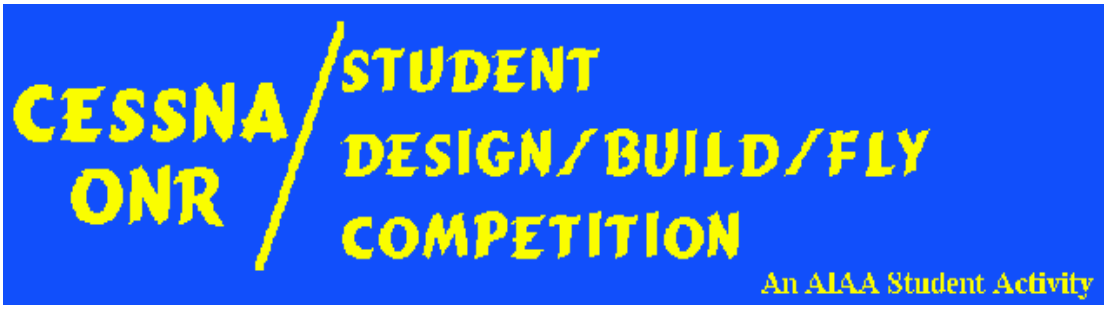


2003 Rules and Vehicle Design
Updated 31 July 2002
Note: Rules are “Draft” until 31 October 2002

Summary:

The AIAA through the Applied Aerodynamics, Aircraft Design, Design Engineering 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 that can best meet the specified mission profile. 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 year, the design requirements and performance objectives 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 the AIAA's Aircraft Technology, Integration, and Operations (ATIO) 2003 Technical Forum.

Judging:

Students must design, document, fabricate, and demonstrate the aircraft they determine as best capable of achieving the highest score on the specified mission profile(s). Flight scores will be based on the demonstrated mission performance obtained during the contest.

Each team must also submit a written Design Report. A maximum of 100 points will be awarded for the team design report. Scores for the written reports will be announced at the beginning of the fly-off.

Each aircraft will have computed a Rated Aircraft Cost, reflecting the complexity/technology of the design.

The overall team score is a combination of the Design Report, Rated Aircraft Cost and Flight scores. The team with the highest overall team score will be declared the winner.

Contest Site:

Host for the competition will be the Office of Naval Research. The fly-off will be held at Webster Field in St. Inigos Maryland. Webster Field is a part of the NAVY Patuxent River Flight Test Center complex.

Note: Due to the contest being held on a military base it will be necessary for ALL attendees to supply security information well in advance of the contest date (we will e-mail the teams to request the information two to three months prior to the contest date). Foreign participants are requested to obtain a passport well in advance of the contest date, as your passport number and issue date will be REQUIRED to process you for field access. Because of the time needed to obtain and process security information late additions to the team roster will not be able to attend the fly-off.

You can check on weather historical conditions at www.weatherbase.com or www.weatherunderground.com.

Team Requirements:

All team members (except for a pre-approved designated pilot) must be full time students at an accredited University or College and student members of the AIAA. The team must be composed of both under classmen and upper classmen, with at least 1/3 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. We will also provide qualified pilots on the contest day for any teams who are unable to have their pilot attend.

Past Year Reports:

The top scoring report from the past years competition will be available for reference on the contest web site. The team with the top scoring report from this years contest will be required to submit an electronic copy of their report following the competition, which will be placed on the contest web site for the next years competition.

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 student team members.

Schedule:

A completed entry form (electronic) is due to the contest administrator on or before **31 October 2002**. Be sure to include the Phone and FAX number for the team advisor and

at least one student contact so we may reach you in case of any last minute problems or changes. All teams are required to provide two point-of-contact e-mail addresses with their contest application, one of which must be the teams advisor. It is the teams responsibility to make sure the e-mail contact addresses they supply remain active during the entire period from entry to the close of the competition, as e-mail will be the primary means to provide information and updates.

Written reports (**5 hard copies, electronic reports can not be accepted from foreign entrants this year**), are due to the contest administrator by COB **11 March 2003**. COB is taken as 5 pm local time at the address provided for delivery of the written reports. Scores for the written reports will be announced at the beginning of the fly-off.

The contest is scheduled for **25-27 April 2003**. The competition will run from noon to 6PM on Friday, and 8AM to 6PM on Saturday and Sunday. Final awards will be presented at the end of Sunday's competition. All teams are encouraged to stay and attend the awards presentations on Sunday.

Please note that tech inspections will be available on Friday **25 April**. Teams are encouraged to be prepared to have your plane inspected on Friday. Inspections will also be available on Saturday, but waiting until Saturday to go through tech may mean that your team will miss one or more rounds through the flight queue. If we have a full turnout you may not be able to get in a full set of scoring flights unless you are "ready to fly" at every opportunity.

Late entries will **NOT** be accepted. Late or incomplete report submissions will **NOT** be judged. Teams who do not submit the required written reports will not be allowed to fly. It is the teams responsibility to assure that all deadlines are met, as they will be **strictly** enforced.

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 available to build an entry. The contest web site is located at:

http://www.aae.uiuc.edu/aiaadbf

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

The contest administrator will provide e-mail copies of questions received and their answers to all teams of record.

