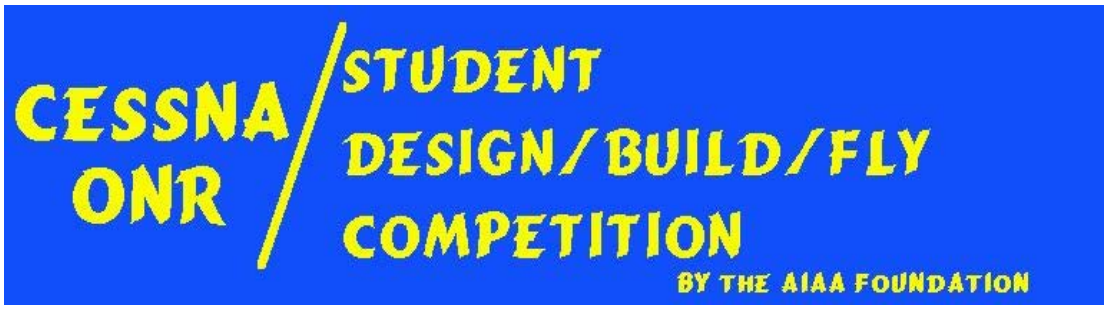

Last update 7/2/97

1997/98 Contest Rules

Summary:

The AIAA through the Applied Aerodynamics, Aircraft Design and Flight Test Technical Committees and the AIAA Foundation invites all university students to participate in the Cessna/ONR student design/build/fly competition. The contest will provide a real-world aircraft design experience for engineering students by giving them the opportunity to validate their analytic studies.

Student teams will design, fabricate, and demonstrate the flight capabilities of an unmanned, electric powered, radio controlled aircraft which can fly the longest range in a specified time period under the constraint of a specified battery weight. The goal is a balanced design possessing good demonstrated flight handling qualities and practical and affordable manufacturing requirements while providing a high vehicle performance.

To encourage innovation and maintain a fresh design challenge for each new years participants, the design requirements and performance objective will be updated for each new contest year. The changes will provide new design requirements and opportunities, while allowing for application of technology developed by the teams from prior years.

Cash prizes are $2500 for 1st, $1500 for 2nd and $1000 for 3rd place. The winning teams will be invited to present their designs at that years World Aviation Congress.

Judging:

For the 1997-98 contest year aircraft will be designed to fly a maximum number of complete laps over the specified flight course in the specified time period. Each aircraft must:

Complete a take-off over a six foot obstacle within a marked 300 foot runway area.

Before entering the timed course, the aircraft must execute one left hand and one right hand level 360 degree turn.

Enter the course and fly as many complete laps as possible within the available battery energy and a 7 minute time limit.

Partial laps do not count.

Land within the marked 300 foot runway area. For a full-score landing (1 point), aircraft do not have to

come to a stop within the marked distance, but must remain on the runway until a complete stop and must not "bounce" once past the 300 foot marker cone.

A "zero" landing score will be applied to aircraft which do not achieve a full-score landing (such as running off the runway, "bouncing" after passing the 300 foot marker, or landing along side the runway).

For an officially scored flight, the aircraft must be capable of a second flight with no more than replacement of the propeller(s).

Each team must submit a written Design Report, which is divided into two phases as noted in the documentation requirements section. A maximum of 100 points will be awarded for the team design report. (One score will be given accounting for both sections.) Scores for the written reports will be announced at the beginning of the fly-off.

The overall ranking will be:

RANKING = SCORE * (LAPS + LANDING)

The team with the highest ranking will be declared the winner.

Contest Site:

Wichita Kansas will be the site of the 1997-98 contest, which will be hosted by Cessna Aircraft. The airfield selected will be announced through the contest web page, and by e-mail. The scheduled contest date is 25 April, 1998 (rain date 26 April). Teams will be responsible for their own travel and accommodations at the contest site. A factory tour and reception will be hosted by Cessna following the competition.

Team Requirements:

All team members (except for a pre-approved designated pilot) must be full time students at an accredited University or College. The team must be composed of both under classmen and upper classmen, with at least 1/2 of the members being under classmen (Freshman, Sophomores or Juniors). The pilot must be an AMA (Academy of Model Aeronautics) member. Teams may use a non-university member for the pilot if desired. Such a designated pilot must be from the local area, and pre-approved by the contest officials. We will also provide qualified pilots on the contest day for any teams who are unable to have their pilot attend.

