



**33rd Annual
American Helicopter Society (AHS) International
Student Design Competition**

**2015 Request for Proposal (RFP)
For**

**Air Launched Unmanned Disaster Relief
Delivery Vehicle**

Sponsored by



Table of Contents

1. Basic Proposal Information	2
1.1. Rules	2
1.1.1. Who May Participate	2
1.1.2. Team Size and Number of Teams	2
1.1.3. Categories and Classifications	3
1.1.4. Language of Proposal	3
1.1.5. Units Used in Proposal	3
1.1.6. Proposal Format, Length and Medium	3
1.1.7. Signature Page	4
1.1.8. Withdrawal	4
1.1.9. Special Sponsor Rules	5
1.1.10. Proposal Posting	5
1.2. Awards	5
1.3. Schedule	6
1.4. Contacts	7
1.5. Evaluation Criteria	7
1.6. Proposal Requirements	8
2. System Objectives	10
2.1. Operating Concept	10
2.2. Specific Objectives	10
2.2.1. Vehicle Design	10
2.2.1.1. Primary Mission	10
2.2.1.2. Desired Data Deliverables	11
2.2.1.3. Additional Information	11

1.0 Basic Proposal Information

Bell Helicopter, a Textron Company (BHTI) celebrating its 80th year of changing the way the world flies, extends greetings and invites you to participate in the 33rd Annual AHS International Student Design Competition (SDC). 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 presented by BHTI.

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); the minimum team size is one (1), an individual. 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 collaboration 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.

The members of a team must be named in a Letter of Intent. The Letter of Intent is submitted by the captain of a team and sent to the AHS International by the date specified in section 1.3. Information in the Letter of Intent must include the name of the university or universities forming the team, the name of the team, the printed names of the members of the team from all the universities in the team, the e-mail addresses and education level (undergraduate or graduate) of each team member, the affiliation of each student in the case of a multi-university team, and the printed names and affiliations of the faculty advisors, as well as contact information for the team captain.

1.1.3 Categories and Classifications

The competition has three categories that are eligible for prizes. They are:

- **Undergraduate Student Category (1st, 2nd, 3rd)**
- **Graduate Student Category (1st, 2nd, 3rd)**
NOTE: The classification of a team is determined by the highest educational level currently pursued by any member of the team.
- **New Entrant Category**
A new entrant is defined as any school (undergraduate or graduate) that has not participated in the last three prior competitions.

1.1.4 Language of Proposal

Regardless of the nationality of the teams, all submittals and communications to and from the AHS International will be in English.

1.1.5 Units Used in Proposal

All proposals shall provide answers in English and SI units. The primary units are to be English, followed by the secondary units in parentheses. The use of units shall be consistent throughout the proposal.

1.1.6 Proposal Format, Length and Medium

Two separate files comprise the Final Submittal for teams. 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 Summary and 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.

Final Proposals shall be no more than 50 pages. All pages are to be numbered. 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 Summary are excluded from the page count for the Final Proposal. See section 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 12 point and spacing that is legible and enhances document presentation.

The second file is a PDF file called the Executive Summary. This is a self-contained “executive” briefing of the proposal. Executive Summaries 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 Summary can 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 Summary. The judges shall apply the same page count penalty to the Executive Summary score as with the Final Proposal. The Executive Summary shall account for no more than 10% of the total score of the complete submission.

All submissions shall be made via e-mail, FTP or other electronic submittal program to the AHS. A back-up CD or DVD mailed to AHS International is encouraged.

1.1.7 Signature Page

With the exception of the optional Hardware Validation video, 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.

1.1.8 Withdrawal

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

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. This permission page will not count against the page count. Specific permission must be provided for the optional Hardware Validation video files to be posted.

1.2 Awards

BHTI is very pleased to sponsor the AHS Student Design Competition this year. BHTI will provide the funds for the awards and travel stipends through the AHS.

Submittals are judged in three (3) categories.

Undergraduate category:

- 1st place: \$1,850
- 2nd place: \$1,200
- 3rd place: \$500

Graduate category:

- 1st place: \$2,500
- 2nd place: \$1,750
- 3rd place: \$950

Best first time entrant: \$500 (Undergraduate)

Best first time entrant: \$750 (Graduate)

Certificates of achievement will be presented to each member of the winning teams 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 2016 AHS International Annual Forum. Presenters receive complimentary registration and the representative 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	27 July 2015
Submit Letter of Intent to Participate	No Later Than (NLT) 9 February 2016
Submit Requests for Information/Clarification	Continuously, but NLT 27 February 2016
AHS Issues Responses to Questions	NLT 26 March 2016
Teams submit Final Submittal (Final Proposal and Executive Summary)	NLT 29 May 2016
Sponsor notifies AHS of results	6 August 2016
AHS announces winners	20 August 2016
Winning team presents at AHS Forum	June xx, 2017

We reiterate; if you intend to participate, your Letter of Intent must arrive electronically at the American Helicopter Society, International no later than **9 February 2016**. The signature page must include all of the information requested in section 1.1.6. Submit the Letter of Intent to Kay Brackins at kbrackins@vtol.org.

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. Entrants' requests for information/clarification (questions) will be answered as soon as possible. All of the questions and answers will also be distributed collectively to all entrants no later than **26 March 2016**.

The Final Submittal must be received before midnight of **29 May 2016**.

