2016-17 DBF Rules

Rules

Download DBF Rules

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 year's Rules package along with the current FAQ and 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 may 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.

How to use the Rules Pages

The rules pages are separated out into blocks of material that should help you to quickly and easily find information for which you are looking. In addition, each rules page has a link to download the entire set of rules for the current year.

- **Mission and Vehicle Design** - This page discusses the current year's mission. It notes payload(s) required, types of missions, and number of laps that may be required. It also notes specifications for the current

year's aircraft. The aircraft information includes details about fail-safe, structural integrity and inspection, and general aircraft requirements

- **Schedule** - This page will provide information about deadlines for proposals and design reports. It will also note the date and location of the Flyoff
- **Scoring** - This page indicates how a team's overall score is calculated. It notes the formula for determining each mission score, overall flight score, and Rated Aircraft Cost (RAC). It also provides the rubric for reports that are required to be submitted
- **Flyoff** - This page will note the date and location of the Flyoff. Specific agenda items for contest days may be noted
- **General** - This page will go over the basic information of the competition. Information includes team requirements, reports that are required, general schedule of activities, communications, deadlines, and other basic information
- **FAQ** - This page answers questions that asked often by persons that want to compete in the competition.
- **Q&A** -This page answers specific questions about this year's competition.

General Information

Download DBF Rules

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, 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 2017 FAQ, and 2017 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 may 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.

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 (below senior year, for non-four year programs). 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.

There is no set requirement for the number of students that must attend the flyoff. It is preferred, but not required, for the team advisor or responsible faculty member to 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. We will notify teams when the website update change information may be sent, normally in February. Teams wishing a team member list update at that time must submit an updated copy of the contest entry form with all fields fully filled (but only the team member information may be changed).

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.

There is no entry limit this year.

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 **Scoring** 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.

Communications:

The contest administration will maintain a website containing the latest information regarding the contest schedules, rules, and participating teams. The contest web site is 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 **FAQ**.

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.

Flight Line and 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 Thursday to Friday, Friday to Saturday and Saturday to Sunday at whatever 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).

There will be staging box positions near the flight line.

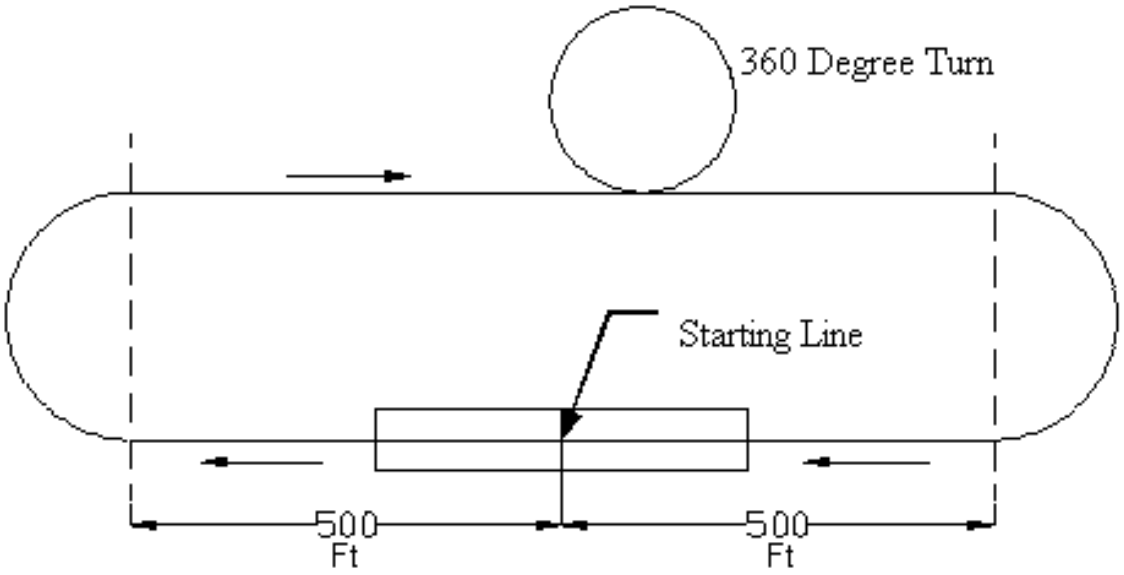
If you are not ready to enter a staging box when your rotation number comes up, you will miss (forfeit) your opportunity for that rotation.

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.

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.

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.



Course Layout
Shown to Scale

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.

Schedule

Download DBF Rules

Entries:

The entry period OPENS 15 October at 8AM (0800) **US East Coast Time**. No entries will be accepted before that time. A completed entry must be RECEIVED by 5 PM (1700) **US East Coast Time** on 31 October. Entries will be collected through the online Submission system.

