

30aug13



2013/14 Rules and Vehicle Design

Draft Rules : 31 Aug 2013

Latest Update : 31 Oct 2013

Entry Deadline: 31 Oct 2013

The contest rules may be augmented/supplemented at any time during the competition through the Q&A process.

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 Aircraft Company/Raytheon Missile Systems - 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.

Check the rules package carefully as items and approaches that were legal in past years may not be legal for this contest year. Only the contents of this Rules package, the 2014 FAQ, and 2014 Q&A documents hold bearing on the requirements and/or allowances for the current contest year. It is the responsibility of the teams to know and follow all provided rules, the FAQ, and all contest day briefings.

Cash prizes are \$2500 for 1st, \$1500 for 2nd and \$1000 for 3rd place. The winning team will be invited to present their design at an AIAA conference. The team with the best Report Score will receive a \$100 prize from the Design Engineering Technical Committee.

Judging:

Students must design, document, fabricate, and demonstrate the 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 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. The overall team score is a combination of the Design Report score, Flight score and Rated Aircraft Cost (RAC). The team with the highest overall team score will be declared the winner. Scores will be FINAL 7 working days after the completion of the contest. This period will allow for review of the scores in a timely fashion following the contest.

All submitted reports are the property of AIAA, Cessna and Raytheon and may be published or reproduced at their discretion.

Contest Site:

Host for the competition will be Cessna Aircraft Co. The fly-off is planned to be held at the Pawnee East Field in Wichita, KS. Details on the contest site and schedule will be sent to registered teams early in the fly-off calendar year. You can check on historical weather conditions at www.weatherbase.com or www.weatherunderground.com.

Teams are advised to check with their airlines on what materials they will be allowed to bring both to and from the contest site.

Hazmat items like paints, thinners and glues may need to be purchased locally and PROPERLY disposed of following the contest.

Team Requirements:

All team members (except for a non-student pilot) must be full time students at an accredited University or College and student members of the AIAA. At least **1/3** of the team members must consist of 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 provide qualified pilots at the contest on an as-available basis to assist teams who are unable to have their pilot attend.

Team members may be updated/changed at any time during the contest but must always comply with the **1/3** rule. Following the initial team postings at the contest beginning we will make a "One Time" update to the team member lists posted on the website. Teams wishing a team member list update must submit an updated copy of the contest entry form with all fields fully filled (but only the team member information may be changed). We will notify teams when the website update change information may be sent, normally in February.

Each educational institution may submit one (1) team entry. The team members may be changed during the contest period, so schools may use an internal selection process to determine their final design and team members prior to the written report submission and fly-off. For schools with multiple campuses in different cities each campus will be considered as a separate entity.

- ⌘ **Two or more schools may combine to submit a single entry.**
- ⌘ **Schools which already have an entry may not have additional students from their school participate as members of a team from a different (shadow) school.**

The number of entries is limited to a maximum of 100 teams. If more than the maximum number of team entries is received during the submission period a selection process will be used by the judges to down-select to the final team list. Priority will be given to high placing teams from prior year(s).

Past Year Reports:

Winning team design reports from prior contest years are posted on the contest website as examples. Note that the formatting and content has evolved from one year to the next. Only the rules noted in this document apply for the current year. The top scoring report(s) from this year's contest will be placed on the contest web site for the next year's 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 electronic entry must be **RECEIVED** by 5 PM US East Coast Time on **31 October 2013** Entry forms may not be submitted before **15 October**.

- ⌘ The DBF entry form is different from the ones used for other AIAA student competitions. The DBF entry form can be found on the contest web site. It must be submitted by e-mail to the contest administrator at director@aiaadb.org .
 - Be sure to include **ALL** information requested in the form. We will use the first (valid) entry received so be sure all supplied information is correct the first time.
 - **Incomplete entry forms will not be accepted. Incomplete forms will be returned for correction and may miss the deadline**
- ⌘ *It is the team's 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. Do not use an internal team correspondence e-mail list server as your point of contact e-mail address.*
- ⌘ **Note: The AIAA mail servers will not send e-mail to @hotmail.com addresses. Do NOT use a hotmail address for any of your team contacts or e-mail.**

Design reports must **ARRIVE** at the designbuildfly@gmail.com email by 5 pm US East coast time on **24 February 2014**.

- ⌘ Reports will be judged "as received", no corrections/additions/changes will be made by the organizers so check your reports carefully before sending them.
- ⌘ **Teams may only submit one report copy, any copies received after the initial submission will be deleted.**

Submission of reports is electronic only (no hard copy required). The details for the electronic report format and submission, including a new requirement for a separate 3-view, are at the end of thereport section in this rules document.

The contest is scheduled for **11-13 April 2014**. The competition is anticipated to run from 8AM to 6PM on Friday, 7AM to 6PM on Saturday and 7AM to 5PM Sunday. Awards will be presented at 5:30PM on Sunday. All teams should plan their travel so that they may stay for the awards presentations on Sunday. A final contest schedule will be e-mailed to the teams prior to the contest date.

Tech inspections will begin on Friday and will continue as required on Saturday and Sunday.

To help streamline the contest flow and maximize opportunities for each team to get their flights in, the Tech inspections will be conducted in the same order as the flight rotation (which is based on report scores) so that the first teams inspected will be the first teams in the flight queue. Teams may use the sequence to help estimate when they need to arrive at the contest site to make sure they do not miss their slot in the first tech inspection rotation.

Note: All schedule deadlines are strictly enforced.

Late entries will NOT be accepted. Late report submissions will NOT be judged. Teams who do not submit the required electronic report will NOT be allowed to fly. It is the team's responsibility to assure that all deadlines are known, understood and met.

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 is located at:

<http://www.aiaadbf.org>

Questions regarding the contest, schedules, or rules interpretation may be sent to the contest administrator by e-mail at:

director@aiaadbf.org

Questions received prior to the official entry submission date will not be answered directly. Select questions "may" be answered in the FAQ prior to the entry submission date. Official questions and answers received following the entry submission date will be posted on the website.

The DBF Organizing Committee will utilize Facebook as an additional means of communicating with the teams during the contest weekend only. This will NOT be a means of communicating rules, FAQ's, protests, etc, but only used in case of emergencies, weather delays or contest weekend schedule updates. Additional information will be included in a contest site/ schedule email to be sent out to the registered teams prior to the fly-off.

Aircraft Requirements - General

- ε The aircraft may be of any configuration except rotary wing or lighter-than-air.
- ε No structure/components may be dropped from the aircraft during flight.
- ε No form of externally assisted take-off is allowed. All energy for take-off must come from the on-board propulsion battery pack(s).
- ε 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.
- ε Motors may be any commercial brush or brushless electric motor.
- ε For safety, each aircraft will use a commercially produced propeller/blades. Must use a commercially available propeller hub/pitch mechanism. 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.
- ε You can change the propeller diameter/pitch for each flight attempt.
- ε Motors and batteries will be limited in current draw by means of a **15 Amp fuse** in the line from the positive battery terminal to the motor controller.
 - Fuse(s) must be located such that no propulsion system component: motor; motor controller; or battery may see more current than the stated limit (fuse value).

- ⌘ Must use over the counter NiCad or NiMH 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/documented (i.e. clear shrink wrap preferred). All battery disconnects must be "fully insulated" style connectors.
- ⌘ **Maximum propulsion battery pack weight is defined in the mission rules section.** This battery pack must power propulsion 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. We will provide qualified pilots at the contest on an as-available basis to assist teams who are unable to have their pilot attend.
- ⌘ **The aircraft must remain substantially the same as documented in the report (for example you can not change a flying wing design to a conventional tail design). You may make small modifications to the design to improve flight performance after the report submission (one example would be changing a control surface size). The three-view drawing supplied in pdf form as described below in the electronic report section will be used to verify the flight article during tech inspection.**

Aircraft Requirements - Safety

All vehicles will undergo a safety inspection by a designated contest safety inspector prior to being allowed to make any competition flight. **All decisions of the safety inspector are final.**

To speed the tech inspection process each team must present a signed **Pre-Tech and First-Flight Certification** when called to begin their on-site tech inspection. Teams may not begin the on-site tech inspection without a completed certification. The **Pre-Tech and First-Flight Certification** sheet is available on the contest website.