Written reports (only) should be sent to the chief of scoring at:

AIAA Design/Build/Fly Contest: Report Judging
Greg Page Bldg 210

ITT / AES
2560 Huntington Ave.
Alexandria, VA 22303
202-404-1251
202-767-6194 FAX

Aircraft Requirements - General

- The aircraft may be of any configuration except rotary wing or lighter-than-air.
- No payload may be carried internal to the wing proper. Payload in the "fuselage" may be carried in the area where the wing carry-over structure passes. For blended-wing configurations, the "fuselage" is defined to be the inner most 18" of span, the remainder is "wing" for payload considerations.
- Must be propeller driven and electric powered with an unmodified, over the counter model electric motor. May use multiple motors and/or propellers. May be direct drive or with gear or belt reduction.
- All motors must be from the ***Graupner*** **or** ***Astro Flight*** families of brushed electric motors, only (motor should have manufacturers label visible to the judges during the technical inspection).
- For safety, each aircraft will use a commercially produced propeller. Teams may modify the propeller diameter by clipping the tip, and may paint the blades to balance the propeller. No other modifications to the propeller are allowed. Commercial ducted fan units are allowed.
- Motors and batteries will be limited to a maximum of 40 Amp current draw by means of a 40 Amp fuse (per motor or pack) in the line from the positive battery terminal to the motor controller. Only ATO or blade style plastic fuses may be used. ("Maxi" size Slow Blow, 1.15"x0.85". Available online www.Mcmaster.com part #7460K51 $1.66 each)
- Must use over the counter NiCad batteries. 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). All battery disconnects must be "fully insulated" style connectors.
- Maximum battery pack weight is 5.0 lb. Battery pack must power propulsion and payload systems only. Radio Rx and servos MUST be on a separate battery pack. Batteries may not be changed or charged between sorties during a flight period.
- 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) to the technical inspection team. Contest supplied qualified pilots will be available to teams who require them.
- Teams will present a completed and signed (by the teams faculty advisor) copy of their Rated Aircraft Cost worksheet to the judges during technical inspection for verification. The Rated Aircraft Cost assigned at the technical inspection will be used for the competition and may not be modified during the event.

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.

1. Verify all components adequately secured to vehicle. Verify all fasteners tight and have either safety wire, locktite (fluid) or nylock nuts.
2. Verify propeller structural and attachment integrity.
3. 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.
4. Radio range check, motor off and motor on.
5. Verify all controls move in the proper sense.
6. Check general integrity of the payload system.

- Structural verification. All aircraft will be lifted with one lift point at each wing tip to verify adequate wing strength (this is "roughly" equivalent to a 2.5g load case) and to check for vehicle cg location. Teams must mark the expected empty and loaded cg locations on the exterior of the aircraft fuselage. Special provisions will be made at the time of the contest for aircraft whose cg does not fall within the wing tip chord. This test will be made with the aircraft filled to its *maximum payload capacity by weight* (Teams must inform the inspector and judges of their maximum design capacity and must make all flights within that capacity).
- 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:

  Throttle closed
  Full up elevator
  Full right rudder
  Full right (or left) aileron
  Full Flaps down (if so equipped)

  During Fail Safe the payload release system must NOT activate.

  The radio Fail Safe provisions will be strictly enforced.

- All aircraft must have a mechanical motor arming system separate from the onboard radio Rx switch. This MUST be the contest specified "blade" style fuse. This device must be located so it is accessible by a crewmember standing **ahead** of the propeller(s) for pusher aircraft, and standing **behind** the propeller(s) for tractor aircraft (i.e. the crew member must not reach across the propeller plane to access the fuse). The "Safety Arming Device" will be in "Safe" mode for all payload changes. The aircraft Rx should always be powered on and the Tx throttle verified to be "closed" before activating the motor arming switch. Fuses MUST be accessible from outside the aircraft and act as the "safeing" device.

Mission Profile:

Teams must complete the flight missions as outlined in the mission matrix below. Teams will have a maximum of **5** flight attempts. A flight attempt is defined as advancing the throttle for take-off. The best ***Single Flight Score*** from each of **2 different mission types** will be summed for the team's ***Total Flight Score***.

In the event that, due to time or facility limitations, it is not possible to allow all teams to have the maximum number of flight attempts, the contest committee reserves the right to

ration and/or schedule flights. The exact determination of how to ration flights will be made on the contest day based on the number of entries, weather, and field conditions.

Each team's overall score will be computed from their ***Written Report Score, Total Flight Score***, and the ***Rated Aircraft Cost*** using the formula:

$$\text{SCORE} = \frac{\text{Written Report Score} * \text{Total Flight Score}}{\text{Rated Aircraft Cost}}$$