Technical Assistance:

A non-exclusive list of some available suppliers for materials, R/C systems, electric motors and NiCad batteries. Vendor List

Sponsorship:

Teams may solicit and accept sponsorship in the form of funds or materials and components from commercial organizations. All design, analysis and fabrication of the contest entry is the sole responsibility of the team members.

Schedule:

A completed entry form, **"Notice of Intent to Compete, 1997-98 Contest Year"** is due to the contest administrator by COB (close of business) **31 October 1997**. Written reports for the **PROPOSAL PHASE** (5 copies), are due to the contest administrator by COB **16 March 1998**. Written reports for the **ADDENDUM PHASE** (5 copies), are due to the contest administrator by COB **13 April 1998**. Scores for the written reports will be announced at the beginning of the fly-off. The contest is scheduled for **25-26 April 1998**.

Late submissions will not be judged. Teams who do not submit the required written reports will not be allowed to fly.

Communications:

The contest administration will maintain a World Wide Web site containing the latest information regarding the contest schedules, rules, and participating teams. The contest web site will also contain a list of potential suppliers for materials and equipment required to build an entry. The contest web site is located at: http://www.aae.uiuc.edu/aiaadbf.

All teams are required to provide a single point-of-contact e-mail address with their contest application.

Teams are invited to provide and host their own web sites providing information on the team members, advisor, sponsors and design. Links to the team web sites will be provided from the participants page on the contest web site.

Questions regarding the contest, schedules, or rules interpretation may be sent to the contest administrator by e-mail at: gregory.s.page@nrl.navy.mil.

Copies of all questions received and their answers will be provided to all teams of record by the contest administrator.

Written correspondence, including the "Notice of Intent to Compete" form; and all reports should be sent by conventional mail to the contest administrator by mail at:

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AIAA Design/Build/Fly Contest
Gregory S. Page / Bldg 210
Kaman Sciences Corporation
2560 Huntington Avenue
Alexandria, VA 22303
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Aircraft Requirements - General

The aircraft may be of any size and configuration except rotary wing or lighter-than-air.

Must be propeller driven and electric powered with an unmodified, over the counter model aircraft electric motor. May use multiple motors and/or propellers. May be direct drive or with gear or belt reduction. For safety, each aircraft will use a commercially produced propeller. Teams may modify the propeller diameter by clipping the tip.

Must use over the counter NiCad batteries. Battery pack weight must not exceed 2.5 lbs. For safety, battery packs must have shrink-wrap or other protection over all electrical contact points. The individual cells must be commercially available, and the manufacturers label must be readable (i.e. clear shrink wrap preferred).

Each aircraft will carry a removable 7.5 pound steel payload. The payload may be segmented into no more than 3 pieces, each of which must be rectangular in shape. (Wedges, cylinders or other "sculpted" shapes are not allowed).

Aircraft and pilot must be AMA legal. This means that the aircraft TOGW (take-off gross weight with payload) must be less than 55 lb., and the pilot must be a member of the AMA. Since this is an AMA sanctioned event, the team must submit proof that the aircraft has been flown prior to the contest date (in flight photo or video).

The pilot need not be a student at the represented university. Application for approval of a non-student pilot must be presented to the contest administrator for approval at least one month prior to the written report, PROPOSAL PHASE submission.

Aircraft Requirements - Safety

All vehicles will undergo a safety inspection by a designated contest safety inspector prior to being allowed to make any competition or non-competition (i.e. practice) flight. All decisions of the safety inspector are final. Safety inspections will include the following as a minimum.

Physical inspection of vehicle to insure structural integrity.

Verify all components adequately secured to vehicle. Verify all fasteners tight and have either safety wire, lock-tite (fluid) or nylock nuts.

Verify propeller structural and attachment integrity.

Visual inspection of all electronic wiring to assure adequate wire gauges and connectors in use. Teams must notify inspector of expected maximum current draw for the propulsion system.

Radio range check, motor off and motor on.

Verify all controls move in the proper sense.

Structural verification. All aircraft will be lifted with one lift point at each wing tip to verify adequate wing strength (this is equivalent to a 2.5g load case) and to check for vehicle cg location. Teams must mark the expected empty and with payload cg location on the exterior of the aircraft fuselage.