The Pre-Tech must be conducted by, and signed off by, a non team member RC pilot or the team faculty advisor. The Pre-Tech will cover the same safety of flight requirements as the on-site tech inspection and will assist teams in making sure they are ready and able to pass the on-site tech inspection the first time. An expanded First-Flight requirement, which also must be signed off by a non team member RC pilot or the team faculty advisor, requires demonstration of a complete flight including take-off, flying a minimum flight pattern, and landing in a pre-designated location without damage to the aircraft. The non team member RC pilot who signs the inspection and flight certifications may be the same as a team's non-student contest pilot.

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. Clevises on flight controls must have an appropriate safety device to prevent their disengaging in flight.
 2. Verify propeller structural and attachment integrity.
 3. Visual inspection of all electronic wiring to assure adequate wire gauges and connectors in use.
 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. 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*.
- ⌘ 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 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 throttle verified to be "closed" before activating the motor arming switch. Fuses **MUST be mounted on the outside the aircraft** (they can not be behind an access panel or door) and **MUST** act as the "safeing" device.

Note: The aircraft must be "safed" (arming fuse removed) any time the aircraft is being manually moved, or while loading/unloading payload during the mission. The arming fuse must be removed anytime the aircraft is in the hanger area.

Scoring:

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. In the event of a tie, Report Score will take precedence over Flight Score as a tie-breaker.

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

$$\text{SCORE} = \text{Written Report Score} * \text{Total Mission Score} / \text{RAC}$$

The **Total Mission Score** is the product of the Taxi Score, **TS** and Flight Score, **FS**: **Total Mission Score = TS*FS**

The flight score is the sum of the individual mission flight scores: **Flight Score = FS = M1 + M2 + M3**

The RAC is a function of empty weight: **RAC = EW**

- ε Empty weight will be measured after each successful scoring flight: **EW = Max(EW1, EW2, EW3)**
- ε **EW_n** is the post flight weight with the payload removed

Mission Task Matrix:

Backcountry Rough Field Bush Plane

General:

- ε Battery pack(s) maximum weight limit is **1.5** lb.
- ε The ground clearance of the bush plane will be measured by passing a standard 2x4 (actual dimension 1 1/2" by 3 1/2") on edge, (3 1/2" vertical) under each wing no further than half span from the centerline during tech inspection. The clearance will be measured with the payload from flight mission 3.
- ε Missions must be flown in order as described below. There is no longer a maximum number of flights a team may attempt. **Upon completion of all three missions, teams may at their option attempt a single re-flight of each of the flight missions previously flown. The larger of the two flight scores for each mission will count toward the total mission score. Normal queuing procedures will be used.**
- ε All payloads must be secured sufficiently to assure safe flight without possible variation of aircraft cg during flight.
- ε Assembly/flight line crew is limited to pilot, observer and 1 ground crew.
- ε Scoring measurement units are feet, lbs, and seconds.

Mission Sequence:

- ε The Taxi Mission must be attempted prior to the Flight Mission 2. At their choice, each team may perform the Taxi Mission first followed by Flight Mission 1, or the reverse. However, no attempts at Flight Mission 2 are allowed until at least one attempt is made for the Taxi Mission.
- ε Flight mission must be performed with the same landing gear and wheel/tire combination as used for the taxi mission.
- ε **The three Flight Missions must be flown in order. A new mission can not be flown until the team has obtained a successful score for the preceding mission.**
- ε **Aircraft must be designed to be capable of performing all required missions.**
 - ε **Aircraft must pass the wing tip load test with the largest cargo loading intended to fly for Mission 2 or 3.**
 - ε **The maximum load demonstrated will be recorded and can not be altered after completing tech inspection.**
- ε The aircraft will enter the assembly area with the payload for mission 2 and 3 uninstalled.
- ε The team will have a total of 5 minutes to load the payload and checkout the aircraft systems as fully functional.
- ε There is no work allowed on the aircraft after the loading/checkout time.
 - ε **The RC receiver should be able to be turned on externally or must be left on. You will not be allowed to re-open any compartment after the loading/checkout time to turn on the receiver.**
- ε Only the assembly crew member, pilot and pilot assistant may go to and enter the staging box.
 - ε After the checkout is complete the assembly crew member may be swapped for a different flight line crew member if desired.
- ε Aircraft will use ground rolling take-off and landing

- Missions will simulate rough/soft field ground handling and short field takeoff
- Takeoff field length will be limited to 40 ft.
- ε The initial upwind turn on the first lap of each mission will occur after passing the turn judge (signaled by raising a flag). The aircraft must remain in unaided visual control distance of the pilot at all times. The **Flight Line Judge** may require turns to be made to remain in a safe visual control range at his discretion.
- ε Aircraft must complete a successful landing at the end of each mission for the mission to receive a score.
 - A successful landing is outlined in the general mission specification section below.

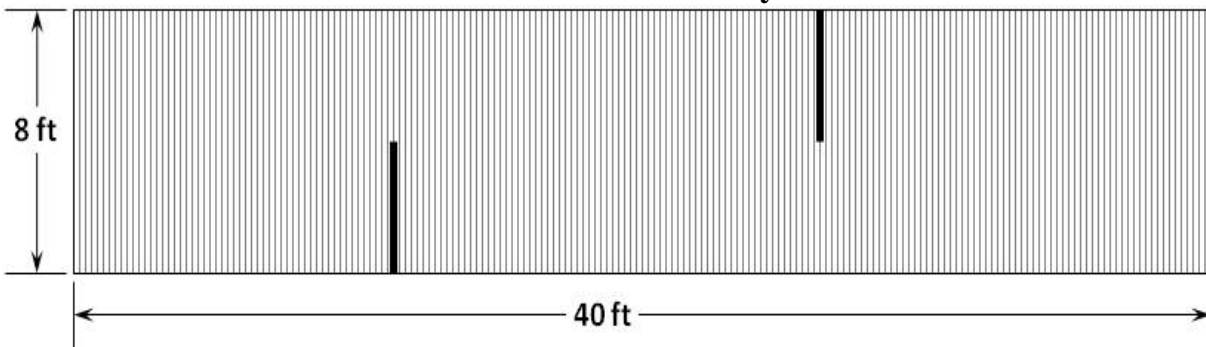
Missions:

- ε **Ground Taxi Mission - Rough Field Taxi**
 - The aircraft will be required to taxi across a 40' x 8' course. See figure below.
 - The course will consist of fiberglass roofing panels oriented normal to the long axis of the course.
 - The panels will be similar to this description: [Palruf Roofing Panel](#).
 - Corrugation spacing is 3" wide x 0.625" high.
 - Two obstacles will be placed on the course, at approximately 1/3 and 2/3 the length of the course. The obstacles will extend from the centerline to one edge, and the height will be that of a standard 2x4 (actual dimension 1 1/2" by 3 1/2") on edge, (3 1/2" vertical). See figure below.
 - Payload for the taxi mission will be the same as for Flight Mission 3, described below.
 - Successful completion requires no damage to the airplane. No broken propellers, bolts, rubber bands, etc. are allowed.
 - If the airplane departs the side of the course, the attempt is disqualified.
 - If the airplane becomes airborne the attempt is disqualified.
 - The mission must be completed within five minutes from the start.
 - If the Taxi Mission is completed successfully, then **TS=1. Otherwise, TS=0.2**

Palruf Roofing Panel



Taxi Mission Course Layout



- ε **Flight Mission 1 - Ferry Flight**
 - No payload installed
 - Take-off within the prescribed field length.
 - Maximum number of complete laps within a **4** minute flight time.
 - Time starts when the throttle is advanced for the (first) take-off (or attempt).
 - A lap is complete when the aircraft passes over the start/finish line in the air.

