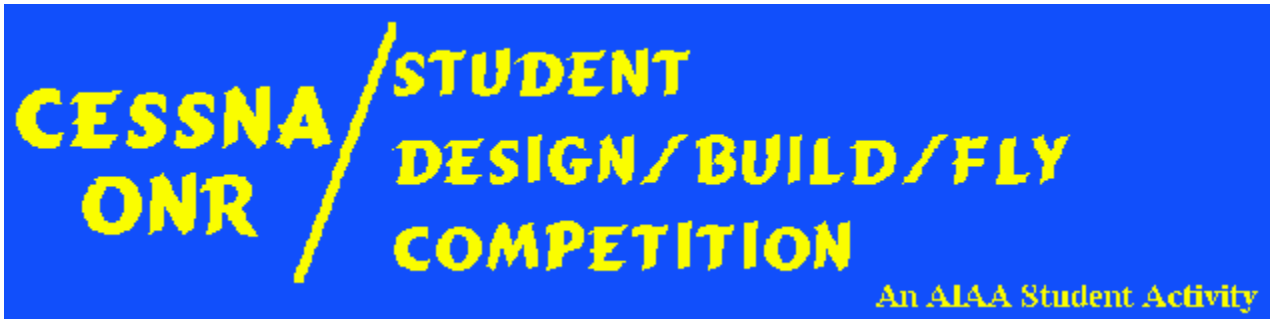


Last update 5/4/96

1996/97 Rules and Vehicle Design Specifications

Summary

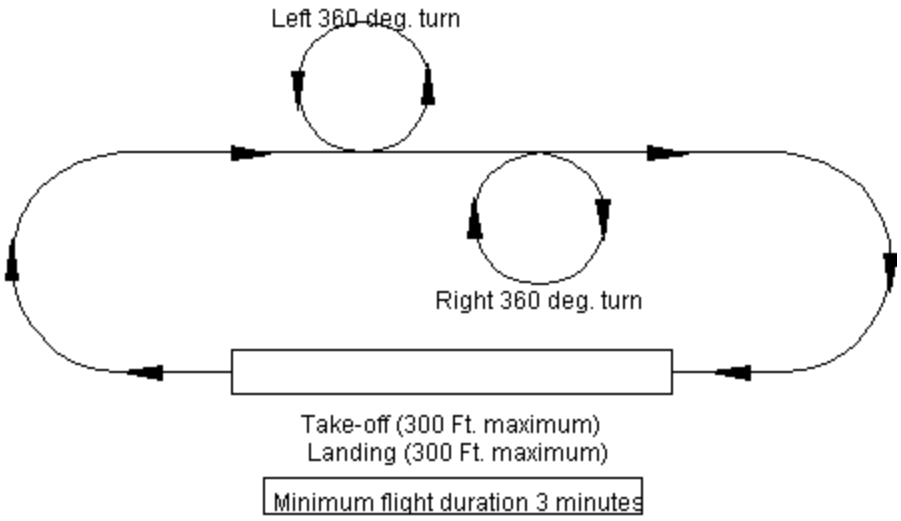
The AIAA through the Applied Aerodynamics, Aircraft Design and Flight Test Technical Committees invites all university students to participate in the AIAA Student Design/Build/Fly Competition. The contest will provide a real-world aircraft design experience for engineering students by giving them the 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 provides the maximum range for 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.

Judging

For the 1996/97 contest year aircraft will be designed to provide the maximum range for a given battery weight. Range will be determined from the maximum number of complete laps made over the specified flight course (see below).



FLIGHT PROFILE

Each aircraft must

- Complete a take-off over a 10 ft obstacle within a marked 300 ft runway area.
- Complete as many laps of the flight course as possible with the available energy.
- Land within the marked 300 ft runway area.
- Partial laps do not count.
- To encourage teams to accurately predict the available range of their entry, a one lap penalty will be added for aircraft which land on the runway but not within the marked 300 ft landing zone. Aircraft which land off of the runway will receive no score for that flight.

Each team must also submit a written Design Documentation 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 the number of laps (N) times the written report score (SCORE).

RANKING = N * SCORE

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

Contest Site

Maryland will be the site of the 1996/97 contest. The airfield selected will be announced through the contest web site and by e-mail or FAX to the contest participants. The scheduled contest date is May 10-11, 1997. Teams will be responsible for their own travel and accomodations at the contest site.

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. 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.

Technical Assistance

A list of the members of the sponsoring AIAA Technical Committees who are available for design consultation will be made available to each participating school. A non-exclusive list of some available suppliers for materials, R/C systems, electric motors and NiCad batteries will also be provided.

Sponsorship

Teams may solict 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 complete entry form, "Notice of Intent to Compete, 1996/97 Contest Year," is due to the contest administrator by COB (close of business) 31 October 1996. (This form is available by mail from the contest administrator or on the www.) Written reports for the PROPOSAL PHASE (10 copies) are due to the contest administrator by COB 31 March 1997. Written reports for the ADDENDUM PHASE (10 copies) are due to the contest administrator by COB 28 April 1997. Scores for the written reports will be announced at the beginning of the fly-off. The contest is scheduled for May 10-11, 1997.

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, and a list of AIAA Technical Committee members who are available to all the teams for consulting on questions of design, analysis and manufacturing.

The contest web site is located at http://aa2.aae.uiuc.edu/~aiaadbf or at the mirror site http://opus.aae.uiuc.edu/~aiaadbf. All teams are encouraged to include a single point-of-contact e-mail address with their contest application. For teams with e-mail access, contest communication and updates will be sent by e-mail. For teams without e-mail access, contest communication and updates will be sent to the advisor's FAX number.

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 dbfadmin@euclid.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, 1996/97 Contest Year" form; and all reports should be sent by conventional mail to the contest administrator by mail at

AIAA Student Design/Build/Fly Competition
Gregory S. Page / Bldg 210
Kaman Sciences Corporation
2560 Huntington Ave.
Alexandria, VA 22303

Aircraft Requirements

- 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 lb.
- 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 provide documentation of prior RC experience and be a member of the AMA. 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.

Flight Demonstration

Aircraft will be judged on the maximum number of *complete* laps over the specified flight course. The course consists of

- An un-assisted takeoff over a 10 ft obstacle (ribbon) within a marked 300 ft zone.
- Aircraft will then fly as many complete laps as possible over the specified course. The course will consist of two 180 degree turns at least 700 feet apart. (Turn spotters will be located 200 ft from either end of the take-off/landing zone.) On the downwind leg of the first lap the aircraft will make a level 360 degree turn to the right and a level 360 degree turn to the left. Both turns must be initiated after passing the upwind spotter, and be completed before passing the downwind spotter.
- 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.
- After completing as many laps as the team calculates is possible with the available energy the aircraft must return and land within the original marked 300 ft zone.
- Total flight time must be at least 3 minutes. No components may be dropped from the aircraft at any time during the flight. Upon landing, the aircraft must be capable of a second flight with no repairs or service other than recharging the batteries, and possible replacement of the propeller(s).
- Partial laps do not count.
- A one lap penalty will be added for any aircraft which lands on the runway, but not within the marked 300 ft landing zone. Aircraft which land off of the runway will receive no score for that 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 min. 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.

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 31 March 1997 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 1 May 1997.

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

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.

Special 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]
Webmaster *m-selig@uiuc.edu*