Mission Task Matrix

Mission	Description
	General Mission Information ... Aircraft must fit in a 2 foot wide by 1 foot high by 4 foot long (interior dimensions) box. Note: The aircraft does not need to "fold" to fit in the box, but may employ "plug-in" joints for rapid assembly/disassembly. All electrical connections should be keyed so they can not be misassembled. Tape may be used as a non-structural "latch" to hold components in place, such as taping a wing joint when using a plug-in spar arrangement to keep the wing from sliding loose. ... Teams must select one of the following missions for each flight. You may select a different mission for each of your scoring flight attempts. ... To commemorate the 1903 Wright Brothers flight distance, take-off must be within 120 ft (wheels off runway) ... On landing the aircraft must land on the runway (but may roll off) to obtain a score for that flight. ... All payloads must be adequately secured using mechanical means. Tape and Velcro are not acceptable forms of restraint. ... Maximum mission time is **10** minutes.
-	**Timed Assembly Task** ... This mission must be completed at least once prior to making a scoring "flight" to establish the teams assembly time score. The "Assembly Time" will be added to the actual "Flight Time" to obtain a "Total Mission Time". ... The timed assembly task need not be repeated for each new flight attempt, but will "carry over" to all

	flights. Teams may repeat the assembly phase to try to obtain an improved assembly time as often as the queue permits. The new assembly time will be applied only to flights made following that assembly time task. ... For the Timed Assembly Task, the aircraft must be removed from the box and assembled to flight ready condition by the ground crew. Maximum ground crew is three (3) people, all must be students (no advisors or outside assistance). Payload ~~and batteries~~ will not be installed during the Timed Assembly Task. Propulsion batteries will not be connected during the assembly task for safety (the safety fuse should be removed, and additionally battery leads may be left un-connected. ... At the end of the Timed Assembly Task the aircraft will be inspected to verify "flight-ready" status by repetition of the wing tip lift test along with a control system function and orientation test. ... There will be a 3 minute time penalty added to the assembly time for each incorrect control surface operation. ... Aircraft failing the wing tip lift test will receive no assembly time score, and must repair and repeat this task.
A	**Missile Decoy – Difficulty Factor 2.0** ... Aircraft must take-off, complete 4 laps, and land. ... Payload for this mission is a simulated avionics package. The payload is a box 6 inches wide by 6 inches tall by 12 inches long and must be ballasted about it's planform centroid to weigh at least 5 lbs. Payload weight will be verified on the judges scale during technical inspection. ... The aircraft must have a simulated cylindrical antenna, a section of (unmodified) "6-inch" Schedule 40 (white) PVC pipe three inches tall, with the top and bottom sealed flush with flat 1/16" Plywood sheets. The antenna must be completely exposed on the exterior of the aircraft and stand-off from the nearest airframe structure by a minimum of 3 inches. The antenna (cylinder) may not be faired in any manner.

	... On all laps flown the aircraft must complete a 360^{o} turn in the direction opposite of the base and final turns on the downwind leg of each lap.
B	**Sensor Deployment – Difficulty Factor 1.5** ... Aircraft must take-off, complete 2 laps, and land. When on the runway and <u>stopped</u> the aircraft will self-deploy the simulated sensor package. The aircraft will then take-off and complete 2 additional laps and land. The ground crew may not reposition the aircraft except to move it from off of the runway (if it runs off) to the nearest runway edge. ... Payload for this mission is a simulated sensor package. The payload is a box 6 inches wide by 6 inches tall by 12 inches long and must be ballasted about it's planform centroid to weigh at least 5 lbs. Payload weight will be verified on the judges scale during technical inspection. ... On all laps flown the aircraft must complete a 360^{o} turn in the direction opposite of the base and final turns on the downwind leg of each lap.
C	**Communications Repeater – Difficulty Factor 1.0** ... Aircraft must take-off, complete 4 laps, and land. ... Payload for this mission is a simulated communications relay device. The payload is a box measuring 6 inches wide by 6 inches tall by 12 inches long and must be ballasted about it's planform centroid to weigh at least 5 lbs. Payload weight will be verified on the judges scale during technical inspection. ... On all laps flown the aircraft must complete **THREE** (3), 360^{o} turns in the direction opposite of the base and final turns on the downwind leg of each lap.

Single Flight Score is:

$$\frac{\text{Difficulty Factor}}{\text{Mission Flight Time + Aircraft Assembly Time}}$$

"Mission Flight Time" is the time from when the official calls "go" until the aircraft comes to a **complete stop** past the starting line at the completion of all laps.

For aircraft not completing the full number of laps specified for a mission, a penalty of 3 minutes will be added to the aircraft's **measured** "Total Mission Time" for **each** lap not completed.

For example, if an aircraft completes only 3 laps of a 4 lap mission in 5 total minutes, the "Total Mission Time" would be: 5 actual minutes + 1 incomplete laps @ 3 minutes each = 8 Minutes.

Aircraft Cost Model

Rated Aircraft Cost, $ (Thousands) = (A*MEW + B*REP + C*MFHR)/1000

Coef.	Description	Value
A	Manufacturers Empty Weight Multiplier	$100
B	Rated Engine Power Multiplier	$1500
C	Manufacturing Cost Multiplier	$20 / hour
MEW	Manufacturers Empty Weight	Actual airframe weight, lb., with all flight and propulsion batteries but without any payload.
REP	Rated Engine Power	(1+.25*(# engines-1)) * ***Total Battery Weight*** ***"Total Battery Weight"*** will be the weight of the propulsion battery pack(s) as determined by the judges scale during technical inspection. Total propulsion battery pack weight may not exceed 5 lbs., but may be lighter.
MFHR	Manufacturing Man Hours	Prescribed assembly hours by WBS (Work Breakdown Structure). MFHR = ∇ WBS hours **WBS 1.0 Wing(s):** 8 hr/ft. Wing Span 8 hr/ft Max exposed wing chord (measured at the point on the wing (s) where the chord is greatest)