The DBF entry form is different from the ones used for other AIAA student competitions. The DBF entry can be found in Resources.

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.

If AIAA membership has been applied for, but a member number has not been issued, use "pending" for the member number in the entry form. The data must then be updated and resubmitted. Team rosters may be resubmitted during the Proposal and Design Report phases of the competition.

Incomplete entry forms will not be accepted.

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.

Proposal:

A new requirement this year is to submit the proposal with the entry form via the online submission system. Entry forms and proposals are due by 5 pm (1700) **US East Coast Time** on 31 October.

The proposals will be scored as defined in the proposal requirements section. The top 100 proposals plus ties will be invited to submit design reports and potentially become eligible for the fly-off. Teams will be notified no later than 18 November if their proposal has been accepted or not.

Design Report:

Design Reports will be submitted using the online system.

The design report submission period OPENS 1 February at 8AM (0800) **US East Coast Time**. The design report must be submitted by 5 pm (1700) **US East Coast Time** on 22 February.

Proposals and Reports submitted by email will not be accepted.

Proposals and Reports will be judged “as received”. No corrections/additions/changes will be allowed by the organizers so check your reports carefully before submitting them.

Once a Proposal or Report is submitted, no changes are allowed.

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

Contest Fly-off:

The contest fly-off is scheduled for 20-23 April 2017 and is anticipated to run from 12PM (1200) to 6PM (1800) on Thursday, 8AM (0800) to 6PM (1800) on Friday, 7AM (0700) to 6PM (1800) on Saturday and 7AM (0700) to 5PM (1700) on Sunday. Awards will be presented at 5:30PM (1730) 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 Thursday and will continue as required on Friday, 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.

PLEASE NOTE: All schedule deadlines are strictly enforced

All deadlines are based on when an entry or submission is **Received** (Save and Finalize) by Contest officials via the online submission system.

Late entries and proposals will **NOT** be accepted.

Late report submissions will be disqualified.

There is no allowance for computer, internet, or power outages by the submitter, or any other type of error beyond the control of the DBF Organizing Committee.

Teams which do not submit the required electronic report and 3-view will **NOT** be allowed to fly.

It is the team’s responsibility to assure that all deadlines are known, understood and met.

Mission and Vehicle Design

Download DBF Rules

Mission Task Matrix:

Tube-Launched UAV

The objective for this year is to design a tube-launched UAV. The UAV must fit complete inside the launch tube, which also acts as the UAV handling and storage container. The launch tube must protect the UAV from damage during normal handling and storage. Upon removal of the UAV from the launch tube, all folded or stowed surfaces or features must move into the flight condition. Teams must design a UAV and launch tube that minimizes system weight while maximizing speed, range, endurance and payload capacity.

General

- The UAV must fit entirely inside the launch tube in a “stowed” condition
- When removed from the tube, the UAV will “transition” to the flight condition
    - All surfaces or aircraft features that are folded, rotated, stowed or otherwise moved to a condition for storage in the launch tube must be moved to the flight condition
    - All surfaces or aircraft features must "move" to flight position using hinges, pivots, or other captive mechanical mechanisms. Surfaces or aircraft features cannot temporarily separate from the aircraft and use "lanyards" or similar devices to provide a connection to the aircraft with the operator controlling the path the surfaces or aircraft features takes from stowed to flight position
    - All surfaces or aircraft features described above must securely lock in the flight condition without the use of tools or manual release or engagement of any locking features (in other words, all locking features must be self-locking)
    - All surfaces or aircraft features described above may be manually moved or rotated to the flight condition by hand. Spring loaded or self-deploying mechanisms are not required
- Payloads
    - Mission 1 – no payload
    - Mission 2 – regulation hockey puck, quantity three (3), the pucks must be carried internally
    - Mission 3 – regulation hockey puck(s); the number of hockey pucks for each team’s payload is a team decision based on maximizing the overall score; the number of pucks carried cannot exceed the number approved during tech inspection (but could be less); the pucks must be carried internally
    - All payloads must be secured sufficiently to assure safe flight without possible variation of aircraft CG outside of design limits during flight

Diameter	3 in
Thickness	1 in
Weight	6 oz

Regulation Hockey Puck

- Launch Tube
    - The launch tube must be a right circular cylinder of constant cross-section
    - The launch tube length to diameter (L/D) ratio must be a minimum of 4
    - The launch tube must be completely sealed in the storage and pre-flight condition
        - No perforations, cut-outs or access holes are allowed
        - The ends must have end caps that completely seal both ends of the tube, one or both of which must be removable by hand only for removing the UAV for flight – no tools or aids are allowed to remove end cap(s)
        - The end cap(s) may be secured internally or externally to the tube – if secured externally, the end cap diameter will be used in the minimum L/D calculation and in the RAC circumference
    - The launch tube must provide sufficient support of the UAV and have sufficient strength to pass the ground mission
    - The launch tube empty weight, including end caps and all internal aircraft supports, as well as overall length and maximum cylindrical circumference will be part of the RAC
- There is no limit on battery weight this year.

