12), distributed in any manner over the multi-university team.

1.1.3 Categories and Classifications

The competition has three categories. They are:

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

The classification of a team is determined by the highest education level currently pursued by any member of the team.

A “new entrant” is defined as any school (undergraduate or graduate) that has not participated in at least two of the prior three competitions.

1.1.4 Language of Proposal

Regardless of the nationality of the teams, all submittals and communications to and from the American Helicopter Society will be in English.

1.1.5 Proposal Format, Length and Medium

Two separate files comprise the Final Submittal and both must be present for a submission to be considered complete. The judges shall apply a significant penalty if either file is missing. The two files are the Executive Briefing and the Final Proposal. Each are described herein.

The first file is called the Final Proposal. It is the complete, self-contained proposal of the team. It shall be submitted in PDF form readable with Adobe Acrobat. Exceptions will be considered with advance request.

A Proposal Summary and Substantiation documentation comprise the Final Proposal. The Proposal Summary describes the vehicle that you designed in response to the RFP. The description includes a dimensioned 3-view drawing, a basic description of the mass properties, the estimated performance of the vehicle and any special details that show how your proposal meets the requirements of the RFP. Following the Proposal Summary, the reader should find the Substantiation documentation, which is a series of appendices that detail the models and trade studies you used to justify your design.

The Undergraduate category Final Proposals shall be no more than 50 pages and graduate category Final Proposals shall be no more than 100 pages. This page count includes all figures, diagrams, drawings, photographs and appendices. In short, anything that can be read or viewed is considered a page and subject to the page count, with the following exceptions. The cover page, acknowledgement page, signature page, posting permission page (see section 1.1.9), table of contents, list of figures, list of tables, nomenclature, reference pages and the Executive Briefing are excluded from the page count for the Final Proposal. See sections 1.1.6 for specific information about the signature page.

Pages measure 8 ½ x 11 inches. Undergraduate submissions may have four (4) larger fold-out pages with a maximum size of 11 x 17 inches, and graduate submissions may have eight (8) larger fold-out pages with a maximum size of 11 x 17 inches. If a submission exceeds the page limit for its category, the judges will apply a penalty equal to ¼ point per page over the limit.

All proposals and summaries shall use a font size of at least 10 point and spacing that is legible and enhances document presentation.

The second file is a PDF file called the Executive Briefing. This is a self-contained “executive” briefing of the proposal. Both undergraduate and graduate category Executive Briefings are limited to twenty (20) pages measuring 8 ½ x 11 inches, with no more than four (4) larger fold-out pages of a maximum size of 11 x 17 inches. The Executive Briefing should take the form of a viewgraph-style presentation, but it must be a PDF file readable with Adobe Acrobat. No additional technical content may be introduced in the Executive Briefing. The judges shall apply the same page count penalty to the Executive Briefing score as with the Final Proposal. The Executive Briefing shall account for no more than 10% of the total score of the complete submission.

All submissions shall be made on a compact disc (CD). A back-up submission via e-mail to the AHS may also be provided by a team, but the submission will not be considered executed without receipt of a compact disc by the submittal deadline.

1.1.6 Signature Page

All submittals must include a signature page as the second page, following immediately after the cover page. The signature page must include the printed name, e-mail addresses, education level, (undergraduate or graduate), and signature of each student that participated. In the case of a multi-university team, the page must also indicate the affiliation of each student.

The submittals must be wholly the effort of the students, but Faculty advisors may provide guidance. The signature page must also include the printed names, e-mail addresses and signatures of the Faculty Advisors.

Design projects for which a student receives academic credit must be identified by course name(s) and number(s) on the signature page.

1.1.7 Withdrawal

If a student withdraws from a team, or if a team withdraws their project from the competition, that team must notify the AHS National Headquarters Office in writing immediately.

1.1.8 Special Sponsor Rules

No special sponsor rules are applied in this RFP.

1.1.9 Proposal Posting

The AHS will post the winning entries in the undergraduate and graduate categories on their web site. Other entries will be posted if the teams provide written permission by their team captain or designated point of contact and a faculty advisor at the time of submission. The written permission shall appear on a separate page immediately following the signature page.

1.2 Awards

Bell Helicopter Textron Inc. is very pleased to sponsor the AHS Student Design Competition this year. Bell Helicopter Textron Inc. will provide the funds for the awards and travel stipends.

Submittals are judged in two (2) categories.

Undergraduate category:

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

Graduate category:

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

In addition, the best "New Entrant" (defined in section 1.1.3) will be awarded \$300.

Certificates of achievement will be presented to each member of the winning team and to their faculty advisors for display at their school. The first place winner or team representative for the graduate and undergraduate categories will be expected to present a technical summary of their design at the 2012 AHS International Annual Forum. Presenters receive complimentary registration and will be provided up to \$1000 in expenses to help defray the cost of attendance.