		3 hr/control surface Sum values for multiple wings **WBS 2.0 Fuselage** 10 hr/ft body maximum length Note: Maximum length of the body is defined to be the longest longitudinal length possible to measure on the aircraft, no mater what physical elements it is composed of **WBS 3.0 Empenage** 5 hr./Vertical Surface (Any vertical surface, including winglets, struts, end plates, ventral etc) with no active control 10 hr/Vertical Surface (Any vertical surface) with an active control 10 hr./Horizontal Surface. A horizontal surface is a "wing" if it is more than 25% of the span of the greatest span horizontal surface.) A "V" tail is considered to be a Vertical surface without control (5 hr) plus a horizontal surface with controls (10 hr), for a total of 15 hrs. **WBS 4.0 Flight Systems** 5 hr./servo or motor controller **WBS 5.0 Propulsion Systems** 5 hr./engine 5 hr./propeller or fan

Rated Aircraft Cost must be supplied when the aircraft enters the technical inspection. The RAC worksheet must be signed by the team advisor. RAC may not be changed during the competition unless it is determined by the contest officials to be inaccurate or inappropriate. The contest officials reserve the right to audit and revise the RAC for omissions or errors at any time.

General Mission Specification and Notes:

- Aircraft are to remain assembled while waiting in the queue. Teams will select their mission payload and install the propulsion batteries once reaching the 3rd "On Deck" position (ie. When your aircraft is 3rd in the queue you must begin loading and installation of batteries).
- Aircraft may not have any work performed in the starting line queue, other than as specified above at the 3rd On Deck position. Aircraft propulsion batteries may be left out of the aircraft when in line.
- Aircraft batteries may be charged while the aircraft is in the queue IF AND ONLY IF the batteries are removed from the aircraft.
- The aircraft propulsion system(s) must be disarmed or "safed" during any time when crew members are preparing the aircraft.
- Maximum flight support crew is: pilot, observer, and 3 ground crew. Only the designated ground crew may conduct the timed aircraft assembly . Pilot and observer may be members of the ground crew, provided total ground crew size remains 3 people.
- Observer and all ground crew must be students, only the pilot may be a non-student. Teams using a non-student pilot must submit a letter of intent to use a non-student pilot at least 2 weeks prior to the fly-off. Teams requiring a contest-supplied pilot should notify the administrator in writing at least 2 weeks prior to the fly-off.
- The upwind turn will be made after passing the upwind pylon. The downwind turn will be made after passing the downwind pylon. Upwind and downwind pylons will be 500 feet from the starting line. Aircraft must be "straight and level" when passing the pylon before initiating the turn.
- Aircraft must land on the paved portion of the runway. Aircraft may "run-off" the runway during roll-out.
- After landing, aircraft may taxi back to the starting line. Alternatively, aircraft may be carried back to the starting line, however the team may not leave the pit area to retrieve the aircraft until the aircraft has come to a complete stop, and they are signaled it is "Ok" to retrieve the aircraft by the flight line judge.
- Aircraft will be considered to have only *minor damage* if they can be repaired and presented as flight worthy within 30 minutes of the end of that flight period. Aircraft with only *minor damage* will be credited with their full ***Single Flight Score***.
- Aircraft which can be repaired during the competition, but not within 30 minutes of the flight period, will NOT be credited with a score for that flight period.
- 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.

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

Protest Procedures

Submitting a protest against a competing team is a serious matter and will be treated as such. Teams may submit a protest to the Contest Administrator at any time during the competition. Protests must be submitted in writing and signed by the team advisor (if present at the competition) or the team captain if a faculty advisor is not present. Protests will be posted for all teams to review.

If the protest is rejected, the submitting team(s) will forfeit one of their remaining flight attempts. If all flight attempts have been used, the team(s) will forfeit their lowest Single Flight score.

Protests and the appropriate penalty (ranging from a requirement to repeat a flight for minor infractions to disqualification from the contest for deliberate attempts to misinform officials or violate the contest rules) will be decided by the Contest Administrator and the Contest Director, in consultation with other Contest Officials. The decision of the Contest Administrator and Contest Director is final.

NEW for This Year

- Maximum stowed aircraft “box” size is defined.
- Aircraft missions are revised.
- Missions have different difficulty factors applied.
- Scoring is based on the best score obtained from two different mission types.
- Teams may select which mission they wish to use for each of their flight attempts.
- A testing section is added to the Design Report.

Design Report:

Each team will submit a judged design report as outlined below. The submission date is contained in the schedule section of this document. Reports must be bound (simple spiral bindings are sufficient and preferred, 3-ring binders are not allowed). All information used for scoring must be in the outlined sections. **Reports exceeding the total page limit will be scored as "1.0 of 100"**. Appendices may not be included.

All reports will be space and one half, 10 point Arial font. Tables and Figures will also be 10 point Arial font. Margins are 1" on all sides. Report pages will be 8 1/2 x 11 with the exception of the drawing package. The drawing package may be 11 x 17 pages. The 3-view drawing must be on one of the 11 x 17 pages.

Absolute maximum page count for the report is **60 pages**, including text, tables, and figures (cover/title page and table of contents is extra). Drawing package may not comprise more than 5 of the pages of the Proposal phase report page limit.