Mission Sequence:

- Aircraft must be designed to be capable of performing all required missions.
    - Aircraft must pass the wing tip load test with the largest payload loading intended to fly.
    - The maximum load demonstrated will be recorded and cannot be altered after completing tech inspection.
- The Flight Missions must be flown in order.
    - A new mission cannot be flown until the team has obtained a successful score for the preceding mission.
    - Flight Mission 1 and the Ground Mission can be completed in either order. Flight Mission 2 cannot be attempted until Flight Mission 1 **AND** the Ground Mission are successfully completed
    - After successfully completing all three flight missions, teams will be allowed one additional attempt for both mission 2 and mission 3 in order to improve their score. The mission 3 payload cannot exceed the maximum number of pucks approved during tech inspection
- The UAV will be brought to the staging box inside the launch tube with the payload for mission 2 or 3 already installed.
    - If you forget something you must leave the staging box and forfeit the flight attempt.
- Only the assembly crew member, pilot and observer may go to and enter the staging box or Ground Mission area
    - The assembly crew member is the only person who can touch the launch tube and airplane while inside the staging box or Ground Mission area during removal of the UAV from the launch tube and to move all surfaces and features to the flight condition
    - The removal of the UAV and checkout must be completed in less than 5 minutes.
    - There is no work allowed on the aircraft after the 5 minute removal and checkout time including connection of batteries, receivers, etc. The aircraft must be ready to fly prior to being called to the flight line less the installation of the arming plug.

    - After aircraft pre-flight checkout is complete the assembly crew member may be swapped for a different flight line crew member, if desired.
- The aircraft will be hand launched in a direction away from the crowd as designated by the flight line judge.
    - Hand launches must be accomplished by holding the fuselage, no wingtip/discus launches allowed.
    - Teams may not use a "hand launch assist" device (such as a spear-thrower or any type of arm extender).
    - The aircraft must be released before crossing the start/finish line in the direction of the flight pattern.
    - For a launch to be ruled "successful" the aircraft must stay airborne after leaving the launcher's hand. Any contact with the ground or a ground based object constitutes a failed launch.
    - There is no runway length requirement this year.
- Teams may make a maximum of 3 launch attempts during a single flight attempt. No repairs may be made between launch attempts.
- 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.
- 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.
- The aircraft empty weight will be recorded after each successful flight mission
- The launch tube weight will be recorded after a successful ground mission

Tech Inspection

- The Aircraft will enter Tech Inspection fully assembled and flight ready
- The Aircraft will undergo the wing tip lift test with the maximum flight payload installed
- During the tech inspection the team will load the Aircraft into the launch tube with all restraints in place ready for the ground mission

Flight Missions:

Mission 1: Demonstration Flight

- There is no payload for the demonstration flight
- Teams must complete 3 laps within the flight window
- There will be a 5 minute flight window for this mission
- Time starts when the aircraft leaves the launcher's hand during the (first) hand launch (or attempt)
- A lap is complete when the aircraft passes over the start/finish line in the air (the landing is not part of the 5 minute time window)
- Must complete a successful landing to get a score

Scoring:

M1 = 1.0 for successful mission

Mission 2: Speed Flight

- The payload for the Speed Flight is three (3) regulation hockey pucks
- The payload must be carried internally
- Timed flight to complete 3 laps
- There will be a 5 minute window for this mission
- Time starts when the aircraft leaves the launcher's hand during the (first) hand launch (or attempt)
- A lap is complete when the aircraft passes over the start/finish line in the air (the landing is not part of the 5 minute time window)
- Time stops when the aircraft passes over the start/finish line in the air at the end of the third lap
- Must complete a successful landing to get a score

Scoring:

M2 = 2*(Min_time / N_time) , where Min_time is the fastest time to complete 3 laps for any team

Mission 3: Range Flight

- The payload for the Range Flight is hockey pucks
- The number of hockey pucks carried is determined by each team
- The payload must be carried internally
- There will be a 5 minute window for this mission
- The score will be the number of laps flown times the number of hockey pucks carried
- Time starts when the aircraft leaves the launcher's hand during the (first) hand launch (or attempt)
- A lap is complete when the aircraft passes over the start/finish line in the air (The landing is not part of the 5 minute time window)
- Must complete a successful landing to get a score

Scoring:

M3 = 4*[N_(laps*pucks) / Max_(laps*pucks)] + 2

Ground Mission

- The Ground Mission must be successfully completed before attempting Mission 2 (the Ground Mission and Mission 1 can be completed in either order)
- The Ground Mission consists of a series of 3 drops from a minimum height of 12 inches onto a hard surface
- The UAV will be installed and sealed inside the launch tube with the maximum weight payload determined during tech inspection
- The assembly crew member will lift the launch tube to the required height and when confirmed by the mission official, will release it. The mission official will confirm a good drop.
    - Drop 1 – flat drop, the launch tube long axis will be parallel to the landing surface; the mission official will select the orientation about the long axis for the drop
    - Drop 2 – end drop, the launch tube long axis will be perpendicular to the landing surface
    - Drop 3 – same as drop 2 on the opposite end
    - The launch tube cannot sustain major damage as a result of the drop tests. Major damage is defined as follows but is not limited to just this. The final decision on major damage to the tube will be made by the mission official

        - Visible cracks or perforations (no longer meets the definition of water tight)
        - External features moving or falling off, including end cap(s)
        - Obvious signs that the structural integrity of the launch tube has been compromised
- After all three drops are completed, the assembly crew member will remove the UAV from the launch tube
    - The UAV must come out in one piece. Any dislodged items or damage to the UAV will be a mission failure
- The assembly crew member will transition the UAV to the flight condition – manually rotate or move surfaces or features to the flight condition.
- The pilot will then verify all flight controls and subsystems are functional, including propulsion
- The assembly crew member and one other crew member (pilot or observer) will conduct a wing tip test
- The Ground Mission is successful if there is no major damage to the launch tube or UAV and flight controls and propulsion are functional.

Aircraft Requirements

General

- The aircraft may be of any configuration except rotary wing or lighter-than-air
- No structure/components may be dropped from the aircraft during flight
- No form of externally assisted take-off is allowed. All energy for take-off must come from the on-board propulsion battery pack(s)
- 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
- Motors may be any commercial brush or brushless electric motor
- 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
- You can change the propeller diameter/pitch for each flight attempt
- Motors and batteries may be limited in current draw by means of a fuse in the line from the positive battery terminal to the motor controller. There is no set limit on the fuse rating. If used, it is the responsibility of each team to properly size the fuse to protect the battery, motor, and controller against overcurrents from any source
    - 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)
    - Fuse must be placed in the positive (+) lead from the battery, and should be as close to the battery(s) as feasible
- Must use over the counter NiCad or NiMH batteries. LiPo batteries are not allowed. 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
- There is no limit to battery pack weight this year. The propulsion 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 during a flight mission attempt.

- 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
- **The aircraft must have an externally accessible switch to turn on the radio control system. It cannot be under a hatch.**

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

For aircraft not equipped with a particular control, then the safety inspector must be satisfied that the intended function of the fail-safe system will be carried out.

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 may be the contest specified "blade" style fuse. Or, an arming plug such as http://wsdeans.com/products/plugs/ultra_plug.html may be used. 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 arming system). 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. The arming system MUST be mounted on the outside the aircraft (they cannot be behind an access panel or door) and MUST act as the "safeing" device.

Note: The aircraft must be “safed” (arming fuse/plug 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.

General Mission Specifications and Notes

- The aircraft propulsion system(s) must be "safed" (fuse or arming plug removed) during any time when crew members are preparing/handling the aircraft
- Maximum flight support crew is: pilot, observer, and ground crew
- Observer and all ground crew must be students. Only the pilot may be a non-student
- 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

- "Successful" Landing - 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
- 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
- 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)

Scoring

Download DBF Rules

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.

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.

Total Score

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

SCORE = Written Report Score * Total Mission Score / RAC

The Total Mission Score is the product of the individual Mission Scores:

Total Mission Score = M1 + M2 + M3

The RAC is a function of aircraft empty weight, launch tube weight, launch tube length and launch tube circumference:

RAC = (EWmax + TW) * (L + C)

EWmax = Maximum aircraft empty weight recorded after each successful mission; aircraft empty weight does not include the payload but does include any payload supports or restraints and batteries

TW = Tube weight recorded after a successful Ground Missions and includes end cap(s) and all internal UAV supports

L = Tube length

C = Tube circumference

Reports

Proposal

Each team will submit a proposal as outlined below that will be judged.

Note: Proposals 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.

- Proposals must have the University name on the cover page

Proposals missing this identification information will not be accepted

- Absolute maximum page count for the proposal is 5 pages, the PDF reader "pages" value will be used as the official page count

Proposals exceeding the maximum page count will not be accepted

- Proposal PDF must be formatted as 8.5 x 11" pages

Proposals 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 will be treated as missing and scored accordingly.**

All proposals must be one and one half line spacing, 10-pt Arial font. Tables and figures should be clear and readable for the judges. The proposals 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.