Radio fail-safe check. All aircraft radios must have a fail-safe mode that is automatically selected during loss of transmit signal. The fail-safe will be demonstrated on the ground by switching off the transmit radio. During fail safe the aircraft receiver must select:

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Throttle closed
Full up elevator
Full right rudder
Full left aileron
Full Flaps down (if so equipped)
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All aircraft must have a mechanical motor arming system separate from the onboard radio Rx switch. This may be a mechanical switch rated for the maximum current draw accessible from outside the aircraft, or can be a removable link such as an automotive "blade" style fuse. The aircraft Rx should always be powered on and the Tx throttle verified to be "closed" before activating the motor arming

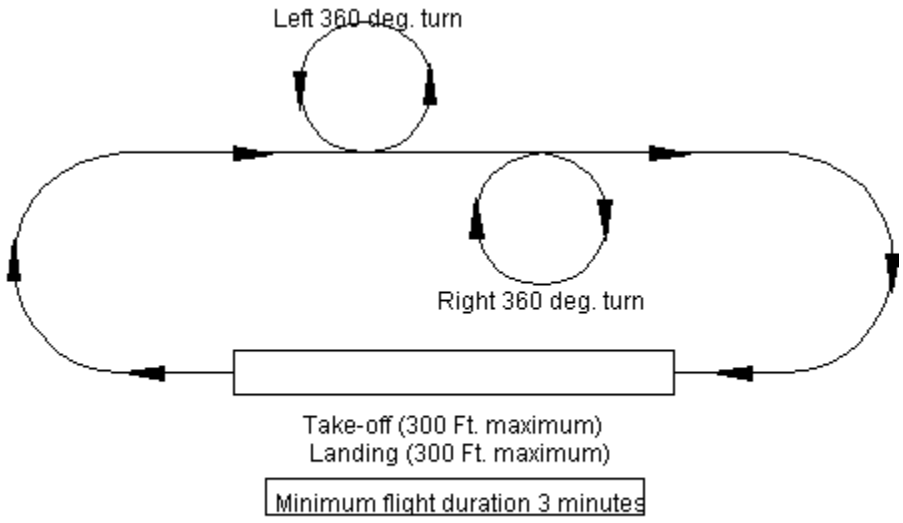
switch.

Flight Demonstration

Aircraft will be judged on the maximum number of complete laps over the specified flight course completed within the 7 minute period. The course consists of:

An un-assisted takeoff over a six foot obstacle within the marked 300 ft "runway".

Aircraft must complete a level 360 degree turn to the right and a level 360 degree turn to the left before entering the timed flight portion.



FLIGHT PROFILE

The aircraft will then fly as many complete laps of the course as possible within the allotted time window (7 minutes). (Time required for the take-off, 360 degree turns, and landing are not included in the time limit.)

The course will be an oval with 700 ft legs as shown in the attached figure. The turns are not initiated until the aircraft has passed the turn judge line(s). (i.e. The aircraft must be wings level when passing the turn judge.)

Aircraft must complete at least one full timed lap prior to landing.

Partial laps do not count.

After completing as many laps as possible within the allotted time, the aircraft must return and land within the original marked 300 ft zone.

For a full-score landing (maximum 1 point), aircraft do not have to come to a stop within the marked distance, but must remain on the runway until a complete stop and must not "bounce" once past the 300 foot marker cone. A "zero" landing score will be applied to aircraft which do not achieve a full-score landing (such as running off the runway, "bouncing" after passing the 300 foot marker, or landing along side the runway).

For an officially scored flight, the aircraft must be capable of a second flight with no more repair than replacement of the propeller(s).

Flight altitude must be sufficient for safe terrain clearance and low enough to maintain good visual contact with the aircraft. Decisions on safe flight altitude will be at the discretion of the flight line judges and all rulings will be final.

No components may be dropped from the aircraft at any time during the flight.

Each aircraft will be presented for judging prior to the first flight with the payload installed. The team will then demonstrate removal of the payload in no more than 10 minutes. Each aircraft will make one qualifying flight of two laps of the course with the payload removed (to demonstrate acceptable handling and cg location without a payload) prior to being allowed to make any scored flights with the payload. Multiple scoring flights may be made as desired and within the available contest time.

Once a team has the active runway, they will have 5 minutes to complete their take-off. If unable to take-off in that time they must surrender their time slot and return to the end of the line.

Additional information is included in the FAQ (Frequently Asked Questions).