- Mission score: **$M1 = 2 * (N_Laps_Flown / Max_N_Laps_Flown)$**
- Must complete a successful landing to get a score.

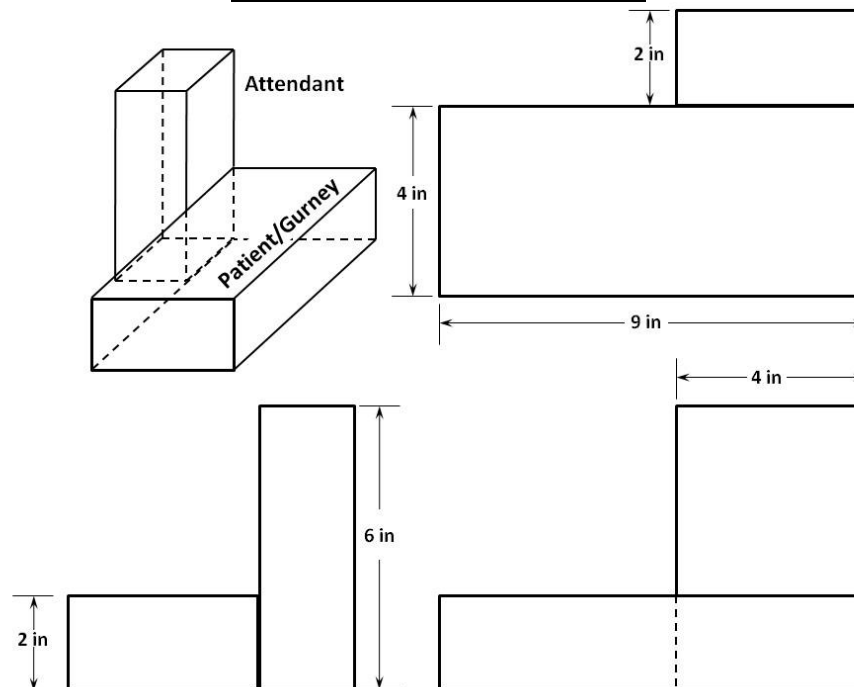
ε **Flight Mission 2 - Maximum Load Mission**

- Take-off within the prescribed field length.
- 3 Lap internal cargo flight.
- Cargo will be simulated by 6" x 6" x 6" wooden blocks, ballasted to 1 lb each.
- All cargo must be carried internally and properly secured.
- Mission score: **$M2 = 4 * (N_Cargo_Flown / Max_N_Cargo_Flown)$**
- Must complete a successful landing to get a score .

ε **Flight Mission 3 - Emergency Medical Mission**

- Take-off within the prescribed field length.
- 3 lap flight with required medical passenger mission consisting of:
 - Two patients on gurneys simulated by wooden blocks 9" long x 4" wide x 2" high oriented flat and lengthwise, ballasted to 0.5 lb each. See figure below for the required configuration of each patient/attendant combination.
 - Two attendants positioned one beside each patient simulated by 6" tall x 2" wide x 4" long ballasted to 0.5 lb each. See figure below for the required configuration of each patient/attendant combination.
 - Patient/gurneys and attendants must be carried internally and properly secured.
 - The arrangement of the patient/gurney and attendant must meet the following criteria:
 - 1) The attendant shall be oriented vertically and the patient shall be horizontal and flat (as shown in the figure).
 - 2) The attendant must be immediately adjacent to the side of the patient
 - 3) The patients must be separated by a minimum of 2" side to side or above/below
 - 4) At least 2" space above the patient shall be an "air space" with no structure or systems present.
 - 5) The attendants must be separated by at least 2" from each other
- Mission score: **$M3 = 6 * (Fastest_Time_Flown / Time_Flown)$**
 - Time flown is measured in seconds.
 - Time starts when the throttle is advanced for the (first) take-off (or attempt).
 - Time ends when the aircraft passes over the finish line (in the air) at the completion of the last lap.
- Must complete a successful landing to get a score.

Mission 3 Payload Configuration



Flight Line Order:

- A **flight order** list will be generated and **emailed to the teams on the Wednesday prior to the fly-off weekend.** Teams

will always rotate in this order. The flight order will be repeated continuously.

- The flight order list will carry over from Friday to Saturday and Saturday to Sunday at what ever spot in the rotation it leaves off.
- Each team's position in the flight order will be determined from their written report score, highest report score goes first.
- Report scores will be available following the pilot briefing at the start of the contest (they will not be included with the rotation sequence e-mail).

ε There will be four *staging box* positions near the flight line.

ε If you are not ready to enter a *staging box* when your rotation number comes up you will miss your opportunity for that rotation.

Note: It is each team's responsibility to monitor the notifications from the scoring table in order to respond if ready. A contest official will be available to help teams enter the *staging box*.

ε Electing to enter one of the *staging box* positions on your turn in the rotation order **will constitute a flight attempt**. If you choose to leave the *staging box* for any reason you may not attempt a flight until your turn comes up again in the rotation order.

General Mission Specification and Notes:

ε The aircraft propulsion system(s) must be "safed" (fuse removed) during any time when crew members are preparing/handling the aircraft.

ε Maximum flight support crew is: **pilot, observer, and ground crew**.

ε Observer and all ground crew must be students. **Only the pilot may be a non-student**.

ε The upwind turn will be made after passing the upwind marker. The downwind turn will be made after passing the downwind marker. Upwind and downwind markers will be 500 ft from the starting line. Aircraft must be "straight and level" when passing the turn marker before initiating a turn.

ε Aircraft must land on the paved portion of the runway. Aircraft may "run-off" the runway during roll-out. Aircraft may not "bounce" off the runway.

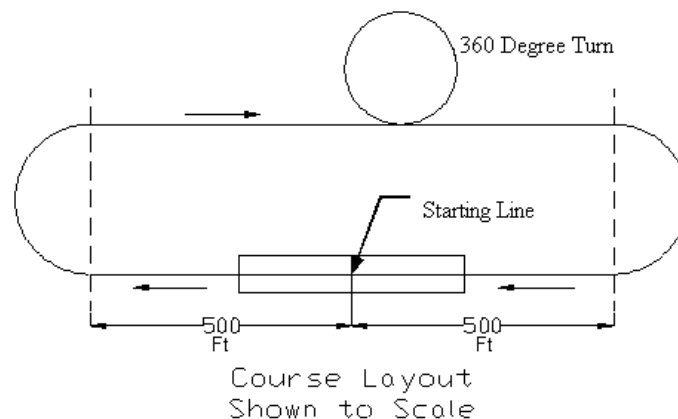
ε *Aircraft obtaining "significant" damage during landing will not receive a score for that flight. Determination of "significant" is solely at the discretion of the Flight Line Judge.*

ε 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 Judge and all rulings will be final.

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

Flight Course:

The orientation (direction) of the flight course will be adjusted based on the prevailing winds as determined by the Flight Line Judge. The flight course will be positioned to maintain the greatest possible safety to personnel and facilities. The nominal flight course is shown in the Figure below.



Protest Procedure:

Submitting a protest is a serious matter and will be treated as such. Teams may submit a protest to the Contest Administration at any time during the competition. Protests may not be submitted after the conclusion of the competition. Protests must be submitted in writing and signed by the team advisor, designees are not allowed for protest submissions. If the team advisor is not present, he may FAX or email a signed protest to the team for them to present. Remotely submitted protests must be on hard copy (printed by the team) and have the advisors signature. A phone number where the advisor may be contacted must be provided. Protests may be posted for review at the decision of the administration.