Proposal Scoring Rubric

All section scores include format, completeness and readability

Executive Summary (10 points)

- Objective Statement
- Planned approach to achieve all objectives
- Format, completeness, readability

Management Summary (40 points)

- Describe the organization, the roles of each team and individual skill sets required
- Organization chart (by team/function, individual names are not required for the proposal)
- Schedule / Major Milestone chart
- Budget (not only for expected materials and manufacturing of the airplane, but for travel to the competition site and any other expenses associated with the competition)
- Format, completeness, readability

Conceptual Design Approach (20 points)

- Describe the mission requirements (problem statement)
- Preliminary design / sizing results; concept sketch, if available (does not have to be representative of the final design)
- Sensitivity Study of Design Parameters
- Format, completeness, readability

Manufacturing Plan (15 points)

- Preliminary manufacturing flow
- Describe critical processes or technologies required
- Format, completeness, readability

Test Planning (15 points)

- Component and ground test plan
- Flight test plan
- Format, completeness, readability

Submission of Proposal

Each team must provide an electronic copy their proposal as outlined below to the online Submission site.

- Electronic proposal must be named: "2017DBF_[university]_PROPOSAL.pdf"
- Electronic proposal must be a single file with all figures/drawings included in the proper sequence in PDF format. (Free PDF file conversion programs are available on the Internet, such as www.pdf995.com.)
- Electronic proposals should have all figures compressed to print resolution to minimize file size.
- Electronic proposals must be less than 20 MB in size

Proposals not following the name format or exceeding the file size will be rejected.

Design report

Each team will submit a design report as outlined below that will be judged.

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
- 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 Scoring Rubric

All section scores include format, completeness and readability

Executive Summary (10 Points)

- Maximum of 2 pages. If exceeded, score as 0 points
- Summary description of selected design and why it best meets the mission
- Describe key mission requirements and associated design features
- Document the performance/capabilities of your system solution

- Format, completeness, readability

Management Summary (5 Points)

- Describe the organization of the design team
- Chart of design personnel and assignments areas
- Milestone chart showing planned and actual timing of major elements
- Format, Completeness, Readability

Conceptual Design (15 Points)

- Describes mission requirements (problem statement)
- Translate mission requirements into design requirements
- Review solution concepts/configurations considered
- Describe concept weighting and selection process and results
- Format, Completeness, Readability

Preliminary Design (15 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
- Format, Completeness, Readability

Detail Design (15 Points + 15 Points for Drawing Package)

- Document dimensional parameters of final design
- Document structural characteristics/capabilities of final design
- Document systems and sub-systems selection/integration/architecture
- Document Weight and Balance for final design
- Must include Weight & Balance table empty and with each possible payload
- Document flight performance parameters for final design
- Document Rated Aircraft Cost
- Document mission performance for final design
- Format, Completeness, Readability
- Drawing package:
    - 3-View drawing with dimensions
    - Structural arrangement drawing
    - Systems layout/location drawing
    - Payload(s) accommodation drawing(s)

Manufacturing Plan (5 Points)

- Document the process selected for major component manufacture
- Manufacturing processes investigated and selection process and results

- Manufacturing milestones chart: plan and actual
- Format, Completeness, Readability

Testing Plan (5 points)

- Test Objectives and schedule
- Test and flight check lists
- Format, Completeness, Readability

Performance Results (10 Points)

- Describe the demonstrated performance of key subsystems
- Compare to predictions and explain any differences and improvements made
- Describe the demonstrated performance of your complete aircraft solution
- Compare to predictions and explain any differences and improvements made
- Format, Completeness, Readability

Bibliography (5 Points)

- List of all published works referenced in the text must be present in this section.
- Any material taken from a published source in all previous sections must have a numerical subscript corresponding to the appropriate citation in this section.
- References should appear in numerical order.
- Format should match AIAA provided guidelines: http://arc.aiaa.org/page/styleandformat?_ga=1.19023614.756532879.1456162686

Submission of Design Report

Each team must provide an electronic copy their design report as outlined below to the online Submission site.

- Electronic report files must be named: "**2017DBF_[university]_DESIGN_REPORT.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

Stand Alone 3-view requirements:

- 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: "**2017DBF_[university]_THREE_VIEW.pdf**"
- The university and team names shall be clearly shown on the drawing
- 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.

Flyoff Site

Download DBF Rules

Host for the competition will be Raytheon Missile Systems. The fly-off is planned to be held at the TIMPA facility in Tucson, AZ. 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.

****NOTE:** It is the team's responsibility to ensure that their aircraft arrives at the flyoff location. Neither AIAA nor the corporate sponsors will assist in getting your aircraft or materials to the flyoff location. Teams may hand carry their aircraft, use a shipping company to have it delivered to their hotel, or use any other means of transportation that they feel is appropriate. But each team must coordinate all aspects of getting the aircraft to the flyoff.