All figures must be either half (1/2) page or full (1) page format. No exceptions.

*Please note that the judges will be using this same report outline for evaluating reports. **ALL** items listed will be expected to be present, easy to locate and identify and well documented in the report for a maximum score.*

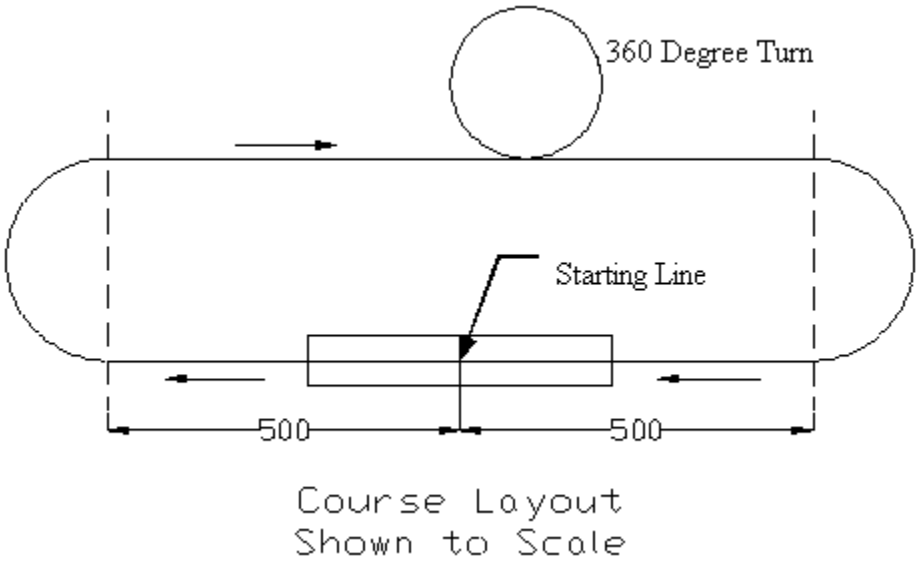
Design Report

1. Executive Summary: (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.
2. Management Summary (5 points):
   Describe the organization of the design team. Provide a chart of design personnel and assignment areas. 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, flight testing and report preparation periods.
3. Conceptual Design (20 points):
   Describe the key elements of the mission requirements (problem statement). Document the alternative configuration concepts (e.g. biplane, canard, flying wing, pusher -Vs tractor, number of engines etc.) investigated during the conceptual design stage and the reason why each concept was considered. Describe and document the numerical figures of merit (FOM's) used to screen competing concepts, and the mission feature each FOM was selected to support. *Rated Aircraft Cost* should be one of the FOM's used during the screening process. 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.
4. Preliminary Design (30 points):
   Document the design parameter and sizing trades investigated during the preliminary design stage, and why each was felt to be important to the mission. Describe the analysis methods used. Describe the mission model used and the predicted performance. Provide estimates of the aircraft lift, drag and stability characteristics. Document the design optimization and trade studies conducted and their results.
5. Detail Design (15 points for discussion items, 10 points for drawing package, 25 points total for the section):
   Document component selection and systems architecture selection. Include your final competition aircraft's *Rated Aircraft Cost* using the contest supplied cost model. RAC table should include all input parameter, intermediate and final computation.

   Include a table giving data for the sized aircraft. One copy of this table will be submitted along with the RAC during the tech inspection and a second must be posted by the team at their "pit" area (poster board). The table should include;
   Geometry: length, span, height, wing area, Aspect Ratio, control volumes
   Performance: CL max, L/D max, maximum Rate of Climb, stall speed, maximum speed, take-off field length (two sets, empty and gross weight)
   Weight Statement (airframe, propulsion system, control system, payload system, payload, empty weight, gross weight)
   Systems (radio used, servos used, battery configuration used, motor used, propeller (nominal), gear ratio (if used)

   The Drawing Package will be included with this section and 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; payload size, location and restraint method; and location of propulsion and flight control system components.

6. Manufacturing Plan and processes (10 points):
   Document the process selected for manufacture of major components and assemblies of the final design. Detail the manufacturing processes investigated, and describe the FOM's 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.
7. Testing Plan (5 points):
   Detail testing objectives, schedules, check-lists, results and any lessons learned for component and full aircraft testing, both static and dynamic (ie. in flight).



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CESSNA ONR / STUDENT DESIGN/BUILD/FLY COMPETITION
An AIAA Student Activity

Frequently Asked Questions (FAQ)
2003 Competition Specific
Updated 28 October 2003

Please check the FAQ often during the competition. Please note that rules interpretation questions are not answered by e-mail until after the entry date (when all participant e-mail address are known), so that all teams will have equal access to all rules information.

General Notes:

1. A question was submitted asking if the Plattenburg "Graupner Style" motors are legal for the competition. The answer is No. Teams should make sure they have documentation for their motor, preferably the purchase invoice(s) and the manufacturers labeling should be easily visible to the judges during the technical inspection. Teams may be asked to remove their motor so the manufacturers label may be checked.