Protests and penalties (up to disqualification from the contest for deliberate attempts to misinform officials, violate the contest rules, or safety infractions) will be decided by the Contest Administration. **Protests submitted but not upheld by the judges *may* be given a penalty of the loss of one flight score to the team submitting the protest.** The decision of the Contest Administration is final.

Design Report:

Each team will submit a judged design report as outlined below and in the **SCHEDULE** section above.

Note: Reports must strictly adhere to the following requirements. Failure to meet requirements will result in penalties that range from score reduction to elimination from the contest.

- ⌚ Reports must have the University name on the cover page.
Reports missing this identification information will not be scored.
- ⌚ Absolute maximum page count for the report is **60 pages**, the PDF reader "pages" value will be used as the official page count.
*Reports exceeding the maximum page count will be given a **10 point penalty** for each additional page.*
- ⌚ Report PDF must be formatted as 8.5 x 11" pages.
 - ⌚ May use 11x17" pages for the drawing package.
- ⌚ **New this year:** A separate stand-alone three view drawing must be submitted along with the report file. See description below in the electronic submission section.

- ⌚ Reports will be scored on a 100 point basis following the guidelines outlined below.
All information used for scoring **must be in the outlined sections, content that is out of sequence, including the drawing package, will be treated as missing** and scored accordingly.
- ⌚ All reports must be one and one half line spacing, 10-pt Arial font. Tables and figures should be clear and readable for the judges. The reports will be judged on format and readability.
- ⌚ **ALL** items requested below should be present, easy to locate and identify, well documented and in the correct section for full scoring.
- ⌚ Examples of winning team design reports from prior contest years are posted on the contest website. Note that the formatting and content has changed from one year to the next. Prior year reports may not reflect or meet the rules listed for the current year.

Design Report

All section scores will include format, completeness and readability

1. Executive Summary: (10 points):
 - ... Provide a summary description of your selected design and why it is the best solution to the specified mission requirements.
 - ... Describe your key mission requirements and design features keyed to those requirements.
 - ... Document the performance/capabilities of your system solution.
2. Management Summary (5 points):
 - ... Describe the organization of the design team.
 - ... Provide a chart of design personnel and assignment areas.
 - ... Provide a milestone chart showing planned and actual timing of the design / fabrication / testing processes.
3. Conceptual Design (15 points):
 - ... Describe mission requirements (problem statement).
 - ... Translate mission requirements into design requirements.
 - ... Review solution concepts/configurations considered.
 - ... Describe selection process and results.
4. Preliminary Design (20 points):
 - ... Describe design/analysis methodology
 - ... Document design/sizing trades
 - ... Describe/document mission model (capabilities and uncertainties)
 - ... Provide estimates of the aircraft lift, drag and stability characteristics.
 - ... Provide estimates of the aircraft mission performance.

5. Detail Design (30 points total. 15 points for discussion items, 15 points for drawing package):
 - ... Document dimensional parameters of final design.
 - ... Document structural characteristics/capabilities of final design.
 - ... Document systems and sub-systems design/component selection/integration/architecture.
 - ... Document Weight and Balance for final design. Must include a Weight & Balance table for the empty aircraft and with each of the possible payloads
 - ... Document **flight** performance parameters for final design.
 - ... Document **mission** performance for final design.
 Drawing Package
 - ... 3-View drawing with dimensions.
 - ... Structural arrangement drawing.
 - ... Systems layout/location drawing.
 - ... Payload(s) accommodation drawing(s).
6. Manufacturing Plan and processes (5 points):
 - ... Document the process selected for manufacture of major components and assemblies of the final design.
 - ... Detail the manufacturing processes investigated and the selection process/results.
 - ... Include a manufacturing milestone chart showing scheduled and actual event timings.
7. Testing Plan (5 points):
 - ... Detail testing objectives, schedules, and check-lists.
8. Performance Results (10 points):
 - ... Describe the **demonstrated** performance of key subsystems and compare it to predictions from Section 5. Explain any differences and improvements made.
 - ... Describe the **demonstrated** performance of your complete aircraft solution and compare it to predictions from Section 5. Explain any differences and improvements made.

Design Report Electronic Submission

Each team must provide an electronic copy of their final design report for the report judging as outlined below.

- ⌚ Electronic copy must **Arrive** at the designbuildfly@gmail.com email by 5PM US East Coast time on 24 February 2014.
- ⌚ Electronic report files must be named: “**2014DBF** *[university]*.pdf”.
- ⌚ Electronic report must be a single file with all figures/drawings included in the proper report sequence in PDF format. (Free PDF file conversion programs are available on the Internet, such as www.pdf995.com.)
- ⌚ Electronic reports should have all figures compressed to print resolution to minimize file size.
- ⌚ Electronic reports must be less than **20 MB** in size (including encoding for e-mail transmission).

New this year:

- ⌚ A separate file with a one page 3-view drawing formatted to fit 8.5" x 11" paper **must be submitted** with the report for confirmation of the basic configuration. Note that this page does not count toward the report total.
- ⌚ The 3-view file shall be named as per above: “**2014DBF** *[university]*_3V.pdf”.
- ⌚ The 3-view file is limited to **2 MB** in size.

Reports and three-views not following the name format or exceeding the file size will be rejected. We will notify the team "only if" the report and 3-view arrive in the email 'in' box. If report and/or 3-view are rejected by the email system for being too large we will NOT be able to send a notification of the problem to the team!

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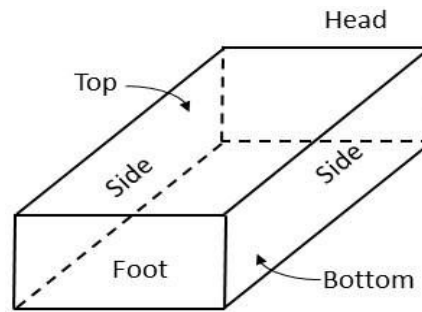
DBF Q&A #1 - 11/4/2013

Battery/General:

- Q. The rules include "Batteries may not be changed or charged between sorties during a flight period." To which period refer 'sorties' here?
- A. None of the missions in this year's contest have multiple sorties/flight in a single mission attempt/period so that clause won't be a factor. You may charge batteries between each mission attempt, which are sequenced by the rotation queue described in the rules.
- Q. Does the battery back weight limit include the receiver battery?
- A. No. There is no restriction on receiver battery weight.
- Q. Can we use Lithium batteries of any type?
- A. No. It is clearly stated in the rules that only over the counter NiCad or NiMH batteries are allowed.
- Q. If a takeoff attempt is unsuccessful, can the battery pack be changed before the second attempt?
- A. No.

Payload:

- Q. When ballasting the payloads is it okay for the payloads to be bottom-heavy? Do the payloads have to be made of wood? Do they need to be solid?
- A. During the contest flyoff the payloads will be provided by DBF officials to ensure consistency. They will be made of solid wood and the CG will be close to the centroid of the payload item. The cargo blocks for mission 2 will be separate and the attendant and patient blocks will be separate. Teams may use payloads of different materials during their own testing as they deem appropriate.
- Q. Can patients be above each other, such as a "bunk bed" scenario? Can they be placed end to end without a 2" spacing? Do the attendant and patient need to be on the same level?
- A. The rules were updated on Oct 31 to further specify the patient/attendant arrangement for mission 3:
1. The attendant shall be oriented vertically and the patient shall be horizontal and flat (as shown in the figure).
 2. The attendant must be immediately adjacent to the side of the patient
 3. The patients must be separated by a minimum of 2" side to side or above/below
 4. At least 2" space above the patient shall be an "air space" with no structure or systems present.
 5. The attendants must be separated by at least 2" from each other
- A. No 2" spacing is required at the ends. The top of the attendant needs to be at least at the same level as the top of the patient.
- Q. Can you be specific as to what the "side" of the patient means?
- A. Please refer to the figure below:



Taxi Mission:

Q. Can the wing tips hang over the side of the course? Can the wings pass over the obstacles?

A. Yes.

Q. Where will the aircraft be placed to begin the mission? Will it be placed on the beginning of the course, or will it begin off the course. If it starts off the course how far from the course will it be started?

