2007 - 2008 AIAA Undergraduate Team Aircraft Design Competition

I. Rules – General

1. All undergraduate AIAA branch or at-large Student Members are eligible and encouraged to participate.

2. An electronic copy of the report in MS Word or Adobe PDF format must be submitted on a CD or DVD to AIAA Student Programs. Total size of the file(s) cannot exceed 60 MB. **A "signature" page must be included in the report and indicate all participants, including faculty and project advisors, along with their AIAA member numbers**. Designs that are submitted must be the work of the students, but guidance may come from the Faculty/Project Advisor and should be accurately acknowledged.

3. *Design projects that are used as part of an organized classroom requirement are eligible and encouraged for competition.*

4. The prizes shall be: First place-$2,500; Second place-$1,500; Third place-$1,000 (US dollars). Certificates will be presented to the winning design teams for display at their university and a certificate will also be presented to each team member and the faculty/project advisor. One representative from the first place design team may be expected to present a summary design paper at an AIAA Conference in 2008. Reasonable airfare and lodging will be defrayed by the AIAA for the team representative

5. More than one design may be submitted from students at any one school. Projects should be *no more than 100 (total) double-spaced typewritten pages and typeset should be no smaller than 10pt Times* (including graphs, drawings, photographs, and appendix) on 8.5" x 11.0" paper. Up to five of the 100 pages may be foldouts (11" x 17" max).

6. If a design group withdraws their project from the competition, the team chairman must notify AIAA Headquarters immediately!

7. Team competitions will be groups of not more than ten AIAA branch or at-large Student Members per entry. Individual competitions will consist of only 1 AIAA branch or at-large Student Member per entry.

II. Copyright

All submissions to the competition shall be the original work of the team members.

Any submission that does not contain a copyright notice shall become the property of AIAA. A team desiring to maintain copyright ownership may so indicate on the signature page but nevertheless, by submitting a proposal, grants an irrevocable license to AIAA to copy, display, publish, and distribute the work and to use it for all of AIAA's current and future print and electronic uses (e.g. "Copyright © 20__ by _____. Published by the American Institute of

Aeronautics and Astronautics, Inc., with permission.).

Any submission purporting to limit or deny AIAA licensure (or copyright) will not be eligible for prizes.

III. Schedule and Activity Sequences

Significant activities, dates, and addresses for submission of proposal and related materials are as follows:

A. Letter of Intent — 14 March 2008
B. Proposal delivered to AIAA Headquarters — 13 June 2008
C. Announcement of Winners — August 2008

Groups intending to submit a proposal must submit a Letter of Intent (Item A), with a maximum length of one page to be received with the attached form on or before the date specified above, at the following address:

AIAA Student Programs
1801 Alexander Bell Drive, Suite 500
Reston, VA 20191-4344

IV. Proposal Requirements

The technical proposal is the most important factor in the award of a contract. It should be specific and complete. While it is realized that all of the technical factors cannot be included in advance, the following should be included and keyed accordingly:

1. Demonstrate a thorough understanding of the Request for Proposal (RFP) requirements.

2. Describe the proposed technical approaches to comply with each of the requirements specified in the RFP, including phasing of tasks. Legibility, clarity, and completeness of the technical approach are primary factors in evaluation of the proposals.

3. Particular emphasis should be directed at identification of critical, technical problem areas. Descriptions, sketches, drawings, systems analysis, method of attack, and discussions of new techniques should be presented in sufficient detail to permit engineering evaluation of the proposal. Exceptions to proposed technical requirements should be identified and explained.

4. Include tradeoff studies performed to arrive at the final design.

5. Provide a description of automated design tools used to develop the design.

V. Basis For Judging

1. Technical Content (35 points)
This concerns the correctness of theory, validity of reasoning used, apparent understanding and grasp of the subject, etc. are all major factors considered and a reasonably accurate evaluation of these factors presented?

2. Organization and Presentation (20 points)
The description of the design as an instrument of communication is a strong factor on judging. Organization of

written design, clarity, and inclusion of pertinent information are major factors.

