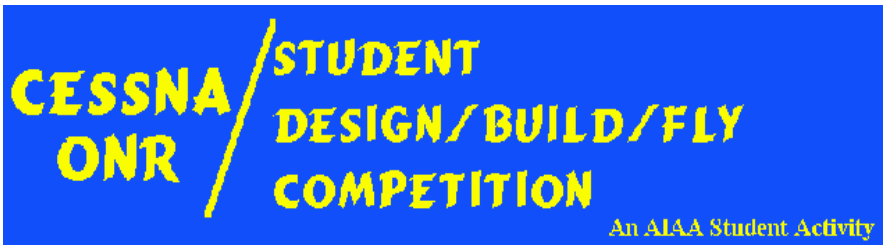


2002 Rules and Vehicle Design
Updated 4 September 2002

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 2002 Applied Aerodynamics Conference.

Judging:

Students must design, document, fabricate, and demonstrate an aircraft they determine to be capable of achieving the highest score on the specified mission profile(s). Flight scores will be based on the demonstrated mission performance in the best three (3) flights 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 completed RAC worksheet must be signed by the team advisor and presented to the judges at the technical inspection.

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 Cessna Aircraft Company. The fly-off will be held in Wichita Kansas, at the Cessna Field flight test facility.

Seasonal weather for April is varied: having a recorded temperature range from 15 to 96°F, with an average of 56°F. Average wind speed for April is 16 mph. Wind speed at the 1998 and 2000 DBF competitions varied from 15 to 25 mph. You can check on more 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 team members.

Schedule:

A completed entry form (electronic) is due to the contest administrator on or before **31 October 2001**. Written reports (5 copies), are due to the contest administrator by COB **12 March 2002**. Scores for the written reports will be announced at the beginning of the fly-off. The contest is scheduled for **26-28 April 2002**. Final awards will be presented at the end of Sunday's competition. All teams are encouraged to attend the awards presentations.

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

Please note that tech inspections will be available on Friday **26 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 your full 3 scoring flights unless you are "ready to fly" at every opportunity.

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

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.

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
Tom Zickuhr
Cessna Aircraft Company
MS 178P
5701 E. Pawnee
Wichita, KS 67218
316-831-2810
316-206-6800 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 may be carried in external pods, or in a fuselage. Payload in a "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. 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.
- All motors must be from the Graupner or Astro Flight families of brushed electric motors. Motors and batteries will be limited to a maximum of 40 Amp current draw by means of a single 40 Amp fuse (per pack) in the line from the positive 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. The pilot need not be a student at the represented university. 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)

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.

Mission Profile:

For the 2002 DBF contest, teams will fly three different mission tasks, in sequence, during a single flight period. A flight period will be the lesser of 10 minutes or the time required to complete all three mission tasks. Teams will have a total of 5 flight attempts. A flight attempt is defined as advancing the throttle for take-off. The best three ***Single Flight Scores*** 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 5 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 No.	Description
1	**Position** ¿ Aircraft will fly two unloaded laps. Aircraft must complete a 360° turn in the direction opposite of the base and final turns on the downwind leg of each lap. ¿ Take-off must be within 200 ft (wheels off runway)
2	**Passenger Delivery** ¿ Land and load a payload of between 10 and 24 softballs. Take-off and fly two (2) laps. Aircraft must complete a 360° turn in the direction opposite of the base and final turns on the downwind leg of each lap. ¿ Take-off must be within 200 ft (wheels off runway) ¿ All payload must be carried internally in a fully faired, fully closed structure. Balls must be a minimum of 2 directly abreast (no staggered rows), and single height.
3	**Return** ¿ Land and unload payload. Take-off and fly unloaded for 2 full laps of the course. No 360° turns are required for these laps. ¿ Take-off within 200 ft (wheels off runway)

Single Flight Score is:

$$\frac{\text{Total \#laps flown + \#balls carried on Passenger flight}}{\text{Total Mission Time}}$$

"Total Mission Time" is the time from when the official calls "go" until the aircraft comes to a complete stop on the runway past the starting line at the completion of all laps. Aircraft must touch down ahead of the starting line, and can roll-out past the starting line. If an aircraft rolls off the runway, the ground crew may retrieve the aircraft and return it to the runway. In this case, the time ends when the "ground crew" returns to the staging "box" after placing the aircraft at the starting line. The ground crew may not leave the staging box to retrieve the aircraft until it has come to a complete stop as directed by the flight line judge.