1.4 Contacts

All correspondence should be directed to:

Ms. Kay Brackins, Deputy Director
AHS International
2701 Prosperity Ave., Suite 210
Fairfax, VA. 22031 USA
Phone: 1-703-684-6777 x103
E-mail: kbrackins@vtol.org

1.5 Evaluation Criteria

The proposals shall be judged on four (4) primary categories with weighting factors specified below. Note that Hardware Validation is not a criterion in determining the ranking of the teams' performance.

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 and their use is appropriate and sufficient for the application.
- All major technical issues are considered
- Appropriate trade studies are performed to direct/support the design process
- Well balanced and appropriate substantiation of complete rotorcraft 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 the appropriateness of the proposed rotorcraft to the mission requirements, how well current and anticipated technologies are applied to the problem, and on the feasibility of the solution. The proposals must ...

- Defend the choice of the rotorcraft based on the mission requirements
- 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 rotorcraft

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 Summary 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
- Complete citations of all previous relevant work (the State-of-the-Art)
- Professional quality and presentation
- The proposal meets all format and content requirement

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 1.5, 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. An explanation of the choice of the type of rotorcraft being offered is expected. 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 and an explanation of why you chose the particular tools and methods.
- 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 electronically. The first file is the Final Proposal, which is the full length, complete and self-contained proposed solution to the RFP. 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 Summary, which presents a compelling story why the sponsor should select your design concept. The Executive Summary should highlight critical requirements and the trade studies you conducted, and summarize the rotorcraft concept design and capabilities.
- F. Judging will focus on innovative solutions, system performance, and system value.
- G. Unless otherwise specified, all engineering units should be expressed in the English units of pounds (force), slugs (mass), seconds, minutes or hours as appropriate (time), feet or inches as appropriate (length).

2.0 System Objectives

2.1 Operating Concept

Recent events have underscored the importance of vertical lift in disaster relief missions. The Nepal earthquake and cyclone Pam that struck Vanuatu left thousands of people stranded in remote locations with no food, water, medical supplies or shelter. Manned helicopters and tilt-rotors were essential in reaching populated areas, with space to safely land, and deliver needed supplies and evacuate the seriously injured. In many instances, the local airports were overwhelmed and slowed the flow of assistance. Aerial drones were used in Vanuatu to help search for victims in remote areas, but were not of sufficient size to deliver any meaningful supplies. We propose the design of an unmanned rotorcraft, capable of deployment from the ramp of a C-130J in flight. The rotorcraft must arrest its descent and transition into its own flight mode to precisely deliver supplies to remote areas from a hover and then return to a predetermined base for recovery. Packaging the rotorcraft to maximize payload (supplies) while constrained by the space available in a C-130J cabin will be a primary metric in scoring each team's design.

2.2 Specific Objectives

This competition is a single task, with Undergraduate and Graduate student teams competing in their respective categories. The intent is for teams to use state-of-the-art technology in their designs.

2.2.1 Vehicle Design

2.2.1.1 Primary Mission. The rotorcraft shall be capable of carrying a minimum of 500 lbs payload, but teams are encouraged to maximize the payload carrying capability. For the primary mission, assume the payload is bottled water in shrink wrapped cases.

The rotorcraft with payload must fit in the cargo hold of a C-130J. The rotorcraft is deployed out of the ramp of the C-130 by any method that does not jeopardize the safety of the C-130 or people on the ground. It is acceptable to assume there is crew assistance onboard the C-130 for release of tie-downs and deployment. Deployment occurs at 15,000 ft and 140 kts.

The rotorcraft must arrest its descent and transition to autonomous flight no lower than 1000 ft AGL. The payload must be delivered from a precision no-wind hover at 50 ft AGL by a tether that places the payload on the ground at precise GPS coordinates. The payload shall contact the ground at less than 5 feet per second. The rotorcraft releases the tether and then continues to a base. The time allotted for delivery in hover is 1 minute. With the tether released, the rotorcraft continues for a minimum distance of 50 nm from the delivery point and lands at precisely determined coordinates for later retrieval.

For this competition, the mission is assumed to be earthquake relief at high altitude in South America. The disaster location is at 10,000 ft ISA. The base for return is at 4,000 ft ISA. Teams

must maximize payload carrying capability. Using multiple rotorcraft that fit inside the C-130J may be considered as an option.

2.2.1.2 Desired Data Deliverables. The following deliverables are required for the undergraduate teams and shall be provided in the format described in Section 1.1:

1. General description of the proposed vehicle which highlights how it meets the stated requirements. The rotorcraft's deployment from the C-130J ramp through payload delivery must be illustrated and described in detail. (This includes the sequence of ejecting the rotorcraft, arresting its descent/rotor deployment, developing autorotation, initiating hover, payload delivery, and continued flight to base)
2. Three-view drawings of the vehicle in its major phases of deployment, including the placement of major components.
3. Segment by segment summary of the mission performance including flight speed, energy consumed and power required for the entire vehicle system.
4. Performance data at the individual component level (rotor, transmission, etc) that substantiates the total power required in each segment of the mission.
5. A detailed weight statement with substantiating analysis.
6. An estimate of the cost to produce the vehicle based on assembly labor and bill of materials.

2.2.1.3 Additional Information. The following information is provided as baseline data for the competition to ensure fairness and avoid any confusion regarding the task.

C-130J cargo and cabin dimensions and capacities.

Cargo Bay: length, 40 feet; width, 119 inches; height, 9 feet. Rear ramp: length, 123 inches; width, 119 inches. Maximum normal Payload, 34,000 lb.

Disaster relief payload (any number of cases of bottled water in shrink wrap). Dimensions are 16 x 11 x 9 inches and 28.2 lb each.