3. Originality (20 points)
The design proposal should avoid standard textbook information, and should show the independence of thinking or a fresh approach to the project. Does the method and treatment of the problem show imagination? Does the method show an adaptation or creation of automated design tools?

4. Practical Application and Feasibility (25 points)
The proposal should present conclusions or recommendations that are feasible and practical, and not merely lead the evaluators into further difficult or insolvable problems.

VI. Request for Proposal

Agricultural Unmanned Aircraft System (AUAS)

1. OPPORTUNITIES DESCRIPTION

There is a need for an affordable agricultural aircraft that can serve the needs of both developed and under-developed nations worldwide.

Most existing agricultural aircraft require complex or expensive initial investments that many times are out of reach from the average farmer or community in many parts of the world. The specific needs of the agricultural industry dictate that both liquid and solid particles must be applied periodically to many crops and fields, including sugar cane for the production of biofuels that can be used to power internal combustion engines.

2. PROJECT OBJECTIVE

This specific Request For Proposal (RFP) provides the requirements for an unmanned aircraft that is practical, easy to acquire, and operate. The aircraft will be supported by a ground station that can be easily reconfigured to be transported anywhere.

This is not just another crop duster, but a truly rugged, low cost, easy to fly aircraft that will serve the needs of farmers around the world, operating as a complete, yet simple system that reaches all kinds of crops and areas, greatly contributing to the needs of societies everywhere.

3. DESIGN REQUIREMENTS AND CONSTRAINTS

The vehicle must be a fixed wing, unmanned aircraft.

The expendable payload consists of 100 liters of liquid chemical (weight 235 lbs, 64 lb/ft^3) or 300 lb of solid particles (for example seeds or fertilizer with 70lb/ft^3) in a hopper tank.

There should be provisions for the most expeditious loading of the hopper tank for the payload in the field.

Fuel reserves for 20 minutes of flight.

Operating altitude: 20 feet above the ground.

Determine the best operating speed for the mission. The payload may be

expended at any rate to assure complete coverage of the field of interest.

Clean stall speed: operating speed/1.3.

Maximum landing and takeoff distance: 750 feet within a 50 feet wide gravel or grass improvised airstrip.

Cruise altitude for short ferry flights of 1 to 2 miles with no payload: 1000 feet above ground level.

No range credit should be allotted for the climbs and descents.

The aircraft, the ground station, and all other necessary supporting equipment needs to be carried in and/or towed by a standard pick up truck.

Easy operation, repair, maintenance, and support in the field.

Based on technology available today, you must choose the best propulsion system to be used for the vehicle.

The equipment used on board for agricultural applications (pumps, hoses, etc), both liquid and solid can be considered to be contained within a sphere of 1 ft radius that weights 30 lbs. Twin booms on each side of the aircraft will be used for spraying.

Low acquisition cost, low operating and maintenance cost, low initial training cost.

The aircraft must be safe enough to protect people and property on the ground from unnecessary harm in case of failure of any of its systems during flight.

The design must account for future growth for more capable versions of the aircraft that can fly longer and deliver more payload.

The baseline design will be used at sea level (standard day conditions), but future, more capable versions, will be used at higher altitudes.

The vehicle should use as many commercially available, "off the shelf" components and standard parts as possible including a powerplant that is in production and widely available today.

See included typical mission profile for zero wind, standard atmosphere, sea level.

You are not required to design a mission control system for the vehicle, this would have to be acquired "off the shelf". The vehicle will be controlled by a qualified Pilot from the ground, who should be aware of the extent of the spray area and any obstacles in the area of operation.

3.1 Required Mission Performance (see mission profile)

1. Warm-up and taxi at idle power for 5 minutes.
2. Takeoff.
3. Climb to 50 feet above ground level (AGL).
4. Align with the chosen field and descend to 20 feet AGL.
5. Spray a rectangular area of 0.5 miles x 1000 feet with the available chemical or seeds. Perform as many passes and turns over the field as necessary to cover the entire area. This is considered the cruise portion of the mission, although it also includes many turns.