Design Report:

Each team will submit a judged design report as outlined below. The design report will be submitted in two sections. The PROPOSAL PHASE will be submitted by COB 16 March 1998 and will include all sections identified except the "Lessons Learned" section. The ADDENDUM PHASE will contain the "Lessons Learned" section and will be submitted by COB 13 April 1998.

Design Report-PROPOSAL PHASE

1. Executive Summary: (Maximum 2 pages, 5 points): Provide a summary of the development of your design. This should be a narrative description highlighting the major areas in the development process for your final configuration and a broad description of the range of design alternatives investigated. Include an overview of the design tools used for each phase of the design development: conceptual design, preliminary design, and detailed design.

2. Management Summary (Maximum 1 page, 5 points): Describe the architecture of the design team. Provide a list of design personnel and assignment areas. Document the management structures used for personnel assignments, schedule control, and configuration control. Include a (single) milestone chart showing planned and actual timing of major elements of the design process, including as a minimum the conceptual design stage, preliminary design stage, detailed design stage, and report preparation periods.

3. Conceptual Design (Configuration Selection, Maximum 3 pages, 10 points): Document the alternative concepts investigated during the conceptual design stage. Detail the design parameters investigated, and why each was felt to be important. Describe the figures of merit (FOMs) used to screen competing concepts, and the mission feature each FOM was selected to support. Describe the analytic methods used during the conceptual design stage, the expected accuracy and why each was selected for this design phase. Numerical data need not be extensive at this stage, but should include as a minimum a final ranking chart giving the quantitative value of each design for each FOM, the FOM importance factors or ranking, and an explanation of the features that produced the final configuration selection.

4. Preliminary Design (Performance Estimation and Vehicle Sizing, Maximum 5 pages, 20 points): Document the design parameter and sizing trades investigated during the preliminary design stage. Detail the design parameters investigated, and why each was felt to be important. Describe the FOMs used and the mission or design feature each FOM supports. Describe the analytic methods used during the preliminary design stage, the expected accuracy and why each was selected for this design phase. Numerical data will be more extensive at this stage, and should include as a minimum configuration and sizing parameter values sufficient to justify the selection of the final value chosen for each of the major design and sizing parameters. Include a summary of the key features that distinguish the final configuration.

5. Detail Design (Final Design, Drawings and Performance Predictions, Maximum 5 pages Plus Drawing Package, 20 points): Final performance data should be provided for the design, including take off performance, handling qualities and g load capability, range and endurance, and payload fraction. Component selection and systems architecture should be included in this section. The Drawing Package must contain as a minimum a 3-view drawing of the design in sufficient detail to indicate aircraft size and configuration, primary structure component size and location, and location of propulsion and flight control system components. Special credit will be given for innovative configurations, manufacturing processes, and airframe cost reduction methods.

6. Manufacturing Plan (Materials Selection and Fabrication Processes, Maximum 5 pages, 20 points): Document the process selected for manufacture of major components and assemblies of the final design. Detail the manufacturing processes investigated, and describe the FOMs used (including but not limited to: availability, required skill levels and cost) to screen competing concepts. Describe the analytic methods (cost, skill matrix, scheduling time lines) used to select the final set of manufacturing processes. Include a manufacturing milestone chart showing scheduled event timings. Special credit will be given for innovative configurations, manufacturing processes, and airframe cost reduction methods.

Design Report-ADDENDUM PHASE

7. Lessons Learned (Maximum 4 pages, 20 points): Document any areas where the final contest aircraft differs from the PROPOSAL design. Also identify areas for improvement in the next design and manufacturing process implementation. Include estimates of time and cost required to implement the changes and the design or process improvement that should be realized in a second generation design approach. Include a table of "Manufacturers List Price" for all materials, components, and systems in the final design. Costs may be grouped as appropriate and need not be listed by each individual piece. Include a narrative assessment of how the actual costs compare to the expected costs used for design evaluations in sections 5 and 6 of the PROPOSAL PHASE report. Notes: · Page counts do not include figures or tables. · "Cost Reduction" does not mean donated materials or discounted prices from selected vendors. For cost considerations in the design selection and ranking all components and materials should be evaluated based on manufacturer list prices.

[Top] [AIAA Student Design/Build/Fly Competition homepage][AIAA Homepage]
Webmaster *m-selig@uiuc.edu*