For aircraft not completing the full compliment of laps, a penalty of 3 minutes will be added to the aircraft's measured "Total Mission Time" for **each** lap not completed. If the aircraft is in the air at the end of the 10 minute maximum time window, the lap in progress will be counted as a "not completed" lap.

For example, if an aircraft completes the "Position" and "Passenger" flights in 5 minutes, but is not able to complete takeoff for the "Return" flight, the "Total Mission Time" would be: 5 actual minutes + 2 incomplete laps @ 3 minutes each = 11 Minutes. If an aircraft has completed the "Position" and "Passenger" flights, and one of the two laps of the "Return" flight when the 10 minute flight window expires, the "Total Mission Time" would be: 10 actual minutes + 1 incomplete lap @ 3 minutes = 13 Minutes.

Payload Notes:

- Passenger "payload" is a varied number of specified size softballs. Balls **MUST** be an ASA Approved 12" .47cor Softball.
- No "Speed Loader" or other rapid-insertion container is allowed. Balls must be individually loaded/unloaded. Teams may use a "box" to carry the balls to the flight line, but nothing other than the balls themselves may be loaded into the aircraft.
- Balls may NOT be modified. They may not be taped, bolted, screwed or otherwise held together. Balls must be restrained inside the aircraft by a mechanical device. Tape may not be used as the "restraint" device, however Velcro is allowed provided it is not attached to the balls themselves.

Aircraft Cost Model

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

Coef.	Description	Value
A	Manufacturers Empty Weight Multiplier	$100 ~~* Material Multiplier~~
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 **Material Multiplier:*DELETED***
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, ventrals 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:

- The contest requires multiple missions and sorties during each flight period; ground handling, take-off and landing are paramount design considerations.
- Each mission must be completed within a *10 minute* flight period. The time to unload and reload the payload for the next sortie is part of the flight period.
- Aircraft may not have any work performed in the starting line queue. Aircraft propulsion batteries may be left out of the aircraft when in line. Teams will be given a maximum of 2 minutes to place their aircraft on the starting line and prepare for competition before the judges start the timed flight period. During the two minute period teams may install batteries and make any final adjustments. Aircraft not ready to fly at the end of the 2 minute period will go to the back of the flight queue.
- The aircraft propulsion system(s) must be disarmed or "safed" during all payload changes.
- Maximum flight support crew is: pilot, observer, and 3 ground crew. Only the designated ground crew may conduct the unloading/reloading. Pilot and observer may be members of the ground crew, provided total ground crew size remains 3 people.
- 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 to unload their payload, and reload for the next sortie. 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 experiencing minor landing damage may be repaired and fly additional sorties within the flight period. Repairs must be made on the starting line, and may not begin until the payload has been unloaded. Repairs must be completed before the payload is reloaded for the next sortie. All team members may assist in repairs, only ground crew members may reload the aircraft.
- 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

- The contest date is moved to the last weekend in April. This date removes the conflict with the PE exams, and is anticipated to become a new permanent date for the competition.
- Wing span limit is removed.
- The maximum current limit is modified. Fuse types are restricted. Fuses MUST be accessible from outside the aircraft and act as the "safeing" device.
- The cost formula is modified.
- Aircraft missions are revised.
- Report page limits and formats are modified.
- Addendum report requirement is deleted.
- Protest procedure is initiated and described.

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 will also be 10 point Arial font. Margins are 1" on all sides. All pages will be 8 1/2 x 11.