A. The start of the taxi mission will be on a smooth surface in front of the panels. The exact distance in front of the panel and the space available has not yet been determined, but will be sufficient to accommodate a variety of airplane sizes.

DBF Q&A #2 - 11/12/2013

Battery:

Q. Can a team make use of two motors powered by two different battery packs connected to two different ESCs and also having two different 15 Amp fuses?

A. Yes. Multiple battery packs may be used as long as the total weight does not exceed the maximum.

Fuses/Motors:

Q. If our design uses more than one motor, does the 15 Amp limit apply to each motor or is that 15 Amp total?

A. Each motor gets its own 15A fuse.

Payload:

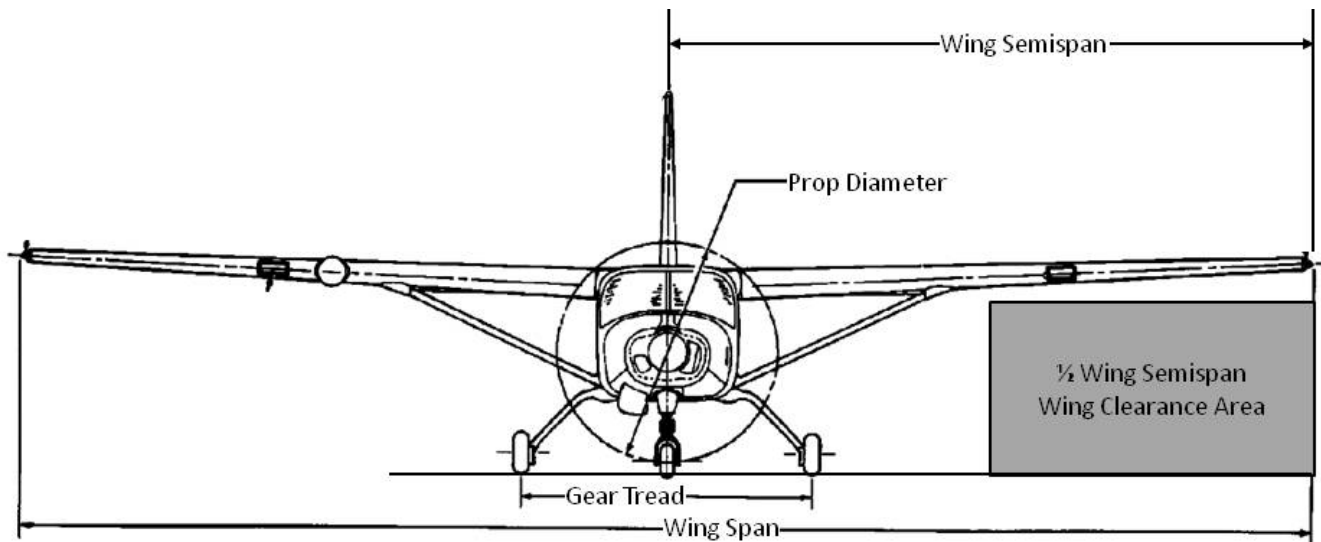
Q. Given that the patients need to have 2" of airspace above them, what constitutes a legal means of securing the patients properly? Do items such as straps, wires, etc. used to tie down the patient violate the airspace rule?

A. Reasonable means of securing the patient (as you describe) are allowed in the airspace.

Ground Clearance:

Q. Will the propeller(s) be included in the ground clearance test, assuming they are within 1/2 span from the centerline? For a tail-dragger type aircraft, will the rear fuselage (i.e. the area immediately around the tail wheel) be subjected to the ground clearance test? Will the landing gear or a nose mounted propeller be subjected to the rule?

A. Please refer to the diagram below. Any item on the aircraft that extends beyond 1/2 semispan from the centerline and located between the wing leading and trailing edges will be subject to the ground clearance requirement. This includes the propeller arc for wing or body mounted engines, wing struts, landing gear, and the fuselage itself. The clearance test will use a standard 2x4 (actual dimension 1-1/2" by 3-1/2") on edge, (3 1/2" vertical) under each wing. To accomplish the test, the 2x4 will be placed just ahead of the LE and be passed under the wing until just past the TE. For practical purposes, the clearance area includes a distance 1-1/2" ahead of the LE and behind the TE.



DBF Q&A #3 - 11/16/2013

Battery Packs:

Q. Can we change our cg position by moving the location of the components, for example, propulsion and receiver battery pack, to optimize the cg position in each mission? The location of battery pack(s) in mission 1 will differ from mission 2 and/or mission 3?

A. Yes. Battery packs may be positioned differently for each mission. They may not be relocated once you have entered the staging box.

Taxi Mission:

Q. Please define "airborne" in the rules statement: "If the airplane becomes airborne the attempt is disqualified".

A. The attempt will be disqualified if - in the opinion of the judge(s) - the airplane becomes airborne in a way such that the airplane is flying and supported by airflow over the wing(s) and/or the thrust of the propulsion system. A momentary bounce will not be disqualifying, but the final decision will be up to the taxi mission judge(s).

Takeoff:

Q. Will the surface of the 40' "field" from which we must take off; specifically, should we expect to take off from a hard surface, grass (long or short), or on a surface similar to that of the obstacle course? Also, will the take off area be a 40' x 40' square (similar to last year) or is it a straight shot?

A. The takeoff surface will be asphalt and not the same or similar to the taxi mission. The entire width of the runway (which coincidentally is 40 feet) will be available for the takeoff run. All takeoffs must be parallel to the centerline or away from the safety line.

DBF Q&A #4 - 11/27/2013

Battery Packs:

Q. Can we use Alkaline batteries?

A. No. It is clearly stated in the rules that only over the counter NiCad or NiMH batteries are allowed.

Payload:

Q. Can we have the patient and attendant fastened to a loading "cage" or "tray" that is in turn inserted into our aircraft?

A. Yes. The payloads must be properly secured onto the loader, which then in turn must be properly secured inside the aircraft. The loader and securing mechanisms will be part of the empty weight used to determine the RAC. Please be reminded that the payloads may not be altered by any means.

Q. What is the type of wood of the wooden blocks that you'll provide us in the missions?

A. This has not yet been determined, but it will likely be pine or spruce.

Landings:

Q. In the first mission, do we have to land in 4 minutes to get score? If our time is over during the flight and then we complete landing successfully, will we be able to get score?

A. The mission 1 score will be based on the number of laps completed in four minutes. The landing portion of the mission is not timed, however the landing must be successful for the score to count.

DBF Q&A #5 - 12/11/2013

Payload:

Q. The rules tells us about wooden blocks with a specific size for missions 2 and 3 (6"x6"x6" for mission 2 and two different blocks, 2"x4"x9" and 2"x4"x6" for mission 3). There is any specific tolerance on the fabrication of the blocks that we can take into account when manufacturing the cargo bay?

A. All payloads will be provided by contest officials for tech inspection and scoring flights. The tolerance for all dimensions will be +/- 1/8". The payloads may have lightening holes or weights added to them to ensure the correct weight.

Taxi Mission Attempts:

Q. The rules state: "There is no longer a maximum number of flights a team may attempt." Does this only apply to "flight" missions? Will we be allowed to make multiple attempts for the taxi mission if we initially fail?

A. There is no set maximum attempts for the taxi mission. Multiple attempts are allowed.

Team Composition and AIAA Membership Status:

Q. What is the last date to update the list of team members?

A. This is addressed in the rules: "Following the initial team postings at the contest beginning we will make a "One Time" update to the team member lists posted on the website. Teams wishing a team member list update must submit an updated copy of the contest entry form with all fields fully filled (but only the team member information may be changed). We will notify teams when the website update change information may be sent, normally in February".