6. Climb back to 50 feet.
7. Align with landing area and descend.
8. Land, taxi and shutdown.

The landing site can be either on the other side of the field for later retrieval or flying back to the same location where the aircraft took off from, in that case the mission will need an additional leg to fly at 50 ft AGL back to the original takeoff location. You have the choice.

4. DATA REQUIREMENTS

The technical proposal must convincingly demonstrate that the design team can provide a superior and cost effective solution to the need identified by this RFP. The proposal should satisfy the following tasks to show how the team would develop the design of a new aircraft.

1. Justify the final design and describe in detail the technologies and technical approach used to meet the mission requirements.

2. Provide carpet plots used to optimize the final selected design.

3. Include a dimensioned 3-view general arrangement drawing.

4. Include an inboard profile showing the general internal arrangement.

5. Include an illustrated description of the primary load bearing airframe structure and state rationale for material selection.

6. Include a V-n diagram.

7. Show an estimated drag build up and drag polar for the cruise configuration, the takeoff configuration and the landing configuration.

8. Show a weight breakdown of major components and systems, and center of gravity travel.

9. Provide performance estimates and demonstrate aircraft stability for all flight and loading conditions.

10. Describe any advanced technologies and their relative benefits as used to obtain performance improvements. Address risk mitigation if these technologies fail to materialize including potential cost increases or decrement to performance.

11. Provide flyaway cost and life cycle cost estimates for a production runs of 50, 100, and 500 aircraft.

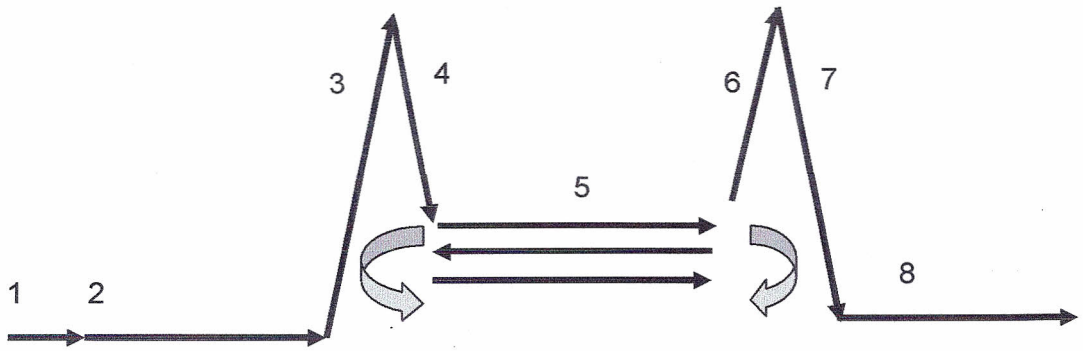
12. Provide the projected cost effectiveness of cost per acre of field sprayed.

13. Once you have come up with a workable design that meets the requirements, evaluate if using another method of propulsion you would be able to decrease purchase price, life cycle cost, and direct operating cost, increase safety, and decrease turnaround time.

Questions

All technical questions pertaining to this RFP should be directed to Guido Fuentes, via email at guidofuentes1@yahoo.com

AUAS MISSION PROFILE



Intent Form

2007/2008
AIAA
Undergraduate Team Aircraft Design Competition
Request for Proposal: **Agricultural Unmanned Aircraft System (AUAS)**

Title of Design Proposal:

_____

Name of School:

_____

Designer's Name	**AIAA Member #**	**Graduation Date**	**Degree**
_____	_____	_____	_____
Team Leader			
_____			
Team Leader E-mail			
_____	_____	_____	_____
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_____	_____	_____	_____
_____	_____	_____	_____

In order to be eligible for the 2007/2008 AIAA Undergraduate Team Aircraft Design Competition, you must complete this form and return it to the AIAA Director of Student Programs ***before 14 March 2008***, at AIAA Headquarters, along with a one-page "Letter of Intent" as noted in Section II, "Schedule and Activity Sequences." For any nonmember listed above, a student member application and member dues payment should also be included with this form.

_____

Signature of Faculty Advisor Signature of Project Advisor Date

_____

Faculty Advisor – Printed Project Advisor – Printed Date