International Teams: Special information for non-US teams can be found here.

FAQ

Download DBF Rules

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 band radios are recommend for the contest. 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.

Li-Poly batteries are NOT legal for use either as propulsion or RC batteries.

Flight / Mission Questions

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.

Question: If the airplane is damaged on a flight can we use another copy of the aircraft which has the same design?
Answer: No, you must repair the original aircraft.

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.

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.

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.

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”.

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 the that may be considered.

Aircraft Configuration Questions

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.

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.

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.

General Questions

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.

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.

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.

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 Freshmen, Sophomores or Juniors. Team members may be updated/changed at any time during the contest but must always comply with the 1/3 rule.

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.

Question: Is it allowed to have/declare more than 1 pilot in a team (in case one of them cannot 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.

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.

<End FAQ>

Q&A

Download DBF Rules

2016-17 Design, Build, Fly Q&A #1
13 December 2016

Q1. Will pucks be provided at the competition site, or can we bring our own pucks to fly? Specifically, can we glue our pucks together to better secure them for flight, or will we be dealing with individual provided pucks?

Answer: The teams will be required to bring their own hockey pucks. The pucks must be presented individually to the tech inspectors for verification of conformance and the pucks must be secured inside the aircraft for flight. Any additional features to secure the pucks is at the discretion of each team, but all features will be included in the aircraft empty weight.

Q2. Can the aircraft have a removable lock pin?

Answer: All features must be self-locking. A removable locking pin for locking in the flight condition does not meet this requirement.

Q3. Regarding the folding wing rule.

“All surfaces or aircraft features described above must securely lock in the flight condition without the use of tools or manual release or engagement of any locking features (in other words, all locking features must be self-locking)”

Does this mean that I am not allowed to touch any mechanism that will be responsible for locking the wing in place?

Answer: That is correct. It will be allowed to unlock the mechanism, but not for locking.

Q4. Is the use of a "pusher" propulsion system is allowed for this years competition. They have been allowed in the past, but due to the hand launching nature, we want to be sure this is still allowed.

Answer: **Pusher propulsion is allowed. The Flight Director is responsible for safety among other things on the flight line and it is at his discretion and final decision if a launch attempt can be executed safely for any aircraft configuration.**

Q5. What will the units be measured in for the Rated Aircraft Cost (RAC)? (ie. lbs, ft, m, N)

Answer: US/English system of measurement: pounds (lbs), inches (in), seconds (s). The final competition rules were updated to clarify this as well as the number of significant digits to be recorded for each value.

Q6. We had a question involving how the wing tip test is applied to a bi-plane. Since we will have 2 wings will the wing tip test be done on one set or can the load be spread between the two? If the load cannot be split, can we decide which wing is used for the test or must both wings each pass the test?

Answer: **If the load can be clearly shown to be carried by a single wing into the main attachment on the fuselage, then a single tip test of that wing is all that is required. In the event it cannot be demonstrated sufficiently to the tech inspector, a tip test of each wing will be required. The tech inspector has final say regarding this requirement. The best approach is to assume that a tip test will be required on each wing.**

Q7. I have a question about securing the wings whilst stowed in the launch tube. Are we allowed to use a strap to ensure the wings are secure? For example a velcro strap, that is completely detached from the aircraft.

Answer: No. All moveable features or surfaces must be free to move to the flight condition upon exiting the tube.

Q8. Could you please confirm if the following design concepts are allowed in the competition:

a) For storage, the UAV is placed inside a 2-piece foam mold casing (two halves of a cylindrical tube with the inside molded to the contours of the folded UAV). The UAV inside foam mold casing is then slid into the tube from one end.

b) The storage tube is a 2-piece cylinder (two halves of a cylindrical tube) with a hinge to allow the tube to be opened. The storage tube is lined with a foam molded to the contours of the folded UAV. For storage the UAV is placed inside the opened storage tube and then the storage tube is closed with a hinge.

Answer: 8a – Yes as long as the casing is free to fall off of the airplane without manual removal (i.e., gravity only); 8b – No, the airplane must exit from one of the ends of the tube

Q9. Are we allowed to stick Velcro to the hockey pucks before placing them in our plane?

Answer: See answer to question #1 above. Also, the Velcro must be removed from the hockey pucks for measuring the empty weight of the airplane after each successful mission. It will be up to the teams to do this in a timely manner after a successful mission.

Q10. Are we allowed to use off the shelf folding propellers?

Answer: Yes

Q11. I wanted to ask if the foldable surfaces on the aircraft can be folded or held in place only by use of springs and magnets, without any fixed hinge.

Answer: Springs and magnets are not considered sufficient mechanical attachments for securing features on the aircraft.