Q. Is there any deadline for the AIAA membership verification? Since there is two team from our university and we didn't make the fly-off. After fly-off, the participant students will be selected by chair of our department. Then the people will get their verified memberships and we will send the team members list to renew.

A. For your situation, AIAA membership should be made prior to the final team update in February.

Fuses:

Q. Is there any limitation on the burn out time of the electric fuse? If yes what is the maximum time and the corresponding current value?

A. There is no set time limitation for the fuses. Fuses must be the contest specified "blade" style, properly rated at 15 Amps, and commercially available.

Course Layout:

Q. Is there any specific turn radius for both 180 degree and 360 turn? Or it depends on the aircraft capability or pilot handling performance?

A. There is no set minimum or maximum radius. If the radius is too large, the flight director may ask that the airplane be brought closer in.

Use of Spares for Repair:

Q. If the aircraft happens to crash in any time during the flight in any mission and some of its parts are broken and torn apart (skins, frames, ribs etc.), can these parts be replaced by spares which are prepared before the competition?

A. As long as the spares are of the same basic design as the original, they may be used for repair. Note that broken components such as wings, tails, etc must be repaired, not replaced. Replacement of subcomponent parts such as ribs, stringers, skins, etc are allowed. After a crash, a judge will initial the major pieces to ensure components get repaired.

Wing Incidence:

Q. Is the manual changing of the wing's angle of incidence, not remotely controlled, permitted? Or is it considered a change of aircraft geometry as stated in the FAQ?

A. Manual changes to the incidence of flying surfaces are allowed.

Autopilots/Autonomous Flight:

Q. Is an onboard microcontroller autopilot for semi-autonomous flight permitted? i.e Control flight attitude, direction, and motor power. e.g autopilot?

A. Gyros are legal for stability purposes. We allow only model airplane rate gyros that are in line between the receiver and servo without heading lock mode. No microcontrollers, autopilots or any other form of stability augmentation is allowed.

Takeoff Direction:

Q. What is the direction of takeoff? Will it be into the wind?

A. The takeoff direction will be nominally into the wind only if the wind direction is the same heading as the runway. A crosswind component is very likely, and the direction will be chosen to give the largest headwind component. If the wind is light and variable the Flight line official will dictate the takeoff direction. See Q&A #3, above.

DBF Q&A #6 - 12/19/2013

Payload:

Q. Do the attendants need the 2" head room as is required for the patients? I.E. Can the head of the nurses touch the top of the payload section?

A. The 2" head room requirement does not apply to the attendants.

Airplane Configuration Changes:

Q. Can the fuselage outside lines change between missions?

A. No, the airplane configuration may not be changed between missions.

Commercial Components:

Q. Can we buy wheel pants or do we have to manufacture them ourselves?

A. Small components such as wheels, wheel pants, spinners, landing gear struts, tail booms, etc. may be purchased from commercial vendors. Major structural components such as wings, fuselages, tails, etc must be manufactured by your team.

DBF Q&A #7 - 1/13/2014

Payload:

Q. From the rule stating that 'the patients must be separated by a minimum of 2" side to side or above/below and the attendants must be separated from by at least 2" from each other': does this particular separation include separation from the structure (no structure will be present within 2" measured the payload) also or just below the payloads themselves ?

A. The space described in Q&A #1 must be free from any structure, system, or payload. No separation from structure is required to the sides, below, or ends of the patient.

Q. Does the attendant have to be placed exactly like in the figure shown or it can be moved to any location that immediately adjacent to the side of the patient ? And can it be moved to another side ?

A. The attendant may be located on either side of the patient.

Motor:

Q. Can motor be changed in each mission?

A. The motor may be changed if damaged.

Landing Gear:

Q. Can we use a flying wing in the competition and use its belly for takeoff and landing (no landing gear). Is it legal in the competition?

A. Yes, although the taxi mission must be completed with the same configuration.

DBF Q&A #8 - 1/24/2014

Payload Restraint:

Q. Is the use of velcro allowed for securing the payload to the inside of the aircraft fuselage?

A. Yes.

Q. For Mission 3, the rules state the passenger/attendant payload must be properly secured. Is it required to restrict vertical motion of the passenger?

A. Yes.

Configuration Changes:

Q. Does a wing span, airfoil shape change, adding vortex generators, or adding winglets constitutes as a major design change?

A. Small changes to span or wing tip style are allowed. Note that this answer is related to changes made between report submission and the flyoff. Changes made at the flyoff between flights are strictly limited and these examples would not be allowed.

Takeoff Field:

Q. I read in the rules that it will be a rough/soft field. Will this be a well kept field, or will it be more like a rough unkept field with long grass and small mounds of dirt.?

A. Please see Q&A #3

Current Limiting:

Q. Is current limiting using a microcontroller allowed? I.e. The microcontroller senses current drawn and automatically lowers the throttle signal between the receiver and the electronic speed controller whenever the current is about to exceed 15A. The microcontroller is to do only this and does not control the control surfaces?

A. No, electronic current limiting is not allowed. This is considered to be an automation device which removes pilot responsibilities to control the overall system. As with previous years, no microcontrollers or autopilots are allowed. A 15 Amp fuse is sufficient protection for the motor and controller.

Telemetry:

Q. Is telemetry allowed during the mission flights? E.g. Use of ardupilot to monitor airspeed and transmit wirelessly to ground station for feedback to pilot. Again, it is not used for auto piloting of control surfaces.

A. Due to the inherent autopilot capabilities in Ardupilot, its use is prohibited. Downlink capabilities are available in many 2.4 Ghz radios and may be used, but no additional RF devices beyond those in the existing RC receiver/transmitter are allowed.

Scoring Formula:

Q. The formula for Mission 3 Emergency Medical Mission reads: $M3=6*(Fastest_Time_Flown / Time_Flown)$. Does "Fastest_Time_Flown" refer to our teams' time and "Time Flown" refer to the overall fastest time flown or is it the opposite?

A. "Fastest_Time_Flown" refers to the fastest time for all teams. "Time_Flown" refers to your team's time for that flight.

DBF Q&A #9 - 2/11/2014**Configuration Changes:**

Q. With regards to the configuration change item in Q&A #8: What constitutes a small change? For example is there a percentage change limit on any design parameter such as taper, chord, landing gear height, tail boom length, fuselage shape, wing position? Are changes to internal structure allowed? For example a change in manufacturing technique from balsa build up to foam core wing, a change in material from glass fiber to carbon fiber, or a change in number and position of ribs or bulkheads.

A. It is not possible to anticipate all potential changes or to place a quantifiable standard that applies across the board. The configuration will be checked in tech against the 3-view supplied with your report. If the airplane looks substantially like the 3-view drawing then it will be allowed to compete. If the span is doubled, you've added a wing, or added a tail to a flying wing design, then the entry would not pass tech. The spirit of the competition is to design an airplane and bring that same design to the flyoff, and that is the spirit under which this rule will be interpreted.

Batteries:

Q. Can we solder our own battery packs or do we have to use store-bought packs?

A. You may assemble the battery packs using over the counter NiCad or NiMH cells. Please follow the guidelines in the rules, Aircraft Requirements – General, regarding the visibility of the manufacturers markings so we can verify the chemistry used during the tech inspection.

Q. Can the battery packs be securely attached to the side of the airplane fuselage, open to the air stream for cooling?

A. No. The batteries must be carried inside of the aircraft surface.

Payload:

Q. The rules say that there will be blocks 6"x6" and 2"x4." Are these the exact dimensions or are they being produced from 2 by 4's?

A. This question is covered in Q&A #5.

Payload Restraint:

Q. Is a strap passing over the top of the patient (zip tie, velcro, etc.) to restrict vertical motion (as mentioned in Q&A #8) considered a violation of the 2" air space rule?