1.3 Schedule

Schedule milestones and deadline dates for submission are as follows:

Milestone	Date
AHS Issues a Request For Proposal	August 09, 2010
Submit Letter of Intent to Participate	NLT February 18, 2011
Submit Requests for Information/Clarification	Continuously, but NLT February 25, 2011
AHS Issues Responses to Questions	NLT March 25, 2011
Teams submit Final Submittal (Final Proposal and Executive Briefing)	NLT June 01, 2011
Sponsor notifies AHS of results	August 01, 2011
AHS announces winners	August 08, 2011
Winning team presents at AHS Forum	May, 2012

We reiterate; if you intend to participate, your Letter of Intent must arrive at the American Helicopter Society, International no later than February 18, 2011. The signature page must include all of the information requested in section 1.1.6.

All questions and requests for information/clarification that are submitted by teams to the AHS will be distributed with answers to all participating teams and judges.

The Final Submittal must be postmarked by June 01, 2011.

1.4 Contacts

All correspondence should be directed to:

Ms. Kay Brackins, Deputy Director
AHS International
217 N. Washington Street
Alexandria, Va. 22314
Phone: (703) 684-6777
Fax: (703) 739-9279
E-mail: kbrackins@vtol.org

1.5 Evaluation Criteria

The proposals shall be judged on four (4) primary categories with weighting factors specified below.

A. Technical Content (40 points)

The Technical Content of the proposal requires that ...

- The design meets the RFP technical requirements
- The assumptions are clearly stated and logical
- A thorough understanding of tools is evident
- All major technical issues are considered
- Appropriate trade studies are performed to direct/support the design process
- Well balanced and appropriate substantiation of complete aircraft and subsystems is present
- Technical drawings are clear, descriptive, and accurately represent a realistic design

B. Application & Feasibility (25 points)

The proposals will be judged on how well current and anticipated technologies are applied to the problem, and on the feasibility of the solution. The proposals must ...

- Justify and substantiate the technology levels that are used or anticipated
- Direct appropriate emphasis and discussion to critical technological issues
- Discuss how affordability considerations influenced the design process
- Discuss how reliability and maintainability features influenced the design process
- Discuss how manufacturing methods and materials were considered in the design process
- Show an appreciation for the operation of the aircraft

C. Originality (20 points)

The originality of the proposal shall be judged on ...

- How innovative is the solution
- How much does the solution demonstrate originality and show imagination
- Vehicle/system aesthetics

D. Organization & Presentation (15 points)

The organization and presentation of the proposal requires ...

- A self-contained Executive Briefing that contains all pertinent information and a compelling case as to why the proposal should win. It must be a separate file.

- An introduction that clearly describes the major features of the proposed system
- A well organized proposal with all information presented in a readily accessible and logical sequence
- Clear and uncluttered graphs, tables, drawings and other visual elements
- Citations of all previous relevant work (the State-of-the-Art)
- Professional quality and presentation
- The proposal meets all format and content requirements

The RFP describes the contest and the requirements. Schedule, page count and other limits, and the basic rules are part of the RFP and will be judged under section D.

1.6 Proposal Requirements

The Final Submittal 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. Use the following as guidance while developing a response to this Request for Proposal (RFP):

- A. Demonstrate a thorough understanding of the RFP requirements.
- B. 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.
- C. Identify and discuss critical technical problem areas in detail. Present descriptions, method of attack, system analysis, sketches, drawings, and discussions of new approaches in sufficient detail in order to assist in the engineering evaluation of the submitted proposal. Identify and justify all exceptions to RFP technical requirements. Design decisions are important, but so are process and substantiation.
- D. 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.
- E. Section 1.1.5, titled "Proposal Format, Length and Medium" describes the data package that a team must provide in the Final Submittal. Specifically, the Final Submittal must contain two files transmitted on a Compact Disc. The first file is the Final Proposal, which is the full length, complete and self-contained proposed solution to the RFP, composed of Proposal Summary and the appendices that provide the Substantiation documentation. By self-contained, we mean that the proposal does not refer to and does not require files other than itself. The second file is an Executive Briefing, which presents a compelling story why the sponsor should select your design concept. The Executive Briefing should highlight critical requirements and the trade studies you conducted, and summarize the aircraft concept design and capabilities.
- F. Judging will focus on innovative solutions, system performance, and system value.

2.0 System Objectives

2.1 Operating Concept

We desire a new vertical lift system with increased versatility, one that is capable of multiple types of missions. The wide distribution of one rotorcraft that can execute several types of missions increases the availability of an aircraft for a given mission and reduces inventory and maintenance costs due to commonality of parts.