Payload Questions:

1. **Question:** Are wing pods for carrying the cargo permitted?
   Answer: External pods (wing or fuselage mounted) may NOT be used for carrying the payload. (rev 22Oct02)
2. **Question:** Can the payload box have provisions outside the required dimensions for attaching it to the airframe or can they be internal?
   Answer: There may not be any "holes" through the payload box for mounting. You may have external "tabs" for mounting, or may make brackets that surround and secure the payload.
3. **Question:** Does the payload have to be a "perfect" box or can it have rounded or chamfered corners?
   Answer: You may round the payload box corners up to a 3/16" radius or chamfer.
4. **Question:** Since self-deployment of the payload in mission B will be accomplished by remote, can we use the receiver to activate the payload drop, or "can the students run out and deploy the payload"?
   Answer: The payload deployment MUST be controlled by the RC Tx/Rx system. No physical "intervention" is allowed.
5. **Question:** Can the antenna and mount for the Decoy mission (A) be left installed on the aircraft when flying the other missions.
   Answer: No. The antenna and mount must be removed from the aircraft for the alternate missions.
6. **Question:** Can fairings be applied to the fuselage that "in effect" fair the antenna if they remain at least the specified 3" away.

Answer: No. The statement “the antenna must not be faired in any manor” can also be viewed such that the “antenna must have an unobstructed 360 degree horizontal field of view”. An exception to the field of view will be made for the vertical tail(s) and/or wing struts.

7. **Question:** Can we add nose or tail cones to the avionics box to be dropped with it.
   Answer: No. The only thing which can be “deployed” is the box itself.
8. **Question:** The rules state "The aircraft must have a simulated cylindrical antenna, a section of (unmodified) "6-inch" Schedule 40 (white) PVC pipe three inches tall, with the top and bottom sealed flush with flat 1/16" Plywood sheets." Since the 1/16" plywood is pretty thin, can I assume that it is attached as end caps to the PVC (i.e. over the ends as opposed to inside the inner diameter) to create a total combined height of 3 inches? That is the PVC is actually cut to 3 inches minus the combined 1/8 inch thickness of the two plywood ends - resulting in 2 7/8 inch of PVC plus 1/8 inch of plywood ends?

   Also, is the 1/16 inch plywood considered to be the minimum? If I need to thicken it to provide sufficient strength to support the 'antenna' from a pylon, is that permitted, provided the entire height stays at 3 inches? Is it permissible to add whatever internal structure I might need to support the antenna - again provided that the outer dimensions are not violated?
   Answer: The PVC section must be 3”. The plywood may be either “inside” or “capping” (which would make the total height 3 1/8”). You may add what ever bracing/gussets you want inside the antenna.
9. **Question:** Can we attach a hook (or eyelet) to the top of the box by screwing it in.
   Answer: No, as stated above you may not drill holes in the box. You can attach a “tab” to the outside of the box by glue/welding/rivets (yes, the rivets can go through holes in the box, but this is the only exception).
10. **Question:** Is the payload box provided by the competition or may we make our own?
    Answer: Each team will make and bring their own payload “box” and antenna disk
11. **Question:** Can we add nose and tail cones to the avionics box to be dropped with it. If not, then can we make something that falls separately at the same time as the box?
    Answer: Fairing/Cones may not be added to the box. For the sensor deployment mission only the box may leave the aircraft. The exception is that a lower “hatch” may be released separately and does not need to be replace providing the aircraft is structurally and aerodynamically able to fly the remaining mission without it. Also, to prevent jettisoning half of the fuselage, the “hatch” must be no larger in planform than the box planform plus ½” in length and width.
12. **Question:** Since no “3 inch away” fairing of the antenna is allowed (see #6 above) does this means the antenna cannot be directly forward or aft of the payload box, in other words the antenna and payload box can't be on the same horizontal plane.

    Answer: If the payload box is on the same plane as the antenna it would clearly violate the 360^{o} field of view required by response #6 above, so would not be allowed.

Flight / Mission Questions

1. **Question: D**oes the ten minute mission window apply to one flight attempt (chosen from Mission A, B, or C) or to two different Missions flown in one uninterrupted sequence?
   Answer: The 10 minute window is for a single mission event (A, B or C).
2. **Question:** For mission 2, how is the takeoff distance judged after the airplane lands and deposits its cargo? Does the pilot have to drive to the takeoff line, or must the whole landing/takeoff operation be performed in the 120 feet assigned?
   Answer: The plane may land anywhere on the runway. After depositing the payload it must take-off (wheels off the ground) before reaching the take-off “marker” 120 feet past the start line. The plane does not need to first taxi to the start line, but may begin the take-off from wherever it is following release of the payload. If the plane is “past” the start line, you may

taxi back to the start line to begin the take-off if desired.