A. No, it is not a violation. It is anticipated that a restraint system similar to a seat belt may be used, as it would in a full scale passenger vehicle. As long as a large majority of the air space above the patient is free, it will be allowed.

Q. In regards to the payload for mission three, if the inside contour of the fuselage is made to tightly fit the 6in cubes, does that constitute as the payload being secured?

A. There is insufficient information in the question to give you a complete answer. Acceptability of the method to secure cargo and

passengers will be made during technical inspection. (The cargo cubes are for Mission 2, so I assume that is the mission you are referring to.)

DBF Q&A #10 - 2/19/2014

Payload Restraint:

Q. In regards to the payload for mission three, if the inside contour of the fuselage is made to tightly fit the 6in cubes, does that constitute as the payload being secured.

A. The 6in cubes are used for mission two, not three. All payloads must be secured in all three directions using standard model aircraft techniques. Verification will be performed in tech inspection, as it is not possible to anticipate all methods that might be used. Additional rules regarding space above the patient for mission three are discussed in the rules and in several previous Q&A items. Please review them.

Q. Can we locate the Wing-Fuselage Connection between 2 inch distances of [the payload]?

A. For mission 2 payload there is no clearance requirement from the cargo blocks. For Mission 3, there must be a 2" air space above the patient. Please refer to the rules and previous Q&A listings on this topic.

Configuration Changes:

Q. Can the dimensions of the nose cone or tail cone of the aircraft be altered after submission of the report, if the nose and tail cone do not hold any payload, but are for aerodynamic purposes only?

A. Please refer to the answer in Q&A #9.

Battery Weight:

Q. If we add wire to connect battery packs that are located in the back of the plane to the front, do they count as part of the 1.5 lb battery limit?

A. The batteries weight will include any wiring and connectors that are permanently attached to the pack.

Q. How accurate is the scale that will be weighing the batteries?

A. The scales are accurate to +/- 0.01 lb. They are certified and have had a calibration within the past six months.

Payload:

Q. The rules for Mission 3 state that: "The attendant must be immediately adjacent to the side of the patient". Does this statement infer that the patient and the attendant must be in contact with each other? Can we have maybe one inch of space between the patient and the attendant while them being adjacent to each other?

A. "Immediately adjacent to" implies that the patient and attendant should be touching or very near touching (<1/16"). This rule will be checked by visual inspection in Tech.

Landing Gear:

Q. Can we fabricate suitable wheel for taxi mission; for example made by balsa or any suitable material?

A. Yes. Be reminded that the same landing gear must be used for the flight and taxi missions.

Q. Could we use multiple wheels on the landing gear strut?

A. Yes. Be reminded that the same landing gear must be used for the flight and taxi missions.

Report Units:

Q. Is it permitted to use gr,mm,sec units for our report?

A. Yes, standard SI units may be used.

Pilot:

Q. We have a pilot that is not a student and we did not register him as a team member. Do we need to register him as a team member, or do the rules of the competition allow us to just show up with him?

A. No, the pilot does not need to be a student or a team member. As stated in the rules: "All team members (except for a non-student pilot) must be full time students at an accredited University or College and student members of the AIAA"

Q. If our pilot is not an AMA member, can he register as an AMA member at the competition itself?

A. Onsite AMA pilot registration is limited to international teams. US pilots should use the online membership registration prior to the contest.

Taxi Mission:

Q. For the Taxi Mission, do the tail surfaces have to clear the obstacles?

A. Clearance of the tail is not a requirement.

DBF Q&A #11 - 3/10/2014

We Need a Pilot:

- Q. We are unable to get our own pilot to the contest so we request a qualified pilot for the contest.
A. Please request a pilot at the judging table when you arrive at the contest. One will be supplied to you at that time.

Report Scores:

- Q. When will the design report score be out?
A. Report scores will be available at the flyoff.

Landing Gear Configuration Changes:

- Q. Can a team change the landing gear design from what it has been declared in the design report? For eg. The landing gear configuration would remain same, only change in design and material for better performance.
A. If the basic configuration is the same, and you are mostly changing gear diameter or width, then it will likely be ok. For more information, please refer to the answer in Q&A #9.

72 Mhz:

- Q. Can we still use a 72 Mhz radio?
A. Yes. Please let us know which frequency you will be using.

Shipping Airplanes and Equipment to the Contest Site:

- Q. Can we ship our model directly to Cessna?
A. No. Cessna is not able to handle shipments. Have it shipped to your hotel or held at the shipper facility in Wichita.

Taxi Mission:

- Q. Will there be a separate team rotation for the Taxi Mission in addition to the rotations for tech inspection and flight line? Will the 5-minute loading time constraint apply to the Taxi Mission, and will there be a separate set of staging boxes for the Taxi mission?
A. Yes. There will be a separate queue and staging area, and a 5-minute time for you to prep your airplane when it is your turn.
Q. Has the material for the corrugation been chosen? I have read that it will be similar to the plastic panels in the rules but we are wondering if it will be identical.
A. The material will be exactly as described in the mission rules.

Taxi Mission:

- Q. What are the requirements to get AMA pilot license for the international team. Any test that pilot needs to pass?
A. AMA is a membership organization for insurance purposes, it does not issue "licenses". International pilots can submit the AMA membership form for "Affiliate Membership" via Fax or e-mail to the AMA and bring confirmation of membership to the DBF Fly-off. Joining before the fly-off is preferred to save time trying to register onsite. AMA website: <http://www.modelaircraft.org>. AMA Membership application PDF: <http://www.modelaircraft.org/files/902.pdf>

Battery Packs:

- Q. We understand we can use different battery packs throughout the competition, but can the batteries be of different configurations? i.e different cell type/cell count depending on the mission?
A. Yes. You must present all packs you intend to use at tech inspection for approval and weighing. The heaviest pack will determine your RAC.

Cameras and First Person View:

- Q. Can a camera be attached to the plane to provide a first person view (FPV) for the pilot to navigate the course?
A. AMA rules for first person view are not compatible with DBF rules. For this reason and the possibility of radio interference FPV is not allowed. On-board cameras are allowed without telemetry.

Payload Restraint:

- Q. Is the use of velcro allowed for securing the payload to the inside of the aircraft fuselage?
A. Yes.

DBF Q&A #12 - 3/18/2014

Landing Gear Configuration Changes:

Q. What would be an acceptable change to the aircraft 3View with regards to the landing gear layout? Our analysis has shown the addition of skis to our aircraft will allow us to reduce weight, therefore increasing score. We would not be changing the landing gear layout (eg., going from a tricycle to taildragger configuration). In addition, our reasoning behind why this is acceptable has to do with the ability of commercial aircraft such as the Cessna 172 to have many different options, such as floats or skis, to add to the landing gear. Furthermore, we would not remove the skis for different missions (all flight missions and taxi mission would be flown with the same configuration).

A. By way of example, a change in the number of gear struts or significant change in location (such as nose wheel to tail wheel) would be considered a major change. A change to wheel size or number per strut, or the addition of skis will be allowed. However, as stated in Q&A #9: "It is not possible to anticipate all potential changes or to place a quantifiable standard that applies across the board." A final determination of the legality of a change will be determined in tech. **REMINDER:** The same landing gear used for the taxi mission must also be used for all flight missions.

DBF Q&A #13 - 3/27/2014**Use of Tape for Hatch Covers:**

Q. Is it ok to use of silver cloth tape allowed to secure the fuselage cover?

A. Yes. This is standard model airplane practice

Configuration Changes:

Q. Would it be considered a major design change to add one foot of length to a six foot wing?

A. Please refer to the answer in Q&A #9. Legality of configuration changes will be determined in Tech by comparison to the three-view.