Q12. Is the person launching the aircraft from his/her hand allowed to run during the launch? If yes, are there any restrictions? For example the distance that he/she can run.

Answer: Running is allowed and there is no distance restriction. The aircraft must be released prior to crossing the start/finish line.

Q13. Is there a limit on what can be considered to be part of the tube? Would lining the inner part of the tube with bubble wrap be against the rules?

Answer: Dunnage such as bubble wrap is allowed and will included in the empty weight of the tube.

Q14. If we decide to use a high lift device during takeoff, such as a flap, can we use our transmitter to move the flap into the desired flight condition right before we hand launch our plane? Or, would the flaps need to be in that desired position when it is stowed in the tube?

Answer: **Any servo actuated surface or feature that is controlled through the transmitter can be placed in any position in the tube the team desires and can be actuated with the transmitter at any time prior to or during the flight.**

Q15. We wanted to check into the feasibility of a friction fit design component for the DBF 2017 competition. The rules state that all parts must be self-locking. We are currently considering a tail boom that rotates and/or extends into flight-ready position and stays in place using a tightly fitted brace connecting it to the main wing. Does this design meet the requirement of a captive mechanical mechanism?

Answer: Friction is not an acceptable locking mechanism.

2016-17 Design, Build, Fly Q&A #2
31 January 2017

Note of further definition of moving surfaces or features to the flight condition and self-locking mechanisms: The design intent of this rule is related to the requirement that in tactical applications, when an UAV is ejected from its launch tube, it must transition from the stored condition to the flight condition without any outside assistance. All power to achieve this is in the form of stored energy – mechanical, electrical, chemical, pyrotechnic, pneumatic, etc. In the interest of safety and to also allow the design effort to focus on the aircraft, the intent of the rules is to allow the ground crew member to manually move or rotate surfaces or features in place of this stored energy. This does not allow the ground crew member to determine how far to move or rotate a surface or feature. This also precludes any surfaces or features to be manually positioned or aligned since this cannot be done in a tactical scenario. The ground crew operator cannot align the self-locking device, it must be self-aligning and self-engaging. All movement must be through a captive mechanical mechanism – at no time can any part of the airplane separate from the airplane, even with the pieces being connected by a lanyard, rubber band, bungee cord, string, rope, etc.

Q1. We have question regarding the feasibility of one of our design choices within the confines of the rules, specifically this passage: "All surfaces or aircraft features must "move" to flight position using hinges, pivots, or other captive mechanical mechanisms. Surfaces or aircraft features cannot temporarily separate from the aircraft and use "lanyards" or similar devices to provide a connection to the aircraft with the operator controlling the path the surfaces or aircraft features takes from stowed to flight position". We intend to have struts attaching the outer wings to the fuselage via ball links. These mechanisms allow for pivoting at each end of the strut, and lock the strut into place when both are secured. During the storage configuration, we would detach the strut from the fuselage manually without tools. The strut would still be attached via the ball link to the outer wing, but not attached at the fuselage. Would this constitute a "lanyard" and therefore violate the rule?

Answer: Nothing can be detached, manually or otherwise, during deployment of any surfaces or features. “Captive mechanical mechanisms” in the rules clearly asserts this requirement.

Q2. Regarding the movable surface requirements, we came up with two different options for self-locking mechanism. The first one is a rubber band between wing and fuselage. For locking, a nest that locks the wing at flight condition. The second one is a seatbelt mechanism that locks the wing which is moved manually to that place. Are they suitable for the restrictions?

Answer: Rubber bands are not sufficient self-locking mechanisms as they do not provide a positive lock. A seat belt type mechanism would be acceptable as long as it self-aligned – no manual intervention for alignment will be allowed.

Q3. All surfaces or aircraft features must "move" to flight position using hinges, pivots, or other captive mechanical mechanisms. Surfaces or aircraft features cannot temporarily separate from the aircraft and use "lanyards" or similar devices to provide a connection to the aircraft with the operator controlling the path the surfaces or aircraft features takes from stowed to flight position. The question is are "lanyards" or similar devices allowed or not for the purpose listed above?

Answer: Lanyards are not an acceptable “captive mechanical mechanism” as defined in the rules. See clarification above.

Q4. Does a 2 degree of freedom ball joint count as an appropriate pivot mechanism, or is it similar to the forbidden lanyard in that it will "provide a connection to the aircraft with the operator controlling the path the surfaces or aircraft features takes from stowed to flight position?”

Answer: Ball joints are acceptable captive mechanical mechanisms. But, the operator can move the features and surfaces but CANNOT align the surfaces to the self-locking position. It must be self-aligning and self-positioning in addition to self-locking.

Q5. Can the tube separate in places other than the end caps?