The purpose of the SDC this year is to design a multi-mission vertical lift system that optimally blends the competing requirements of three very different missions. The missions for this aircraft are motivated by the needs of current events.

2.2 Specific Objectives

We desire a proposal for an aircraft that meets the requirements of three different missions. These missions are described below.

2.2.1 Mission 1 – Search and Rescue

This mission requires the aircraft to carry a crew of four, and carry an additional six passengers, or carry two litters and two medical personnel plus equipment. A typical mission profile includes a five minute start-up/warm-up time, a 6K95 HOGE for one minute, a climb to best altitude, a 225 nm radius, descent to search altitude, thirty minute loiter at best endurance, five minute HOGE to effect the rescue, a climb to best altitude, followed by a return at maximum continuous power, a descent to 6K95 HOGE for one minute, and finally landing, cool down and shutdown lasting five minutes. Critically injured passengers are best served if they reach the medical facility in the “golden hour”, a window which we define as 50 to 70 minutes on the return flight.

2.2.2 Mission 2 - Insertion

This mission requires the aircraft to carry a crew of four and six additional persons plus equipment totaling a minimum payload of 4000 pounds internal for a minimum distance of 250 nm. A typical mission profile includes a five minute start-up/warm-up time, a 6K95 HOGE for one minute, a climb to best altitude, a 250 nm radius at best range speed, descent to HOGE for one minute, landing, unloading the payload, take-off, climb to best altitude, return to start point at best range speed, descent, and finally landing, cool down and shutdown lasting five minutes.

2.2.3 Mission 3 - Resupply

This mission requires the aircraft to carry a crew of four and carry/ deliver a minimum payload of 3000 pounds internal for a minimum distance of 250 nm, and then return to the starting point with an alternate payload of 3000 pounds internal. A typical mission profile includes a five minute start-up/warm-up time, a 6K95 HOGE for one minute, a climb to best altitude, a 250 nm radius, descent to HOGE for one minute, landing, unloading the payload, loading the alternate payload, take-off, climb to best altitude, return to start point at best range speed, descent, and finally landing, cool down and shutdown lasting five minutes.

Tables 2.1 and 2.2 illustrate the Payload/Range requirements and Mission segments.

Table 2.1 - Payload/Range Requirements for Mission Types

	Mission 1	Mission 2	Mission 3
Title	Search and Rescue	Insertion	Resupply
Crew	4	4	4
Payload (Outbound)	Empty or 2 empty litters + 2 medical personnel + 500 lbs medical equipment	6 passengers + equipment, total weight 4000 lbs	3000 lbs total weight
Payload (Inbound)	6 passengers or 2 occupied litters + 2 medical personnel + 500 lbs medical equipment	Empty	3000 lbs total weight
Radius	225 nautical miles	250 nautical miles	250 nautical miles

Table 2.2 - Profiles for Mission Types

	Mission 1	Mission 2	Mission 3
Title	Search and Rescue	Insertion	Resupply
Start up/Warm Up	5 minutes	5 minutes	5 minutes
6K95 HOGE	1 minute	1 minute	1 minute
Climb	Best Altitude	Best Altitude	Best Altitude
Outbound Leg	225 nm @ V br	250 nm @ V br	250 nm @ V br
Descent	To Search Altitude	To 6K95 HOGE	To 6K95 HOGE
Loiter	30 minutes @ V be	N/A	N/A
Descent	To 6K95 HOGE	N/A	N/A
6K95 HOGE	5 minutes	N/A	N/A
6K95 Landing	N/A	1 minute	1 minute
Unload (Hot) /Load (Hot)	N/A	10 minutes	20 minutes
6K95 HOGE	N/A	1 minute	1 minute
Climb	To Best altitude	To Best Altitude	To Best Altitude
Inbound Leg	225 nm @ V mcp for 50 to 70 minutes	250 nm @ V br	250 nm @ V br
Descent	To 6K95 HOGE	To 6K95 HOGE	To 6K95 HOGE
6K95 HOGE	1 minute	1 minute	1 minute
Landing / Cool Down / Shutdown	5 minutes	5 minutes	5 minutes

Nomenclature

V br - Speed, best range

V be – Speed, best endurance

V mcp – Speed, maximum continuous power

6K95 – 6000 feet, 95 degrees F

2.2.4 Additional Requirements

The aircraft must be reconfigurable. For instance, the insertion and/or resupply missions likely will not want the extra weight of empty litters and medical equipment, so this material must be easily removed and inserted.

A “rubber” engine based on the CT7-8A characteristics is recommended as the representative engine technology.

The aircraft must meet IOCA Level 4 noise requirements, and for possible military use, IR suppression treatment should be considered.

For purposes of this proposal, non-recurring costs and hourly operating costs comprise the total operating costs. Assume three missions per week.

Enjoy the challenge and let your imaginations fly!