Fuse Location:

Q. We have two motors and a single battery. Where should the fuse(s) go?

A. According to the rules:

- Motors and batteries will be limited in current draw by means of a **15 Amp fuse** in the line from the positive battery terminal to the motor controller.
 - Fuse(s) must be located such that no propulsion system component: motor; motor controller; or battery may see more current than the stated limit (fuse value).

You can either use one fuse between the battery and the two speed controllers or you can have one fuse per propulsion system that is located between the battery and each speed controller. Where the fuses physically go in the plane is up to you.

DBF Q&A #14 - 4/7/2014**AMA Requirements for Taxi Mission:**

Q. Can a team member who is not an AMA member be used to control the aircraft for the taxi mission?

A. No. Anyone operating the airplane during a Flight or Taxi mission must be an AMA member.

Parking Availability:

Q. I would like to know whether there will be parking availability at the contest site?

A. Yes. Parking is available, but it is more limited than in past years.

Taxi Mission:

Q. Will the taxi mission be aligned parallel with the wind direction or with the runway direction or indoor?

A. The taxi course will be outdoors aligned north/south. All missions will be run in a southerly direction, away from crowds, for safety concerns.

Fuse Location:

Q. On the most recent Q&A, the question of fuse placement was answered by "You can either use one fuse between the battery and the two speed controllers or you can have one fuse per propulsion system that is located between the battery and each speed controller." Is the propulsion system above defined as a battery, speed controller, and motor, or just the speed controller and motor?

The reason for this clarification is that multiple speed controllers with a fuse for each connected in parallel to one battery will each see less current than the battery, leading to an infraction of the rule "no component may see more current than the stated limit (fuse value)."

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If you use one fuse per propulsion system that could allow for more than 15 amps to be drawn from the single battery in their configuration. I believe the response to this question should be revised.

A. The intent of this rule is to prevent damage to motors and speed controllers. Batteries are less susceptible to damage from over-current. In past years we have allowed more than one fuse per battery, and that is the way the rule will be enforced again this year.

Battery/Speed Controller Wiring:

Q. If the gauge of the battery pack leads is larger than the leads from the speed controller, but the leads on both sides of the speed controller are the same and of adequate gauge, is this okay?

A. Yes. As long as the smallest gauge wire is adequate for the current.

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Frequently Asked Questions (FAQ)

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.

***** All Rulings In This FAQ Supplement The Official Rules! *****

General Notes:

- 2.4 GHz ISM band radios are now legal and recommend for the contest. They MUST be capable of implementing the full fail-safe sequence procedure outlined in the rules. We will accept an email request to use a 72 MHz style radio from teams with accepted entries following the close of the entry submission period.
- Brushless motors are now legal.
- Ni-mH batteries are now legal. Li-Poly batteries are NOT legal for use either as propulsion or RC batteries.

Flight / Mission Questions

1. **Question:** Do we have to fly all of the different missions to get a score?
Answer: You will get a score for each mission you successfully complete. The flights must be completed in the order specified to obtain a score.
2. **Question:** Do we have to use the same plane for each mission?
Answer: You must use a single plane for the entire contest weekend.
3. **Question:** If the airplane is damaged on a flight can we use the another copy of the aircraft which has the same design?
Answer: No, you must repair the original aircraft.
4. **Question:** Can we tailor the configuration of the aircraft differently for the different missions? For example, could we use different sized propulsion systems for each flight?
Answer: You cannot change the hardware configuration of the aircraft for the different missions.
5. **Question:** What constitutes a successful landing?
Answer: The aircraft must touch down ON the runway. It may roll/slide, not bounce, off the runway after touchdown.
6. **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.

7. **Question:** What would constitute “non-critical” versus “significant damage” on landing as described in the rules?

Answer: The decision will be at the discretion of the flight line judges. In general, “non-critical” damage would allow the aircraft to be easily returned to safe flight status. A couple of examples of “non-critical” damage would be a broken propeller, bent landing gear, sheared nylon bolts or minor scratches to the finish. If any component is structurally damaged and would be considered a hazard to safe flight then it will be considered as “significant damage”.

8. **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 director will determine if it becomes unsafe for teams to fly. Wind speed is not the only factor that may be considered.

Aircraft Configuration Questions

1. **Questions:** 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 doesn’t cross over the line into vertical flight capability.

2. **Question:** Can we change the aircraft geometry, such as wing sweep or span, for different missions?

Answer: Variable geometry is allowed provided it is controlled remotely through the RC control system. You may not “swap out” parts for different missions.

3. **Question:** We have talked with an outside vendor and they possess a *manufacturing* technique that we are not capable of producing here at the school. The design of the part would be done by us, with *manufacturing* done by them.. Is this permitted by the rules?

Answer: No. The rules (sponsor section) say “All design, analysis and fabrication of the contest entry is the sole responsibility of the student team members.” Commercial components may be used if part of the manufacturer’s public product line.

4. **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? If our school does not have machining capabilities can we have a vendor laser cut our ribs and formers or machine our original design molds?

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. You may also have *components* of your design machined to your design specifications by an outside contractor if the team and/or university does not have the required machining facilities. You may have molds machined for composite parts, but the team must make the actual parts themselves.

5. **Question:** Are gyros legal for stability purposes?

Answer: Yes

6. **Question:** Do the external fuse accessibility requirements (from behind if tractor, from the front if pusher) exclude the use of a pusher-puller type multi-engine configuration?

Answer: You may use a push-pull configuration but must locate the fuse(s) such that they can be accessed by the crew member without having to reach over or around either propeller or being in the propeller disk plane of either propeller.

7. **Question:** Does the propulsion battery have to be a single unit (with all cells physically and electrically connected) or can it consist of separate packs.

Answer: You may use multiple battery “packs” to power either multiple or a single motor(s) provided the total weight of all packs flown as a set meet the rules requirement. Any/all packs/motors must be fused such that no single battery or motor can exceed the maximum current requirement. If it requires multiple fuses to meet the current protection requirement, then **ALL** fuses must be removed whenever you are required to “safe” the aircraft system.

8. **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. For aircraft configurations where the CG is not within the chord of the wing tips, a third lift point, located as far from the CG as possible, will be used to balance the aircraft.

Report Questions

Report rules may be changed from prior years. Be sure to follow the current rules. Being allowed in prior years is not grounds for expecting the same item to be allowed this year.

1. **Question:** Do we need to use a Figure of Merit (FOM) chart?

Answer: No. You should describe and explain the decision making process you used. If you used a FOM chart, you should explain how you determined your weightings and assigned values. Your discussion should not be a justification for an arbitrary selection of what you wanted to build.

General Questions

1. **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 administrator's discretion.

2. **Question:** Regarding the test flight photo, does this photo have to be submitted with the report, or just brought to the competition?

Answer: The photo must be shown to the judges during the technical inspection. We will not have copies of the reports available at the contest, so if you want to use a photo in your report you must bring your own copy.

3. **Question:** Can we use LiPo batteries in our transmitter?

Answer: No.

4. **Question:** Are the transmitter and receiver allowed to be store bought?

Answer: The transmitter and receiver MUST be a commercial FCC approved system. No modifications to the transmitter (or it's case) or the receiver (or it's case) are allowed.

5. **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.

6. **Question:** What is 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. Please see the CURRENT YEAR RULES for more details on the limitations on the flight and ground crews.

7. **Question:** Is it necessary to list all team members on the entry.

Answer: Yes, we need to know all the team members to verify that at least 1/3 of the team members are Freshman, Sophomores or Juniors. Team members may be updated/changed at any time during the contest but must always comply with the 1/3 rule.

8. **Question:** Can we change team members during the contest year?

Answer: You may change team members anytime during the contest year as long as you continue to meet the team composition rules.

9. **Question:** Is it allowed to have/declare more than 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.

10. **Question:** Can we have corporate sponsors? If so, can we put their logo on the aircraft 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.

11. **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.

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