Answer: No. The airplane must be loaded and removed from one end of the tube.

Q6. What qualifies as "damage" to the UAV after the ground mission?

Answer: Damage will be determined by the ground mission judge, but is classical in its definition. Any dents, cracks, scratches, breakage, etc. that is caused by the act of dropping the launch tube with the airplane inside during the ground mission is not allowed. The launch tube must protect the airplane.

Q7. Q11 on the current Q&A asks if springs and magnets, without a fixed hinge, are allowed; the answer provided was no. Are magnets allowed as an attachment mechanism if there is a fixed hinge?

Answer: Magnets are not an acceptable locking feature.

Q8. Must all elements "lock" in place, even non-structural elements? For example, would spring-loaded wires on wingtips be allowed? Such a configuration would have these wires fold down for storage but spring into place during flight.

Answer: The rules do not distinguish between structural or non-structural features or surfaces. All surfaces or features that move from a position in the stowed configuration to a different position in the flight condition must be self-locking.

Q9. Where is the distinction made between a locking element and an aircraft component, particularly if the two are integrated? For example, a stand-alone clasp surely counts as a locking element and must be self-locking; however, what if a clasp was integrated into the aircraft, such that moving an element of the aircraft into position secured the clasp?

Answer: Self-locking elements are only required to secure surfaces or features that are moved from the stowed configuration to the flight configuration. Any other locking features are for other applications are not bound by this requirement.

Q10. May a fairing be used to house a locking element? A fairing would be part of the aircraft structure, and should therefore be able to be moved into flight position?

Answer: Location of locking mechanisms within the aircraft are at the discretion of the teams. If a fairing must be moved to engage the locking mechanism, then it becomes a moveable

surface or feature and must have its own self-locking mechanism. A fairing could be fixed and could be part of the surface or feature that is being moved, but if it moves separately, it must have its own self-locking feature.

Q11. Is Velcro allowed as a self-locking mechanism? In this sense, two components could come together with Velcro pre-attached to them (no application of the Velcro, e.g. a strip).

Answer: No.

Q12. The rules state that components may not be moved via string or lanyard. Is string allowed as a stand-alone structural element? In this sense, the piece of string would be a taut structural element during flight (wing support), but under no load when stored; therefore, when stored, the string would be non-rigid and moveable, but it would still not enable the free movement of any pieces but itself.

Answer: Strings or lanyards cannot be used in place of captive mechanical mechanisms for moving or rotating surfaces or features into the flight condition. A string that is permanently attached at both ends that becomes taught in the process of moving or rotating the surface or feature to the flight condition and locking in place is allowed, but no adjustment to the string or its tautness is allowed and the position of the string cannot be controlled by the ground crew (i.e., the string cannot be touched during deployment of the surfaces or features)

Q13. Since the teams will be providing their own pucks ("Q1." of Q&A section), is there a tolerance for the dimensions and weight of each puck? Pucks we have purchased commercially were advertised as "Regulation Hockey Pucks", but according to our scale each puck weighs about 5.2 oz.

Answer: The regulation weight of the hockey pucks are defined in the rules – 5.5 – 6.0 ozs. This will be verified during tech inspection.

Q14. The rules and Q&A state the mechanism must be "self-locking" upon exiting the tube and the mechanism does not need to be spring loaded. However, does the aircraft require two locking positions: one inside the tube (stored condition) and one in flight condition? Or is the aircraft able to be taken from the tube and folded and locked into flight condition without "unlocking" it from the stored condition?

Answer: Locking features in the stored condition inside the tube are not required. However, if a team choses to implement a locking feature in the stored condition for surviving the ground mission as an example, it cannot be manually released by hand or tools. It must be "released" by movement of the surface or feature by the ground crew member only.

Q15. We have a question regarding the mounting of the Payload and Batteries: Is it allowed to use screws to mount the battery to the plane (with fixed Nuts on the battery pack)? Is it allowed to use screws to secure the pucks (cargo bay cap secured with 4 screws), because in our design the cargo bay cap has to hold the weight of the pucks inflight? Changing of battery and cargo would require ~45 seconds, because one has to take out the screws and tighten them again.

Answer: How each team choses to secure batteries and payloads is at their discretion. During tech inspection, the method to secure all internal components and payloads will be inspected to assure it will not come lose during flight. And no components, internal or otherwise, can come lose as a result of the drops during the ground mission.

Q16. The team has developed a mechanism, where the structural elements are two pins and an elastic band that holds the halves of wings together as shown on picture in the attachment. We would like to know if our design is in accordance with rules.

Answer: Elastic bands are not acceptable as self-locking mechanisms. Additionally, pins or other alignment features must be self-aligning as described above. So positioning or aligning of features by the ground crew member during deployment of surfaces or features to the flight condition are allowed.