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.*

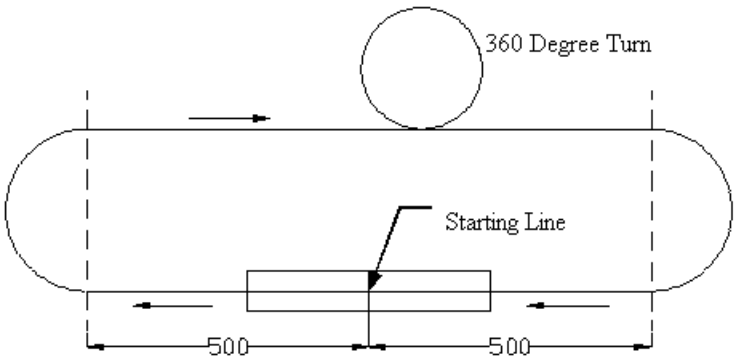
Design Report-PROPOSAL PHASE

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. 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 (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 (25 points):
   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 rationale for the overall level of technology selected. Detail the design parameters investigated, and why each was felt to be important. 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. Include the values for *Rated Aircraft Cost* assigned to each concept during the FOM screening process. Include a description of significant assumptions made, and the methods used to validate them. 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 weighting; and an explanation of the features that produced the final configuration selection.
4. Preliminary Design (20 points):
   Document the design parameter and sizing trades investigated during the preliminary design stage, the design parameters investigated, and why each was felt to be important. Describe the FOM's used and the mission or design feature each FOM supports. Include a summary of the key features that distinguish the final configuration including: determination of the required wing and power loading to meet the mission; assumptions made and justification for their validity; and a comparison of the results obtained in the Preliminary phase with the assumptions used in the Conceptual phase.
5. Detail Design (25 points for discussion items, 10 points for drawing package, 35 points total for the section):

Final performance data should be provided for the design including: take off performance; handling qualities and g load capability; predicted mission performance, and aircraft weight and balance worksheets. Document component selection and systems architecture selected. Document your final competition aircraft's *Rated Aircraft Cost* using the contest supplied cost model. Describe the assumptions made and compare these to the values used for the Conceptual and Preliminary design phases.

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.



Course Layout
Shown to Scale

Sample of Judges Scoring Worksheet

Executive Summary		**Max**
	Summary of development of the design	**5**
	Highlights major areas in the development process for final configuration	
	Describes range of design alternatives investigated	
	Overview of the design tools used in each phase	
	Format, completeness, readability	
Management Summary		
	Architecture of the design team	**5**
	List of design personnel and assignments areas	
	Documents personnel assignments, schedule control, and configuration control	
	Milestone chart showing planned and actual timing of major elements	
	Format. Completeness, Readability	
Conceptual Design		
	Documents alternative configuration concepts investigated	**25**
	Design parameters investigated and why important	
	Figures of merit used, mission feature of each FOM	
	Discussion of Rated Aircraft Cost for each concept	

	Assumptions made and justification for their validity	
	Final ranking chart of each design for each FOM	
	Features that produced the final configuration selection	
Preliminary Design		
	Design parameters and sizing trades investigated and why important	**20**
	Figures of merit used, mission feature of each FOM	
	Wing and Power loading requirements	
	Assumptions made and justification for their validity	
	Comparison of assumptions used with those from Conceptual phase	
Detail Design		
	Performance data (takeoff, handling qualities, g-loads)	**35**
	Estimated mission performance	
	Weight and Balance sheet	
	Component selection and systems architecture	
	RAC worksheet	
	Assumptions made and justification for their validity	
	Drawing package (3-view, dimensions, structure, systems layout)	
Manufacturing Plan		
	Process selected for major component manufacture	**10**
	Manufacturing process investigated and FOM's used	
	Analytic methods (cost, skill matrix, scheduling)	
	Manufacturing milestones chart: plan and actual	

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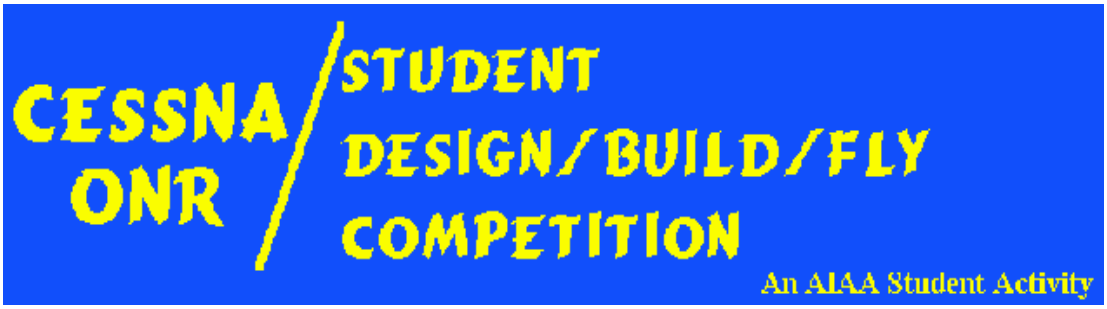

Frequently Asked Questions (FAQ)
2002 Competition Specific
Updated 25 September 2001

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.