3. **Question:** In the rules examples, all the times are in round minutes. What accuracy will be used for determining flight times?
   Answer: It's just to make the rules document cases simple. We will record times to the accuracy possible, probably to nearest second.
4. **Question:** The rules state the aircraft must have the wheels off the ground in 120 feet. Is there any height requirement?
   Answer: No, the rules are correct as stated. Aircraft must have **ALL** wheels off the ground by the 120 foot line, and they must remain off until the landing. There is no "obstacle" height requirement for this year.
5. **Question:** Is there a minimum altitude for flying the course?
   Answer: No. Altitude must be high enough for safe flight as set by the discretion of the Contest Director.
6. **Question:** How are the turns made, and is there a set turn radius?
   Answer: The turns may not be initiated until the turn judge raises his flag (for the two 180 degree turns), but may then proceed to be any turn radius and rate the aircraft is capable of. The 360 degree turn can be initiated anytime the aircraft is on the "downwind" leg and also may be any turn radius and rate the aircraft is capable of.
7. **Question:** In the rules, it says that the flight time lasts "...until the aircraft comes to a complete stop past the starting line at the completion of all laps..." Does the ground crew have to return the aircraft to the runway before the time is stopped?
   Answer: If the airplane rolls off of the runway BEFORE reaching the starting line it must be returned to the runway to taxi or be carried to the starting line. If it rolls off of the runway PAST the starting line it does not need to be returned to the runway.
8. **Question:** Is it safe to assume that if the rules do not explicitly forbid something, it is allowed?
   Answer: The rules are intentionally designed to not impose too many limitations while allowing each team an equal chance. If something adheres to the "spirit" of the rules it is likely to be allowed. If you have any specific questions you would like clarified they may be addressed in a private e-mail to the contest administrator. Ideas will not be disclosed to other teams if they represent a legal and innovative approach. If it is deemed to be not legal, it may be added to this FAQ or posted to the other teams at the administrators discretion.

Report Questions

1. **Question:** Is the antenna mount in mission A included in the RAC as a vertical surface? Is the servo(s) for deploying the payload included in the "Flight Systems" costs?
   Answer: No, the RAC **does not** include the payload antenna either as weight (as noted in the MEW) or surfaces/sizes. It **does** include any servos required by the payload deployment system, as that must be a permanent part of the aircraft.
2. **Question:** For the "Testing Plan" section of the report in-flight tests are required. Is there a point penalty for not completing the in-flight tests?
   Answer: To obtain the maximum points **all** information asked for in a section must be present. Point deductions will be determined by the judges based on provided-vs-missing information.
3. **Question:** In the RAC is "motor controller" the same as "speed controller".
   Answer: Yes, the two terms could be taken interchangeably.
4. **Question:** In the RAC do electric brakes count as a type of controller
   Answer: Yes. A single servo or solenoid controlling air or hydraulic brakes would count as one controller. If a separate electric actuators are used for each wheel, that would count as two (or more) controllers

5. **Question:** The RAC states: "A "V" tail is considered to be a Vertical surface without control (5 hr) plus a horizontal surface with controls (10 hr), for a total of 15 hrs" .How is the horizontal span of the V-tail applied under the provision that: "A horizontal surface is a 'wing' if it is more than 25% of the span of the greatest span horizontal surface."?
   Answer: For the “25% span” rule the horizontal projection of a V-tail will be used as the effective horizontal span.
6. **Question:** Could you please define "control volumes" as stated in the 2003 Rules, Design Report section, paragraph 5
   Answer: These are the classic static control volumes, (Surface_area x Lever Arm)/Reference_length
7. **Question:** How will the maximum exposed wing chord would be measured for a flying wing. For payload considerations, it is stated that the "fuselage" is the inner most 18" of span. Does this also apply for the maximum exposed chord measurement, or will the max chord be measured at the centerline (if this is the largest chord length).
   Answer: For “All Wing” configurations the maximum wing chord will be measured 18” out from the centerline or at the largest chord location that is MORE than 18” out from the centerline.

General Questions

1. **Question:** Can there be thrust vectoring via rotating the engine, nozzles, blown surfaces etc.?
   Answer: Yes. Any of the above options is allowed, and may be varied during flight. However, "rotary wing" vehicles are not allowed, so you may need to consult the judges with your specific design and it's thrust levels to be sure it doesn't cross over the line into vertical flight capability.
2. **Question:** Do all of the team members need to be student members of AIAA?
   Answer: Since the DBF is part of the AIAA competitions sanctioned by the Student Activities Committee and the AIAA Foundation, all team members should be student members of the AIAA.
3. **Question:** What was the maximum number of people that can make-up a team.
   Answer: There is no specific limit on team size. It is up to the team itself to determine a size sufficient to meet the required tasks and small enough to remain manageable. It is expected most teams would fall in the 5 to 10 member size range, but this is only an estimated guideline.

   There is a maximum size of the flight crew (pilot and assistant) and ground crew (3) for this years competition. Please see the RULES section for more details on the limitations on the flight and ground crews.
4. **Question:** Is it necessary to list all team members on the entry.
   Answer: Yes, we need to know all the team members to verify the under/upper classmen rule.
5. **Question:** What is meant by "Upper and Under Classmen"
   Answer: Upper Classmen are (for purposes of the contest) seniors and/or graduate students. Lower Classmen are Freshmen, Sophomores and Juniors.
6. **Question:** Is it allowed to have/declare more then 1 pilot in a team (in case one of them can not go to the contest, or simply have a back-up pilot)?
   Answer: Yes, teams may register multiple pilots as long as each meets the requirements listed in the rules.
7. **Question:** Can we have corporate sponsors? If so, can we put their logo on the UAV at any place that pleases them?
   Answer: 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.

   Sponsor and university decals or logos may be placed as desired. Teams should make sure that the

final color scheme of the aircraft provides good visibility of the aircraft location and orientation for the pilot.