Payload Questions:

1. **Question:** Are wing pods for carrying the cargo permitted? Is removal of the pods for a different mission flight a modification to the aircraft structure?
   Answer: Wing pods may be used for carrying the payload. If used for any mission, they must be present for all missions. The pods may be removed to change payload.
2. **Question:** In the "Passenger Delivery" section of the chart it states, "Balls must be a minimum of 2 directly abreast (no staggered rows), and single height." We have a few questions about the loading configuration of the softballs.
   Q1: does this allow for two balls stacked vertically instead of horizontally? Meaning two balls high and one wide.
   Q2: More generally, is the "single height" a minimum, maximum, or a mandate?
   Answer: Balls must be “only” a single row high (vertical) and “at least” two rows wide (spanwise-horizontal). They can be wider, but not higher.
3. **Question:** In the contest rules it says “softballs must be loaded/unloaded individually." Does this entail that each ball must be loaded/unloaded by hand? Or, can they "individually" roll into the payload compartment of an aircraft with some sort of ramp-mechanism or tube?
   Answer: You may not use any type of “device” to load or unload the aircraft, either one that fly’s with the aircraft (the old “speed loader”) or a ground based loading device. You may use a box or container to carry the balls, but may not “pour” them into the aircraft from the container (or vise versa), they must be loaded “individually” by hand.
   As an example, you can't put all the balls in a big tube, line the tube up with the aircraft, and pour them in. Similarly you can't make a box with a removable bottom that matches your payload bay, hold the box over the bay, and slide out the bottom to load all the balls at once. You also can’t “group” the balls together by any means (remember it says no tape, bolts, nylon socks etc to hold the balls together) and put all the balls in with one fell swoop. And finally, you can’t tip the aircraft up or over and just let all the balls rolls out into the box, they must be “removed” and moved to the box “individually”.
4. **Question:** Does "...directly abreast (no staggered rows) and single height..." mean the adjacent balls must touch each other?
   Answer: No, they don’t need to touch, but they can’t overlap.

5. **Question:** May we tip the aircraft to get the balls to a location where they can be unloaded if we do not "pour" them into a container (for unloading)?
   Answer: The aircraft does not need to remain perfectly level when unloading, but the main gear must remain in contact with the ground.
6. **Question:** For removing the payload, does the "individually" allow that we are allowed to let the balls roll out of the aircraft into the hands of the crew?
   Answer: The balls must move from the aircraft to the “box” and vise versa by a crew member. They may roll around in the aircraft itself during loading, as long as they are adequately secure when the plane is loaded and ready for take-off.

Flight / Mission Questions

1. **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.
2. **Question:** The rules state the aircraft must have the wheels off the ground in 200 feet. Is there any height requirement?
   Answer: No, the rules are correct as stated. Aircraft must have **ALL** wheels off the ground by the 200 foot line, and they must remain off until the landing. Their is no "obstacle" height requirement for this year.
3. **Question:** Can the battery pack be **changed out** or "**topped off**" between sorties?
   Answer: No. Only payload may be unloaded and reloaded. Batteries may not be recharged.
4. **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.
5. **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.
6. **Question:** In the rules, it says that the flight time lasts "...until the aircraft comes to a complete stop on the runway past the starting line at the completion of all laps..." then goes on to say "If the aircraft rolls off the runway, the ground crew may retrieve the aircraft and return it to the runway. In this case, the time ends when the ground crew returns to the staging 'box' after placing the aircraft at the starting line." So why would a crew go get the aircraft if it runs off the runway? Wouldn't it be stopped? Are you saying that if the plane rolls past the starting line and stops, then the time stops, but if the plane rolls past the starting line and off the runway, the crew must return it to the starting line?
   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 must be returned to the runway (but not necessarily to the starting line). In either of these cases, time stops when the pit crew returns to the staging box.
7. **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.

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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