8. **Question:** What is COB in the submission dates mean?
   Answer: COB - Close of Business: data must ARRIVE by 5 PM local time at the specified location.
9. **Question:** The contest day is graduation. Is there any possibility of moving the contest.
   Answer: In selecting the contest date we have tried to minimize the conflicts with graduation, finals, mothers day,... We can't miss all possible conflicts as each university is on a slightly different schedule. Moving the date earlier would greatly increase the risk of unacceptable weather, and further shorten the time available to design and build the entries (which will seem VERY short by then).
10. **Question:** We were wondering if it wouldn't be easier to just send an official representative from the competition to our school, fly our plane, and take down the score. Then compare with all the other schools competing(they'd probably be on home turf as well), and make the final decision that way?
    Answer: The single site -vs- fly-at-home issue was discussed much by the contest organizers prior to selecting the current contest structure for many of the same reasons you raised. We realize that it is difficult for students to obtain funds for fabricating an entry, even without the added costs of travel. In the end we selected the single-site format for mainly two reasons: (1) the single-site format will allow the teams to see each others entries and learn from each other and will add to the competitive fever always present when pitting your best efforts against others; and (2) the single site is the only way to assure a level playing field for all entries, as weather variations at multiple sites and days would inevitably help some entries and hinder others.
11. **Question:** At what wind speed will the contest be called.
    Answer: It will be up to each team to determine whether they want to fly or not. The contest will be called (and the rain date used) if the wind speed exceeds 30 mph for a period of time sufficient to prevent all teams who are ready to fly from being assigned a flight time slot. The 30 mph limit is consistent with normal AMA competitions and is required to retain our contest insurance coverage.
12. **Question:** Will a hard runway be used?
    Answer: We will select a site that provides a paved runway. Note that a "smooth" paved runway for manned aircraft may still seem "rough" for contest aircraft.
13. **Question:** Our team has completed our design calculations and we have found a manufacturer that carries wing components that will meet our design criteria. Can we purchase components (i.e. foam cores and skins) to construct the wing for our UAV, or are we required to build it from scratch?
    Answer: You may use unassembled components such as wing cores providing they are integrated in a way that results in the final configuration being an original design.
14. **Question:** Does the plane have to be an external propeller plane, or can it be a duct fan UAV?
    Answer: Ducted fans are also legal if they use a commercial fan assembly.
15. **Question:** In terms of propellers. Can they be any kind of Gas engine propeller if we wish? Or do they have to be Electric motor propellers? And if we can only use electric motor propellers, can we cut them? Basically, if we wish to, can we use any kind of non-electric motor propellers if they are commercially available?
    Answer: Any commercial propeller for either gas or electric models may be used. Props may be cut to reduce their diameter but the blades may not be reduced in thickness (such as by sanding the airfoils to a new profile) or in chord (such as by trimming the trailing edges).
16. **Question:** What constitutes "over the counter" batteries, and does this apply to the battery pack or to the individual cells?
    Answer: The "Over the Counter" refers to the individual cells. This is a change from the rule for the 1996/97 contest year.

17. **Question:** How is the radio fail-safe described in the safety supplement to be implemented.
Answer: This is a feature available in many production RC radio systems. It is ***required*** that your radio system be able to provide this function.
18. **Question:** Can we construct a composite can for an otherwise stock over the counter model motor?
Does the motor controller have to be an over-the-counter controller?
Answer: The motor and/or controller must be an unmodified commercial product. The intent of this rule is to prevent excessive cost, and to provide all teams access to equal propulsion technology so they can concentrate on the aircraft aerodynamics and structural aspects.
19. **Question:** Do the wires and connectors have to be commercially available?
Answer: Yes
20. **Question:** When you check the CG, what kind of a point will you use? For example will it be checked with fingers or dowels or something even sharper?
Answer: The CG check will be coincident with the structural verification test described in the Safety Requirements supplement to the basic rules. Specifically, two team members will be asked to pick the aircraft up by the wing tips using their hands (usually a clenched fist placed under the wing at the desired location works well). They will (gently) lift the aircraft at it's full contest weight by the wing tips at the marked axial CG location.
21. **Question:** Will the payload be supplied by the team or the contest administration?
Answer: By the team.
22. **Question:** If battery power fails can an immediate landing be made without making a complete lap (question paraphrased by editor)
Answer: First priority is safety of personnel, followed by minimizing damage to equipment. If power fails unexpectedly the pilot will setup for as safe an emergency landing as possible. If the plane does not pass the downwind pylon that sortie's payload will not count, but any prior sorties will still be credited toward the overall score.
23. **Question:** Will there be a maximum altitude, other than the visibility requirement?
Answer: There is no specific numerical altitude limit. It would be very difficult to enforce a rigorous altitude limit without altitude telemetry equipment on each aircraft which would be a significant expense burden. The contest flight judge will enforce maintaining a "safe" altitude for both personnel/ground and flight visibility reasons, and may order the pilot to descend if he feels the altitude is too high. In general, altitudes of 300 to 500 feet are probably nominal, and altitudes near 1000 feet are likely to have the judge order a decent.
24. **Question:** Is information available about previous year designs and results?
Answer: A summary of characteristics for all the entries that competed in the last years contest will be available on the contest web site. Remember that the objective of the prior years contest was slightly different, so you will have to adapt the design data accordingly. (Prior year rules will also be maintained on the web site for reference.)
25. **Question:** Would we ever have to make any vertical loops with the UAV?
Answer: No

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